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DEPARTMENT OF
ENVIRONMENTAL QUALITY

ENERGYSOLUTIONS

April 11 2012

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Mr Rusty Lundberg
Executive Secretary
Utah Division of Radiation Control
Utah Division of Water Quality
195 North 1950 West
P O Box 144850
Salt Lake City UT 84114 4850

DRC-2 17

Re Radioactive Material License #UT 2300249 and Ground Water Quality Discharge Permit No UGW450005 Amendment and Modification Request – Class A West Embankment Complete Electronic Submittal

Dear Mr Lundberg

On April 5 2012 Energy*Solutions* submitted its response to interrogatory CAW R313 25 8(4) 16/3 – *Seismic Hazard Evaluation* and committed to provide a complete electronic copy of the Class A West application in its entirety As such please find attached to this letter a complete electronic copy of Energy*Solutions* Class A West application

If you have any questions regarding this submittal please contact me at 801 649 2000

Sincerely

Sean McCandless
Director Compliance and Permitting

DRC-2012-001317

Enclosures

cc John Hultquist DRC (w/ encl )
Robert Baird URS (w/ encl )

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information the information submitted is to the best of my knowledge and belief true accurate and complete I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations

# UTAH LOW-LEVEL RADIOACTIVE WASTE DISPOSAL LICENSE AMENDMENT REQUEST (UT2300249) FOR THE CLASS A WEST EMBANKMENT

## ENERGY*SOLUTIONS* RESPONSE TO ROUND 3 INTERROGATORIES

**February 23, 2012**

**For**

**Utah Division of Radiation Control**

195 North 1950 West

Salt Lake City, UT  84114-4850

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## 1. INTERROGATORY CAW R313-25-7(3)-04/3: SPECIFIC TECHNICAL INFORMATION – DESIGN CRITERION FOR DISTORTION OF LINER AND CLAY COVER COMPONENTS

**Division's Interrogatory Statement:**

1. *Please demonstrate that the maximum tensile strain associated an angular distortion of 0.02 is sufficiently less than the strain which causes a compacted clay liner (CCL) to crack, considering the properties of the soils in question and the results/findings from recent investigations of compacted clay layer deformation behavior. In particular, the demonstration should consider the effects of both localized axial lengthening and bending when relating tensile strain to angular distortion.*
2. *Please revise Table 3 of the response to include only references and cases that are directly applicable to assessing the strain at which a CCL might crack. As part of this revision, assure that each cited strain level is that associated with cracking and not simply the maximum tensile strain reached at the end of the experiment, well after the onset of cracking.*
3. *Please consider and explain whether results from controlled, shorter-term laboratory tests as cited by the Licensee from technical literature are directly transferable to the long-term performance of clayey soils where soil creep and/or moisture changes can potential affect the soil behavior.*
4. *Please justify the margin between the tensile strain at cracking and the allowable maximum tensile strain selected for design.*
5. *Prepare and submit results of technical analyses that demonstrate that maximum allowable strains determined as described in Items 1 through 4 above are not exceeded under conditions expected to exist within the proposed CAW Embankment.*

**Energy*Solutions* Response:** As part Interrogatory CAW R313-25-7(3)-04/1, the Division directed Energy*Solutions* to provide "*additional documentary evidence . . ., if such evidence is available and applicable, of the basis for choosing 0.02 as the design criterion for evaluating allowable distortion of the liner and clay components of the CAW Embankment cover.*" In this Interrogatory, the Division recognized that "additional documentary evidence" may not be "available" or directly "applicable." Even so, Energy*Solutions* summarized the results of a broad-reaching literature search from which seven "additional documentary evidence" references were identified with varied applicability to clay barrier deformation. Energy*Solutions* included indirectly applicable references to provide additional bounding context to the response.

In reply to Energy*Solutions*' response to Interrogatory CAW R313-25-7(3)-04/1, the Division noted that they consider four of the seven clay barrier deformation references initially presented by Energy*Solutions* as "not directly relevant," further directing that they "should be removed," from the response to Interrogatory CAW R313-25-7(3)-04/1. Accordingly, Energy*Solutions* has removed all references from its response, with the exception of those the Division considers

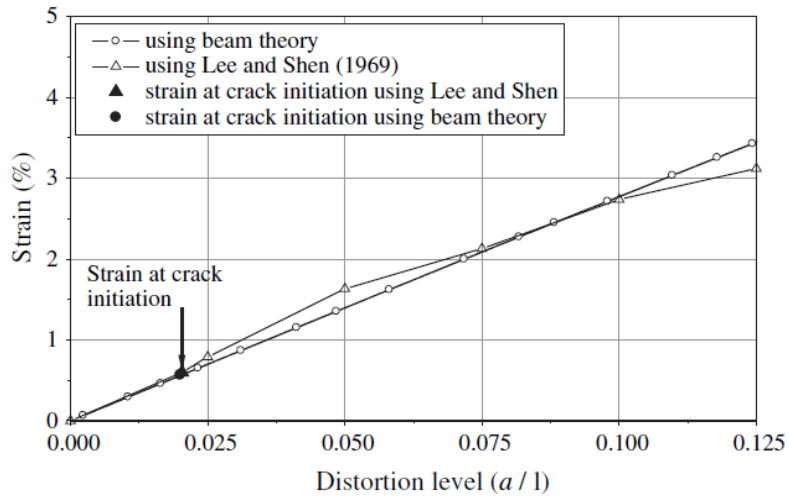
"directly relevant . . . additional documentary evidence" (e.g., Camp, 2010; Gourc, 2010; and Rajesh, 2010) in its response to Interrogatory CAW R313-25-7(3)-04/1. From these responses, Energy*Solutions* recognizes that measured strains at crack initiation in laboratory and field tests are conservatively higher (ranging from 0.3% to 2.5%) for a measured distortion of 0.02 (consistent with the design maximum tensile strain of 0.2% recommended by the AMEC, (2000) reference in question).

The Division further requested on 6 February 2012 that Energy*Solutions* corroborate as "applicable" the remaining three "relevant" references, requesting:

1. ***Please demonstrate that the maximum tensile strain associated an angular distortion of 0.02 is sufficiently less than the strain which causes a compacted clay liner (CCL) to crack, considering the properties of the soils in question and the results/findings from recent investigations of compacted clay layer deformation behavior. In particular, the demonstration should consider the effects of both localized axial lengthening and bending when relating tensile strain to angular distortion.***

   Gourc (2010) provides additional documentary evidence reaffirming the selection of 0.02 as the design criterion for evaluating allowable distortion of the liner and clay components (and the corresponding maximum tensile strain criterion of 0.2%) of the CAW Embankment cover. Gourc (2010) reports that for "distortion levels at crack initiation" in the range of 0.02 – 0.03 (which Energy*Solutions* notes are similar to those reported by AMEC, 2000) that "strains at crack initiation" were observed in the range of 0.57% - 2.5% for both field and laboratory tests (which are conservatively above Energy*Solutions*' maximum tensile strain criterion of 0.2%). Furthermore, Gource (2010) observes,

   > "*The influence of differential settlements on the cap cover can be modeled by subjecting a clay layer to bending stresses . . . The stretched zone in this test is located along the top surface of the clay barrier, which is consequently not confined . . . these tests give an opportunity to observe cracking initiation along the most-stretched surface of the clay barrier (i.e. at the center along the top surface of the clay barrier).*
   >
   > *Strain distribution along the horizontal distance could be obtained by considering the algebraic summation of the elongation strain and the curvature strain. The basis and assumptions involved in computing strain distribution are discussed in detail by Lee and Shen (1969) . . . Tensile strains were found to be maximum (i.e. along the central vertical line) along the top-most surface of the clay barrier . . . As can be noted from Fig. 10* [copied below], *a good agreement is obtained between strains computed using the procedure outlined by Lee and Shen (1969) and beam theory.*"

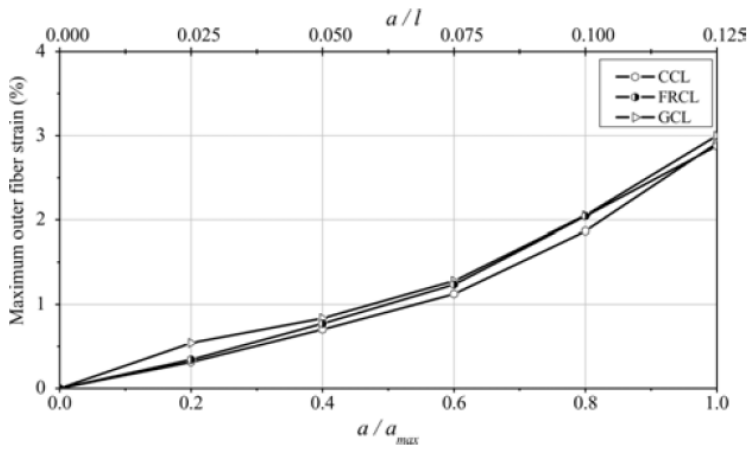



Camp (2010) also provides additional evidence reaffirming the selection of 0.02 as the design criterion for evaluating allowable distortion of the liner and clay components of the CAW Embankment cover. Camp (2010) concludes that laboratory and field strains exceed the CAW design maximum tensile strain of 0.2% for the design criterion distortion level of 0.02. Furthermore, Camp (2010) concludes,

> "*Strains related to the field tests and those related to the laboratory tests are compared with a focus on the elongation of the tensile fiber in every kind of test. The results in the laboratory bending tests are in satisfactory agreement with the observations made in the field tests . . . On-site, the image analysis returned the global strain of the tensile fiber at the initiation of cracks between 0.3% and 0.6% . . . Therefore, the values of the strain at the crack initiation in the laboratory and in the field are the same.*"

Finally, Rajesh (2010) provides the observation that the,

> "*Maximum outer fiber strain computed by the algebraic sum of elongation strain and bending strain were plotted against various settlement ratios for all the three barriers as shown in Figure 5* [copied below]. *It can be observed that as the distortion level increases the maximum outer fiber strain of all the barrier increases. It can also be observed that up to a settlement ratio of 0.6 (distortion level of 0.075), variation of maximum outer fiber strain with settlement ratio has a gentle slope . . .*"




2. ***Please revise Table 3 of the response to include only references and cases that are directly applicable to assessing the strain at which a CCL might crack. As part of this revision, assure that each cited strain level is that associated with cracking and not simply the maximum tensile strain reached at the end of the experiment, well after the onset of cracking.***

   The references cited have been limited to the three initially provided in response to Interrogatory CAW R313-25-7(3)-04/1 that the Division deems "directly applicable." As part of demonstration of applicability and in response to the Division request for clarification, Energy*Solutions* notes the similarity in definitions of Tensile Strain in the original AMEC (2000) reference accepted by the Division in previous license actions, as "*tensile strain at failure is the maximum strain that can occur before cracking of the clay material is observed*," and the responses provided in Camp (2010) and Gourc (2010), as "*tensile strain at crack initiation*." While not directly measured as part of its technical analysis, Rajesh (2010) uses a similar definition in summary of a literature review conducted as part of its documented research, "*from the literature review that the clay-based hydraulic barrier tends to experience initiation of cracking when the tensile strain developed due to differential settlement is in the range of 0.5–1%.*"

3. ***Please consider and explain whether results from controlled, shorter-term laboratory tests as cited by the Licensee from technical literature are directly transferable to the long-term performance of clayey soils where soil creep and/or moisture changes can potential affect the soil behavior.***

   Gourc (2010) notes that through use of a centrifuge for laboratory-scale analysis, "*identical stress-strain behavior of the soil in the model and the prototype can be achieved.*" Gourc (2010) further remarks that because of this, "*a majority of the researchers adopted the centrifuge modeling technique to study the response of clay barriers to artificially induced continuous differential settlements.*" Similarly, Ralesh (2010) observes,

   > "*The concept of small-scale model testing to study physical phenomena is widespread in the engineering field. However, in the geotechnical field, since the stress levels in a small laboratory model are not the same as the*

*stress levels in the full-scale prototype, the small-scale modeling may not simulate the exact field conditions. This problem can be tackled by providing an artificial gravitational field through centrifuge, which makes the stress-strain behavior of the model identical to that of the prototype.*"

Gourc, (2010) also observes that,

"*in order to evaluate the influence of molding water content . . . on the integrity of clay barriers subjected to differential settlements, field bursting and centrifuge model tests were carried out. . . Further, an attempt has been made to compare observed results of centrifuge model test results with field bursting tests.*"

Camp (2010) further concludes that,

"*the average strain of the stretched fiber at crack initiation has been determined in the laboratory (four points bending tests) and on-site (large scale bursting tests). Because the main goal is to optimize the clay implementation in capping systems, the limit extension strain (before cracking) is a relevant parameter. The relevant parameter, as defined, is the limit of the local tensile strain . . . The strain of the stretched fiber at crack initialization is basically the same for both tests (laboratory and on-site) under similar conditions (water content, dry density, mechanical parameters). Because good agreement is obtained between field bursting tests and laboratory bending tests, preliminary costly field tests can be avoided. Laboratory tests can be used to estimate the capability of the clay to sustain extension without cracking.*"

The applicability of the referenced tests to field conditions is further discussed by Rajesh (2010),

"*Since the problem related to deformation behavior of barriers at the onset of differential settlement is a stress-related problem, the body forces play an important role. Hence, small-scale model tests at 1 g may not represent the actual field conditions. To overcome this problem, either full scale model testing or centrifuge testing are essential. As the full scale field-testing involves higher cost and time, centrifuge modeling may be the ideal solution to tackle the above-mentioned problem. Centrifuge modeling technique is now firmly established as a dependable research tool that can provide solutions to many of the hitherto intractable problems in geotechnical engineering.*"

***4. Please justify the margin between the tensile strain at cracking and the allowable maximum tensile strain selected for design.***

The cited research substantiates that measured strains at crack initiation in laboratory are statistically equivalent to those measured in field tests. Furthermore, measured strains at crack initiation (ranging from 0.3% to 2.5%) remain conservatively higher for distortions equivalent to the Class A West maximum tensile strain design criterion of 0.2% (as recommended by the AMEC, 2000). Using the results obtained in the cited research, a revised factors of safety

for the Class A West distortion design criterion are estimated to range from 150% to 1,250%. Furthermore, while Energy*Solutions* recognizes that there is no statutory-based minimum margin of safety for the selected distortion design criteria, this cited research demonstrates that there is an inherent factor of safety between the strain shown to cause cracking in the cited research and that criterion selected in the Class A West design.

5. ***Prepare and submit results of technical analyses that demonstrate that maximum allowable strains determined as described in Items 1 through 4 above are not exceeded under conditions expected to exist within the proposed CAW Embankment.***

   Because the existing design criteria are supported, existing analyses – that have already been reviewed and accepted – provide this demonstration. No further new analysis is required.

## REVISED LIST OF TABLE 3 REFERENCES


AMEC. "Allowable Differential Settlement and Distortion of Liner and Cover Materials New LARW and Proposed LLRW Embankments, Clive, Utah." (Job No. 0-817-003091A). Letter to Ken Alkema. 4 October 2000.

Camp, S., et al., "Landfill Clay Barrier Subjected to Cracking: Multi-Scale Analysis of Bending Tests." Applied Clay Science 48 (2010) 384-392.

Gourc, J.P., et al., "Deformation Behavior of Clay Cap Barriers of Hazardous Waste Containment Systems: Full-Scale and Centrifuge Tests." Geotextiles and Geomembranes 28 (2010) 281-291.

Rajesh, S. and B.V.S. Viswanadham. "Performance Assessment of Deformation Behavior of Landfill Barriers at the Onset of Differential Settlement." International Journal of Environmental Engineering 2.1 (2010) 269-289.


## 2. INTERROGATORY CAW R313-25-8(4)-11/3 TECHNICAL ANALYSIS - ROCK COVER DESIGN AND ROCK COVER DESIGN CALCULATIONS/ ANALYSES

**Division's Interrogatory Statement:** Refer to Attachment 10 of Energy*Solutions* 2012:

1. *A revised PMP calculation updating the PMP distribution that incorporates information from the following documents, in addition to HMR 49 (NOAA 1984):*
   i. *"2002 Update for Probable Maximum Precipitation, Utah 72 Hour Estimates to 5,000 sq. mi". – March 2003 (Jensen 2003); and*
   ii. *"Probable Maximum Precipitation Estimates for Short Duration, Small Area Storms in Utah" – October 1995 (Jensen 1995)*
2. *Provide a revised Rock Cover Design calculation package (revised Attachment 10 to the CAW LAR) reflecting the updated PMP information, in accordance with the revised PMP information, as appropriate.*

**Energy*Solutions* Response:** In order to have a stand-alone document, revised PMP calculations using the information from the two Jensen reports referenced in this interrogatory are provided in the updated Rock Cover Design Calculations, Attachment 10 of the CAW LAR. The revised 1-hr PMP is 1.37 inches using the Jensen reports. The rock cover calculations utilize the previous 1-hr PMP of 6.1 inches; therefore, an additional safety factor of 4.45 is imparted to the rock sizing calculations.

## 3. INTERROGATORY CAW R313-25-8(4)-16/3: SEISMIC HAZARD EVALUATION / SEISMIC STABILITY ANALYSIS UPDATE

**Division's Interrogatory Statement:**

*SEISMIC HAZARD ANALYSIS*

*The responses to Interrogatory CAW R313-25-8(4)-16/2A are inadequate and do not address the requests stated in the interrogatory. The Round 2 interrogatory is, therefore, restated and extended below:*

1. *Perform and submit results of a probabilistic seismic hazard analysis (PSHA). Utilize a corrected version of EZ-FRISK or other accepted software for conducting PSHAs. Prepare the PSHA without using the Pankow and Pechmann (2004) ground motion model and giving full weight to the NGA models. Remove foreshocks and aftershocks from the earthquake history by de-clustering the earthquake catalog as done in standard probabilistic approaches and as was done by Pechmann and Arabasz (1995). Use the resulting earthquake catalog in any ground motion calculations.*
2. *Correctly label the vertical axis in Figure 3 and correctly interpret the information presented in Figure 3 (cumulative frequency plot).*

*SOIL LIQUEFACTION/CYCLIC SOFTENING*

3. *The Applicant's response to Round 2 CAW interrogatories does not include a response to Interrogatory CAW R313-25-8(4)-16/2C. Please respond to Interrogatory CAW R313-25-8(4)-16/2C, repeated and extended below:*

   *Please demonstrate that the potential effects of soil liquefaction and/or cyclic softening phenomena in native soils at the Clive Facility have been adequately accounted for in the geotechnical analyses supporting the design of the proposed CAW Embankment. In doing so, clearly justify the selection of soil parameters and any design assumptions by comparison of such with correlations, field test results, and/or laboratory test results (including cyclic shear testing) consistent with the guidance given by developers of current, published analytical methods. Also, evaluate and document the effects on previous liquefaction and embankment stability assessments and cyclic softening resulting from changes to the seismic hazard analysis addressed in Items 1 and 2 of this interrogatory.*

**Energy*Solutions* Response:** This response will be forwarded under separate cover.

**ROUND 3 RESPONSE TO CAW R313-25-7(3)-04**

As part Interrogatory CAW R313-25-7(3)-04/1, the Division directed Energy*Solutions* to provide "*additional documentary evidence . . ., if such evidence is available and applicable, of the basis for choosing 0.02 as the design criterion for evaluating allowable distortion of the liner and clay components of the CAW Embankment cover*." Rather than attempt to arbitrarily quantify uncertainties created by sampling the population of published clay distortion research, Energy*Solutions* considers it more accurate and therefore appropriate to assess the tensile strain and distortion-induced crack resistant properties of site-specific clays expected to be used in the eventual construction of the proposed Class A West embankment cover.

In preparation for imminent construction of cover over its Mixed Waste embankment, Energy*Solutions* is already mining, preparing, and stockpiling these native clays. In order to resolve concerns over distortion-induced crack resistant properties of site-specific clays that are proposed for use in eventual cover construction for the Class A West embankment, Energy*Solutions* will analyze its native clays and report the laboratory findings prior to any construction of cover over the proposed Class A West embankment. These results will also be included in Energy*Solutions*' Radioactive Material License renewal application due for submittal to the Division on or before 25 December 2012.

To provide additional reassurance to the Division regarding limitation of cracking due to differential settlement, Energy*Solutions*' current LLRW and 11e.(2) CQA/QC Manual (version 26b, dated 15 November 2011) already specifies that temporary cover placement must be monitored for a minimum of 1 year after placement, until all monitored distortions are less than or equal to 0.007 ft/ft. Once this point is reached, an analysis will be conducted to affirm that future propagation of the current consolidation trend will not exceed 0.01 ft/ft. Only after this degree of consolidation and settlement has been reached can final cover construction begin.

Until the laboratory analysis can be completed and distortion-induced crack resistant properties of site-specific clays reported to the Division, Energy*Solutions* has modified its LLRW and 11e.(2) CQA/QC Manual (version 26c, dated 20 March 2012) to specify that temporary cover placement must be monitored for a minimum of 1 year after placement, until all monitored distortions are less than or equal to 0.007 ft/ft. Once this point is reached, an analysis will be conducted to affirm that future propagation of the current consolidation trend will not exceed <u>0.007 ft/ft</u>. It is noted that the basis for changing the criterion to 0.007 ft/ft is that this value correlates to a tensile strain much less than that expected to initiate cracking (using the Lee and Shen correlation)[1]. Only after this degree of consolidation and settlement has been reached can final cover construction begin. Additionally, since the temporary cover surface will be re-graded prior to final cover construction, it is important to note that the final tensile stain baseline will be reset at zero. A replacement page to the CQA/QC Manual, reflecting this change, is attached.

---

[1] AMEC. "Allowable Differential Settlement and Distortion of Liner and Cover Materials New LARW and Proposed LLRW Embankments, Clive, Utah." (Job No. 0-817-003091A). Letter to Ken Alkema. 4 October 2000.

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| than 0.007 foot/foot for all of the grid points in a given area, and each grid point has at least one year's monitoring data; then final cover construction may proceed. Once an area is approved, final cover construction shall be completed within 3 years of this determination. | settlement data for each area of cover construction to determine distortion between all adjacent points in that area. If the criteria are met, a written report shall be prepared and forwarded to DRC at least 7 calendar days prior to removing the pre-final cover settlement monuments. | |
| The Director of Engineering shall perform the analysis of projected future distortions. The analysis shall be submitted no later than the end of the 16th year since waste placement began in the oldest lift area subject to analysis. | Inspect and document that all pre-final cover settlement monuments have been removed prior to final cover construction. | |
| If an area is not approved for final cover construction by the end of the 16th year of the 18-year open cell period, an analysis of projected future distortions shall be performed and submitted to DRC. The analysis shall evaluate settlement through the end of year 17 of the open-cell period, at a minimum. If the analysis indicates that the future distortions between any two adjacent points will be more than 0.007~~1~~ foot/foot, then surcharging over the area(s) in question will be required to stabilize settlement prior to final cover construction. If surcharging is required, a plan and schedule shall be provided to DRC by the end of the 16th year of the open-cell period. The surcharging schedule shall show that surcharging will be complete by the end of the 17th year of the open-cell period. Settlement monitoring frequency during surcharging shall be at least equivalent to that required in Year 16. | Survey and document the temporary cover surface to confirm that the top of waste design grades and elevations are achieved. Document lift thickness and compaction for any debris-free soil material placed to bring the temporary cover surface to the design top of waste grades and elevations. | Verify that pre-final cover settlement monuments have been removed and that the temporary cover surface meets design top of waste grades and elevations. |
| Immediately prior to placement of the first lift of radon barrier, the pre-final cover settlement monuments shall be removed and the temporary cover surface restored. | Provide DRC notification of pending temporary cover removal. Document lift area and location on a Daily Construction Report. | |
| Additional clean debris-free soil material shall be placed; or excess temporary cover material shall be cut, as needed | | Periodically observe paperwork for temporary cover removal. |

April 6, 2012
Job No 10-817-05290

Mr. Sean McCandless
Compliance and Permitting Manager
Energy*Solutions,* Inc.
423 West 300 South, Suite 200
Salt Lake City, Utah 84101

**Re: Response to Interrogatory CAW R313-25-8(4)-16/3:**
**Seismic Hazard Evaluation / Seismic Stability Analysis Update,**
Energy*Solutions* Clive Facility
Class A West Embankment
Clive, Tooele County, Utah

Dear Mr. McCandless:

AMEC previously performed geotechnical investigations at the site and summarized the results in a report dated December 13, 2005 (AMEC Job No. 4-817-004769). Changes in the waste embankment configuration required re-evaluation of the findings and conclusions presented in the 2005 report; therefore, we issued an updated report dated February 15, 2011 (AMEC Job No. 10-817-05290). These reports were subsequently submitted to the State of Utah for their review and comments.

In a letter dated October 25, 2011, we provided our responses to comments received from the State of Utah in their Round 1 Interrogatory CAW R313-25-8(4)-16/1. The October 25th letter specifically addressed review comments regarding procedures used in our prior seismic hazard evaluation, the peak ground acceleration (PGA) value used in seismic slope stability analyses of the embankment, and the results summarized in our February 2011 report.

The Round 2 interrogatory comments were presented in their interrogatory CAW R313-25-8(4)-16/2 which was received from the State of Utah on December 8, 2011. We provided our response to the comments in a letter dated December 23, 2011. The December 23rd letter specifically addressed review comments to justify using a “semi-probabilistic” approach to seismic hazard evaluation and incorporated results from a probabilistic seismic hazard analysis (PSHA) using EZ-Frisk for the background seismicity. The Round 3 interrogatory comments were received from the State of Utah on January 30, 2012 (a copy is included in Appendix A). The interrogatory comments that are specifically addressed within this letter are presented in interrogatory CAW R313-25-8(4)-16/3.

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The professional opinions presented in this letter have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this letter.

***Interrogatory CAW R313-25-8(4)-16/3 - Review Comments (abbrv., full text in Appendix A)***

**Seismic Hazard Analysis**

- Verify/update PGA's for deterministic fault sources identified in Table 1 of the October 25th letter using a Deterministic Seismic Hazard Analysis (DSHA) with full weight of the Next Generation Attenuation (NGA) relationships.
- Perform a site-specific PSHA to assess PGA associated with background seismicity. Prepare the PSHA with removing foreshocks and aftershocks from the historical earthquake record.
- The design PGA is to be selected as the maximum PGA from consideration of the 84th percentile estimates from deterministic sources and the mean value for probabilistic PGA from background seismicity.

**Soil Liquefaction/Cyclic Softening**

- Demonstrate that the potential effects of soil liquefaction and/or cyclic softening phenomena in native soils at the Clive Facility have been adequately accounted in the geotechnical analysis supporting the design of the proposed CAW Embankment.
- Clearly justify the selection of soil parameters and design assumptions

**Response to Interrogatory *CAW R313-25-8(4)-16/3* – Seismic Hazard Evaluation**

In this response, AMEC presents an updated assessment of the seismic hazard for the site consistent with the requirements of the Utah Code of Regulations R313-25-8(5) and the information requested in Interrogatory Round 3. The seismic hazard assessment is based on an assessment of the peak ground acceleration (PGA) associated with the Maximum Credible Earthquake (MCE) for known active or potentially active faults in the site region, and the PGA obtained from a probabilistic seismic hazard analysis (PSHA) to assess the seismic hazard for earthquakes that may occur on unknown faults in the area surrounding the project site (i.e., background seismicity). For fault sources, the PGA is calculated at the 84th percentile level and is based on the maximum rupture length and rupture area for each fault. The return period for ground motions resulting from a background earthquake is identified as 5000 years (equal to a one percent probability of exceedance in 50 years). The approach to select a MCE PGA from the larger of the values associated with the deterministic MCE for faults or the PSHA result for background earthquakes at a 5000 year return period is consistent with the discussions among AMEC, ES, Utah DEQ and their peer reviewer, URS Corporation, and is consistent with the recommendations of the Utah Seismic Safety Commission (2003) and as required by the Utah Division of Water Rights (Dam Safety Section) for assessment of dams.

The deterministic assessment follows the approach described in our October 25, 2011 letter, and is updated in the following paragraphs. Potential fault sources are shown on Figure B-1.1 and are listed in Table B-1.1 of Appendix B, including an assessment of the fault parameters, source to site distance, and PGA. Specific fault parameters and other information in Table B-1.1 include fault name, slip type, maximum magnitude, location of site on hanging wall or footwall, fault dip, rake, maximum rupture length (fault length), downdip rupture width, distance measures required for ground motion attenuation relationships, and PGA for median and 84$^{th}$ percentile levels. We use a suite of four Next Generation Attenuation (NGA) relationships, namely those of Abrahamson and Silva (2008), Boore and Atkinson (2008), Campbell and Bozorgnia (2008), and Chiou and Youngs (2008), all of which are applicable for the site conditions and types of sources in Utah and the Intermountain Region. Additional parameters for attenuation relationships include site shear wave velocity, $V_{S30}$, taken as 305 m/s as described in the October 25 Letter, and depth to top of bedrock ($Z_{1.0}$ and $Z_{2.5}$), taken as default values calculated from the site $V_{S30}$ as recommended by the authors of the NGA relationships (also as described in the October 25 Letter).

The maximum magnitude for each fault is based on rupture of the full length of the fault, and where available is taken as the maximum value published by the Utah Working Group on Earthquake Probabilities (WGUEP, 2011), except for the Stansbury fault as noted below. For faults not assessed in the previous studies, including the Skull Valley fault, the maximum magnitude was assessed using the same methodology as the WGUEP study, based on maximum rupture length, rupture width, and the empirical relationships of Wells and Coppersmith (1994). For short faults where the calculated maximum magnitude is less than $M_W$ 6.5, a maximum magnitude of 6.5 is adopted because this is judged to be a reasonable minimum value of magnitude for earthquakes that rupture to the ground surface.

For the Stansbury fault, the maximum magnitude is assessed as $M_W$ 7.3 based on consideration of the maximum rupture length, fault width, and maximum fault displacement identified in previous investigations (Geomatrix Consultants, 1999; WGUEP, 2011). The value of $M_W$ 7.5 listed in the October 25 Letter and by the WGUEP is judged to be too conservative because it is higher than the maximum value obtained from empirical relationships, considering all combinations of rupture length, rupture width, and maximum fault displacement cited in those previous investigations. We note that it may be reasonable to consider an extreme value with a very low weighting (e.g., less than 10 percent) in a probabilistic analysis, but that it is not reasonable practice to adopt an extreme value for the MCE for a deterministic analysis.

The maximum of the 84$^{th}$ percentile PGA values calculated for the $M_{max}$ events on the fault sources is equal to 0.24 g, as obtained for the Stansbury and the Skull Valley faults (Table B-1.1).

For the PSHA, we used the current version (Ver. 7.62) of commercial program EZ-FRISK to calculate the PGA for the background earthquake. The program developer, Risk Engineering, has prepared input fault and background seismicity files for Utah for use in calculating seismic hazard; these files are based on the same fault source parameters and independent seismicity catalog used by the U.S. Geological Survey (USGS) to prepare the 2008 National Seismic Hazard Maps.

The seismicity catalog is an independent (de-clustered) catalog based on moment magnitude ($M_W$) that covers the Western United States; the seismicity in the vicinity of the project site is shown on Figure B-1.1. The recurrence rates for the background seismicity are based on the same recurrence models and maximum magnitudes used by USGS, which is a spatially smoothed gridded approach, with a maximum magnitude of 7.0 for Utah (Peterson et al., 2008). As for the deterministic analysis, we use the same suite of four NGA relationships and the site $V_{S30}$ of 305 m/s. The PGA is taken as the weighted average of the mean values for the four NGA relationships at a return period of 5000 years (equal to 0.24 g, Table B-1.1).

The largest PGA from the deterministic assessment of fault-specific sources and the probabilistic assessment of the background earthquake is 0.24 g. The maximum magnitude varies from 7.0 to 7.3 for the sources that result in the maximum PGA; we identify the largest value, $M_W$ 7.3, as appropriate for use in the seismic stability analyses for this project.

**Response to Interrogatory CAW R313-25-8(4)-16/3 – Soil Liquefaction/Cyclic Softening**

The following section of this letter presents responses to the comments received from the State of Utah in regards to soil liquefaction/cyclic softening. Specifically, this section addresses several review comments regarding the presentation and methodologies used in our previous liquefaction hazard analyses, including the consideration of the differences between liquefaction of “sand-like” soil and cyclic-softening of “clay-like” soil. Our responses have incorporated the results of the seismic hazard evaluation presented above. These sections describe the procedures used to perform these evaluations and the means for selecting soil parameters and design assumption.

The subsurface soil profile below the CAW Embankment has been described previously in detail in Table 2.2 of AMEC (2005) and subsequently restated in Table 2.1 of AMEC (2011a). The soil liquefaction/cyclic softening evaluations for this response utilized data from six cone-penetrometer soundings (CPT’s) that were obtained in 1999 and 2004. They are individually identified as CPT99-01, CPT99-02, CPT99-03, CPT04-04, CPT04-05, and CPT04-06. Previous Borings B-1 and B-2 from AMEC 2005a were extended to depths of 94.5 and 100 feet, respectively. Relatively undisturbed samples were obtained from these exploratory excavations using a Dames & Moore type tube sampler. Standard Penetration tests (SPT’s) were not performed at these borings. The design depth for groundwater at the site is at a depth of not less than 22 to 25 feet. For analysis purposes the groundwater is placed at 22 feet below the ground surface.

Similarly to past conclusions the potential for liquefaction of sand-like soil has been determined to be low and the potential for seismic settlement to be on the order of one to two inches. The potential for cyclic-softening was also found to be low.

**<u>Soil Liquefaction Evaluation “Sand-like” Soil</u>**

Liquefaction is a soil behavior phenomenon in which saturated, medium dense to loose, sand-type soils experience losses of shear strength and stiffness associated with accumulation of excess pore-pressures that develops during seismic shaking. Liquefaction potential was evaluated using

the analysis methodology described in Youd, et al. (2001). More recent publications on liquefaction analyses such as Seed, et al. (2003) and Boulanger and Idriss (2008) were not used in our anlayses because there is not yet consensus among geotechnical/earthquake practitioners regarding the reliability of these methods. In addition to a lack of consensus, Boulanger and Idriss (2008) which is gaining support among practitioners in California, is considered by many to be unconservative for critical facilties. As such, a more widely accepted and conservative method was used to assess liquefaction potential at the site. As described in the previous section the site-specific ground shaking is based on a design PGA of 0.24 g and a Magnitude of 7.3. We use a PGA of 0.28 g and magnitude of 7.3 for our analyses; the larger PGA value was selected in 2005 and has served as the basis for design since that time. Based upon averaged laboratory densities from borings B-1 and B-2, wet and dry densities were calculated to be approximately 121 pcf and 97 pcf, respectively.

Figures illustrating the comparison of penetration resistances versus depth or elevation measured in the six CPTs to the critical penetration resistances for design ground motion hazard levels have been used to depict zones within the subsurface profile that are potentially liquefiable soils. The figures help understand where liquefaction hazards may exist and how severe they may be. The plots of factor of safety against liquefaction are shown on Figures C-1.1 through C-1.6

The liquefaction potential was considered for each of the four geologic units listed in Table 2.1 of AMEC (2011a). Unit 4 and the majority of Unit 3 is in an unsaturated state and can be considered non-liquefiable due to lack of saturation because the water table depth is 22 feet below site grade. The remainder of Unit 3 from 22 to 28 feet below grade is typically too dense to liquefy based on data from five CPTs. Values of $q_{c1n(cs)}$ for 5 of the 6 CPTs in Unit 3 ranged from 105 to 546 with an average of 278. Corrected tip resistance exceeding 160 is considered non-liquefiable based on graphs of Cyclic Resistance Ratio (CRR) versus Corrected CPT Tip Resistance in Robertson and Wride (1998). Also, the factor of safety for Unit 3 was calculated to be above 1 in all CPTs except CPT04-05. In CPT04-05, however, a liquefiable layer from 25.3 to 26.9 feet was encountered. This layer had an average corrected tip resistance of 65 and a corresponding average factor of safety of 0.61.

Unit 2 is primarily clay-like in nature consisting of clay and silt with seams of sand. Sand seams are generally less than 1 foot, but range up to 3 feet. These sand layers are generally dense and have corrected CPT tip resistances greater than 160 with corresponding factors of safety greater than 1. Liquefaction analyses of CPT data within Unit 2 indicate cummulative liquefiable thickness for the individual CPT locations ranging from 2 to 14 inches with no individual liquefiable layer exceeding 6 inches. Several of the individual layers are confined by soft clays. Soft clays below the sand layers may be reducing CPT tip resistances, even after the thin layer correction is applied. Based upon low liquefaction potential due to thin liquefiable layers and the predominantly clay-like soils within this unit, a cyclic shear softening analysis is applied to Unit 2, in lieu of a liquefaction analysis appropirate for sand-like soils.

Unit 1 is characterized as interbedded sand, silt and clay. Generally, soil intervals demonstrating sand-like behavior within this unit are dense with a range of data that has an average corrected tip resistance of 197 and a median corrected tip resistance of 186.4. The data indicates that approximately 98 percent of soils in this unit exibiting sand-like characteristics have a factor of safety greater than 1. Liquefaction analyses using Youd et al. (2001) indicate that CPT's 99-02, 04-04, and 04-05 have no liquefiable materials in Unit 1. CPT99-03 has two 2-inch-thick liquefiable layers and one 4-inch-thick layer at 80.1, 93.5 and 100.1 feet below site grade. CPT99-01 has one 4-inch layer at 101.4 feet below grade, whereas CPT04-06 has one 2-inch layer at 79.1 feet below grade, and one 10-inch layer of liquefiable material at 79.7 feet below grade. Boring B-2 located adjacent to CPT04-05 indicated samples collected below 85 feet were either unsaturated, had estimated $N_{1(60)}$ blow counts above 30, or were cohesive. These soils were classified as not susceptible to liquefaction-type behavior. Penetration tests at 90 feet had corrected blow counts consistent with liquefiable materials. The sample at 90 feet consisted of medium dense silty sand. CPT04-05, however, indicated soils at this elevation behaved as a sand, but were too dense to liquefy. At 98 feet, sample recovery indicated the soil was a hard silty clay with sand and gravel.

**Volumetric Strain in "Sand-like" Soil**

Resulting liquefiable layers in Units 3 and 1 were then analyzed for post-liquefaction volumetric strain using Ishihara and Yoshimine (1992). The resulting estimated settlements due to post-liquefaction volumetric strain are in the range of 0 to ¾ inch.

By another method, CPT tip resistances were converted to equivalent $N_{60}$ values using a relationship developed by Jefferies and Davies (1993). The resulting $N_{60}$ values were corrected for overburden pressure and then used to develop post-liquefaction volumetric strain based on relationships by Tokimatsu and Seed (1987). The resulting post-liquefaction volumetric strain estimates are also in the range of 0 to ¾ inch for Units 3 and 1. A summary of resulting settlements at various CPTs are presented below.

| **Liquefaction Settlement Ishihara and Yoshimine (1992)** | | | | | | |
|---|---|---|---|---|---|---|
| Geologic Units | CPT99-01 | CPT99-02 | CPT99-03 | CPT04-04 | CPT04-05 | CPT04-06 |
| 3 | 0 | 0 | 0 | 0 | 0.68 | 0 |
| 1 | 0.2 | 0 | 0.23 | 0 | 0 | 0.32 |
| **Liquefaction Settlement Tokimatsu and Seed (1987)** | | | | | | |
| Geologic Units | CPT99-01 | CPT99-02 | CPT99-03 | CPT04-04 | CPT04-05 | CPT04-06 |
| 3 | 0.05 | 0.17 | 0 | 0.08 | 0.65 | 0 |
| 1 | 0.18 | 0.03 | 0.37 | 0 | 0.01 | 0.47 |

**Lateral Spread Evaluation**

Earthquake induced lateral spreads occur on sloping ground or at sites with free-face conditions such a ditch or river bank. The Clive Facility is located on the ancient Bonneville lakebed, which is likely too flat to generate lateral spread. Additionally, the site of the waste embankment is not adjacent to known free face conditions that might contribute to lateral movement during a liquefaction event. The topographic site characteristics are not consistent with known lateral spread events.

The density profile of sand-like soils is laterally and vertically variable, but is generally dense. Thin liquefiable layers are encountered in the soil profile, but they tend to be discontinuous and are generally not encountered in adjacent CPTs or borings. The lack of a continuous liquefiable layer beneath the site reduces the likelihood of lateral spread due to the resistance of non-liquefiable material between discontinuous layers, Youd et al. (2009).

Due to site topography, thin discontinuous liquefiable layers, and a generally dense profile with significant density variability across short distances and at variable depths, it is our opinion that the likelihood of liquefaction-induced lateral spread occuring at the site is very low.

**Cyclic Softening of "Clay-like" Soil**

In addition to the liquefaction evaluation of the "sand-like" soils as presented in the previous section of this report, we have evaluated the potential for cyclic softening in "clay-like" soils underlying the site. The potential for cyclic softening was evaluated using the procedures published by Boulanger and Idriss (2004) and Boulanger and Idriss (2007).

Based on the results of the explorations at the site and knowledge of the site geology, an idealized geologic cross-section was developed indicating the different geologic units and their predominant soil type using the Unified Soil Classification Systems (USCS). The geologic cross-sections were presented in Figures 5A and 5B of AMEC (2011a). The cross-sections show that geologic Units 2 and 4 consist of predominately clayey soils; geologic Unit 3 consists of sandy soils and Unit 1 consists of interbedded sand, silt and clay layers.

The results of over 30 Atterberg limits tests conducted on samples in Units 2 and 4 indicate that the plasticity index of these soils vary from 7 to 20 percent. Based on these results, the soils are considered to exhibit "clay-like" behavior and are not anticipated to be susceptible to liquefaction. Therefore, an evaluation of cyclic softening was performed in Units 2 and 4, which could be subject to cyclic softening and associated loss of shear strength and vertical strains during ground shaking.

To conduct an evaluation of cyclic softening, undrained shear strength ($S_u$) and overconsolidation ratio (OCR) or preconsolidation stress ($\sigma_p$') are required. The undrained shear strength can be obtained from field vane shear tests or using empirical correlation of cone penetration test (CPT) tip resistance with $s_u$ or using the SHANSEP approach (Ladd and Foott, 1974). Vane shear testing was not performed as part of the geotechnical investigations performed at the site. Therefore,

SHANSEP model along with consolidation test results for OCR were used for evaluation of cyclic softening. In addition, the potential for cyclic softening was checked using the CPT data. Both of these evaluation procedures are described in the following sections.

**(1) <u>SHANSEP Model</u>**
$S_u / \sigma_p' = m\,[OCR]^n$, where m = 0.26 and n = 0.79 (based on lab testing of Lake Bonneville clays conducted for I-15 improvements project)

**(2) <u>CPT Correlation with $S_u$</u>**
$S_u = (Q_t - \sigma_v) / N_k$, where $Q_t$ = cone tip resistance, $\sigma_v$ = total stress and $N_k$ = varies from 10 to 20 (average of 15)

For the SHANSEP model, the $\sigma_p$' and OCR were estimated from laboratory consolidation tests on high quality samples of the clayey soils. An OCR of 5.3 for Unit 4 and 1.2 for Unit 2 were used in the evaluation as they were previously used for other settlement calculations as reported in AMEC (2011a). Using these parameters, the undrained shear strength was estimated in Units 2 and 4 for every 2-foot depth increment. It is noted that the $S_u$ estimated thus far is based on site conditions that existed at the time of sampling. Since embankments with average height of about 60 feet will be constructed, it is expected that the underlying soils (including Units 2 and 4) will be subject to additional stresses from embankment loading and will undergo settlement over a period of time. As the consolidation of the clay units continue over a period of time, the effective stresses within these units come into equilibrium with the applied embankment stresses. We anticipate that the stress equilibrium will occur after a period of about 2 years or so (assuming 90% consolidation of Units 2 and 4). The OCR at the end of this period is anticipated to be around 1.0. The post-construction $S_u$ is then estimated using the OCR, appropriate stresses under embankment loading and SHANSEP model. If desired, additional borings may be performed at the end of 2 year period to evaluate the OCR of the soils.

Another important parameter that governs the factor of safety against cyclic softening is the presence of static shear stresses ($\tau_s$) within the units such as under the embankment loading at the site. The pre-existence of static shear stresses usually tends to reduce the cyclic resistance of the clays. The average static shear stresses normalized to the undrained shear strength ($\tau_s/S_u$) can be obtained from the static slope stability analysis using the undrained shear strength properties of the soils. Based on such analysis, a static factor of safety of 2.64 for a failure surface through Unit 2 and a static factor of safety of 4.19 for a failure surface through Unit 4 were computed. The results of these slope stability analyses are included in Appendix C as Figures C-1.7 and C-1.8.

For evaluating the seismic factor of safety against cyclic softening, the cyclic stress ratio (CSR), cyclic resistance (CRR), magnitude scaling factor (MSF) and stress reduction factor ($r_d$) were computed using equations published in Boulanger and Idriss (2004) and Boulanger and Idriss (2007). The results of the evaluation of cyclic softening using the SHANSEP model are presented in Tables C-1.1 and C-1.2, which are included in Appendix C. The results in Table C-1.1 are based on a design earthquake magnitude of 7.3 and PGA of 0.24 g and those in Table C-1.2 are

based on the same design earthquake magnitude and a slightly higher PGA of 0.28 g which was used in all prior seismic calculations.

Based on the results presented in Table C-1.1 which were computed for the design earthquake event ($M_w$ = 7.3 and PGA = 0.24 g), the factors of safety against cyclic softening within Units 2 and 4 are greater than 1.0 and therefore cyclic softening of the clay-like soils at the site is considered to be negligible. However, using a PGA of 0.28 g, the factor of safety within Unit 2 is greater than 1.0, but the factor of safety within shallower Unit 4 is slightly lower than 1.0 (about 0.92). Since Unit 4 is above current and design groundwater level and the assumed post-construction OCR of 1.0 is probably conservative for this shallower unit, it is our opinion that the potential for cyclic softening within Unit 4 is overestimated and evaluation based on a higher PGA of 0.28 g adds unnecessary conservatism.

Cyclic softening was also evaluated using the data from six CPTs performed at the site. Undrained shear strength ($S_u$) was computed using the CPT tip resistance and the equations presented on the previous page with an $N_k$ of 15. Accounting for the interlayered nature of the clay and silt sequences within Units 2 and 4, the average tip resistance and the computed $S_u$ within each Unit are presented in the table below.

| CPT No. | Tip Resistance, $Q_c$ (ksf) | Average Undrained shear strength, $S_u$ (psf) |
|---|---|---|
| CPT99-01 | 60 – 70 | 3,630 – 4,545 |
| CPT99-02 | 30 – 50 | 1,995 – 2,910 |
| CPT99-03 | 38 – 50 | 2,500 – 3,160 |
| CPT04-04 | 28 – 55 | 1,840 – 3,330 |
| CPT04-05 | 33 – 80 | 2,165 – 4,960 |
| CPT04-06 | 30 – 60 | 1,950 – 3,700 |

Comparing the estimated $S_u$ values based on the CPT data with those computed from SHANSEP model and laboratory consolidation testing, it is evident that the $S_u$ computed using the CPT data are much greater and would only result in a higher factor of safety than those evaluated using the SHANSEP model.

It is also noted that the $S_u$ values presented in the above table are representative of strengths at the time of investigation. As the soils consolidate under embankment loading over the period of time, the tip resistance as well as the shear strength of the underlying soils will improve with time. Therefore, the actual shear strength of the soils at the end of consolidation period (assumed to be

about 2 years) will be higher than those presented in the table resulting in a much higher factor of safety against cyclic softening.

**Discussion and Conclusions**

Based on the deterministic seismic hazard assessment (DSHA) results presented in our October 25, 2011, report, and described above in the Seismic Hazard Evaluation section, the maximum 84$^{th}$-percentile PGA from fault-specific earthquake sources is computed to be 0.24 g for a maximum magnitude earthquake occurring on the Stansbury fault (M 7.3) or the Skull Valley fault (M 7.1). Our probabilistic analysis of the background seismicity shows the mean PGA for a return period of 5000 years is 0.24 g for non-fault-specific earthquakes up to M 7. Therefore, the largest PGA computed for the Energy*Solutions* site is 0.24 g based on deterministic procedures and using NGA models for fault-specific sources and on probabilistic procedures for the background earthquake with a recurrence interval of 5,000 years.

Liquefaction and cyclic softening evaluations, as well as previous embankment stability calculations, were based on a PGA of 0.28 g, which is higher than the updated maximum 84th percentile PGA calculated with deterministic procedures in the present study; it is also higher than the median PGA value for background earthquakes with 5000-year recurrence intervals calculated with PSHA procedures. Therefore, we are of the opinion that the results of seismic stability calculations of the embankments at the Energy*Solutions* site presented in our report dated February 15, 2011 (AMEC 2011a) remain appropriate and applicable because the updated PGA for the site does not exceed the PGA previously used.

It has been a pleasure to be of professional service to you. Please contact us with questions or if we can be of further assistance.

Sincerely,

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**Attachments:**

Appendix A – Round 3 Interrogatory CAW R313-25-8(4)-16/3, URS, 1/30/2012
Appendix B -- Figures and Tables for Seismic Hazard Evaluation
Appendix C -- Figures and Tables for Soil Liquefaction and Cyclic Softening Evaluation

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**Appendix A**

**Round 3 Interrogatory CAW R313-25-8(4)-16/3**
**URS, 1/30/2012**

***The URS reference document has been modified so that only the text for Interrogatory CAW R313-25-8(4)-16/3 is presented.***

# UTAH DIVISION OF RADIATION CONTROL: ENERGY*SOLUTIONS'* CLIVE LLRW DISPOSAL FACILITY;

# LICENSE AMENDMENT REQUEST; CLASS A WEST EMBANKMENT

# ROUND 3 Interrogatories

***This reference document has been modified so that only the following Interrogatory CAW R313-25-8(4)-16/3 is presented.***

**4. SEISMIC**

**INTERROGATORY CAW R313-25-8(4)-16/3: SEISMIC HAZARD EVALUATION / SEISMIC STABILITY ANALYSIS UPDATE**

**PRELIMINARY FINDING:**

*Refer to R313-25-8(5). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.*

**INTERROGATORY STATEMENT:**

*SEISMIC HAZARD ANALYSIS*

*The responses to Interrogatory CAW R313-25-8(4)-16/2A are inadequate and do not address the requests stated in the interrogatory. The Round 2 interrogatory is, therefore, restated and extended below:*

1. *Perform and submit results of a probabilistic seismic hazard analysis (PSHA). Utilize a corrected version of EZ-FRISK or other accepted software for conducting PSHAs. Prepare the PSHA without using the Pankow and Pechmann (2004) ground motion model and giving full weight to the NGA models. Remove foreshocks and aftershocks from the earthquake history by de-clustering the earthquake catalog as done in standard probabilistic approaches*

*and as was done by Pechmann and Arabasz (1995). Use the resulting earthquake catalog in any ground motion calculations.*

2. *Correctly label the vertical axis in Figure 3 and correctly interpret the information presented in Figure 3 (cumulative frequency plot).*

*SOIL LIQUEFACTION/CYCLIC SOFTENING*

3. *The Applicant's response to Round 2 CAW interrogatories does not include a response to Interrogatory CAW R313-25-8(4)-16/2C. Please respond to Interrogatory CAW R313-25-8(4)-16/2C, repeated and extended below:*

   *Please demonstrate that the potential effects of soil liquefaction and/or cyclic softening phenomena in native soils at the Clive Facility have been adequately accounted for in the geotechnical analyses supporting the design of the proposed CAW Embankment. In doing so, clearly justify the selection of soil parameters and any design assumptions by comparison of such with correlations, field test results, and/or laboratory test results (including cyclic shear testing) consistent with the guidance given by developers of current, published analytical methods. Also, evaluate and document the effects on previous liquefaction and embankment stability assessments and cyclic softening resulting from changes to the seismic hazard analysis addressed in Items 1 and 2 of this interrogatory.*

**BASIS FOR INTERROGATORY:**

*SEISMIC HAZARD ANALYSIS:*

*As requested in Interrogatory CAW R313-25-8(4)-16/2A, the Licensee did not justify the use of the semi-probabilistic approach for addressing the hazard from background earthquakes. The semi-probabilistic approach is not "standard practice for earth embankments" as stated in the response. For example, Utah Dam Safety and the Utah Division of Water Resources use a 5000-year return period probabilistic hazard map for the State produced by the U.S. Geological Survey to address background earthquakes in Utah. Utah Dam Safety recognized the deficiencies in semi-probabilistic approaches and decided to take a probabilistic seismic hazard analysis (PSHA) approach to address background earthquake hazard, as do the majority of seismic hazard evaluation practitioners currently. The Licensee did not address the criticisms of Pechmann and Arabasz (1995) of the semi-probabilistic approach as described in the Basis for Interrogatory. Although the Licensee did perform a PSHA in lieu of the semi-probabilistic approach as requested in the Interrogatory, the following comments must be addressed to produce an acceptable PSHA.*

*It appears that the Licensee used the semi-probabilistic approach to address the hazard from background earthquakes because they did not have a PSHA code that they thought was suitable for use for the Clive site. The Licensee should not constrain their response by their earlier seismic hazard evaluation (October 25, 2011 letter) simply because they lack a suitable PSHA*

*code. Also the Licensee is using a version of the proprietary code EZ-FRISK that contains an error in the hanging wall term of the Abrahamson and Silva (2008) NGA ground motion prediction model. The Licensee states that they requested Risk Engineering in 2009, the developer of EZ-FRISK, to make the correction but that they are still waiting for a corrected version of EZ-FRISK. It is suggested that the Licensee switch to another available PSHA code. Alternatively, Bob Youngs of AMEC Geomatrix is a nationally recognized practitioner in PSHAs who has developed his own codes.*

*The reviewer is puzzled why the ground motion prediction model by Pankow and Pechmann (2004) was used in the response (Addendum) to Interrogatory 2 when it was not used in their 25 October 2011 analysis, which only used the NGA models. The use of this model by the Licensee in the deterministic hazard analysis and PSHA described in the Addendum is not state-of-the-practice. The USGS did not use the Pankow and Pechmann (2004) model in the National Seismic Hazard Maps because the NGA models were available. Both Drs. Pankow and Pechmann at the University of Utah support the use of the NGA models in lieu of their own model. The Licensee's assertion that the NGA models are based mainly on California data and data from compressional tectonic regimes is incorrect. The NGA models are appropriate for normal faulting regimes (such as Utah), as was recognized by the USGS in their development of the National Seismic Hazard Maps. The database of normal faulting strong motion data used in the NGA models is superior to the database used in the original Spudich et al. (1999) model and subsequently by Pankow and Pechmann (2004). Hence the calculations performed by the Licensee should be repeated without the use of the Pankow and Pechmann (2004) ground motion model and the full weight should be given to the NGA models.*

*The current state-of-practice in seismic hazard evaluations is to not consider the hazard from foreshocks or aftershocks. In the calculation of historical seismicity recurrence, dependent events such as foreshocks and aftershocks are removed from the historical catalog through the process of declustering. In particular, it is important to remove dependent events when calculating seismicity rates for input into probabilistic seismic hazard analysis (PSHA) because PSHA assumes that earthquakes follow a Poisson process; that is they are independent events. As stated by McGuire (2004), "foreshocks and aftershocks are by definition smaller than the mainshock and thus the associated motions will generally be smaller. As a result, the standard procedure in PSHA is to include only mainshocks in deriving magnitude distributions". We note the Licensee is not following standard practice by including dependent events in their semi-deterministic approach; however, we agree that their calculated recurrence is conservative. The use of the 84th percentile ground motions is an accepted approach to include conservatism in a deterministic hazard analysis. Hence it should be noted that the Licensee is including additional conservatism over and above the use of 84th percentile ground motions in their hazard analyses.*

*The continued use of the terms "recurrence interval" and "return period" by the Licensee as interchangeable is incorrect. The USGS website cited by the Licensee in their response is incorrect and the USGS has been notified and are in the process of correcting this error (Mark Petersen, USGS, written communication, 2012). As stated by Robin McGuire, the author of the*

*PSHA code EZ-FRISK used by the Licensee, in his book on "Seismic Hazard and Risk Analysis" the two terms are defined as follows:*

> *Return Period: the mean (average) time between occurrences of a seismic hazard, for example, a certain ground motion at a site, or a certain level of damage or loss.*
>
> *Recurrence Interval: the mean (average) time between occurrences of a given type of earthquake, for example, an earthquake of a specified magnitude, on a fault or in a region.*

*SOIL LIQUEFACTION/CYCLIC SOFTENING:*

*In recent years, the geotechnical engineering profession's understanding of, and analysis methods for, liquefaction-related phenomena have evolved. In the past, liquefaction was treated as a phenomenon largely associated with the seismic loading of loose, clean sands which could result in significant loss of strength and large deformations. However, the 1999 earthquakes in Kocaeli, Turkey and Chi-Chi, Taiwan both highlighted the potential for significant strength loss and deformation of finer-grained soils – soils previously considered "non-liquefiable." Subsequent research (e.g., Andrews and Martin, 2000; Seed et al., 2003; Boulanger and Idriss, 2004, 2005, and 2006; Bray and Sancio, 2006; and Youd et al., 2009) has generally led to a distinction between "sand-like" soils which undergo liquefaction and "clay-like" soils which undergo cyclic-softening. Both phenomena are generally associated with generation of high pore pressures and strains during shear; however, the distinction between liquefaction and cyclic softening is important in that the methods of analysis and assessment are different for the different types of soil. Also important is that the resulting behaviors can vary.*

*In previous reports as well as "Geotechnical Update Report" dated February 15, 2011 (Attachment 5 to EnergySolutions, 2011), the Licensee addressed liquefaction susceptibility using site specific data and analyses (see Section 4.5.2, page 19, of referenced document). However, rather than presenting quantitative factors of safety and/or cyclic resistance and cyclic stress ratios, the Licensee qualitatively summarized the results of the analyses thusly:*

> *"The 2005 study determined that for the design event, the majority of the soils in the upper 30 to 60 feet of the soil profile consist of cohesive deposits, which have a low probability of liquefaction due to their high clay content. It was also found that the interbedded cohesionless silt and silty sand deposits would also be unlikely to liquefy under the design seismic event."*

*A close reading of this statement reveals that the susceptibility of non-silty or "clean" sands (those which, if loose, are most prone to liquefaction) which may be at the site has not been addressed. Also, from the information provided, it is not clear how the finer-grained soils were treated in the analyses. Similarly, with respect to slope stability and other deformation-related assessments, it is unclear how the shear strengths of finer-grained soils subject to seismic loading conditions were assessed and quantified. Reported fines content, moisture content, and Atterberg limit data suggest that some of the loose/soft soils at the site are "marginal" soils which may or may not experience liquefaction and/or cyclic softening. Published guidance and criteria (e.g., Youd et al., 2001; Boulanger and Idriss, 2008, Bray and Sancio, 2008, Boulanger*

*and Idriss, 2011) currently referenced in the geotechnical engineering profession typically recommend that such soils be examined in greater detail and potentially be subjected to cyclic shear testing.*

*Stability and deformation calculations for existing embankments may be affected by the particular issues described in this interrogatory. Stability and deformations associated with the proposed CAW Embankment, particularly given the increase in embankment height and longer slopes of this embankment relative to other embankments at the Clive Facility, need to be assessed with consideration given to these issues.*

*Also, it should be noted that other current/recent interrogatories submitted for the proposed CAW Embankment License Amendment Request focus on further verifying the level of ground acceleration expected at the site. The effect of any revisions to such parameters on previous liquefaction and embankment stability assessments need to evaluated and documented.*

**REFERENCES**

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*Abrahamson, N.A. and Silva, W.J., 2008, Summary of the Abrahamson and Silva NGA ground motion relations: Earthquake Spectra, v. 24, p. 67-97.*

*McGuire, R.K., 2004, Seismic hazard and risk analysis: Earthquake Engineering Research Institute, MNO-10, 240 p.*

*Pankow, K.L. and Pechmann, J.C., 2004, The SEA99 ground-motion predictive relations for extensional tectonic regimes: Revisions and a new peak ground velocity relation: Bulletin of the Seismological Society of America, v. 94, p. 341-348.*

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*SOIL LIQUEFACTION/CYCLIC SOFTENING:*

*Andrews, D.C.A. and Martin, G.R. (2000).“Criteria for liquefaction of silty soils.” Proc. Twelfth World Conf. on Earthquake Eng., Auckland, New Zealand.*

*Boulanger, R.W. and Idriss, I.M. (2004). “Evaluating the potential for liquefaction or cyclic failure of silts and clays.” Rep.No.UCD/CGM-04/01, Center for Geotechnical Modeling, Dept. of Civil and Environmental Eng., Univ. of California, Davis ,CA, USA.*

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*Bray, J.D. and Sancio, R.B. (2008). Closure to "Assessment of the liquefaction susceptibility of fine grained soils." J. of Geotechnical and Geoenvironmental Eng., ASCE, Vol. 134, No. 7, pp. 1031-1034.*

*EnergySolutions (2011). License Amendment Request: Class A West Embankment, with Attachments 1 through 7 and cover letter to Mr. Rusty Lundberg at Utah Division of Radiation Control dated May 2, 2011.*

*Seed, R.B., Cetin, K.O., Moss, R.E.S., Kammerer, A.M., Wu, J., Pestana, J.M. Riemer, M.F., Sancio, R.B., Bray, J.D., Kayen, R.E., and Faris A. (2003). "Recent advances in soil liquefaction engineering: A unified and consistent framework." Keynote presentation, 26th Annual ASCE Los Angeles Geotechnical Spring Seminar, H.M.S. Queen Mary, Long Beach, CA, USA, Report EERC-2003–06, Earthquake Engineering Research Institute, Berkeley, CA, USA.*

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*Youd, T. L., Idriss, I. M., Andrus, R. D., Arango, I., Castro, G., Christian, J. T., Dobry, R., Finn, W. D. L., Harder, L. F., Jr., Hynes, M. E., Ishihara, K., Koester, J. P., Liao, S. S. C., Marcuson, W. F., III, Martin, G. R., Mitchell, J. K., Moriwaki, Y., Power, M. S., Robertson, P. K., Seed, R. B., and Stokoe, K. H., II. (2001). "Liquefaction resistance of soils: summary report from the 1996 NCEER and 1998 NCEER/NSF workshops on evaluation of liquefaction resistance of soils." J. of Geotechnical and Geoenvironmental Eng., ASCE, Vol. 127, No. 10, pp. 817-833.*

**Appendix B** – **Figures and Tables for Seismic Hazard Evaluation**

Figure B-1.1 – Quaternary Faults and Historical Seismicity near Energy*Solutions* Site

Table B-1.1 – Summary of Earthquake Source Parameters and DSHA and PSHA Results

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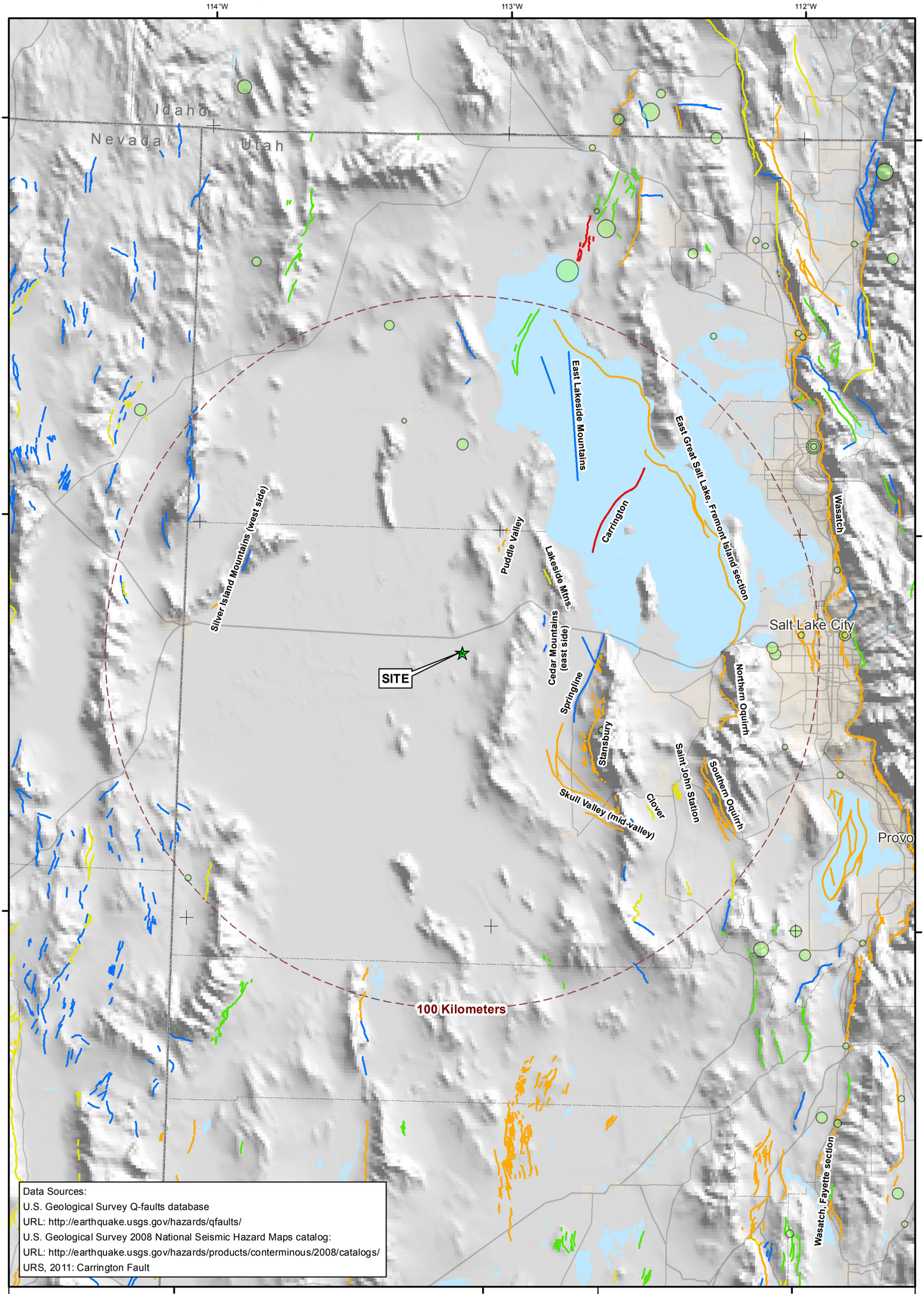



Explanation
Fault line color denotes age of most recent displacement

- Historic
- Holocene/Late Pleistocene
- Late Quaternary
- Mid Quaternary
- Quaternary

Independent Seismicity (1769-2006)
Magnitude (M)

- 4.0
- 5.0
- 6.0
- 7.0

0 10 20 Miles

N

QUATERNARY FAULTS AND HISTORICAL SEISMICITY NEAR ENERGY SOLUTIONS SITE
Clive, Tooele County, Utah

| By: _____ | Date: 04/04/2012 | Project No. 10-817-05290.2 |
|---|---|---|
| amec | | Figure B-1.1 |

**Table B-1.1 Summary of Earthquake Source Parameters and DSHA and PSHA Results**
**Response to Interrogatory: Seismic Hazard Evaluation**
**Energy*Solutions* Clive Facility**
**Clive, Utah**

| Fault Sources - DSHA | Fault Parameters | | | | | | | Distance (km) | | | PGA (g) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | $M_{max}$ | HW | Dip | Rake | Length | Width | $r_x$ | $r_{jb}$ | $r_{rup}$ | Median | 84th |
| East Cedar Mountains | NM | 6.6 | No | 55 | -90 | 10 | 18.3 | 23.0 | 23.0 | 23.0 | 0.12 | 0.21 |
| Puddle Valley | NM | 6.5 | Yes | 55 | -90 | 7 | 18.3 | 30.0 | 19.5 | 24.6 | 0.12 | 0.21 |
| Lakeside Mountain | NM | 6.5 | Yes | 55 | -90 | 4 | 18.3 | 31.0 | 20.5 | 25.4 | 0.12 | 0.20 |
| Skull Valley | NM | 7.1 | Yes | 55 | -90 | 32 | 18.3 | 34.5 | 24.0 | 28.3 | 0.14 | 0.24 |
| Springline | NM | 6.8 | Yes | 55 | -90 | 18 | 18.3 | 35.0 | 24.5 | 28.7 | 0.12 | 0.21 |
| Stansbury | NM | 7.3 | Yes | 55 | -90 | 69 | 18.3 | 37.0 | 26.5 | 30.4 | 0.16 | 0.24 |
| Carrington | NM | 7.1 | Yes | 55 | -90 | 30 | 18.3 | 47.0 | 36.5 | 39.5 | 0.10 | 0.17 |
| East Lakeside Mountain | NM | 6.9 | No | 55 | -90 | 36 | 18.3 | 57.0 | 57.0 | 57.0 | 0.06 | 0.11 |
| Silver Island Mountains | NM | 6.5 | No | 55 | -90 | 6 | 18.3 | 65.0 | 65.0 | 65.0 | 0.04 | 0.07 |
| Clover | NM | 6.5 | No | 55 | -90 | 4 | 18.3 | 68.0 | 68.0 | 68.0 | 0.04 | 0.07 |
| Saint John Station | NM | 6.5 | Yes | 55 | -90 | 5 | 18.3 | 70.0 | 59.5 | 61.4 | 0.05 | 0.08 |
| Oquirrh-East Great Salt Lake | NM | 7.5 | Yes | 55 | -90 | 61 | 18.3 | 75.0 | 64.5 | 66.2 | 0.08 | 0.14 |
| **Background Source - PSHA** | **Type** | **$M_{max}$** | | | | | | | | | **Median** | |
| Western U.S. Extensional Gridded Background, 5000 year return period | SS & NM | 7.0 | | | | | | | | | 0.24 | |

Notes:
1. Spectral accelerations are mean of four NGA relationships (Abrahamson and Silva (2008), Boore and Atkinson (2008), Campbell and Bozorgnia (2008) and Chiou and Youngs (2008)).
2. Site shear wave velocity ($V_{S30}$) is 305 m/s; default (calculated ) values of $Z_{1.0}$ and $Z_{2.5}$ are 417 m and 2.02 km, respectively.
3. Fault Type: NM – Normal, SS – Strike slip
4. $M_{max}$ - Maximum magnitude from Utah Working Group on Earthquake Probabilities or maximum magnitude based on empirical relationships of Wells and Coppersmith (1994). For short faults of less than 10 km length, including Puddle Valley, Lakeside Mountain, Silver Island Mountains, Clover, and Saint John Station, a minimum value of maximum magnitude is assessed as 6.5. See text for additional discussion.
5. Fault geometry is based on the geometry of the closest fault segment to the site, not the average geometry of the combined rupture segment.
6. HW: Hanging wall condition; Yes = On Hanging Wall, No = Not On Hanging Wall
7. TOR = Depth to top of rupture (0 for all faults); DTR = Depth to bottom of rupture (15 km for all faults); DWR = Down dip width of rupture (18.3 km for 55º dip for all faults).
8. $r_x$ = Horizontal distance from top of rupture measured perpendicular to fault strike; $r_{jb}$ = Boore-Joyner distance; $r_{rup}$ = Fault Rupture Distance

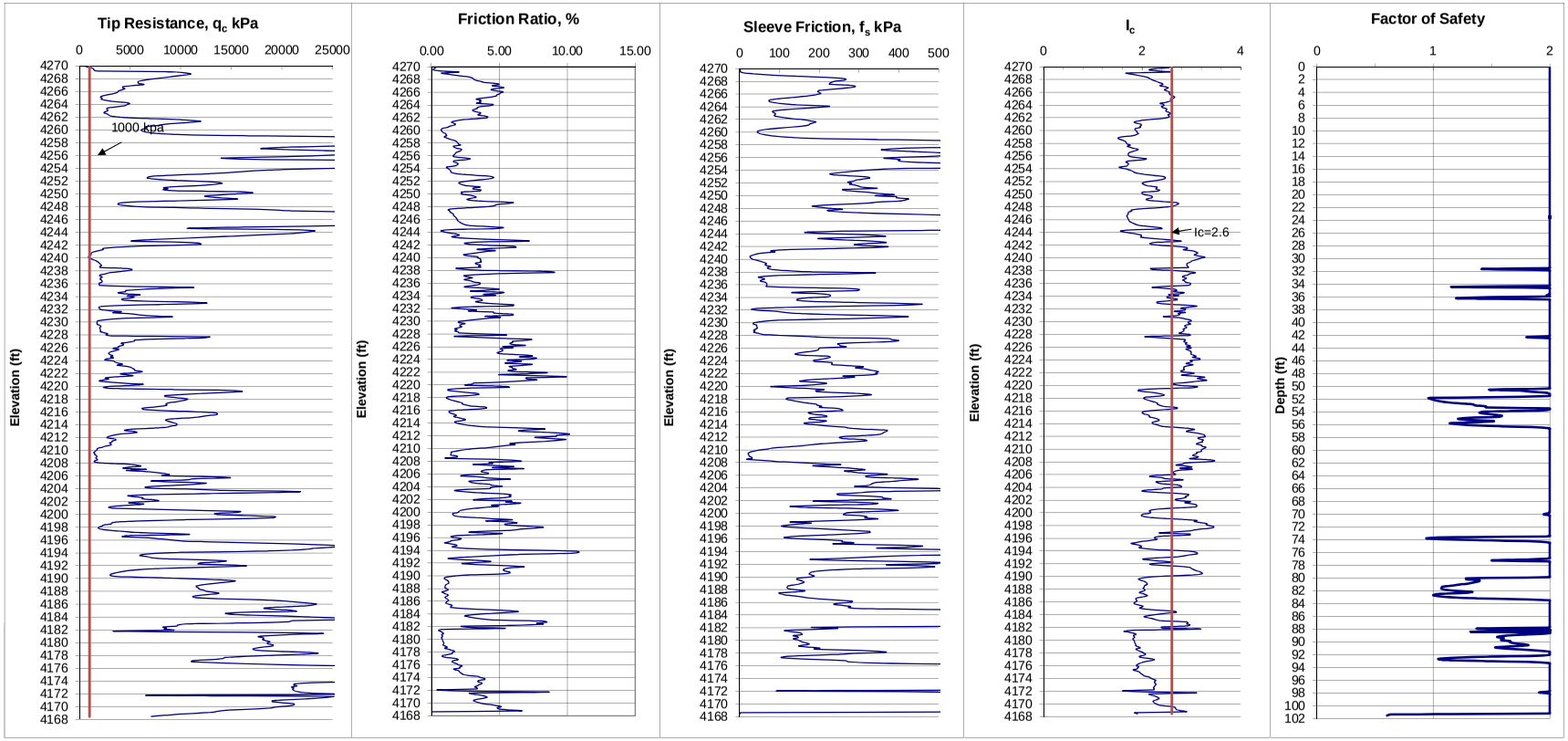
**Appendix C** – **Figures and Tables for Soil Liquefaction and Cyclic Softening Evaluation**

Figures C-1.1 through C-1.6 – Factor of Safety vs. Depth
Figures C-1.7 & C-1.8 – Slope Stability Calculations (static undrained strengths)

Table C-1.1 -- Cyclic Softening of "Clay-like" Soils using M = 7.3 and PGA = 0.24 g
Table C-1.2 -- Cyclic Softening of "Clay-like" Soils using M = 7.3 and PGA = 0.28 g

EnergySolutions -CAW Embankment
No.:10-817-05290
April 3, 2012

**Cone Log #99-01**

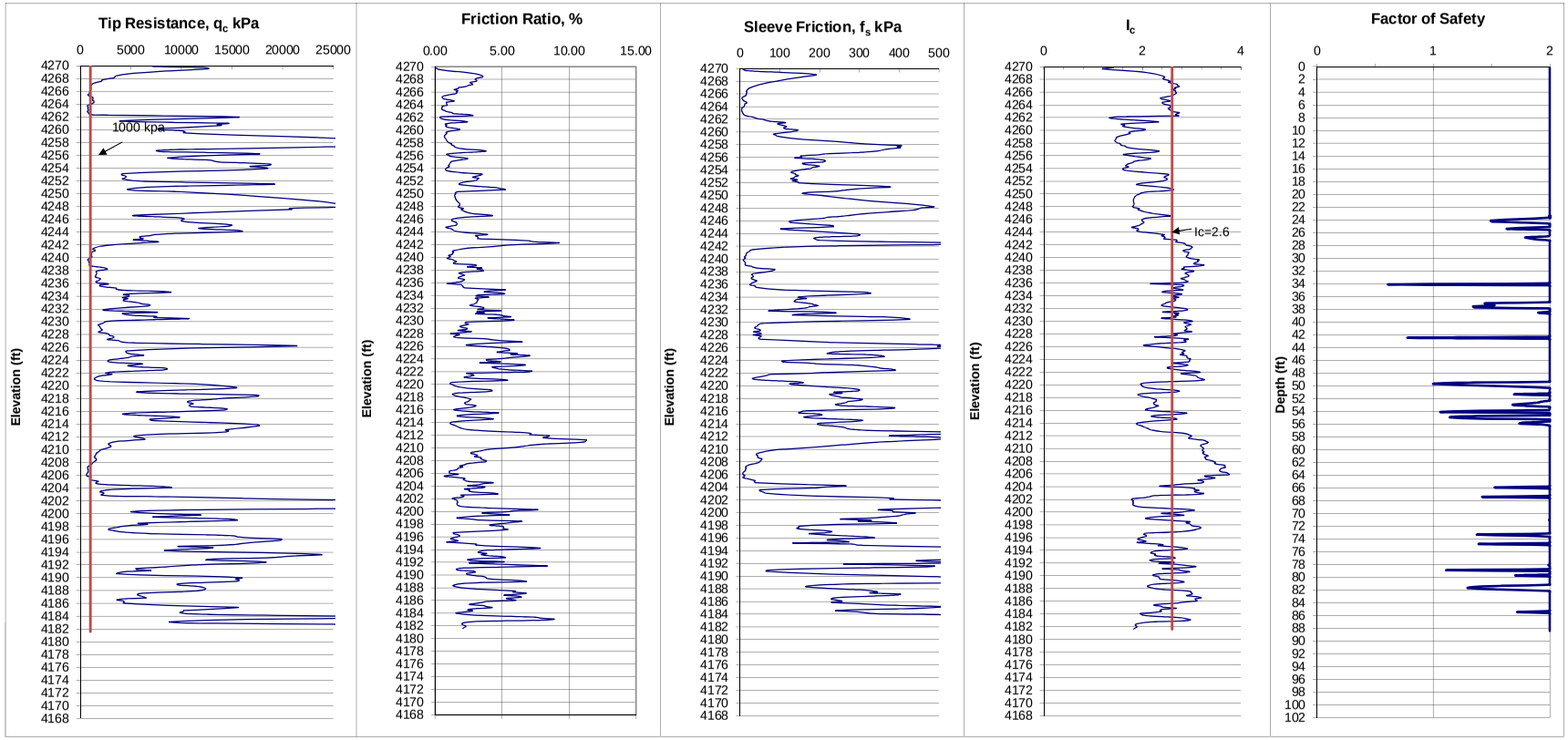



**Values used in Analysis: M=7.3, amax=0.28, Ground elev=4270, Water table elev=4248.00**

Figure C-1.1

EnergySolutions - CAW Embankment
Project No.: 10-817-05290
April 3, 2012

**Cone Log #99-02**

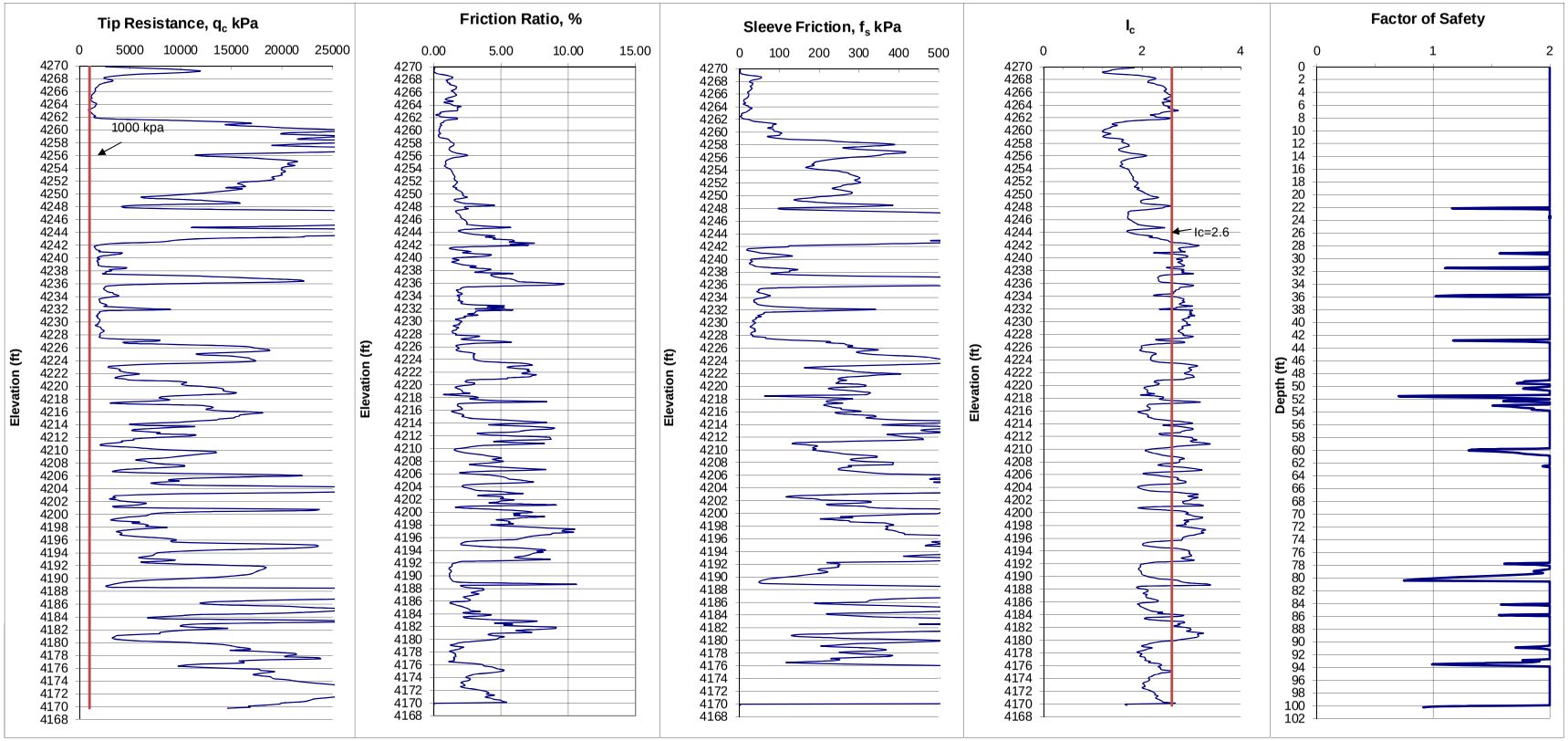



**Values used in Analysis: M=7.3, amax=0.28, Ground elev=4270, Water table elev=4248**

Figure C-1.2

Energy Solutions -CAW Embankment
Project No. 10-817-05290
April 3, 2012

**Cone Log #99-03**

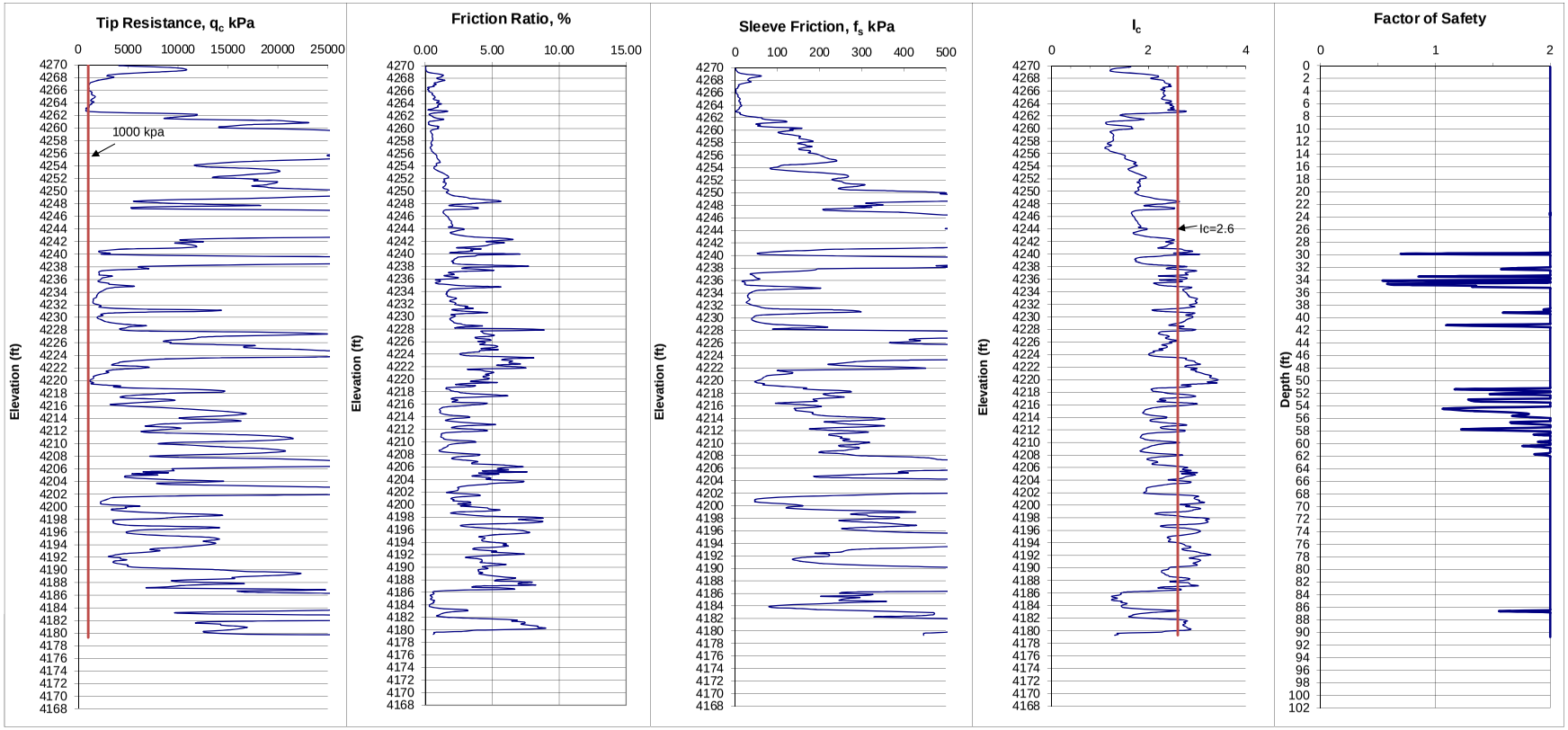



**Values used in Analysis: M=7.3, amax=0.28, Ground elev=4270, Water table elev=4248**

Figure C-1.3

Energy Solutions - CAW Embankment
Project No.: 10-817-05290
April 3, 2012

**Cone Log #04-04**

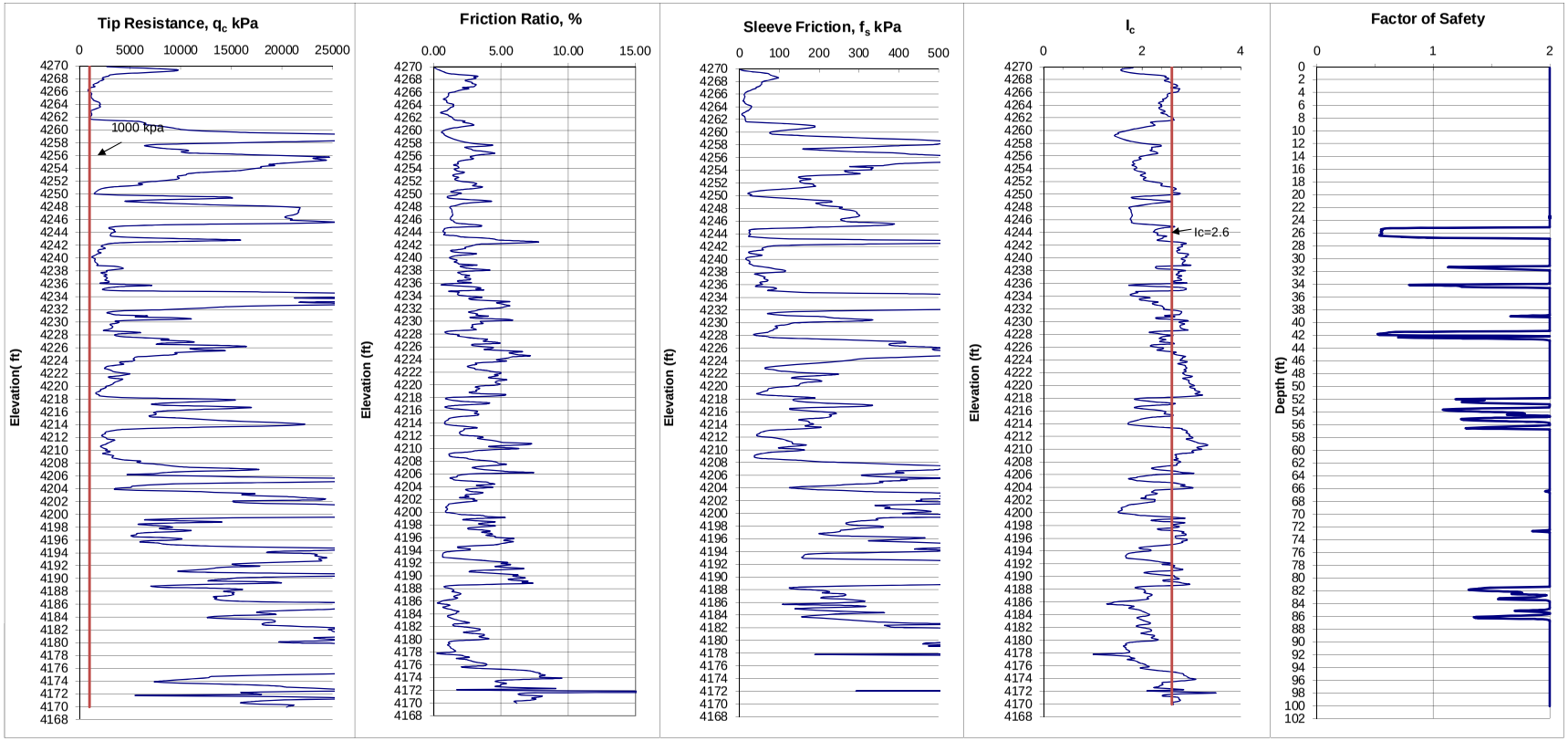



**Values used in Analysis: M=7.3, amax=0.28, Ground elev=4270, Water table elev=4248.00**

Figure C-1.4

EnergySolutions - CAW Embankment
Project No.: 10-817-05290
April 3, 2012

## Cone Log #04-05

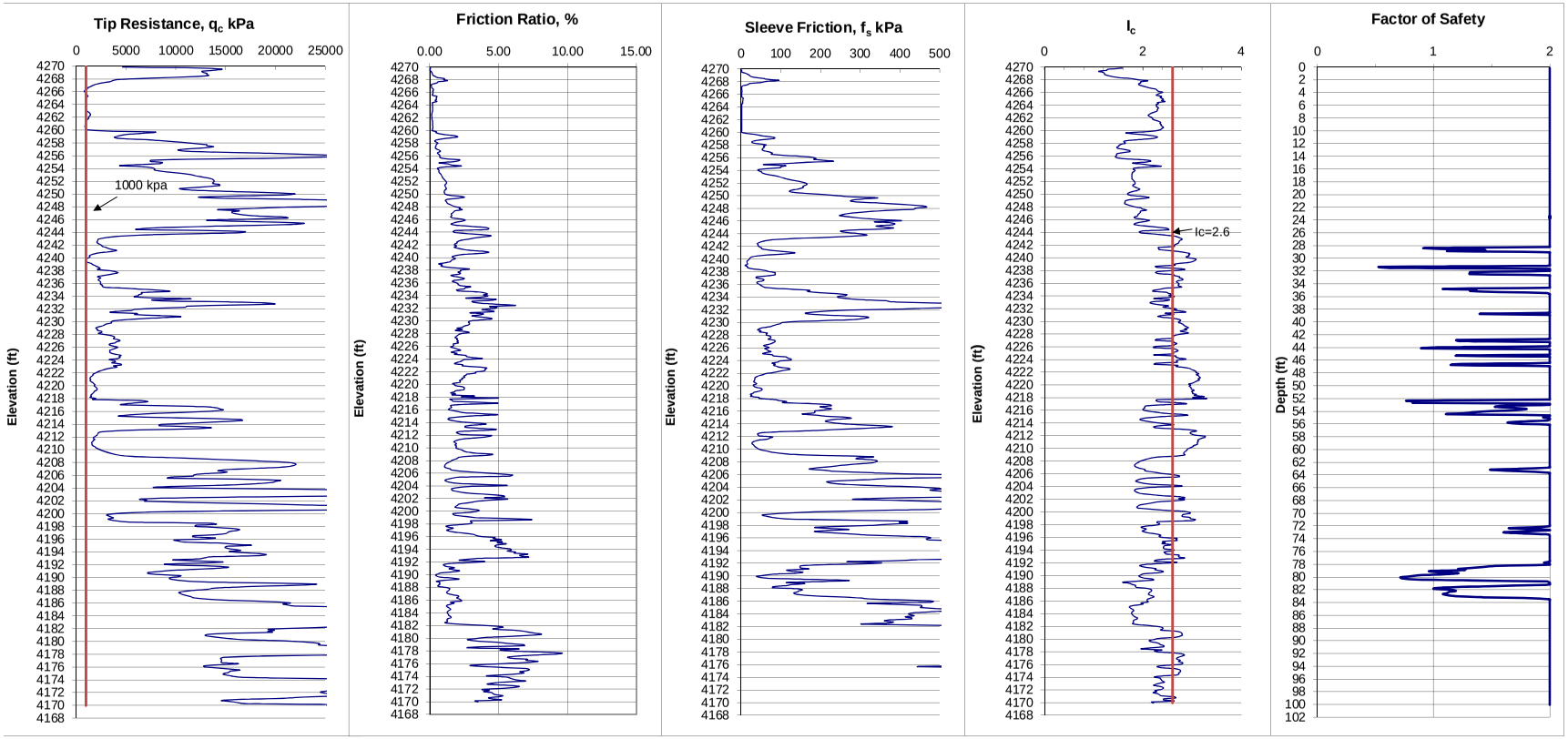



**Values used in Analysis: M=7.3, amax=0.28, Ground elev=4270, Water table elev=4248**

Figure C-1.5

Energy Solutions - CAW Embankment
Project No.:10-817-05290
April 3, 2012

## Cone Log #04-06




**Values used in Analysis: M=7.3, amax=0.28, Ground elev=4270, Water table elev=4248.00**

Figure C.1-6

# CAW Emb 38' 5(H):1(V) side-slopes, static - Su, Deep Surf 020212 CAWFU.DTA

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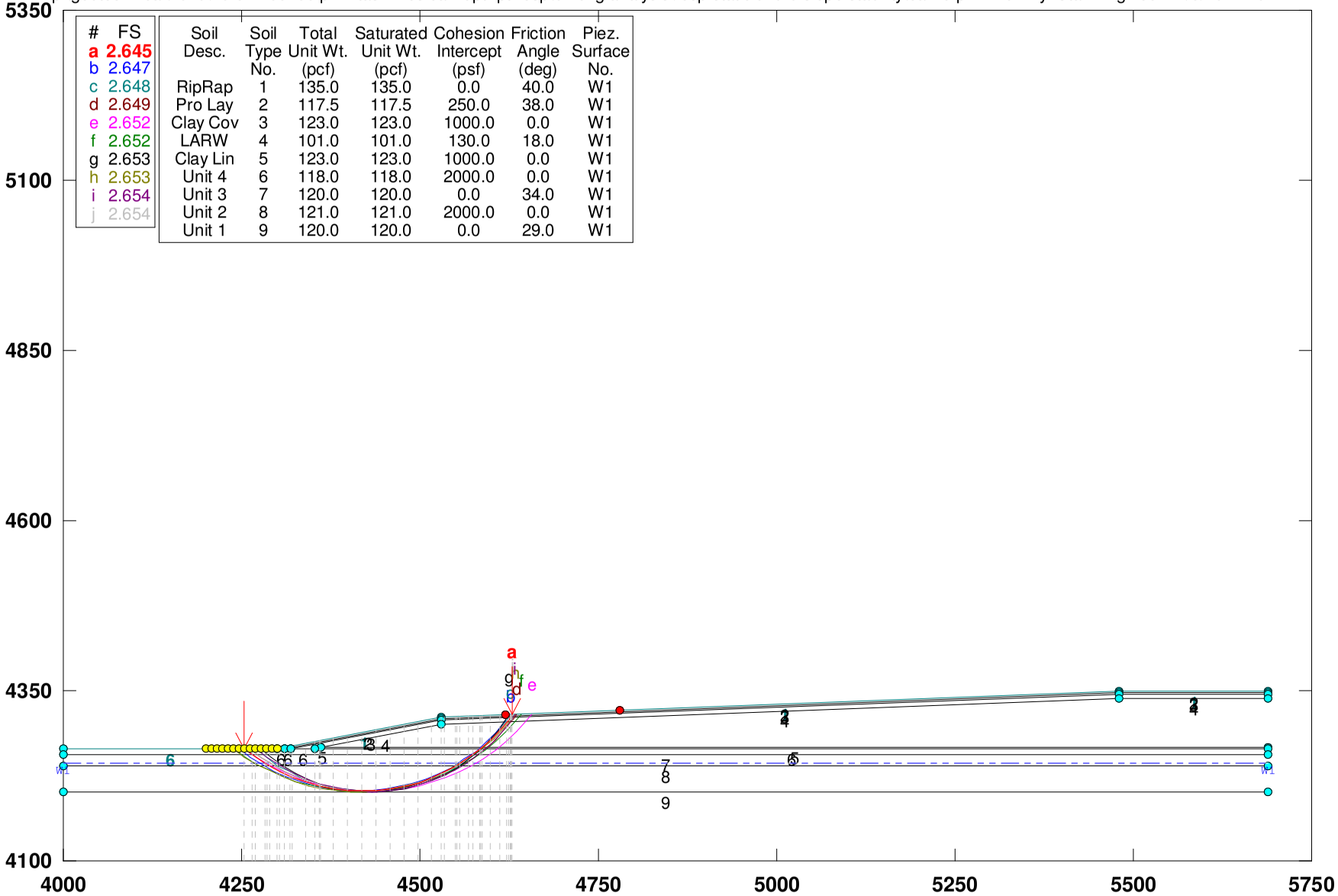
| # | FS |
|---|---|
| a | 2.645 |
| b | 2.647 |
| c | 2.648 |
| d | 2.649 |
| e | 2.652 |
| f | 2.652 |
| g | 2.653 |
| h | 2.653 |
| i | 2.654 |
| j | 2.654 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | W1 |




**GSTABL7 v.2 FSmin=2.645**

**Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, static - Su, Deep Surf 020212 CAWFU.DTA

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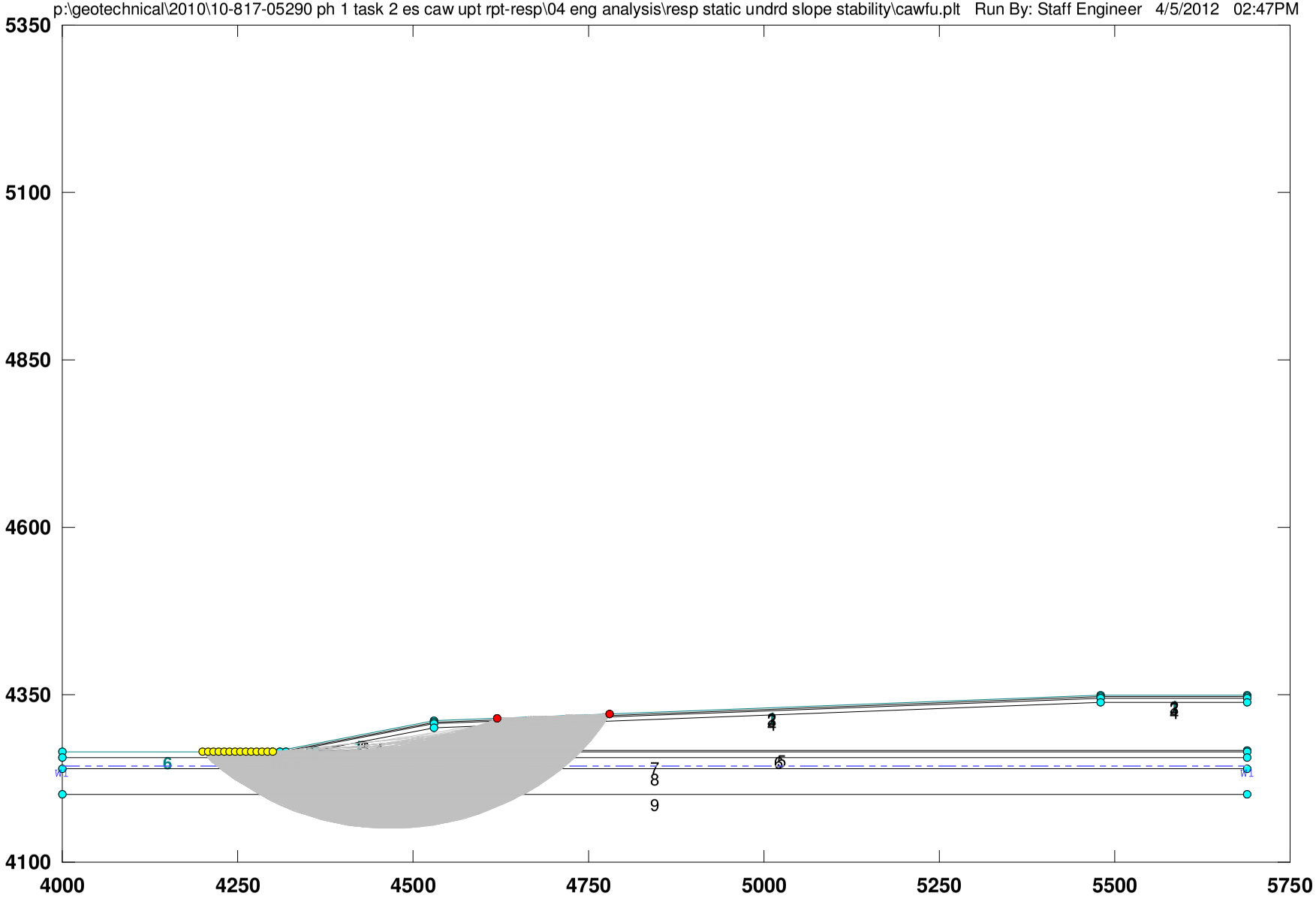


GSTABL7

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                                   ***  GSTABL7  ***

                          ** GSTABL7 by Garry H. Gregory, P.E. **

             ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
                         (All Rights Reserved-Unauthorized Use Prohibited)


          ******************************************************************************
                              SLOPE STABILITY ANALYSIS SYSTEM
                     Modified Bishop, Simplified Janbu, or GLE Method of Slices.
                     (Includes Spencer & Morgenstern-Price Type Analysis)
                     Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
                     Nonlinear Undrained Shear Strength, Curved Phi Envelope,
                     Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
                     Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
          ******************************************************************************


          Analysis Run Date:        4/5/2012
          Time of Run:              02:47PM
          Run By:                   Staff Engineer
          Input Data Filename:      P:\Geotechnical\2010\10-817-05290 Ph 1 Task 2 ES CAW Upt Rpt-Resp\04 ENG ANALYSIS\Resp
Static Undrd Slope Stability\cawfu.in
          Output Filename:          P:\Geotechnical\2010\10-817-05290 Ph 1 Task 2 ES CAW Upt Rpt-Resp\04 ENG ANALYSIS\Resp
Static Undrd Slope Stability\cawfu.OUT
          Unit System:              English

          Plotted Output Filename:  P:\Geotechnical\2010\10-817-05290 Ph 1 Task 2 ES CAW Upt Rpt-Resp\04 ENG ANALYSIS\Resp
Static Undrd Slope Stability\cawfu.PLT




          PROBLEM DESCRIPTION:  CAW Emb 38' 5(H):1(V) side-slopes,
                                static - Su, Deep Surf 020212 CAWFU.DTA



          BOUNDARY COORDINATES

              4 Top   Boundaries
             22 Total Boundaries


          Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
             No.        (ft)       (ft)       (ft)       (ft)     Below Bnd

              1       4000.00    4265.00    4300.00    4265.00        6
              2       4300.00    4265.00    4530.00    4311.00        1
              3       4530.00    4311.00    5480.00    4349.00        1
              4       5480.00    4349.00    5689.00    4349.00        1
              5       4300.00    4265.00    4310.00    4265.00        6
              6       4310.00    4265.00    4530.00    4309.00        2
              7       4530.00    4309.00    5480.00    4347.00        2
              8       5480.00    4347.00    5689.00    4347.00        2
              9       4310.00    4265.00    4318.00    4265.00        6
             10       4318.00    4265.00    4530.00    4307.50        3
             11       4530.00    4307.50    5480.00    4345.50        3
             12       5480.00    4345.50    5689.00    4345.50        3
             13       4318.00    4265.00    4353.00    4265.00        6
             14       4353.00    4265.00    4361.00    4267.00        5
             15       4361.00    4267.00    4530.00    4300.50        4
             16       4530.00    4300.50    5480.00    4338.50        4
             17       5480.00    4338.50    5689.00    4338.50        4
             18       4361.00    4267.00    5689.00    4267.00        5
             19       4353.00    4265.00    5689.00    4265.00        6
             20       4000.00    4256.00    5689.00    4256.00        7
             21       4000.00    4239.00    5689.00    4239.00        8
             22       4000.00    4201.00    5689.00    4201.00        9

          User Specified Y-Origin =      4100.00(ft)

          Default X-Plus Value = 0.00(ft)

          Default Y-Plus Value = 0.00(ft)
1


         ISOTROPIC SOIL PARAMETERS


           9 Type(s) of Soil


          Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
          Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
           No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.

             1   135.0    135.0       0.0     40.0    0.00       0.0      1
             2   117.5    117.5     250.0     38.0    0.00       0.0      1
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

EARTHQUAKE DATA HAS BEEN SUPPRESSED

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

4200 Trial Surfaces Have Been Generated.

300 Surface(s) Initiate(s) From Each Of 14 Points Equally Spaced
Along The Ground Surface Between X =4200.00(ft)
and X =4300.00(ft)

Each Surface Terminates Between X =4620.00(ft)
and X =4780.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

20.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 4200

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS = 3

Number of Trial Surfaces with Misleading FS = 1

Number of Trial Surfaces With Valid FS = 4196

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted = 0.1 %

Statistical Data On All Valid FS Values:
FS Max = 5.907 FS Min = 2.645 FS Ave = 4.024
Standard Deviation = 0.726 Coefficient of Variation = 18.05 %

((Modified Bishop FS for Critical Surface = 2.649))

Failure Surface Specified By 23 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4253.847 | 4265.000 |
| 2 | 4269.415 | 4252.445 |
| 3 | 4285.930 | 4241.165 |
| 4 | 4303.288 | 4231.229 |
| 5 | 4321.378 | 4222.701 |
| 6 | 4340.088 | 4215.635 |
| 7 | 4359.300 | 4210.074 |
| 8 | 4378.892 | 4206.054 |
| 9 | 4398.741 | 4203.601 |
| 10 | 4418.722 | 4202.729 |
| 11 | 4438.709 | 4203.444 |
| 12 | 4458.577 | 4205.742 |
| 13 | 4478.200 | 4209.607 |
| 14 | 4497.454 | 4215.017 |
| 15 | 4516.219 | 4221.937 |
| 16 | 4534.376 | 4230.322 |
| 17 | 4551.811 | 4240.121 |
| 18 | 4568.414 | 4251.271 |
| 19 | 4584.081 | 4263.704 |
| 20 | 4598.712 | 4277.339 |
| 21 | 4612.216 | 4292.091 |
| 22 | 4624.508 | 4307.868 |
| 23 | 4629.185 | 4314.967 |

Circle Center At X = 4419.711 ; Y = 4454.752 ; and Radius = 252.026

*** FOS = 2.645 Theta (ki=1.0) = 4.79 ***
Lambda = 0.084

Individual data on the 39 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 11.2 | 5926.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 2 | 4.4 | 5621.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 3 | 13.8 | 28420.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 4 | 2.7 | 7341.3 | 0.0 | 186.4 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 5 | 3.8 | 11238.2 | 0.0 | 793.2 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 6 | 10.3 | 35580.6 | 0.0 | 5137.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 7 | 3.3 | 13061.0 | 0.0 | 2560.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 8 | 6.7 | 29622.4 | 0.0 | 6183.2 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 9 | 8.0 | 40138.4 | 0.0 | 9283.1 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 10 | 3.4 | 18504.9 | 0.0 | 4545.3 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 11 | 18.7 | 117366.2 | 0.0 | 29742.3 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 12 | 12.9 | 94455.4 | 0.0 | 24520.1 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 13 | 6.3 | 49694.8 | 0.0 | 13101.6 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 14 | 1.7 | 13802.3 | 0.0 | 3584.8 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 15 | 17.9 | 153212.0 | 0.0 | 40015.1 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 16 | 19.8 | 184911.8 | 0.0 | 47640.2 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 17 | 20.0 | 198214.0 | 0.0 | 49714.6 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 18 | 20.0 | 206552.7 | 0.0 | 49813.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 19 | 19.9 | 209707.5 | 0.0 | 47932.5 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 20 | 19.6 | 207650.7 | 0.0 | 44086.3 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 21 | 19.3 | 200520.9 | 0.0 | 38297.8 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 22 | 18.8 | 188645.0 | 0.0 | 30604.9 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 23 | 13.8 | 132009.7 | 0.0 | 16937.8 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 24 | 4.4 | 40346.0 | 0.0 | 4117.2 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 25 | 15.4 | 132982.6 | 0.0 | 9216.3 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 26 | 2.0 | 16067.9 | 0.0 | 491.1 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 27 | 4.3 | 33556.7 | 0.0 | 463.8 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 28 | 12.3 | 88588.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 29 | 6.0 | 38430.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 30 | 9.7 | 55754.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 31 | 1.4 | 7281.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 32 | 2.1 | 10820.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 33 | 11.1 | 49078.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 34 | 13.5 | 43300.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 35 | 9.4 | 17853.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 36 | 2.9 | 3135.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 37 | 2.3 | 1514.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 38 | 1.0 | 363.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 39 | 1.4 | 182.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

Failure Surface Specified By 23 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4246.154 | 4265.000 |
| 2 | 4261.792 | 4252.532 |
| 3 | 4278.352 | 4241.316 |
| 4 | 4295.733 | 4231.422 |
| 5 | 4313.831 | 4222.909 |
| 6 | 4332.535 | 4215.828 |
| 7 | 4351.733 | 4210.222 |
| 8 | 4371.309 | 4206.125 |
| 9 | 4391.144 | 4203.562 |
| 10 | 4411.118 | 4202.549 |
| 11 | 4431.111 | 4203.091 |
| 12 | 4451.001 | 4205.185 |
| 13 | 4470.668 | 4208.819 |
| 14 | 4489.993 | 4213.970 |
| 15 | 4508.859 | 4220.608 |
| 16 | 4527.153 | 4228.692 |
| 17 | 4544.763 | 4238.173 |
| 18 | 4561.582 | 4248.995 |
| 19 | 4577.510 | 4261.090 |
| 20 | 4592.449 | 4274.388 |
| 21 | 4606.310 | 4288.806 |
| 22 | 4619.008 | 4304.257 |
| 23 | 4626.417 | 4314.857 |

Circle Center At X = 4414.152 ; Y = 4459.664 ; and Radius = 257.133

*** FOS = 2.647 Theta (ki=1.0) = 4.75 ***
Lambda = 0.083

1

Failure Surface Specified By 22 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4269.231 | 4265.000 |
| 2 | 4284.375 | 4251.936 |
| 3 | 4300.589 | 4240.227 |
| 4 | 4317.752 | 4229.960 |
| 5 | 4335.738 | 4221.212 |
| 6 | 4354.411 | 4214.049 |
| 7 | 4373.633 | 4208.523 |
| 8 | 4393.259 | 4204.676 |
| 9 | 4413.145 | 4202.536 |
| 10 | 4433.140 | 4202.120 |
| 11 | 4453.097 | 4203.431 |
| 12 | 4472.867 | 4206.458 |
| 13 | 4492.301 | 4211.180 |
| 14 | 4511.256 | 4217.560 |
| 15 | 4529.590 | 4225.552 |
| 16 | 4547.167 | 4235.096 |
| 17 | 4563.854 | 4246.121 |
| 18 | 4579.527 | 4258.543 |
| 19 | 4594.071 | 4272.272 |
| 20 | 4607.376 | 4287.205 |
| 21 | 4619.343 | 4303.229 |
| 22 | 4626.557 | 4314.862 |

Circle Center At X = 4427.871 ; Y = 4433.422 ; and Radius = 231.371

*** FOS = 2.648 Theta (ki=1.0) = 4.84 ***
Lambda = 0.085

Failure Surface Specified By 23 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4261.539 | 4265.000 |
| 2 | 4277.084 | 4252.417 |
| 3 | 4293.584 | 4241.114 |
| 4 | 4310.934 | 4231.165 |
| 5 | 4329.022 | 4222.632 |

| | | |
|---|---|---|
| 6 | 4347.734 | 4215.570 |
| 7 | 4366.950 | 4210.025 |
| 8 | 4386.547 | 4206.031 |
| 9 | 4406.401 | 4203.614 |
| 10 | 4426.384 | 4202.789 |
| 11 | 4446.369 | 4203.562 |
| 12 | 4466.228 | 4205.928 |
| 13 | 4485.835 | 4209.871 |
| 14 | 4505.065 | 4215.367 |
| 15 | 4523.795 | 4222.381 |
| 16 | 4541.906 | 4230.867 |
| 17 | 4559.281 | 4240.772 |
| 18 | 4575.810 | 4252.032 |
| 19 | 4591.388 | 4264.575 |
| 20 | 4605.915 | 4278.322 |
| 21 | 4619.297 | 4293.185 |
| 22 | 4631.451 | 4309.068 |
| 23 | 4635.421 | 4315.217 |

Circle Center At X = 4426.706 ; Y = 4453.148 ; and Radius = 250.359

*** FOS = 2.649 Theta (ki=1.0) = 4.80 ***
Lambda = 0.084

1

Failure Surface Specified By 24 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4253.847 | 4265.000 |
| 2 | 4269.793 | 4252.930 |
| 3 | 4286.559 | 4242.024 |
| 4 | 4304.057 | 4232.339 |
| 5 | 4322.200 | 4223.923 |
| 6 | 4340.896 | 4216.819 |
| 7 | 4360.050 | 4211.063 |
| 8 | 4379.564 | 4206.685 |
| 9 | 4399.341 | 4203.705 |
| 10 | 4419.280 | 4202.140 |
| 11 | 4439.279 | 4201.997 |
| 12 | 4459.238 | 4203.276 |
| 13 | 4479.056 | 4205.973 |
| 14 | 4498.631 | 4210.072 |
| 15 | 4517.865 | 4215.553 |
| 16 | 4536.661 | 4222.389 |
| 17 | 4554.922 | 4230.544 |
| 18 | 4572.558 | 4239.978 |
| 19 | 4589.477 | 4250.643 |
| 20 | 4605.595 | 4262.483 |
| 21 | 4620.830 | 4275.441 |
| 22 | 4635.104 | 4289.449 |
| 23 | 4648.347 | 4304.438 |
| 24 | 4657.250 | 4316.090 |

Circle Center At X = 4431.220 ; Y = 4482.637 ; and Radius = 280.762

*** FOS = 2.652 Theta (ki=1.0) = 4.62 ***
Lambda = 0.081

Failure Surface Specified By 24 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4238.462 | 4265.000 |
| 2 | 4254.411 | 4252.932 |
| 3 | 4271.178 | 4242.030 |
| 4 | 4288.678 | 4232.348 |
| 5 | 4306.823 | 4223.936 |
| 6 | 4325.521 | 4216.836 |
| 7 | 4344.676 | 4211.085 |
| 8 | 4364.192 | 4206.712 |
| 9 | 4383.970 | 4203.738 |
| 10 | 4403.909 | 4202.179 |
| 11 | 4423.908 | 4202.043 |
| 12 | 4443.867 | 4203.330 |
| 13 | 4463.683 | 4206.034 |
| 14 | 4483.257 | 4210.142 |
| 15 | 4502.489 | 4215.631 |
| 16 | 4521.281 | 4222.476 |
| 17 | 4539.539 | 4230.640 |
| 18 | 4557.170 | 4240.082 |

| | | |
|---|---|---|
| 19 | 4574.084 | 4250.755 |
| 20 | 4590.196 | 4262.604 |
| 21 | 4605.424 | 4275.570 |
| 22 | 4619.690 | 4289.587 |
| 23 | 4632.923 | 4304.583 |
| 24 | 4641.214 | 4315.449 |

Circle Center At X = 4415.745 ; Y = 4482.571 ; and Radius = 280.653

*** FOS = 2.652 Theta (ki=1.0) = 4.61 ***
Lambda = 0.081

1

Failure Surface Specified By 22 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4276.924 | 4265.000 |
| 2 | 4291.709 | 4251.531 |
| 3 | 4307.659 | 4239.465 |
| 4 | 4324.642 | 4228.902 |
| 5 | 4342.517 | 4219.929 |
| 6 | 4361.134 | 4212.622 |
| 7 | 4380.339 | 4207.040 |
| 8 | 4399.973 | 4203.231 |
| 9 | 4419.873 | 4201.226 |
| 10 | 4439.872 | 4201.041 |
| 11 | 4459.804 | 4202.679 |
| 12 | 4479.505 | 4206.125 |
| 13 | 4498.810 | 4211.351 |
| 14 | 4517.559 | 4218.314 |
| 15 | 4535.596 | 4226.956 |
| 16 | 4552.771 | 4237.204 |
| 17 | 4568.940 | 4248.974 |
| 18 | 4583.971 | 4262.167 |
| 19 | 4597.738 | 4276.675 |
| 20 | 4610.126 | 4292.376 |
| 21 | 4621.033 | 4309.140 |
| 22 | 4623.999 | 4314.760 |

Circle Center At X = 4431.805 ; Y = 4420.006 ; and Radius = 219.124

*** FOS = 2.653 Theta (ki=1.0) = 4.81 ***
Lambda = 0.084

Failure Surface Specified By 24 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4238.462 | 4265.000 |
| 2 | 4254.313 | 4252.804 |
| 3 | 4271.014 | 4241.800 |
| 4 | 4288.474 | 4232.047 |
| 5 | 4306.601 | 4223.597 |
| 6 | 4325.298 | 4216.495 |
| 7 | 4344.464 | 4210.779 |
| 8 | 4363.997 | 4206.481 |
| 9 | 4383.791 | 4203.623 |
| 10 | 4403.742 | 4202.219 |
| 11 | 4423.742 | 4202.279 |
| 12 | 4443.684 | 4203.801 |
| 13 | 4463.461 | 4206.777 |
| 14 | 4482.968 | 4211.192 |
| 15 | 4502.099 | 4217.022 |
| 16 | 4520.753 | 4224.235 |
| 17 | 4538.830 | 4232.793 |
| 18 | 4556.232 | 4242.650 |
| 19 | 4572.867 | 4253.753 |
| 20 | 4588.645 | 4266.043 |
| 21 | 4603.482 | 4279.455 |
| 22 | 4617.298 | 4293.915 |
| 23 | 4630.021 | 4309.347 |
| 24 | 4634.142 | 4315.166 |

Circle Center At X = 4412.847 ; Y = 4475.083 ; and Radius = 273.030

*** FOS = 2.653 Theta (ki=1.0) = 4.65 ***
Lambda = 0.081

1

Failure Surface Specified By 23 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4269.231 | 4265.000 |
| 2 | 4284.558 | 4252.151 |
| 3 | 4300.902 | 4240.624 |
| 4 | 4318.149 | 4230.498 |
| 5 | 4336.180 | 4221.844 |
| 6 | 4354.869 | 4214.723 |
| 7 | 4374.087 | 4209.183 |
| 8 | 4393.699 | 4205.264 |
| 9 | 4413.570 | 4202.993 |
| 10 | 4433.561 | 4202.385 |
| 11 | 4453.532 | 4203.444 |
| 12 | 4473.346 | 4206.164 |
| 13 | 4492.865 | 4210.525 |
| 14 | 4511.952 | 4216.498 |
| 15 | 4530.476 | 4224.040 |
| 16 | 4548.306 | 4233.099 |
| 17 | 4565.320 | 4243.612 |
| 18 | 4581.399 | 4255.506 |
| 19 | 4596.432 | 4268.698 |
| 20 | 4610.312 | 4283.097 |
| 21 | 4622.945 | 4298.603 |
| 22 | 4634.243 | 4315.106 |
| 23 | 4634.279 | 4315.171 |

Circle Center At X = 4430.850 ; Y = 4442.213 ; and Radius = 239.844

*** FOS = 2.654 Theta (ki=1.0) = 4.82 ***
Lambda = 0.084

Failure Surface Specified By 23 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4261.539 | 4265.000 |
| 2 | 4276.996 | 4252.308 |
| 3 | 4293.441 | 4240.925 |
| 4 | 4310.764 | 4230.930 |
| 5 | 4328.849 | 4222.389 |
| 6 | 4347.573 | 4215.359 |
| 7 | 4366.810 | 4209.889 |
| 8 | 4386.431 | 4206.014 |
| 9 | 4406.304 | 4203.761 |
| 10 | 4426.294 | 4203.145 |
| 11 | 4446.268 | 4204.170 |
| 12 | 4466.090 | 4206.830 |
| 13 | 4485.628 | 4211.106 |
| 14 | 4504.749 | 4216.970 |
| 15 | 4523.325 | 4224.382 |
| 16 | 4541.230 | 4233.292 |
| 17 | 4558.345 | 4243.641 |
| 18 | 4574.553 | 4255.358 |
| 19 | 4589.746 | 4268.365 |
| 20 | 4603.821 | 4282.573 |
| 21 | 4616.684 | 4297.888 |
| 22 | 4628.248 | 4314.206 |
| 23 | 4628.687 | 4314.947 |

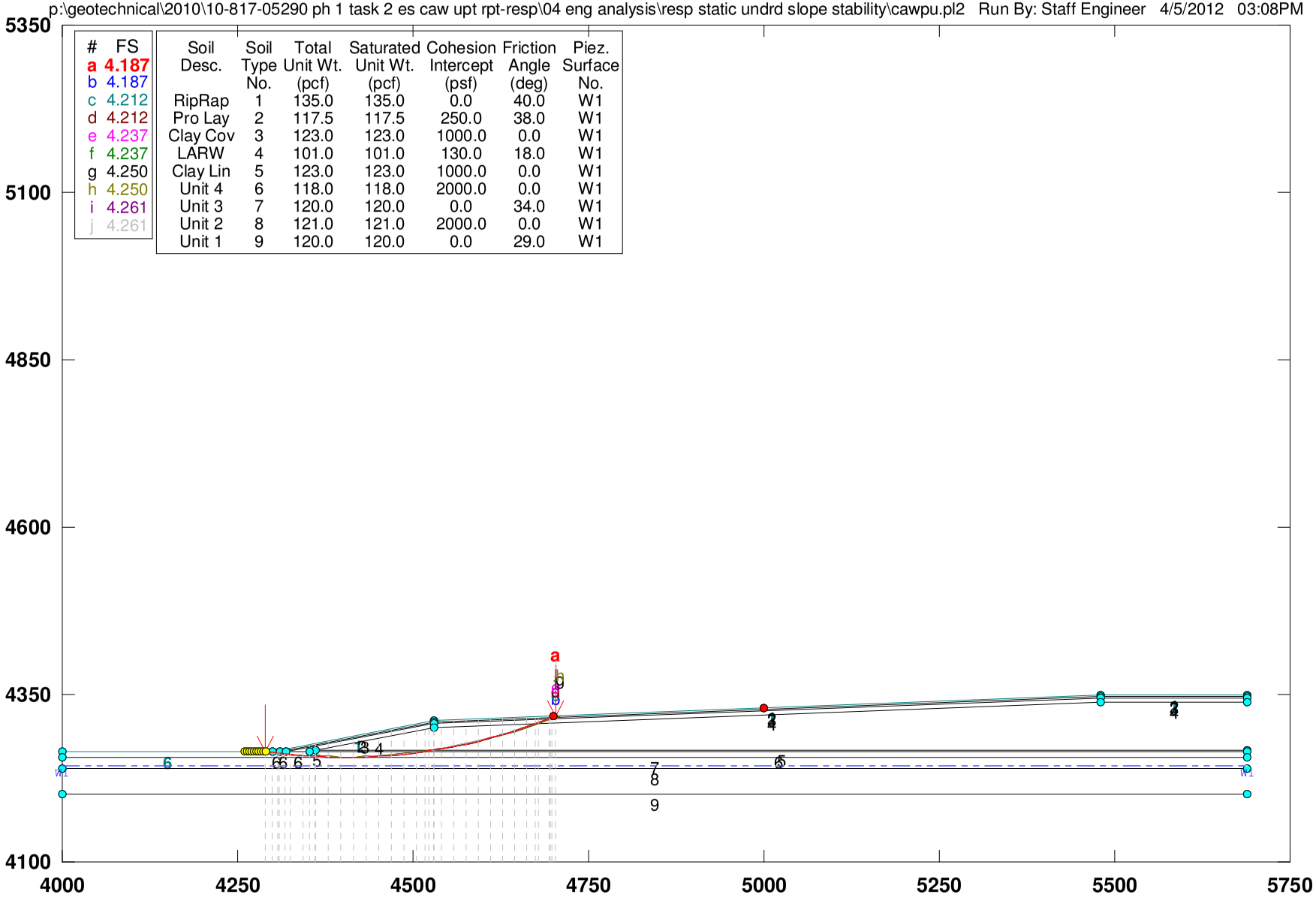
Circle Center At X = 4423.796 ; Y = 4446.835 ; and Radius = 243.703

*** FOS = 2.654 Theta (ki=1.0) = 4.86 ***
Lambda = 0.085

**** END OF GSTABL7 OUTPUT ****

# CAW Emb 38' 5(H):1(V) side-slopes, static - Su, ShalClay unit 020212 CAWPU

p:\geotechnical\2010\10-817-05290 ph 1 task 2 es caw upt rpt-resp\04 eng analysis\resp static undrd slope stability\cawpu.pl2 Run By: Staff Engineer 4/5/2012 03:08PM




| # | FS |
|---|---|
| a | 4.187 |
| b | 4.187 |
| c | 4.212 |
| d | 4.212 |
| e | 4.237 |
| f | 4.237 |
| g | 4.250 |
| h | 4.250 |
| i | 4.261 |
| j | 4.261 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Piez. Surface No. |
|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | W1 |

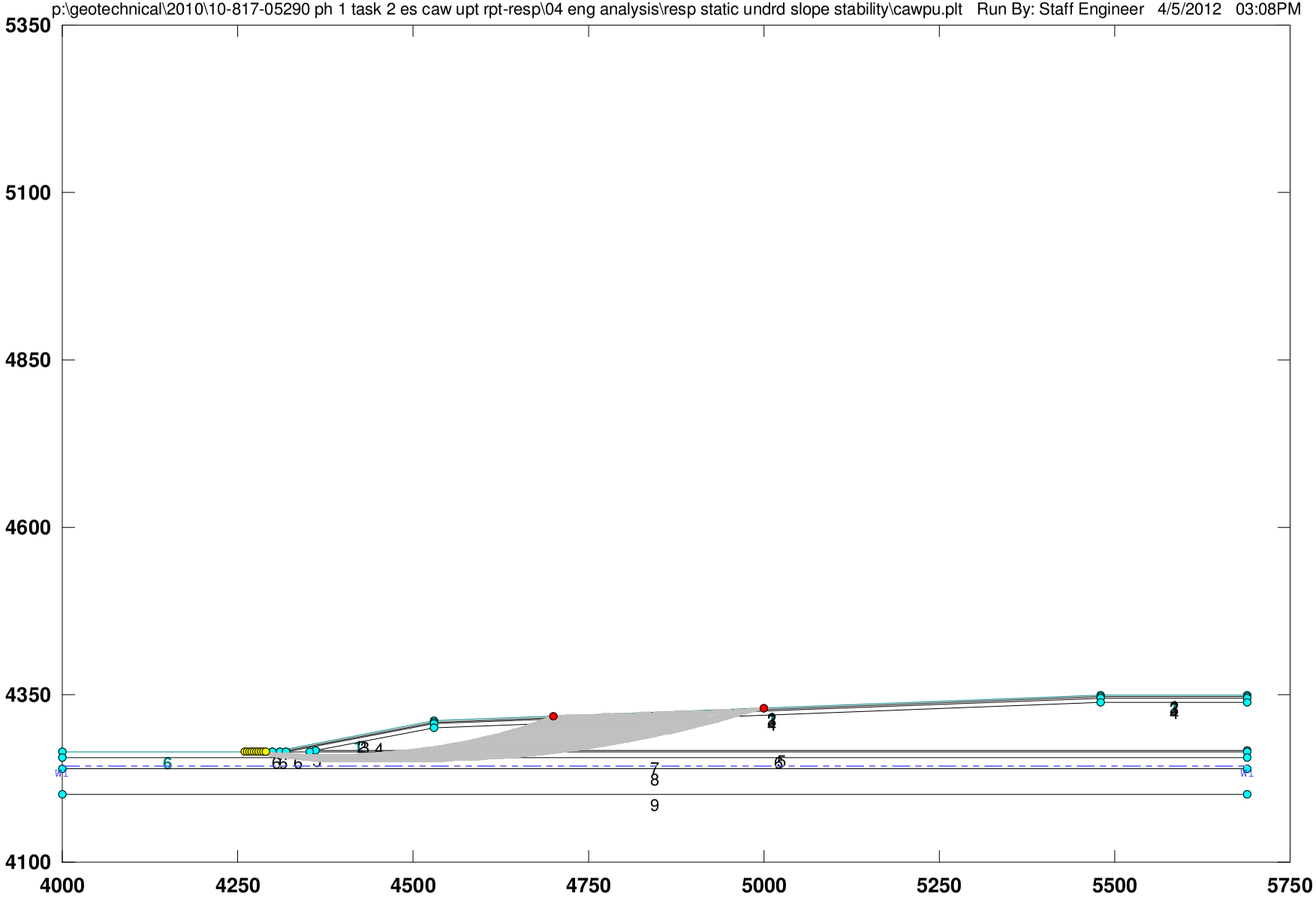
**GSTABL7 v.2 FSmin=4.187**

**Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, static - Su, ShalClay unit 020212 CAWPU

p:\geotechnical\2010\10-817-05290 ph 1 task 2 es caw upt rpt-resp\04 eng analysis\resp static undrd slope stability\cawpu.plt  Run By: Staff Engineer  4/5/2012  03:08PM




GSTABL7

```
                                   ***  GSTABL7  ***

                          ** GSTABL7 by Garry H. Gregory, P.E. **

             ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
                         (All Rights Reserved-Unauthorized Use Prohibited)


          ******************************************************************************
                              SLOPE STABILITY ANALYSIS SYSTEM
                     Modified Bishop, Simplified Janbu, or GLE Method of Slices.
                     (Includes Spencer & Morgenstern-Price Type Analysis)
                     Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
                     Nonlinear Undrained Shear Strength, Curved Phi Envelope,
                     Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
                     Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
          ******************************************************************************


          Analysis Run Date:        4/5/2012
          Time of Run:              03:08PM
          Run By:                   Staff Engineer
          Input Data Filename:      P:\Geotechnical\2010\10-817-05290 Ph 1 Task 2 ES CAW Upt Rpt-Resp\04 ENG ANALYSIS\Resp
Static Undrd Slope Stability\cawpu.in
          Output Filename:          P:\Geotechnical\2010\10-817-05290 Ph 1 Task 2 ES CAW Upt Rpt-Resp\04 ENG ANALYSIS\Resp
Static Undrd Slope Stability\cawpu.OUT
          Unit System:              English

          Plotted Output Filename:  P:\Geotechnical\2010\10-817-05290 Ph 1 Task 2 ES CAW Upt Rpt-Resp\04 ENG ANALYSIS\Resp
Static Undrd Slope Stability\cawpu.PLT




          PROBLEM DESCRIPTION:  CAW Emb 38' 5(H):1(V) side-slopes,
                                static - Su, ShalClay unit 020212 CAWPU



          BOUNDARY COORDINATES

              4 Top   Boundaries
             22 Total Boundaries


          Boundary     X-Left     Y-Left    X-Right    Y-Right    Soil Type
             No.        (ft)       (ft)       (ft)       (ft)     Below Bnd

              1       4000.00    4265.00    4300.00    4265.00        6
              2       4300.00    4265.00    4530.00    4311.00        1
              3       4530.00    4311.00    5480.00    4349.00        1
              4       5480.00    4349.00    5689.00    4349.00        1
              5       4300.00    4265.00    4310.00    4265.00        6
              6       4310.00    4265.00    4530.00    4309.00        2
              7       4530.00    4309.00    5480.00    4347.00        2
              8       5480.00    4347.00    5689.00    4347.00        2
              9       4310.00    4265.00    4318.00    4265.00        6
             10       4318.00    4265.00    4530.00    4307.50        3
             11       4530.00    4307.50    5480.00    4345.50        3
             12       5480.00    4345.50    5689.00    4345.50        3
             13       4318.00    4265.00    4353.00    4265.00        6
             14       4353.00    4265.00    4361.00    4267.00        5
             15       4361.00    4267.00    4530.00    4300.50        4
             16       4530.00    4300.50    5480.00    4338.50        4
             17       5480.00    4338.50    5689.00    4338.50        4
             18       4361.00    4267.00    5689.00    4267.00        5
             19       4353.00    4265.00    5689.00    4265.00        6
             20       4000.00    4256.00    5689.00    4256.00        7
             21       4000.00    4239.00    5689.00    4239.00        8
             22       4000.00    4201.00    5689.00    4201.00        9

          User Specified Y-Origin =      4100.00(ft)

          Default X-Plus Value = 0.00(ft)

          Default Y-Plus Value = 0.00(ft)
1


         ISOTROPIC SOIL PARAMETERS


           9 Type(s) of Soil


          Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
          Type Unit Wt. Unit Wt. Intercept   Angle  Pressure Constant Surface
           No.  (pcf)    (pcf)     (psf)     (deg)    Param.   (psf)     No.
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

3800 Trial Surfaces Have Been Generated.

380 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X =4260.00(ft)
and X =4290.00(ft)

Each Surface Terminates Between X =4700.00(ft)
and X =5000.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 4250.00(ft)

18.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 3800

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS = 95

Number of Trial Surfaces with Misleading FS = 12

Number of Trial Surfaces With Valid FS = 3693

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted = 2.8 %

Statistical Data On All Valid FS Values:
FS Max = 30.528 FS Min = 4.187 FS Ave = 5.070
Standard Deviation = 0.731 Coefficient of Variation = 14.42 %

((Modified Bishop FS for Critical Surface = 4.204))

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.829 | 4262.515 |
| 3 | 4325.710 | 4260.452 |
| 4 | 4343.636 | 4258.812 |
| 5 | 4361.595 | 4257.598 |
| 6 | 4379.578 | 4256.808 |
| 7 | 4397.574 | 4256.444 |
| 8 | 4415.574 | 4256.506 |
| 9 | 4433.567 | 4256.994 |
| 10 | 4451.543 | 4257.908 |
| 11 | 4469.494 | 4259.247 |
| 12 | 4487.407 | 4261.010 |
| 13 | 4505.274 | 4263.196 |
| 14 | 4523.084 | 4265.805 |
| 15 | 4540.827 | 4268.834 |
| 16 | 4558.494 | 4272.282 |
| 17 | 4576.074 | 4276.147 |
| 18 | 4593.558 | 4280.428 |
| 19 | 4610.935 | 4285.120 |
| 20 | 4628.197 | 4290.223 |
| 21 | 4645.333 | 4295.732 |
| 22 | 4662.334 | 4301.646 |
| 23 | 4679.190 | 4307.959 |
| 24 | 4695.893 | 4314.670 |
| 25 | 4703.504 | 4317.940 |

Circle Center At X = 4403.947 ; Y = 5017.113 ; and Radius = 760.695

*** FOS = 4.187 Theta (ki=1.0) = 5.89 ***
Lambda = 0.103

Individual data on the 35 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.0 | 822.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 2 | 7.8 | 2619.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 3 | 2.2 | 1191.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 4 | 8.0 | 5930.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 5 | 7.7 | 7996.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 6 | 17.9 | 26916.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 7 | 9.4 | 18460.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 8 | 8.0 | 18034.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 9 | 0.6 | 1423.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 10 | 18.0 | 47294.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 11 | 18.0 | 55108.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 12 | 18.0 | 61997.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 13 | 18.0 | 67945.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 14 | 18.0 | 72939.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 15 | 18.0 | 76974.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 16 | 17.9 | 80041.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 17 | 17.9 | 82137.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 18 | 12.3 | 57482.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 19 | 5.5 | 25776.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 20 | 6.9 | 32472.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 21 | 0.1 | 398.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 22 | 10.7 | 49630.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 23 | 17.7 | 77923.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 24 | 17.6 | 72300.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 25 | 17.5 | 65951.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 26 | 17.4 | 58899.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 27 | 17.3 | 51177.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 28 | 17.1 | 42813.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 29 | 17.0 | 33840.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 30 | 12.4 | 18803.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 31 | 4.5 | 5419.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 32 | 15.2 | 11950.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 33 | 1.5 | 613.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 34 | 2.5 | 809.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 35 | 5.1 | 693.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.829 | 4262.515 |
| 3 | 4325.710 | 4260.452 |
| 4 | 4343.636 | 4258.812 |
| 5 | 4361.595 | 4257.598 |
| 6 | 4379.578 | 4256.808 |
| 7 | 4397.574 | 4256.444 |
| 8 | 4415.574 | 4256.506 |
| 9 | 4433.567 | 4256.994 |
| 10 | 4451.543 | 4257.908 |
| 11 | 4469.494 | 4259.247 |
| 12 | 4487.407 | 4261.010 |
| 13 | 4505.274 | 4263.196 |
| 14 | 4523.084 | 4265.805 |
| 15 | 4540.827 | 4268.834 |
| 16 | 4558.494 | 4272.282 |
| 17 | 4576.074 | 4276.147 |
| 18 | 4593.558 | 4280.428 |
| 19 | 4610.935 | 4285.120 |
| 20 | 4628.197 | 4290.223 |
| 21 | 4645.333 | 4295.732 |
| 22 | 4662.334 | 4301.646 |
| 23 | 4679.190 | 4307.959 |
| 24 | 4695.893 | 4314.670 |
| 25 | 4703.504 | 4317.940 |

Circle Center At X = 4403.947 ; Y = 5017.113 ; and Radius = 760.695

*** FOS = 4.187 Theta (ki=1.0) = 5.89 ***
Lambda = 0.103

1

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4286.668 | 4265.000 |
| 2 | 4304.496 | 4262.515 |
| 3 | 4322.376 | 4260.447 |
| 4 | 4340.301 | 4258.797 |
| 5 | 4358.259 | 4257.567 |
| 6 | 4376.241 | 4256.758 |
| 7 | 4394.236 | 4256.369 |
| 8 | 4412.236 | 4256.400 |
| 9 | 4430.230 | 4256.853 |
| 10 | 4448.209 | 4257.726 |
| 11 | 4466.163 | 4259.019 |
| 12 | 4484.082 | 4260.731 |
| 13 | 4501.955 | 4262.862 |
| 14 | 4519.774 | 4265.411 |
| 15 | 4537.528 | 4268.375 |
| 16 | 4555.208 | 4271.753 |
| 17 | 4572.805 | 4275.544 |
| 18 | 4590.308 | 4279.746 |
| 19 | 4607.708 | 4284.355 |
| 20 | 4624.995 | 4289.370 |
| 21 | 4642.160 | 4294.787 |
| 22 | 4659.194 | 4300.604 |
| 23 | 4676.088 | 4306.818 |
| 24 | 4692.832 | 4313.426 |
| 25 | 4703.534 | 4317.941 |

Circle Center At X = 4401.880 ; Y = 5026.207 ; and Radius = 769.877

*** FOS = 4.212 Theta (ki=1.0) = 5.87 ***
Lambda = 0.103

Failure Surface Specified By 25 Coordinate Points

| Point | X-Surf | Y-Surf |
|---|---|---|

| No. | (ft) | (ft) |
|---|---|---|
| 1 | 4286.668 | 4265.000 |
| 2 | 4304.496 | 4262.515 |
| 3 | 4322.376 | 4260.447 |
| 4 | 4340.301 | 4258.797 |
| 5 | 4358.259 | 4257.567 |
| 6 | 4376.241 | 4256.758 |
| 7 | 4394.236 | 4256.369 |
| 8 | 4412.236 | 4256.400 |
| 9 | 4430.230 | 4256.853 |
| 10 | 4448.209 | 4257.726 |
| 11 | 4466.163 | 4259.019 |
| 12 | 4484.082 | 4260.731 |
| 13 | 4501.955 | 4262.862 |
| 14 | 4519.774 | 4265.411 |
| 15 | 4537.528 | 4268.375 |
| 16 | 4555.208 | 4271.753 |
| 17 | 4572.805 | 4275.544 |
| 18 | 4590.308 | 4279.746 |
| 19 | 4607.708 | 4284.355 |
| 20 | 4624.995 | 4289.370 |
| 21 | 4642.160 | 4294.787 |
| 22 | 4659.194 | 4300.604 |
| 23 | 4676.088 | 4306.818 |
| 24 | 4692.832 | 4313.426 |
| 25 | 4703.534 | 4317.941 |

Circle Center At X = 4401.880 ; Y = 5026.207 ; and Radius = 769.877

*** FOS = 4.212 Theta (ki=1.0) = 5.87 ***
Lambda = 0.103

1

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4283.334 | 4265.000 |
| 2 | 4301.162 | 4262.515 |
| 3 | 4319.042 | 4260.441 |
| 4 | 4336.966 | 4258.782 |
| 5 | 4354.923 | 4257.538 |
| 6 | 4372.904 | 4256.708 |
| 7 | 4390.899 | 4256.294 |
| 8 | 4408.899 | 4256.296 |
| 9 | 4426.894 | 4256.713 |
| 10 | 4444.875 | 4257.547 |
| 11 | 4462.831 | 4258.795 |
| 12 | 4480.754 | 4260.458 |
| 13 | 4498.634 | 4262.535 |
| 14 | 4516.461 | 4265.024 |
| 15 | 4534.226 | 4267.925 |
| 16 | 4551.918 | 4271.235 |
| 17 | 4569.530 | 4274.953 |
| 18 | 4587.052 | 4279.077 |
| 19 | 4604.473 | 4283.604 |
| 20 | 4621.785 | 4288.533 |
| 21 | 4638.979 | 4293.860 |
| 22 | 4656.044 | 4299.583 |
| 23 | 4672.974 | 4305.700 |
| 24 | 4689.757 | 4312.205 |
| 25 | 4703.604 | 4317.944 |

Circle Center At X = 4399.817 ; Y = 5035.312 ; and Radius = 779.070

*** FOS = 4.237 Theta (ki=1.0) = 5.84 ***
Lambda = 0.102

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4283.334 | 4265.000 |
| 2 | 4301.162 | 4262.515 |
| 3 | 4319.042 | 4260.441 |
| 4 | 4336.966 | 4258.782 |
| 5 | 4354.923 | 4257.538 |
| 6 | 4372.904 | 4256.708 |
| 7 | 4390.899 | 4256.294 |
| 8 | 4408.899 | 4256.296 |

| | | |
|---|---|---|
| 9 | 4426.894 | 4256.713 |
| 10 | 4444.875 | 4257.547 |
| 11 | 4462.831 | 4258.795 |
| 12 | 4480.754 | 4260.458 |
| 13 | 4498.634 | 4262.535 |
| 14 | 4516.461 | 4265.024 |
| 15 | 4534.226 | 4267.925 |
| 16 | 4551.918 | 4271.235 |
| 17 | 4569.530 | 4274.953 |
| 18 | 4587.052 | 4279.077 |
| 19 | 4604.473 | 4283.604 |
| 20 | 4621.785 | 4288.533 |
| 21 | 4638.979 | 4293.860 |
| 22 | 4656.044 | 4299.583 |
| 23 | 4672.974 | 4305.700 |
| 24 | 4689.757 | 4312.205 |
| 25 | 4703.604 | 4317.944 |

Circle Center At X = 4399.817 ; Y = 5035.312 ; and Radius = 779.070

*** FOS = 4.237 Theta (ki=1.0) = 5.84 ***
Lambda = 0.102

1

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.851 | 4262.673 |
| 3 | 4325.748 | 4260.749 |
| 4 | 4343.683 | 4259.228 |
| 5 | 4361.648 | 4258.111 |
| 6 | 4379.634 | 4257.399 |
| 7 | 4397.632 | 4257.093 |
| 8 | 4415.631 | 4257.192 |
| 9 | 4433.625 | 4257.697 |
| 10 | 4451.602 | 4258.606 |
| 11 | 4469.554 | 4259.921 |
| 12 | 4487.472 | 4261.639 |
| 13 | 4505.346 | 4263.761 |
| 14 | 4523.168 | 4266.284 |
| 15 | 4540.929 | 4269.208 |
| 16 | 4558.620 | 4272.532 |
| 17 | 4576.231 | 4276.253 |
| 18 | 4593.754 | 4280.370 |
| 19 | 4611.180 | 4284.880 |
| 20 | 4628.500 | 4289.782 |
| 21 | 4645.705 | 4295.073 |
| 22 | 4662.786 | 4300.750 |
| 23 | 4679.735 | 4306.810 |
| 24 | 4696.544 | 4313.250 |
| 25 | 4708.493 | 4318.140 |

Circle Center At X = 4402.231 ; Y = 5056.216 ; and Radius = 799.136

*** FOS = 4.250 Theta (ki=1.0) = 5.84 ***
Lambda = 0.102

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.851 | 4262.673 |
| 3 | 4325.748 | 4260.749 |
| 4 | 4343.683 | 4259.228 |
| 5 | 4361.648 | 4258.111 |
| 6 | 4379.634 | 4257.399 |
| 7 | 4397.632 | 4257.093 |
| 8 | 4415.631 | 4257.192 |
| 9 | 4433.625 | 4257.697 |
| 10 | 4451.602 | 4258.606 |
| 11 | 4469.554 | 4259.921 |
| 12 | 4487.472 | 4261.639 |
| 13 | 4505.346 | 4263.761 |
| 14 | 4523.168 | 4266.284 |
| 15 | 4540.929 | 4269.208 |
| 16 | 4558.620 | 4272.532 |
| 17 | 4576.231 | 4276.253 |
| 18 | 4593.754 | 4280.370 |
| 19 | 4611.180 | 4284.880 |
| 20 | 4628.500 | 4289.782 |

| | | |
|---|---|---|
| 21 | 4645.705 | 4295.073 |
| 22 | 4662.786 | 4300.750 |
| 23 | 4679.735 | 4306.810 |
| 24 | 4696.544 | 4313.250 |
| 25 | 4708.493 | 4318.140 |

Circle Center At X = 4402.231 ; Y = 5056.216 ; and Radius = 799.136

*** FOS = 4.250 Theta (ki=1.0) = 5.84 ***
Lambda = 0.102

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4280.001 | 4265.000 |
| 2 | 4297.829 | 4262.515 |
| 3 | 4315.708 | 4260.437 |
| 4 | 4333.631 | 4258.768 |
| 5 | 4351.587 | 4257.509 |
| 6 | 4369.567 | 4256.660 |
| 7 | 4387.562 | 4256.221 |
| 8 | 4405.562 | 4256.194 |
| 9 | 4423.558 | 4256.578 |
| 10 | 4441.540 | 4257.372 |
| 11 | 4459.500 | 4258.577 |
| 12 | 4477.427 | 4260.192 |
| 13 | 4495.312 | 4262.215 |
| 14 | 4513.147 | 4264.646 |
| 15 | 4530.922 | 4267.484 |
| 16 | 4548.628 | 4270.728 |
| 17 | 4566.255 | 4274.374 |
| 18 | 4583.794 | 4278.422 |
| 19 | 4601.236 | 4282.869 |
| 20 | 4618.572 | 4287.714 |
| 21 | 4635.792 | 4292.953 |
| 22 | 4652.889 | 4298.584 |
| 23 | 4669.853 | 4304.604 |
| 24 | 4686.674 | 4311.010 |
| 25 | 4703.345 | 4317.798 |
| 26 | 4703.690 | 4317.948 |

Circle Center At X = 4397.755 ; Y = 5044.392 ; and Radius = 788.237

*** FOS = 4.261 Theta (ki=1.0) = 5.81 ***
Lambda = 0.102

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4280.001 | 4265.000 |
| 2 | 4297.829 | 4262.515 |
| 3 | 4315.708 | 4260.437 |
| 4 | 4333.631 | 4258.768 |
| 5 | 4351.587 | 4257.509 |
| 6 | 4369.567 | 4256.660 |
| 7 | 4387.562 | 4256.221 |
| 8 | 4405.562 | 4256.194 |
| 9 | 4423.558 | 4256.578 |
| 10 | 4441.540 | 4257.372 |
| 11 | 4459.500 | 4258.577 |
| 12 | 4477.427 | 4260.192 |
| 13 | 4495.312 | 4262.215 |
| 14 | 4513.147 | 4264.646 |
| 15 | 4530.922 | 4267.484 |
| 16 | 4548.628 | 4270.728 |
| 17 | 4566.255 | 4274.374 |
| 18 | 4583.794 | 4278.422 |
| 19 | 4601.236 | 4282.869 |
| 20 | 4618.572 | 4287.714 |
| 21 | 4635.792 | 4292.953 |
| 22 | 4652.889 | 4298.584 |
| 23 | 4669.853 | 4304.604 |
| 24 | 4686.674 | 4311.010 |
| 25 | 4703.345 | 4317.798 |
| 26 | 4703.690 | 4317.948 |

Circle Center At X = 4397.755 ; Y = 5044.392 ; and Radius = 788.237

```
***  FOS =     4.261   Theta (ki=1.0) =     5.81  ***
                 Lambda =   0.102


          **** END OF GSTABL7 OUTPUT ****
```

| | | |
|---|---|---|
| Curernt GWT = | 26 | ft |
| Design GWT = | 22 | ft |
| Mw = | 7.3 | |
| PGA = | 0.24 | g |

## Table C-1.1: Cyclic Softening of "Clay-like" Soils using M = 7.3 and PGA = 0.24g

| Geologic Unit No. | Predominant Soil Type | Depth (ft) | Moist Unit Weight (pcf) | Current Total Stress (psf) | Current Eff. Stress (psf) | OCR (at the time of investigation) | Preconsolidation Stress (psf) | Free-Field Su (psf) | Embank stress (psf) | Post-construction Total Stress (psf) | Post-construction Eff Stress (psf) | OCR (post-construction) | Post-construction Su (psf) | Su/eff stress | Static FS | $Ts/S_u$ (based on FS) | K.alpha | MSF | $CRR_{M=7.5}$ | rd | CSR | FS | Average FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT 4 | Clay-Like | 0 | | | | | | | | | | | | | | | | | | | | | |
| | | 2 | 118 | 236 | 236 | 5.3 | 1,251 | 229 | 6,720 | 6,956 | 6,284 | 1.0 | 1,634 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 1.00 | 0.17 | 1.06 | 1.1 |
| | | 4 | 118 | 472 | 472 | 5.3 | 2,502 | 458 | 6,720 | 7,192 | 6,520 | 1.0 | 1,695 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 1.00 | 0.17 | 1.07 | |
| | | 6 | 118 | 708 | 708 | 5.3 | 3,752 | 687 | 6,720 | 7,428 | 6,756 | 1.0 | 1,757 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 0.99 | 0.17 | 1.08 | |
| | | 8 | 118 | 944 | 944 | 5.3 | 5,003 | 916 | 6,720 | 7,664 | 6,992 | 1.0 | 1,818 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 0.98 | 0.17 | 1.09 | |
| | | 9 | 118 | 1,062 | 1,062 | 5.3 | 5,629 | 1,031 | 6,720 | 7,782 | 7,110 | 1.0 | 1,849 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 0.98 | 0.17 | 1.09 | |
| UNIT 3 | Sand-Like | 10 | 120 | 1,182 | 1,182 | | | | 6,720 | 7,902 | 7,230 | 1.0 | | | 2.64 | | | | | 0.98 | | | |
| | | 12 | 120 | 1,422 | 1,422 | | | | 6,720 | 8,142 | 7,470 | 1.0 | | | 2.64 | | | | | 0.97 | | | |
| | | 14 | 120 | 1,662 | 1,662 | | | | 6,720 | 8,382 | 7,710 | 1.0 | | | 2.64 | | | | | 0.96 | | | |
| | | 16 | 120 | 1,902 | 1,902 | | | | 6,720 | 8,622 | 7,950 | 1.0 | | | 2.64 | | | | | 0.96 | | | |
| | | 18 | 120 | 2,142 | 2,142 | | | | 6,720 | 8,862 | 8,190 | 1.0 | | | 2.64 | | | | | 0.95 | | | |
| | | 20 | 120 | 2,382 | 2,382 | | | | 6,720 | 9,102 | 8,430 | 1.0 | | | 2.64 | | | | | 0.94 | | | |
| | | 22 | 120 | 2,622 | 2,622 | | | | 6,720 | 9,342 | 8,670 | 1.0 | | | 2.64 | | | | | 0.93 | | | |
| | | 24 | 120 | 2,862 | 2,862 | | | | 6,720 | 9,582 | 8,910 | 1.0 | | | 2.64 | | | | | 0.92 | | | |
| UNIT 2 | Clay-Like | 26 | 120 | 3,102 | 3,102 | 1.2 | 3,722 | 931 | 6,720 | 9,822 | 9,150 | 1.0 | 2,379 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.91 | 0.15 | 1.28 | 1.3 |
| | | 28 | 120 | 3,342 | 3,217 | 1.2 | 3,861 | 966 | 6,720 | 10,062 | 9,265 | 1.0 | 2,409 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.91 | 0.15 | 1.27 | |
| | | 30 | 120 | 3,582 | 3,332 | 1.2 | 3,999 | 1,001 | 6,720 | 10,302 | 9,380 | 1.0 | 2,439 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.90 | 0.15 | 1.27 | |
| | | 32 | 120 | 3,822 | 3,448 | 1.2 | 4,137 | 1,035 | 6,720 | 10,542 | 9,496 | 1.0 | 2,469 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.89 | 0.15 | 1.27 | |
| | | 34 | 120 | 4,062 | 3,563 | 1.2 | 4,275 | 1,070 | 6,720 | 10,782 | 9,611 | 1.0 | 2,499 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.88 | 0.15 | 1.27 | |
| | | 36 | 120 | 4,302 | 3,678 | 1.2 | 4,414 | 1,104 | 6,720 | 11,022 | 9,726 | 1.0 | 2,529 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.87 | 0.15 | 1.27 | |
| | | 38 | 120 | 4,542 | 3,793 | 1.2 | 4,552 | 1,139 | 6,720 | 11,262 | 9,841 | 1.0 | 2,559 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.86 | 0.15 | 1.28 | |
| | | 40 | 120 | 4,782 | 3,908 | 1.2 | 4,690 | 1,174 | 6,720 | 11,502 | 9,956 | 1.0 | 2,589 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.85 | 0.15 | 1.28 | |
| | | 42 | 120 | 5,022 | 4,024 | 1.2 | 4,828 | 1,208 | 6,720 | 11,742 | 10,072 | 1.0 | 2,619 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.84 | 0.15 | 1.28 | |
| | | 44 | 120 | 5,262 | 4,139 | 1.2 | 4,967 | 1,243 | 6,720 | 11,982 | 10,187 | 1.0 | 2,649 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.83 | 0.15 | 1.29 | |
| | | 46 | 120 | 5,502 | 4,254 | 1.2 | 5,105 | 1,277 | 6,720 | 12,222 | 10,302 | 1.0 | 2,679 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.82 | 0.15 | 1.29 | |
| | | 48 | 120 | 5,742 | 4,369 | 1.2 | 5,243 | 1,312 | 6,720 | 12,462 | 10,417 | 1.0 | 2,708 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.81 | 0.15 | 1.30 | |
| | | 50 | 120 | 5,982 | 4,484 | 1.2 | 5,381 | 1,347 | 6,720 | 12,702 | 10,532 | 1.0 | 2,738 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.80 | 0.15 | 1.30 | |
| | | 52 | 120 | 6,222 | 4,600 | 1.2 | 5,520 | 1,381 | 6,720 | 12,942 | 10,648 | 1.0 | 2,768 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.79 | 0.15 | 1.31 | |
| | | 54 | 120 | 6,462 | 4,715 | 1.2 | 5,658 | 1,416 | 6,720 | 13,182 | 10,763 | 1.0 | 2,798 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.78 | 0.15 | 1.31 | |
| | | 56 | 120 | 6,702 | 4,830 | 1.2 | 5,796 | 1,450 | 6,720 | 13,422 | 10,878 | 1.0 | 2,828 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.77 | 0.15 | 1.32 | |
| | | 58 | 120 | 6,942 | 4,945 | 1.2 | 5,934 | 1,485 | 6,720 | 13,662 | 10,993 | 1.0 | 2,858 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.76 | 0.15 | 1.33 | |
| | | 60 | 120 | 7,182 | 5,060 | 1.2 | 6,072 | 1,520 | 6,720 | 13,902 | 11,108 | 1.0 | 2,888 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.75 | 0.15 | 1.33 | |
| | | 62 | 120 | 7,422 | 5,176 | 1.2 | 6,211 | 1,554 | 6,720 | 14,142 | 11,224 | 1.0 | 2,918 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.74 | 0.15 | 1.34 | |
| | | 64 | 121 | 7,664 | 5,293 | 1.2 | 6,351 | 1,589 | 6,720 | 14,384 | 11,341 | 1.0 | 2,949 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.73 | 0.14 | 1.35 | |
| UNIT 1 | Sand-Lke | 66 | 121 | 7,906 | 5,410 | | | | 6,720 | 14,626 | 11,458 | 1.0 | | | 4.19 | | | | | 0.72 | | | |
| | | 68 | 121 | 8,148 | 5,527 | | | | 6,720 | 14,868 | 11,575 | 1.0 | | | 4.19 | | | | | 0.71 | | | |
| | | 70 | 121 | 8,390 | 5,644 | | | | 6,720 | 15,110 | 11,692 | 1.0 | | | 4.19 | | | | | 0.71 | | | |

**Notes :**

1 Groundwater: Current = 26 ft bgs, Design = 22 ft bgs (see Section 2.2.3, February 15, 2011 Report)
2 Design Earthquake: Mw = 7.3 and PGA = 0.24g for Stansbury Fault, based on PSHA for 5,000-yr return period (See page 4 of this report)
3 Generalized Geologic Profile: Based on CPT99-01 through CPT99-03 and CPT-04 through CPT-06 (See Figures 5a and 5b of February 15, 2011 Report). Units 1 and 3 are primarily "sand-like" materials and were not analyzed for cyclic softening
4 Unit Weights: See Table 3.1 of February 15, 2011 Report, Unit weight of embankment =112 pcf
5 Overconsolidation ratio (OCR): Unit 4 - varies from 2 to 8 (used 5.3), Unit 2 - varies 1 to 2 (used 1.2). These OCR values were previously used in other calculations, as presented in February 15, 2011 report
6 Preconsolidation Pressure: Effective Stress x OCR
7 Free-Field Undrained Shear Strength: Use SHANSEP Model with m = 0.26 and n = 0.79 (see Section 3.2 and page 15 of December 13, 2005 Report)
8 Embankment Stress: Embankment height varies from 45 to 85 feet, Used 60 ft as average
9 Postconstruction Total Stress = Current Total Stress + Embankment Stress (plane-strain condition, no reduction with depth)
10 Postconstruction Effective Stress = Current Effective Stress + 90% of Embankment Stress (assumed 90% consolidation in all Units at the end of 2 years after construction)
11 Postconstruction OCR: 1.0 (assumed for all Units)
12 Postconstruction Undrained Shear Strength: Use SHANSEP Model with m = 0.26 and n = 0.79 and Postconstruction Effective Stress and respective OCR
13 Static Factor of Safety: min FS = 2.64 through Unit 4 and 4.19 through Unit 2 (using undrained strengths), see Appendix C of this report
14 Average Static Shear Stress Due to Embankment Loading/Undrained Shear Strength (Ts/Su) = (1/FS) for static limit equilibrium analysis
15 Static Shear Stress Correction Factor (K. alpha): Computed using Equation 9 in Boulanger-Idriss (2007), ASCE Geotechnical Journal, Vol. 133, No. 6, p. 645
16 Magnitude Scaling Factor (MSF): Computed using Equation 6 in Boulanger-Idriss (2007), ASCE Geotechnical Journal, Vol. 133, No. 6, p. 645
17 Cyclic Resistance Ratio (CRR): Computed using Equation 12 in Boulanger-Idriss (2007), ASCE Geotechnical Journal, Vol. 133, No. 6, p. 645
18 Stress Reduction Coefficient (rd): Computed using Idriss (1999) and Idriss-Boulanger (2004) - see Page 3-1 and 3-2 of UC-Davis Report No. UCD/CGM-04/01 dated December 2004
19 Cyclic Stress Ratio (CSR) = 0.65 * PGA * (postconstruction total stress / postconstruction effective stress) * rd
20 Factor of Safety for Cyclic Softening = CRR/ CSR

| | | |
|---|---|---|
| Curernt GWT = | 26 | ft |
| Design GWT = | 22 | ft |
| Mw = | 7.3 | |
| PGA = | 0.28 | g |

## Table C-1.2: Cyclic Softening of "Clay-like" Soils usign M = 7.3 and PGA = 0.28g

| Geologic Unit No. | Predominant Soil Type | Depth (ft) | Moist Unit Weight (pcf) | Current Total Stress (psf) | Current Eff. Stress (psf) | OCR (at the time of investigation) | Preconsolidation Stress (psf) | Free-Field Su (psf) | Embank stress (psf) | Post-construction Total Stress (psf) | Post-construction Eff Stress (psf) | OCR (post-construction) | Post-construction Su (psf) | Su/eff stress | Static FS | $Ts/S_u$ (based on FS) | K.alpha | MSF | $CRR_{M=7.5}$ | rd | CSR | FS | Average FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT 4 | Clay-Like | 0 | | | | | | | | | | | | | | | | | | | | | |
| | | 2 | 118 | 236 | 236 | 5.3 | 1,251 | 229 | 6,720 | 6,956 | 6,284 | 1.0 | 1,634 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 1.00 | 0.20 | 0.91 | 0.92 |
| | | 4 | 118 | 472 | 472 | 5.3 | 2,502 | 458 | 6,720 | 7,192 | 6,520 | 1.0 | 1,695 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 1.00 | 0.20 | 0.92 | |
| | | 6 | 118 | 708 | 708 | 5.3 | 3,752 | 687 | 6,720 | 7,428 | 6,756 | 1.0 | 1,757 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 0.99 | 0.20 | 0.93 | |
| | | 8 | 118 | 944 | 944 | 5.3 | 5,003 | 916 | 6,720 | 7,664 | 6,992 | 1.0 | 1,818 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 0.98 | 0.20 | 0.93 | |
| | | 9 | 118 | 1,062 | 1,062 | 5.3 | 5,629 | 1,031 | 6,720 | 7,782 | 7,110 | 1.0 | 1,849 | 0.26 | 2.64 | 0.38 | 0.88 | 1.01 | 0.18 | 0.98 | 0.20 | 0.94 | |
| UNIT 3 | Sand-Like | 10 | 120 | 1,182 | 1,182 | | | | 6,720 | 7,902 | 7,230 | 1.0 | | | 2.64 | | | | | 0.98 | | | |
| | | 12 | 120 | 1,422 | 1,422 | | | | 6,720 | 8,142 | 7,470 | 1.0 | | | 2.64 | | | | | 0.97 | | | |
| | | 14 | 120 | 1,662 | 1,662 | | | | 6,720 | 8,382 | 7,710 | 1.0 | | | 2.64 | | | | | 0.96 | | | |
| | | 16 | 120 | 1,902 | 1,902 | | | | 6,720 | 8,622 | 7,950 | 1.0 | | | 2.64 | | | | | 0.96 | | | |
| | | 18 | 120 | 2,142 | 2,142 | | | | 6,720 | 8,862 | 8,190 | 1.0 | | | 2.64 | | | | | 0.95 | | | |
| | | 20 | 120 | 2,382 | 2,382 | | | | 6,720 | 9,102 | 8,430 | 1.0 | | | 2.64 | | | | | 0.94 | | | |
| | | 22 | 120 | 2,622 | 2,622 | | | | 6,720 | 9,342 | 8,670 | 1.0 | | | 2.64 | | | | | 0.93 | | | |
| | | 24 | 120 | 2,862 | 2,862 | | | | 6,720 | 9,582 | 8,910 | 1.0 | | | 2.64 | | | | | 0.92 | | | |
| UNIT 2 | Clay-Like | 26 | 120 | 3,102 | 3,102 | 1.2 | 3,722 | 931 | 6,720 | 9,822 | 9,150 | 1.0 | 2,379 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.91 | 0.18 | 1.09 | 1.1 |
| | | 28 | 120 | 3,342 | 3,217 | 1.2 | 3,861 | 966 | 6,720 | 10,062 | 9,265 | 1.0 | 2,409 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.91 | 0.18 | 1.09 | |
| | | 30 | 120 | 3,582 | 3,332 | 1.2 | 3,999 | 1,001 | 6,720 | 10,302 | 9,380 | 1.0 | 2,439 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.90 | 0.18 | 1.09 | |
| | | 32 | 120 | 3,822 | 3,448 | 1.2 | 4,137 | 1,035 | 6,720 | 10,542 | 9,496 | 1.0 | 2,469 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.89 | 0.18 | 1.09 | |
| | | 34 | 120 | 4,062 | 3,563 | 1.2 | 4,275 | 1,070 | 6,720 | 10,782 | 9,611 | 1.0 | 2,499 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.88 | 0.18 | 1.09 | |
| | | 36 | 120 | 4,302 | 3,678 | 1.2 | 4,414 | 1,104 | 6,720 | 11,022 | 9,726 | 1.0 | 2,529 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.87 | 0.18 | 1.09 | |
| | | 38 | 120 | 4,542 | 3,793 | 1.2 | 4,552 | 1,139 | 6,720 | 11,262 | 9,841 | 1.0 | 2,559 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.86 | 0.18 | 1.09 | |
| | | 40 | 120 | 4,782 | 3,908 | 1.2 | 4,690 | 1,174 | 6,720 | 11,502 | 9,956 | 1.0 | 2,589 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.85 | 0.18 | 1.10 | |
| | | 42 | 120 | 5,022 | 4,024 | 1.2 | 4,828 | 1,208 | 6,720 | 11,742 | 10,072 | 1.0 | 2,619 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.84 | 0.18 | 1.10 | |
| | | 44 | 120 | 5,262 | 4,139 | 1.2 | 4,967 | 1,243 | 6,720 | 11,982 | 10,187 | 1.0 | 2,649 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.83 | 0.18 | 1.10 | |
| | | 46 | 120 | 5,502 | 4,254 | 1.2 | 5,105 | 1,277 | 6,720 | 12,222 | 10,302 | 1.0 | 2,679 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.82 | 0.18 | 1.11 | |
| | | 48 | 120 | 5,742 | 4,369 | 1.2 | 5,243 | 1,312 | 6,720 | 12,462 | 10,417 | 1.0 | 2,708 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.81 | 0.18 | 1.11 | |
| | | 50 | 120 | 5,982 | 4,484 | 1.2 | 5,381 | 1,347 | 6,720 | 12,702 | 10,532 | 1.0 | 2,738 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.80 | 0.18 | 1.12 | |
| | | 52 | 120 | 6,222 | 4,600 | 1.2 | 5,520 | 1,381 | 6,720 | 12,942 | 10,648 | 1.0 | 2,768 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.79 | 0.17 | 1.12 | |
| | | 54 | 120 | 6,462 | 4,715 | 1.2 | 5,658 | 1,416 | 6,720 | 13,182 | 10,763 | 1.0 | 2,798 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.78 | 0.17 | 1.13 | |
| | | 56 | 120 | 6,702 | 4,830 | 1.2 | 5,796 | 1,450 | 6,720 | 13,422 | 10,878 | 1.0 | 2,828 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.77 | 0.17 | 1.13 | |
| | | 58 | 120 | 6,942 | 4,945 | 1.2 | 5,934 | 1,485 | 6,720 | 13,662 | 10,993 | 1.0 | 2,858 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.76 | 0.17 | 1.14 | |
| | | 60 | 120 | 7,182 | 5,060 | 1.2 | 6,072 | 1,520 | 6,720 | 13,902 | 11,108 | 1.0 | 2,888 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.75 | 0.17 | 1.14 | |
| | | 62 | 120 | 7,422 | 5,176 | 1.2 | 6,211 | 1,554 | 6,720 | 14,142 | 11,224 | 1.0 | 2,918 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.74 | 0.17 | 1.15 | |
| | | 64 | 121 | 7,664 | 5,293 | 1.2 | 6,351 | 1,589 | 6,720 | 14,384 | 11,341 | 1.0 | 2,949 | 0.26 | 4.19 | 0.24 | 0.93 | 1.01 | 0.20 | 0.73 | 0.17 | 1.16 | |
| UNIT 1 | Sand-Lke | 66 | 121 | 7,906 | 5,410 | | | | 6,720 | 14,626 | 11,458 | 1.0 | | | 4.19 | | | | | 0.72 | | | |
| | | 68 | 121 | 8,148 | 5,527 | | | | 6,720 | 14,868 | 11,575 | 1.0 | | | 4.19 | | | | | 0.71 | | | |
| | | 70 | 121 | 8,390 | 5,644 | | | | 6,720 | 15,110 | 11,692 | 1.0 | | | 4.19 | | | | | 0.71 | | | |

**Notes :**

1 Groundwater: Current = 26 ft bgs, Design = 22 ft bgs (see Section 2.2.3, February 15, 2011 Report)
2 Design Earthquake: Mw = 7.3 and PGA = 0.24g for Stansbury Fault, based on PSHA for 5,000-yr return period (See page 4 of this report)
3 Generalized Geologic Profile: Based on CPT99-01 through CPT99-03 and CPT-04 through CPT-06 (See Figures 5a and 5b of February 15, 2011 Report). Units 1 and 3 are primarily "sand-like" materials and were not analyzed for cyclic softening
4 Unit Weights: See Table 3.1 of February 15, 2011 Report, Unit weight of embankment =112 pcf
5 Overconsolidation ratio (OCR): Unit 4 - varies from 2 to 8 (used 5.3), Unit 2 - varies 1 to 2 (used 1.2). These OCR values were previously used in other calculations, as presented in February 15, 2011 report
6 Preconsolidation Pressure: Effective Stress x OCR
7 Free-Field Undrained Shear Strength: Use SHANSEP Model with m = 0.26 and n = 0.79 (see Section 3.2 and page 15 of December 13, 2005 Report)
8 Embankment Stress: Embankment height varies from 45 to 85 feet, Used 60 ft as average
9 Postconstruction Total Stress = Current Total Stress + Embankment Stress (plane-strain condition, no reduction with depth)
10 Postconstruction Effective Stress = Current Effective Stress + 90% of Embankment Stress (assumed 90% consolidation in all Units at the end of 2 years after construction)
11 Postconstruction OCR: 1.0 (assumed for all Units)
12 Postconstruction Undrained Shear Strength: Use SHANSEP Model with m = 0.26 and n = 0.79 and Postconstruction Effective Stress and respective OCR
13 Static Factor of Safety: min FS = 2.64 through Unit 4 and 4.19 through Unit 2 (using undrained strengths), see Appendix C of this report
14 Average Static Shear Stress Due to Embankment Loading/Undrained Shear Strength (Ts/Su) = (1/FS) for static limit equilibrium analysis
15 Static Shear Stress Correction Factor (K. alpha): Computed using Equation 9 in Boulanger-Idriss (2007), ASCE Geotechnical Journal, Vol. 133, No. 6, p. 645
16 Magnitude Scaling Factor (MSF): Computed using Equation 6 in Boulanger-Idriss (2007), ASCE Geotechnical Journal, Vol. 133, No. 6, p. 645
17 Cyclic Resistance Ratio (CRR): Computed using Equation 12 in Boulanger-Idriss (2007), ASCE Geotechnical Journal, Vol. 133, No. 6, p. 645
18 Stress Reduction Coefficient (rd): Computed using Idriss (1999) and Idriss-Boulanger (2004) - see Page 3-1 and 3-2 of UC-Davis Report No. UCD/CGM-04/01 dated December 2004
19 Cyclic Stress Ratio (CSR) = 0.65 * PGA * (postconstruction total stress / postconstruction effective stress) * rd
20 Factor of Safety for Cyclic Softening = CRR/ CSR

# UTAH LOW-LEVEL RADIOACTIVE WASTE DISPOSAL LICENSE AMENDMENT REQUEST (UT2300249) FOR THE CLASS A WEST EMBANKMENT

## ENERGY*SOLUTIONS* RESPONSE TO ROUND 2 INTERROGATORIES

**January 12, 2012**

**For**

**Utah Division of Radiation Control**

195 North 1950 West

Salt Lake City, UT 84114-4850

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## 1. INTERROGATORY CAW R313-25-6(3)-01/2A: DESCRIPTION OF FACILITY

**Division's Interrogatory Statement:** *Refer to Sections1.2.2.12 and 1.2.3 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

1. *Provide a revised description in Section 1.2.2.12 indicating that, contrary to the statement made that "No existing facilities will be impacted by the CAW embankment", a number of "facilities" will be affected by the proposed CAW Embankment (e.g., the Class A and Class A North Embankments, groundwater monitoring wells, and selected lysimeters [as described in Section 1.2.3]).*

**Energy*Solutions* Response:** The following text has been added to Section 1.2.2.12 (see italics):

A current site layout is provided on drawing 0801-G03 in Attachment 2. Engineering Drawing 10014-U01 illustrates the location of the Class A West embankment in relation to other site facilities. *Various lysimeters and groundwater monitoring wells will be impacted by the Class A West embankment footprint; also, as discussed in the introduction to this document, this License Amendment Request also proposes combining the Class A and Class A north embankments into one embankment. As such, those two facilities will also be impacted by this submittal. The rest of this document will describe in further detail how these changes are to be integrated in the overall design of the facility.*

Waste placement will generally progress from the southern boundary of the existing Class A footprint to the north, with large component and Containerized Waste Facility disposal areas developed separately prior to being enveloped by bulk waste placement. This is consistent with current approved practices.

## 2. INTERROGATORY CAW R313-25-7(2)-03/2A: SPECIFIC TECHNICAL INFORMATION – BUFFER ZONE

**Division's Interrogatory Statement:** *NOTE: The following comments apply to revisions of drawings issued prior to issuance of revisions submitted to the Division with Revision 1 of the License Amendment Request on October 31, 2011. These comments apply to the revisions transmitted on November 29, 2011 to the extent that they have not been addressed by the latest revisions.*

*Please revise Drawing 10014 C01 as follows:*

1. *Correctly show the "CAW Waste Break Line" in the drawing (presently, the line style for CAW Waste Limit appears to be used to denote the CAW Waste Break Line).*
2. *Use a line style for Class A and Class A North Embankments that is easily distinguishable from that used to denote the CAW Waste Break Lines.*
3. *Provide coordinate sets that define the end points of the heavy dashed line. Label these coordinate sets so that it is clear what they represent. Explicitly state that the heavy dashed line defines the eastern extreme of waste placement and that no waste will be*

*placed east of that line from its north end to its south end. NOTE: The line is presently labeled as representing an "area".*

4. *Revise the legend label from "Waste Restricted Area" to "Eastern extreme of CAW waste placement" or similar. Maintain consistency between terminology used in the entire drawing set.*
5. *Revise references to the "Waste Restricted Area" so that it refers to a line, limit, or boundary.*

*Please revise Drawing 10014 C02 as follows:*

6. *Identify the location of the "Eastern extreme of CAW waste placement" in Cross Section A.*
7. *Maintain consistency between terminology used in this drawing (that for "Shoulder") and in Drawing 10014 C05 [that for "CAW Break Line (Typical)"].*

*Please revise Drawing10014 C03 as follows:*

8. *Revise the term "Toe of Waste (Actual)" to "Eastern extreme of CAW waste placement" or otherwise maintain consistency between terminology used throughout this drawing set.*
9. *Revise the term "Waste Limits" to be "Authorized CAW Waste Limits".*

*Please revise Drawing 10014 C05 as follows:*

10. *Maintain consistency between terminology used in this drawing [that for "CAW Break Line (Typical)"] and in Drawing 10014 C03 (that for "Shoulder").*

***Note:*** *Additional suggested changes/corrections to drawings will be provided in Round 2b Interrogatories, as necessary.*

**Energy*Solutions* Response:** The recommended changes to line types and references to break-line, etc. have been incorporated into Drawings C01 and CO2.

During the evaluation of the recommended changes to the "Waste Restricted Area" (Drawings C01, C02 and CO3), it was determined that a special waste limit along the east side of the Class A/Class A West embankment is not required. The license drawings and CQA/QC plan (all revisions) that apply to the Class A and Class A North embankments by design built in a minimum 5 ft waste holdback from the permitted waste limits. These same governing design and construction specifications are carried forward to the proposed Class A West embankment (drawings and CQA/QC plan). More specifically, the permitted waste limits (toe of waste) defined on the license drawings (Class A and Class A North) places the toe of waste on top of the clay liner (elevation 4265). However, the embankment design and CQA/QC plan require that rather than waste, the first foot of material above the liner is liner protective cover (clean native soils). Therefore, when approved liner is "opened" for waste placement, the waste limit (actual toe of waste) is required to be set back 5 ft from the permitted limits. These design constraints are what the "Toe of Waste, Actual" and "Toe of Waste" labels and leaders on Drawing C03 depict.

Consequently, Energy*Solutions* has revised the CAW embankment design drawings to more accurately define the waste limit (toe of waste) by revising the waste limit to be 1 ft higher

(4266) and offset 5 ft inward from the previous limits. This change eliminates the confusion of permitted vs. actual waste limits and whether or not liner protective cover is included with the design waste capacity. It also eliminates the need for a "Waste Restricted Area" or "Eastern extreme of CAW waste placement" or other special limit. Also, importantly, it carries forward the as-built conditions for the Class A and Class A North embankments. Lastly, it complies with the 90 ft buffer zone requirement around the entire embankment perimeter, including along the Vitro property boundary. In addition to Drawings C01, C02 and C03, Drawings C08, U01 and U02 have been revised to show the new waste limit. Please note that waste capacity for the Class A West embankment remains unchanged, since the liner protective cover was previously excluded from the volume.

The line types denoting the CAW embankment waste break-lines and the Large Component and CWF waste limits on Drawing C05 were revised to be consistent with other drawings.

In addition to the interrogatory recommendations, a new cross section and detail was added to Drawing C08 to provide clay liner tie-in information between the existing Class A and Class A North constructed and approved liners. Along these same lines, Note 4 was added to Drawing C01 to clarify that the top of liner elevations for the Class A, Class A North and Class A West are the same (elevation 4265) and are flat.

## 3. INTERROGATORY CAW R313-25-7(3)-04/2A: SPECIFIC TECHNICAL INFORMATION – DESIGN CRITERION FOR DISTORTION OF LINER AND CLAY COVER COMPONENTS

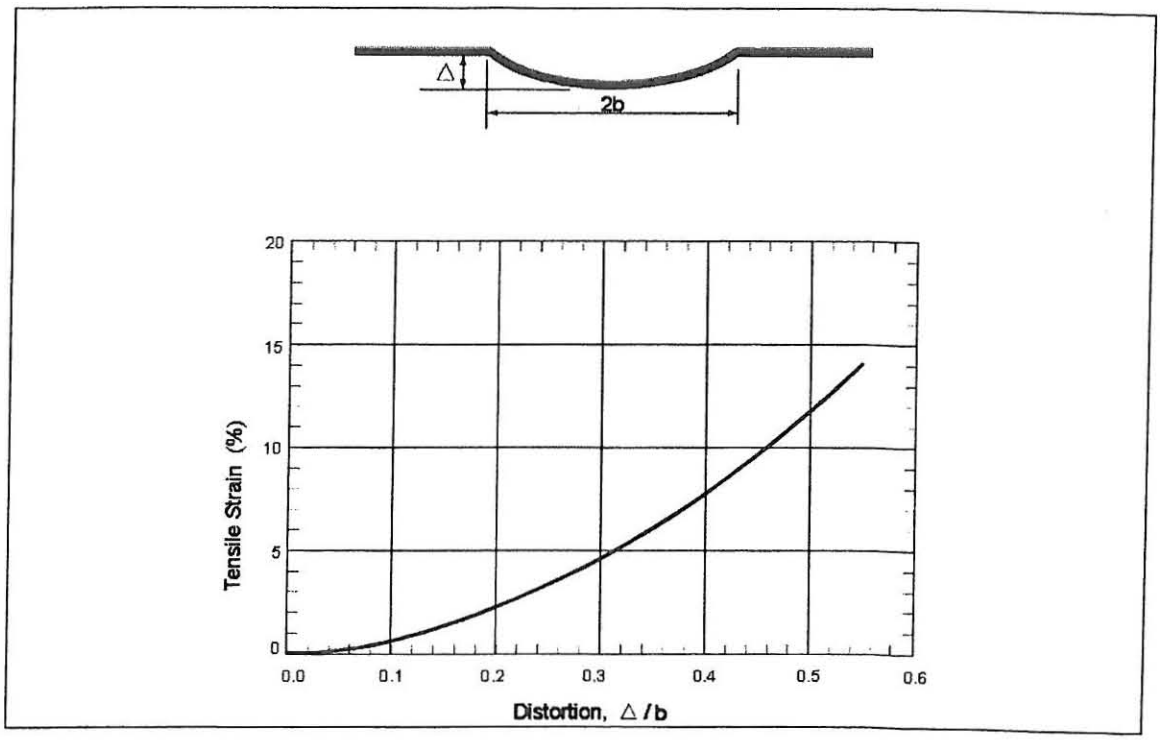
**Division's Interrogatory Statement:**

1. *Please demonstrate that the maximum tensile strain associated with an angular distortion of 0.02 ft/ft is sufficiently less than the strain which causes a compacted clay liner (CCL) to crack, considering the properties of the soil(s) in question. As part of this demonstration, please integrate results/findings from more recent investigations of compacted clay layer deformation behavior with prior investigation/testing results. The demonstration should consider both axial and bending strains when relating maximum tensile strain to angular distortion. The demonstration should also address the potential role of soil creep and/or moisture changes over time in determining the maximum allowable tensile strain.*
2. *In Table 1, page 8, of the Response to Round 1 Interrogatories (EnergySolutions 2011), please revise entries in the last column is titled "Maximum Tensile Strain (%") to list the correct parameter reported for each cited case study, or delete the row summarizing results for the study if the listed value is not tensile strain. For example, the study by Le et al. 2009 measured maximum tensile strength which is not the same as maximum tensile strain as listed in the table.*

**Energy*Solutions* Response:** Differential settlement is usually quantified in terms of the magnitude of differential settlement (Δ) that occurs over a distance (b), yielding angular distortion, Δ/b. Angular distortion may damage clay layers, because distortion produces tensile strains, and tensile strains cause clay materials to fail if the strains are excessive. Tensile strains

are generated by the material elongation associated with geometric distortion. A relationship between angular distortion and tensile strain is shown in Figure 1.

**Figure 1. Theoretical Relationship Between Tensile Strain and Angular Distortion (EPA, 2004)**




The proposed Class A West Embankment cover system described in Tables 1 and 2 (below) serves several purposes. First, the cover systems promote evapotranspiration from the surface of the disposal cover. Second, the cover systems intercept moisture before it contacts the cover barrier and transmits it laterally away from the disposal unit. Third, the cover system provides a reliable, low-conductivity, vertical barrier between the upper cover horizon and the waste disposal unit. The cover systems also accommodate uniform and differential settlement without compromise. This criterion is satisfied by the overall thickness and resilience of low-permeability clay layers. In addition to reduced hydraulic cover conductivity, the clay layers ensure that localized settlement can be accommodated by plastic deformation.

## Table 1. Top Slope Design – Class A West Embankment

| Layer | Material | Thickness (inches) | Layer Type | Material Description |
|---|---|---|---|---|
| Layer 1 | Type-B Rip Rap | 24 | vertical percolation | 1.25 inches |
| Layer 2 | Type-A Filter (upper) | 6 | vertical percolation | Coarse Sand - Fine Cobble |
| Layer 3 | Sacrificial Soil | 12 | vertical percolation | Silty Sand and Gravel |
| Layer 4 | Type-B Filter (lower) | 6 | lateral drainage | Coarse Sand -Fine Gravel |
| Layer 5 | Upper Radon Barrier | 12 | barrier soil | Clay |
| Layer 6 | Lower Radon Barrier | 12 | vertical percolation | Clay |
| Layer 7 | Waste | 100 | vertical percolation | Sand |
| Layer 8 | Clay Liner | 24 | barrier soil | Clay |

## Table 2. Side Slope Design – Class A West Embankment

| Layer | Material | Thickness (inches) | Layer Type | Material Description |
|---|---|---|---|---|
| Layer 1 | Type-A Rip Rap | 24 | vertical percolation | 12 inches |
| Layer 2 | Type-A Filter (upper) | 6 | vertical percolation | Coarse Sand - Fine Cobble |
| Layer 3 | Sacrificial Soil | 12 | vertical percolation | Silty Sand and Gravel |
| Layer 4 | Type-B Filter (lower) | 18 | lateral drainage | Coarse Sand -Fine Gravel |
| Layer 5 | Upper Radon Barrier | 12 | barrier soil | Clay |
| Layer 6 | Lower Radon Barrier | 12 | vertical percolation | Clay |
| Layer 7 | Waste (Side Slopes) | 100 | vertical percolation | Sand |
| Layer 8 | Clay Liner (Side Slope) | 24 | barrier soil | Clay |

Several studies employing a variety of testing techniques on various clays have been conducted since AMEC's initial 2000 analysis (as summarized in Table 3 – reflecting requested revisions). However, it is important to note that the clays from the cited studies exhibit similar measures of ductility to Clive's clay material, with cited average plasticity indices of 16% (generally ranging from 8% - 22%). The studies summarized in Table 3 report several common critical properties

for the clays evaluated, including maximum tensile strain, maximum outer fiber strain, and maximum strain at crack initiation (failure).

**Table 3 – Summary of Maximum Tensile Strain Studies for Clay Barriers**

| | Reference | Plasticity Index (%) | Liquid Limit (%) | Maximum Dry Density (pcf) | Parameter of Interest |
|---|---|---|---|---|---|
| **Energy*Solutions'* Clay** | AMEX, 2000 | 10 - 25 avg 16 | 36 | 97 - 106 | Maximum Tensile Strain = 0.8% |
| **Speswhite Kaolin Clay** | Viswanadham, 2002 | 16.5 | 44.5 | 87.1 - 102.9 | Maximum outer fiber strain = 16% - 20% |
| **Nuozhadu Dam** | Wang, 2007 | 8.9 | 29.1 | 99.9 - 109.9 | Maximum axial strain before failure = 0.54% |
| **Generic Clay** | Le, 2009 | | | | Strains corresponding to maximum compression stresses = 2.5% - 4.7% |
| **Aube, France (Aptien Clays)** | Camp, 2010 | 22 | 44 | 47.1 - 115.3 | Strain at crack initiation = 0.3% to 0.6% |
| **Aube, France (Aptien Clays)** | Gourc, 2010 | 16-22 | 38 - 44 | 101.3 - 110.8 | Strains at crack initiation = 0.3% - 0.9% |
| **Landfill Barriers** | Rajesh, 2010 | 16 | 38 | 101.3 | Maximum outer fiber strain = 2.8% - 3.0% |
| **Model Clay (80% Kaolin, 20% sand)** | Viswanadham, 2009 | 16 | 38 | 101.3 | Strain at crack initiation = 0.71%<br>Maximum outer fiber strain=3.11% |

Failure of covers due to excessive differential settlement from linear elastic fracture mechanics has been long known to be problematic in cover performance integrity. As is reflected in the sample of references cited above in Table 3, the deformation behavior of clay barriers at the onset of continuous differential settlements, relationship of maximum tensile strain to angular distortion, relationship of axial and bending strains to angular distortion, and the potential role of soil creep and/or moisture changes over time to maximum allowable tensile strain have been analyzed analytically, in full-scale field tests, and through reduced-scale laboratory testing. Based on these and other studies, clays tested under unconfined or low confinement conditions exhibit relatively brittle behavior and reach failure at axial extensional strains of 0.02 to 4%, with most compacted clays exhibiting failure at extensional strains of 0.5% or less (EPA, 2004).

Viswanadham (2002) presented results conducted on less dense clays (with slightly higher liquid limits than those native to EnergySolutions' Clive site) in small-centrifuge laboratory tests, with maximum out fiber strains ranging from 16% to 20%. Wang (2007) utilized an improved 3-point bending beam loading assembly to measure fracture resistance in clays used in earth-rock fill dams of Western China (maximum axial strain before failure of 0.54%). Wang's clays exhibited a lower plasticity index and liquid limit than those native to EnergySolutions' Clive site. Le (2009) used a Discrete Element Method to measure strains corresponding to maximum compression stresses for generic clays between 2.5% and 4.7%. Following his analysis in 2002, Viswanadham (2009) again used his centrifuge model to measure strain at crack initiation of 0.7% and maximum outer fiber strain of 3.11%, for similar clays of those native to EnergySolutions' Clive site. Camp (2010) utilized a 4-point bending test protocol to measure strains at crack initiation of 0.3% to 0.6% for Aptien clays (similar to those native to EnergySolutions' Clive site). Subsequently, Gourc (2010) used fill-scale and centrifuge tests again on Aptien clays to observe strains at crack initiation of 0.3% to 0.9%. Finally, Rajesh (2010) utilized a hydraulic trap-door centrifuge system on clays used on Bombay, India landfills (which are also similar to those native to EnergySolutions' Clive site) to observe maximum outer fiber strains of 2.8% to 3.0%.

These references further substantiate LaGatta's (1997) demonstration of the relationship between differential settlement, tensile strain, and angular distortion, noting that at very small values of angular distortion, clay tensile strains are also very small. From these references, the selection of a maximum tensile strain of 0.2% is demonstrated to be a very conservative lower bound. At such a small tensile strain, LaGatta estimates an angular distortion of 0.06 (providing basis for the selected design criterion of 0.02 for allowable distortion of the liner and clay components of the Class A West Embankment cover).

## 4. INTERROGATORY CAW R313-25-7(7)-05/2B: SPECIFIC TECHNICAL INFORMATION -- CLOSURE PLAN

**Division's Interrogatory Statement:**

- *Please revise Attachment 9 to the CAW LAR to address and justify the increased demand for clay and rock, as stated in Attachment 5 to ES letter CD11-0327.*
- *Please demonstrate quantitatively that the amount of rock available for constructing the revised CAW cover system is adequate to meet the need for rock stated in the Round 1 Response to this interrogatory in Section 2.5.4 of CAW LAR, rev. 2.*
- *Provide evidence that EnergySolutions has valid claims to rock in any of the "adjoining pit areas [that] contain several hundred thousand additional cubic yards of material." State and justify the total amount of rock to which EnergySolutions has valid claims.*
- *Demonstrate that rock from these adjoining pits to which EnergySolutions has valid claims and has included in the total amount stated in Item 3 above is of adequate quality under NUREG-1623 for use in constructing the CAW cover system.*

**Energy*Solutions* Response:** Attachment 9 has been revised to address and justify the increased demand for clay and rock.

Clay borrow (required for liner, liner protective cover, temporary cover and radon barrier) is available on Energy*Solutions* property. Rock, sand and gravel borrow material (needed for the filter, sacrificial soil and riprap cover layers) is available on BLM land in the Grayback Hills north of the facility. As is depicted in Attachment 9 to the License Amendment Request, there are four potential clay borrow areas located within Section 29 on Energy*Solutions* property. Calculations attached therein conservatively estimate sufficient suitable clay within these 4 areas. The clay resource in these areas is larger than the material required for construction of clay liner, liner protective cover, temporary cover and radon barrier.

The total rock, sand and gravel borrow requirements for the Class A West, 11e.(2) and Mixed Waste embankments is presented in Attachment 9. Energy*Solutions* has previously demonstrated (through the annual surety review process) that there is sufficient resource of suitable rock borrow within Energy*Solutions*' contract area of BLM Community Pit 24 (62744) located in the Grayback Hills north of the Clive facility. In review, provided as Attachment 9 to the Class A West License Amendment Request, is an excerpt from a report prepared by PEPG Engineering, L.L.C. (2004) that summarizes exploratory digging and evaluation of Site C3, which is the Energy*Solutions* contract area of Pit 24. Per the report (refer to page 2) there is sufficient proven and probable material within the pit.

The Figure entitled, "Central Grayback 24 CP 62744" of Attachment 9 to the License Amendment Request shows the community pit boundaries and the Energy*Solutions* contract area there within. No material has been removed from the contract area since the PEPG exploration was performed. As a result of a recent Energy*Solutions* request, BLM provided an estimate of the resource available within the entire community pit. In response, the BLM confirmed that there is a resource of at least 1.9 million cubic yards within Community Pit 24 (Garahana, 2011, letter provided in Attachment 9 of the Class A West License Amendment Request). Last, in response to a request for information from the Division to demonstrate that the material within Community Pit 24 is suitable for cover materials, Energy*Solutions* has provided in Attachment 9 a letter from John Garr, Montgomery Watson Harza. The attached letter confirms that the rock material within Pit 24 is the same type of material as that from previously approved borrow pits located on the south end of the Grayback Hills.

## 5. INTERROGATORY CAW R313-25-8(4)-11/2B: TECHNICAL ANALYSIS - ROCK COVER DESIGN AND ROCK COVER DESIGN CALCULATIONS/ ANALYSES

1. **Division's Interrogatory Statement: Refer to Drawing 10014 C04 of Energy*Solutions* 2011a; and 2011b and Drawing 10014 C04, Rev. 2 of Energy*Solutions* 2011c:** *To further justify and corroborate the expected hydraulic performance of the Type A Filter Zone/bedding layer and further evaluate its ability to accommodate the proposed change in riprap layer design (EnergySolutions 2011c), please provide the following:*

    1. *Calculations/estimates of expected interstitial flow velocities within the Type A Filter Zone Layer on the topslope and sideslope areas, derived using alternative analysis methods, including, but not necessarily limited to: (a) Abt et al. 1991/Abt et al. 1988, Section 5.3; and (b) Codell et al. 1990;*

2. *Evaluation of the potential impact of results of additional infiltration analyses conducted in response to Interrogatory CAW R313-25-8(4)-14/2B: "Technical Analysis - Infiltration and Transport Modeling: Climate Conditions, Engineered Barrier Conditions, and Vertical Transport Distance" below on the projected performance of, and technical adequacy of, the various cover layers in proposed CAW Embankment cover, including but not limited to, the riprap layer, Type A Filter Zone layer, and the underlying Sacrificial Soil layer.*

3. *Other additional information to fully justify the selection of a thickness of 6 inches for the Type A Filter Zone layer, which appears to be contrary to the following published guidance:*

    - *Nelson et al. 1986, Section 4.4, which indicates that a filter/bedding layer thickness of one-half the riprap layer thickness, but not less than 6 to 9 inches, depending on the riprap thickness and riprap design procedure, is recommended; and*

    - *Abt et el. 1988, Section 7.1, which highly recommends the use of a filter/bedding layer greater than 6 inches thick (to ensure stability of the riprap, prevent migration of particles beneath the filter/bedding layer, and reduce any pressure gradient that may exist from seepage).*

**Energy*Solutions* Response:**

1. The calculation methods described in this interrogatory (Abt, 1991 and Codell, 1990) were performed as additional verification within Section 3.0 of the CAW Rock Cover Calculations found in Attachment 10 of the License Amendment Request. The revised calculations are dated December 27, 2011 and are provided as Attachment 10 to the License Amendment Request.

2. Please refer to Interrogatory CAW R313-25-8(4)-14/2B for a response to part 2 of this interrogatory.

3. As cited, NUREG/CR-4620 (1986) recommends that the filter layer should be at least half the thickness of the riprap layer. However, this recommendation is not made in NUREG-1623 (2002), which is considered to provide updated design criteria for stabilization of waste repositories and is considered to supercede and replace many portions of NUREG/CR 4620.

    To determine the reasons why the recommendations were not carried forward in NUREG-1623, Energy*Solutions* contacted the author of NUREG-1623; Ted Johnson (now retired from NRC). Mr. Johnson indicated that NUREG-1623 provides some discussion as to why a filter is needed, and in some cases, not needed, but there was no attempt made to provide a quantitative method for determining the filter layer thickness. Mr. Johnson provided the following rationale for the design of a filter layer under a riprap layer, from an erosion protection standpoint.

    (1) <u>The filter layer on the CAW, and most other waste repositories, does not serve the same purpose as other filter layers.</u>

The purpose and requirements for a filter layer for this application are much different than filter requirements for riprap along a river bank, for example, where there could be significant seepage flows through the filter. In such cases, a filter layer is provided to prevent migration of fines through the filter. In cases where there is only overland flow, the requirements are different. For the CAW embankment, there will be no seepage flows through the filter, since the embankments will not be saturated in such an arid climate.

(2) The purpose of the filter layer is different.

The main purpose of a filter layer in the cover of the CAW embankment is to prevent interstitial velocities in the larger rock from eroding the soil/radon barriers. The design of the filter layer is dependent only on the rock sizes needed to prevent erosion caused by the interstitial velocities in the larger riprap layer above the filter layer. The thickness of the layer would, therefore, be based on the gradation needed to provide rock of sufficient size to prevent erosion, but well-graded to meet the gradation criteria. In general, a 6-inch filter layer with a D50 of about 1½ inches should be more than adequate at a typical waste repository to achieve the purposes stated. This statement is further validated by the estimated Type A Filter interstitial velocity provided in the Rock Cover Design Calculations (included as Attachment 10 of the CAW License Amendment Request). The calculated interstitial velocity is approximately 0.20 ft/sec on the top slope and 0.49 ft/sec on the side slope, yielding factors of safety of 7.4 for the top slope and 3.0 for the side slope based on the erosion limiting velocity for the sacrificial soil layer of 1.48 ft/sec.

The rock sizes and gradations can be computed using specific criteria where the D15/85 ratio must be less than or greater than the overlying and underlying layers of soil and rock. These gradation ratios are described in the Rock Cover Design Calculations. The recommended ratio for rock cover stability is 5.0; the calculated ratios between the riprap and the Type A Filter are 0.19 on the top slope and 0.52 on the side slope.

(3) The main reason for a specific filter thickness is constructability.

In general, a filter layer with a median rock size of about 1-2 inches requires a thickness of 4-6 inches for proper construction. Based on experience with other waste repositories, it is usually necessary to increase the layer thickness only to be able to construct it properly.

(4) A six-inch filter layer has been approved at many other sites.

A six-inch-thick filter layer was used at many uranium mill tailings sites in the western United States for the Title 1 and Title 2 programs. This thickness was approved by NRC at various sites, including recent approvals at the Crescent Junction, Utah uranium mill tailings site.

As further justification for the 6-inch Type A Filter Layer, HEC 11 (1989) provides recommendations for riprap revetment of highways near rivers and streams. As described in reason (1) above, this situation requires a much more stringent design than embankment covers at Energy*Solutions*. The guidance states that the thickness of the filter layer should be between

6-inches and 15-inches and should approach the minimum (6-inches) when the gradation curves of adjacent layers are approximately parallel. This criterion was also discussed by the Soil Conservation Service (1989) and is corroborated by the Bureau of Reclamation technical publication for the 'Design of Small Dams' (1973) which states "The thicker the layer, the greater the permissible deviation from the filter requirements given, especially in the requirement of parallelism of gradation curves between filter and base." As demonstrated in the Rock Cover Design Calculations, the filter requirements are easily met by the current design; furthermore, as shown in the gradation curves provided as Attachment A to this interrogatory response, the Type A Filter Layer is approximately parallel with both the Type A Riprap and the Type B Riprap.

a. U.S. Department of Agriculture, Soil Conservation Service, *Minnesota Technical Note 3, "Loose Riprap Protection"*, St. Paul, Minnesota. 1989.

b. U.S. Department of the Interior, Bureau of Reclamation, *Design of Small Dams, A Water Resources Technical Publication*, Second Edition, p. 235. 1973

c. U.S. Department of Transportation, Federal Highway Administration, *Hydraulic Engineering Circular No. 11 (HEC-11), "Design of Riprap Revetment"*, Publication No. FHWA-IP-89-016. 1989.

## 6. INTERROGATORY CAW R313-25-8(4)-14/2B: TECHNICAL ANALYSES – INFILTRATION AND TRANSPORT MODELING: CLIMATE CONDITIONS, ENGINEERED BARRIER CONDITIONS, AND VERTICAL TRANSPORT DISTANCE

**Division's Interrogatory Statement:** ***Reference the November 28, 2011 (Whetstone Associates 2011c) CAW Cell Infiltration and Transport Modeling Report, Drawing 10014 C04 of EnergySolutions 2011a; and 2011b, and Drawing 10014 C04, Rev. 2 of EnergySolutions 2011c:***

*Please provide the following:*

1. *Provide an analysis, using an appropriate 2-D or 3-D modeling simulation tool other than the HELP Model (e.g., HYDRUS 2D or other appropriate modeling tool), to assess predicted peak moisture conditions and peak flow behavior within various layers of the cover system over different time spans (hours to several years) during the CAW Embankment's required performance period. Provide sensitivity analyses that consider peak precipitation conditions, including extreme, short-duration (e.g., on the order of hours) precipitation events, minimum and/or maximum evapotranspiration conditions, and degraded conditions within the various cover layers. Provide analysis results demonstrating that excessive seepage pressure gradients will not occur within the specific layers of the cover system (e.g., within the Type A Filter Zone layer) during the CAW Embankment's performance period, considering both as-built and degraded conditions. Demonstrate that all cover layers in both the topslope and sideslope areas have sufficient capacity to safely convey lateral flows that may occur within such layers under peak flow conditions, if they occur, and that cover system stability would not be compromised under such conditions. Demonstrate that the expected range of residence times for water accumulating within the riprap and Type A Filter Zone layers on the topslope would not be sufficiently long to allow freezing conditions (e.g., ice bridging) to occur during times*

*of freezing temperatures, possibly resulting in blocking of flow at certain times (e.g., during meltwater flow episodes) within the riprap or Type A Filter Zone layer.*

2. *Provide information supporting the range of climate conditions, including peak precipitation events and durations, and/or periods of assumed higher average precipitation rates, and minimum and/or maximum evapotranspiration rates used in the simulations, and demonstrate that the climatic regime(s) used for modeling infiltration through the cover system bounds the range of uncertainties associated with potential climatic conditions that may occur over the CAW Embankment's performance period. Provide results of infiltration performance analyses incorporating such peak/higher precipitation and/or minimum evapotranspiration conditions into the modeling simulations. Alternatively, provide detailed justification why consideration of such climatic conditions in the infiltration simulations is not required.*

**Energy*Solutions* Response (1 and 2):** The Division has accepted the approach performed as part of previous licensing efforts, including the fate and transport modeling performed for the Class A cell, LARW cell, 11e.(2) cell, and Mixed Waste cell at Energy*Solutions*' Clive facility. This modeling has been based on site-specific parameters, where available, or conservative assumptions where no site-specific data existed. Over time, as more data have been collected for the site, these models have been refined and updated to provide more accurate yet still environmentally conservative estimates of the leaching, transport, and arrival of constituents at compliance monitoring wells for decades and centuries into the future. Specifically, this groundwater flow and contaminant transport Division-approved methodology has been conducted by Adrian Brown Consultants (ABC) (1997a, 1997b, 1997d, 1998), the Utah Department of Environmental Quality (DEQ) Division of Water Quality (1994), and Whetstone Associates (2000a, 2000c, 2000d, 2000e, 2000f, 2001a, 2001b, 2003, 2005, 2006a, 2006b). The approved methodology used in the modeling was initially described in detail in a two-volume comprehensive modeling report for the LARW cell, prepared by Adrian Brown Consultants (ABC) in 1997.

The potential migration of hazardous and radioactive constituents from the CAW cell were investigated using the EPA HELP model (Schroeder and Peyton, 1995), the Pacific Northwest Laboratories UNSAT-H model (Fayer and Jones, 1990; Fayer, 1999), and the PATHRAE-RAD model (Merrell, et al, 1995).

The modeling project was divided into the following four phases:

1. The infiltration through the closed CAW cell was predicted using the EPA HELP model;
2. Percolation rates predicted by the HELP model were input into the UNSAT-H model to predict the moisture content and time of travel from the bottom of the waste to the top of the aquifer;
3. A dispersive solution for contaminant transport from the base of the cell to the top of the water table (vertical solution) was determined using the PATHRAE model; and
4. The horizontal migration of constituents through the saturated zone to a compliance well was modeled, again using PATHRAE.

The HELP weather data input to the CAW cell model is based on 17 years of meteorological data available for the Clive site, as reported by Meteorological Solutions, Inc (MSI, 2010). The average annual precipitation measured at the Energy*Solutions* Clive facility from 1993-2009 is 8.53 inches per year (in/yr). Based on site-specific data, input files for evapotranspiration, precipitation, temperature, and solar radiation data were generated using a synthetic weather generator. The weather generator routine, developed by the USDA Agricultural Research Service (Richardson and Wright, 1984), generated 100 years of daily climate data based on site-specific monthly average precipitation and temperature coupled with the climate distribution parameters for a selected analog city.

Precipitation data were generated using the HELP synthetic precipitation generator to stochastically generate 100 years of daily precipitation data. The mean monthly precipitation values, from which the 100 years of daily precipitation data were generated, include 17 years of recorded precipitation available for the Clive site (MSI, 2010). The annual average precipitation, based on valid data from the 17-year record, is 8.53 in/yr. The monthly values were input to the HELP synthetic weather generator, which generated a 100-year data set with an average annual precipitation of 8.44 in/yr. A statistical analysis of the 100-year synthetic precipitation data set indicates that the synthetic weather generator produced daily data having a mean annual precipitation of 8.44 in/yr, with a minimum of 4.87 in/yr and a maximum of 12.65 in/yr. The 100-year data set contains 232 days having precipitation greater than 0.4 inches, 53 days having precipitation greater than 0.6 inches, and 19 days having precipitation greater than 0.8 inches.

The 100-year synthetic data set had a mean precipitation of 8.44 inches. For comparison, the 8.44 inches of precipitation used in the HELP model is 11% higher than the long-term average annual precipitation measured at Dugway from September 1950 – December 2009. The monthly precipitation received at Clive has been similar to that received at Dugway over a 17-year period. The monthly average during this period has been similar, although the precipitation received at the Energy*Solutions* Clive site has exceeded Dugway's by 3.5%. Precipitation in recent years has exceeded the long-term average. During the 17-year period from July 1992 to December 2009, the average precipitation at Dugway exceeded the long-term average by 8%. Assuming that the Clive precipitation has also exceeded the long-term average by 8%, the calculated long-term precipitation at Clive is 7.88 inches per year and the 8.44 inches used in the model is conservatively high. The synthetic precipitation data set (with a long-term mean of 8.44 in/yr) used in the HELP model is considered environmentally conservative because 1) the precipitation data set is based on a 17-year period of above-average precipitation in the region and 2) the data set captures extreme precipitation and temperature events.

The design of the CAW cell is similar to the design of the existing Class A cell. Waste will be placed above a layer of compacted Unit 4 clayey soils, and covered with a layered engineered cover constructed of natural (no man-made) materials. The top slopes of the cell will be finished at a 4.0% grade, with side slopes no steeper than 5:1 (20%). The cover design is engineered to reduce infiltration, prevent erosion, and protect from radionuclide exposure. The landfill design includes both a low-angled top slope and steeper side slope section of the cover. As is specified in the Division-approved methodology, Energy*Solutions* has modeled the CAW cover on an as-constructed basis – taking no additional credit for any enhanced evapotranspiration resultant from slower vertical transport velocities in a silted-upper RipRap layer. Additionally, the performance of the cover system has been demonstrated to be adequate under the worst-case

Probable Maximum Precipitation (PMP) event in the Rock Cover Design Calculations (Attachment 10 of the CAW LAR).


Adrian Brown Consultants, Inc. (ABC), 1997. Volume I. LARW Infiltration Modeling Input Parameters and Results, prepared for Envirocare of Utah, Inc. 41 pp plus tables, figures, and attachments. May 15, 1997.

Adrian Brown Consultants, Inc. (ABC), 1998. Volume II. LARW Groundwater Fate and Transport Modeling Input Parameters and Results, prepared for Envirocare of Utah, Inc. 44 pp. plus tables, figures and attachments. February 12, 1998.

Department of Environmental Quality (DEQ), Division of Water Quality, 1994. Memorandum from Loren Morton (DWQ) to Dane Finerfrock (DRC) regarding DWQ/USU PATHRAE Contaminant Modeling: Evaluation of Envirocare of Utah's August 30, 1993 Proposed Changes to Embankment Cover Design, February 25, 1994

Garahana, Larry. [Phone interview with Larry Garahana of the U.S. Bureau of Land Management and David Booth of Energy*Solutions*]. (September 14, 2011)

Meteorological Solutions, Inc. (MSI), 2010. "January 2009 Through December 2009 and January 1993 Through December 2009 Summary Report of Meteorological Data Collected at Energy*Solutions*' Clive, Utah Facility", prepared for: Energy*Solutions*, LLC, by Meteorological Solutions Inc., Project No. 021008134. February 2010.

PEPG Engineering, LLC. "Preliminary Report for Envirocare of Utah gravel exploration at locations 5, 6, 7." (Project No. 6108-0318). Letter to David Shockey. 12 January 2004.

Whetstone Associates, Inc, 2000a. Envirocare Of Utah Western LARW Cell Infiltration and Transport Modeling, consultants report dated March 2, 2000a. Document Number 4104M.000302.

Whetstone Associates, Inc, 2000b. Soil Distribution Coefficient for Thallium. Technical Memorandum to Tim Orton dated March 29, 2000b. Document Number 4104M.000329.

Whetstone Associates, Inc, 2000c. Envirocare of Utah Revised Western LARW Cell Infiltration and Transport Modeling, consultants report dated June 12, 2000c. Document Number 4104M.000612.

Whetstone Associates, Inc, 2000d. Envirocare of Utah Revised Western LARW Cell Infiltration and Transport Modeling, consultants report dated July 19, 2000d. Document Number 4104M.000719.

Whetstone Associates, Inc, 2000e. Envirocare of Utah Class A, B, & C Cell Infiltration and Transport Modeling, consultants report dated August 1, 2000e. Document Number 4104O.000801

Whetstone Associates, Inc, 2001. "Results of Cf-251 Modeling for the Class A Cell, Using the 898-Year Half Life", technical memorandum to Dan Shrum, Envirocare of Utah from Susan Wyman, Whetstone Associates, dated August 21, 2001, Document Number 4101M.010821, 5 pp.

Whetstone Associates, Inc, 2003. "Technical memorandum on 11(e).2 Cell Transport Modeling Using New Zn Kd and Higher Radionuclide Concentrations", technical memorandum to Dan Shrum, Envirocare of Utah from Susan Wyman, Whetstone Associates, dated November 10, 2003, Document Number 4101L.031110, 2 pp.

Whetstone Associates, Inc, 2005. Envirocare of Utah Class A Combined (CAC) Cell Infiltration and Transport Modeling Report, dated November 18, 2005. Document Number 4101W.051118.

Whetstone Associates, Inc, 2006b. Envirocare of Utah Class A South Cell Infiltration and Transport Modeling Report, dated December 7, 2007. Document Number 4101L.071207.

Whetstone Associates, Inc., 2006a. "Technical Memorandum on Results of Methylene Chloride and Methanol Modeling for the Class A Cell", technical memorandum to Dan Shrum, Envirocare of Utah, from Susan Wyman, Whetstone Associates, January 20, 2006.

Whetstone Associates, Inc., 2007. "Technical Memorandum on Formerly Characteristic Waste Modeling of the Class A and Class A North Cells", technical memorandum to Dan Shrum, Envirocare of Utah, from Susan Wyman, Whetstone Associates, September 25, 2007.

3. *Provide rationale to support the selection of degraded conditions in the cover system layers that may affect the long-term performance of the CAW Embankment cover, including conditions developed as a result of environmental influences such as bioturbation, burrowing animals, and plant root development. Provide results of infiltration performance analyses incorporating such degraded conditions into the modeling simulations, or, alternatively, provide detailed justification why consideration of such degraded engineered barrier conditions in the infiltration simulations is not required.*

**Energy*Solutions* Response:** In November, 2000, a sensitivity analyses was performed for the HELP infiltration model of the Class A, B, & C cell, to determine the effects of vegetation intrusion through the upper and lower radon barrier of the cover. The extent of potential vegetation intrusion into the upper radon barrier was investigated by vegetation specialists, who identified that greasewood would be the only plant species to potentially invade the upper radon barrier. The density of root penetration was estimated at 0.0068%, which represents the percent of area occupied by greasewood tap roots at depth. Although the vegetation study did not indicate that the greasewood would penetrate the lower radon barrier, a sensitivity analysis was performed to evaluate the potential effects of such an occurrence. The modeling approach is described in detail in a technical memorandum prepared by Whetstone Associates (Whetstone, 2000).

The modeling indicated that siltation and root penetration of the rip rap, Type A filter, and sacrificial soil would result in a net decrease in infiltration, due to increased evaporation. The sensitivity analysis also evaluated greasewood taproot penetration through both the upper radon barrier and the lower radon barrier, and found a net decrease in infiltration compared to the unvegetated case.

Whetstone, 2000. Technical Memorandum to Dan Shrum, Envirocare of Utah, from Susan Wyman, Whetstone Associates, RE: Infiltration Through Lower Radon Barrier, Class A,B,&C Cell Cover, document #4101O.001107, 2 pp plus tables.

4. *For the top slope PATHRAE analysis, please correct discrepancies between the fractional release rates in Table 24 of the November Infiltration and Transport Modeling Report (Whetstone 2011) and the values used in the PATHRAE modeling for the Class A West top slope analysis. State the values of all the input parameters used in the release rate equation in Section 5.1.5 of the report.*

**Energy*Solutions* Response:** The fractional release rates used in the modeling are correct; however, the values shown in Table 24 were incorrect. A revised Table 24 is attached to this interrogatory response (see Attachment B). The equation for fractional release rate is given in Section 5.1.5 of the Infiltration and Transport Modeling report. The values of infiltration rate, waste moisture content, waste thickness, and waste density are listed at the top of Table 24; and the distribution coefficients are also listed in Table 24.

5. *For the side slope PATHRAE analysis, please correct discrepancies between the fractional release rates in Table 25 of the November Infiltration and Transport Modeling Report (Whetstone 2011) and the values used in the PATHRAE modeling for the Class A West side slope analysis. State the values of all input parameters used in the release rate equation in Section 5.1.5 of the report.*

**Energy*Solutions* Response:** The fractional release rates used in the modeling are correct; however, the values shown in Table 25 were incorrect. A revised Table 25 is attached to this interrogatory response (see Attachment B). The equation for fractional release rate is given in Section 5.1.5 of the Infiltration and Transport Modeling report. The values of infiltration rate, waste moisture content, waste thickness, and waste density are listed at the top of Table 25; and the distribution coefficients are also listed in Table 25.

6. *Please correct the values for "Soil Retardation Factors" shown in Table 24 and ensure that the correct values are used in the PATHRAE top slope analysis.*

**Energy*Solutions* Response:** The soil retardation factors in Tables 24 and 25 are incorrect. The correct soil retardation factors are used in modeling. Revised Tables 24 and 25 are attached (Attachment B). The revised Tables have also been placed in Attachment 3 of the License Amendment Request.

Two issues were identified with the "Soil Retardation Factors" presented in the November 2011 modeling report. First, the retardation values shown in Table 24 had not been updated from the previous model submission. This issue did not affect the modeling results, because PATHRAE calculates retardation *internally*, using $K_d$, soil bulk density, and effective porosity:

$$R_d = 1 + \frac{\rho K_d}{\theta_e}$$

Where:

| | |
|---|---|
| $R_d =$ | Retardation factor |
| $\rho =$ | Soil density (kg/m$^3$) |
| $K_d =$ | Soil-water distribution coefficient (L/kg) |
| $\theta_e =$ | Effective soil porosity (i.e., moisture content in the vadose zone) |

Although the report presented a calculated retardation factor for each modeled constituent, the values shown had been calculated externally in a spreadsheet and were not the values used by PATHRAE. The corrected values are shown in the revised Table 24 (Attachment B).

A second issue identified by reviewers was that the effective porosity (or moisture content in the vadose zone) was entered as 0.100 v/v instead of 0.093 v/v for the vertical 0.090 cm/yr top slope PATHRAE modeling.

The use of a higher $\theta_e$ value conservatively over-predicted concentrations at the water table. The effect of moisture content ($\theta_e$) on concentrations is shown in the analytical equations solved by PATHRAE. The nuclide concentration at the water table is calculated in PATHRAE using the following equation for the "groundwater to river" pathway:

$$C = \frac{C_w e^{-\lambda(t_v)} \lambda_L f_o}{q_w}$$

Where $C$ = nuclide concentration "in the river" (i.e., at the water table) (Ci/m$^3$)

$C_w$ = Remaining isotope concentration in waste (pCi)

$\lambda$ = radioactive decay constant (1/yr)

$\lambda_L$ = fraction of a nuclide leached from the waste in a year (1/yr)

$t_v$ = vertical travel time of nuclide to the aquifer (yr)

$q_w$ = flow rate of the river (m$^3$/yr)

$f_o$ = fraction of a nuclide from the waste arriving at the river from transport through the aquifer

PATHRAE uses the soil moisture content to calculate the fraction of a nuclide arriving at the river ($f_o$) and the concentration in the river (i.e., at the water table). The $f_o$ for each modeled nuclide is calculated by the following equations:

$$f_o = \begin{cases} 0 & for \quad t \leq (t_1 - t_0) + t_v \\ \frac{v_a}{LR\lambda_L}\left[1 - e^{-\lambda_L(t-(t_1-t_0)-t_v)}\right] & for \quad (t_1 - t_0) + t_v < t < t_1 + t_v \\ \frac{v_a}{LR\lambda_L} e^{-\lambda_L(t-t_1-t_v)}\left[1 - e^{-\lambda_L t_0}\right] & for \quad t \geq t_1 + t_v \end{cases}$$

Where $v_a$ = interstitial horizontal aquifer velocity m/yr

$L$ = length of waste

$R$ = retardation factor, $R = 1 + \frac{\rho_a}{n} k_d$

$t$ = time

$t_o$ = $RL / v_a$

$t_l =$ $R(L + x_r)/v_a$

$t_v =$ vertical travel time to aquifer (yr)

$x_r =$ distance of groundwater flow from the nearest edge of burial pits to the river (m)

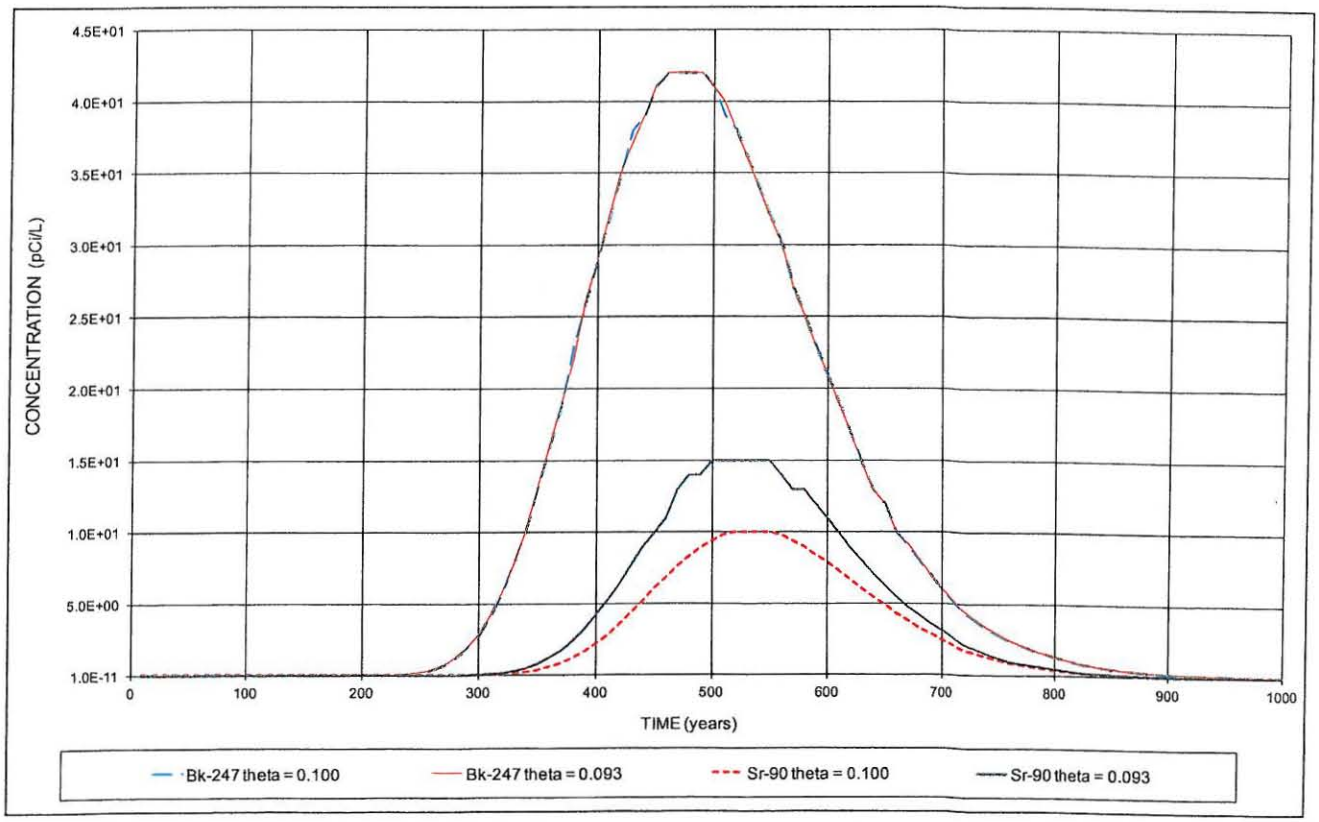
n = effective porosity (= soil moisture content [$\theta_e$] in the unsaturated zone)

$\rho_a =$ aquifer density (kg/m$^{3)}$

$k_d =$ sorption coefficient (m$^3$/kg)

As seen in the preceding equations, soil moisture content ($\theta_e$) appears as porosity (n) in the denominator of the retardation calculation. If the sorption coefficient ($k_d$) is low, a change in soil moisture content has a minimal effect on isotope transport rates because the retardation constant approaches one as the sorption coefficient approaches zero. A comparison of Bk-247 concentrations at the water table for $\theta_e$ values of 0.100 and 0.093 indicates very little difference in arrival times or peak concentrations (**Error! Reference source not found.**).

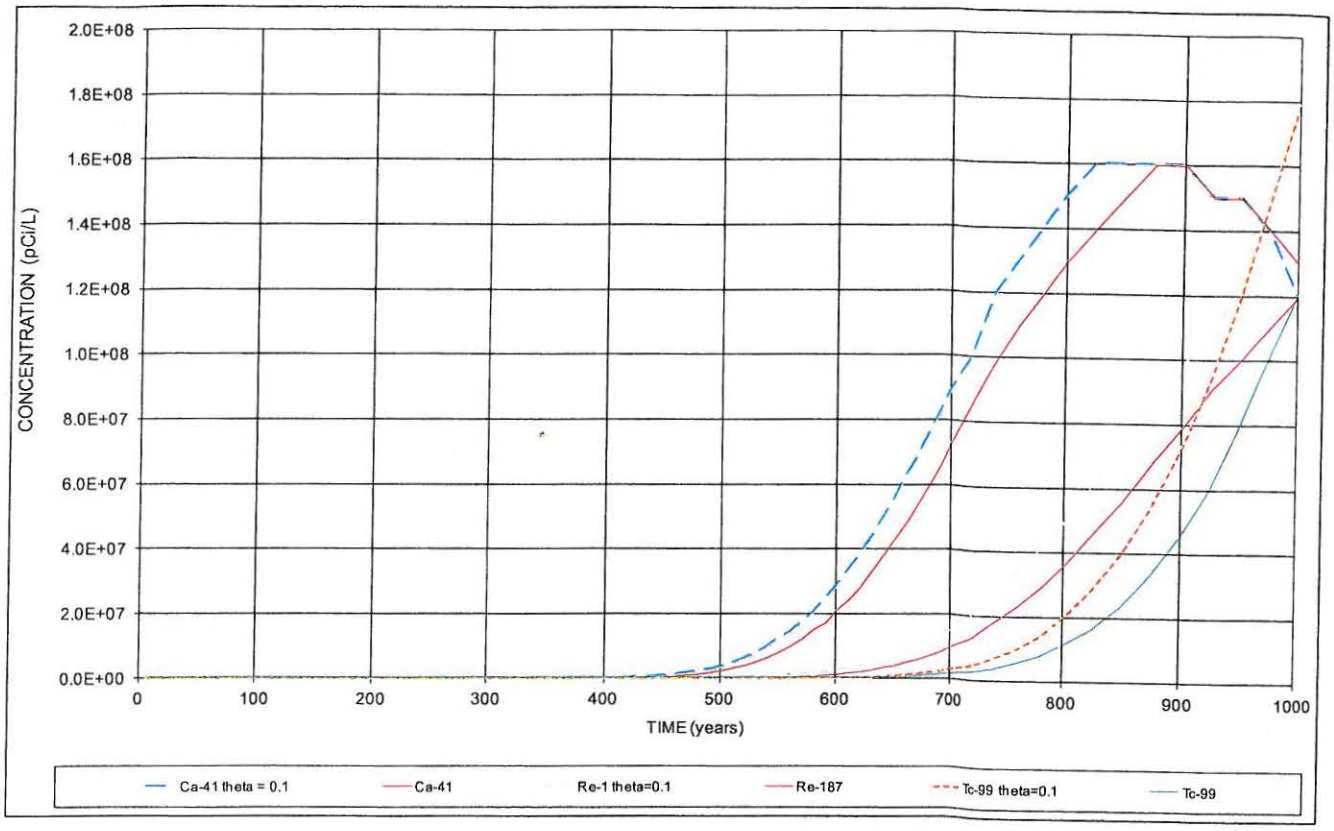
**Figure 2. Bk-247 and Sr-90 Concentrations at the Water Table for θ = 0.093 and θ = 0.100**




In contrast, if the sorption coefficient ($k_d$) is high, a change in soil moisture content may have a significant effect on isotope transport because the retardation constant increases as soil moisture

content decreases. A comparison of Sr-90 concentrations at the water table for $\theta_e$ values of 0.100 and 0.093 indicates that the higher moisture content resulted in earlier arrival times and higher peak concentrations (**Error! Reference source not found.**). For nuclides that peak in later model years, the arrival times were earlier and the model concentrations were higher at the water table for $\theta_e$ values of 0.100 compared to 0.093 (**Error! Reference source not found.**). Therefore, the results modeled using a higher moisture content were conservative.

**Figure 3. Bk-247 Concentrations at the Water Table for $\theta = 0.093$ and $\theta = 0.100$**




7. *Please provide information on transverse and longitudinal dispersivity values used in the horizontal transport component of the modeling done by Whetstone. Provide information justifying the selection of the parameter values used in modeling, including information demonstrating that the range of potential dispersivity values considered reasonably bounds the range of values that could be appropriate for the site conditions and scale of the investigation. Provide sensitivity values as appropriate for different assumed dispersivity values demonstrating the sensitivity of model results to changes in dispersivity values. Provide rationale to support use of dispersivity values in the horizontal transport simulations that are different from those used in MEMO Model simulations, or, alternatively, use the same assumed values for both simulations.*

**Energy*Solutions* Response:** The MEMO Model simulations and the PATHRAE model simulations both use a longitudinal dispersivity equivalent to 10% of the horizontal path length. A scale-dependent dispersivity value of 10% of path length is well documented in the literature (Pickens and Grisak, 1981; Gelhar and Axness, 1981; Gelhar et al., 1992). Because the MEMO model and current PATHRAE model were developed in response to a different problem statement, the horizontal path length, and therefore the dispersivity, is different for each model.

In the Class A West PATHRAE model, the conservative transport distance for top slope was 278 feet (84.7 m), and the longitudinal dispersivity was 27.8 feet (8.47 m). The conservative transport distance for side slope modeling was 90.0 feet (27.4 m), and the longitudinal dispersivity was 9.0 feet (2.74 m).

Due to superposition, transverse dispersivity does not apply to the PATHRAE modeling for the Class A West cell. The PATHRAE model simulates fate and transport from a 1 $m^3$ block of waste, with the understanding that each block of waste is adjacent to another block of waste. Transverse dispersion from each block would overlap, resulting in the same concentration as a non-dispersed solution. In contrast, the MEMO modeling was performed to assess the release of a single plume (or a series of single plumes) from a breach in the cell liner. In this case, each single plume would disperse transversely and horizontally.

Gelhar, L.W. and Axness, C.L. 1981. Stochastic analysis of macrodispersion in three dimensionally heterogeneous aquifers. Report H-8. Hydraulic Research Program. New Mexico Institute of Mining and Technology, Socorro, NM 87801.

Gelhar, L.W., Welty, C. and Rehfeldt, K.R. 1992. A critical review of data on field-scale dispersion in aquifers. Water Resources Research 28(7):1955-1974.

Pickens, J.F. and G.E. Grisak (1981). Scale-Dependent Dispersion in a Stratified Granular Aquifer. Water Resources Research, Vol. 17, No. 4, pp. 1191-1211.

## 7. INTERROGATORY CAW R313-25-8(4)-16/2A: SEISMIC HAZARD EVALUATION / SEISMIC STABILITY ANALYSIS UPDATE

**Division's Interrogatory Statement:**

*Justify using the outdated "semi-probabilistic" approach reported in the response or preferably perform a probabilistic seismic hazard analysis (PSHA).*

**Energy*Solutions* Response:** An Addendum has been provided at the end of the Geotechnical Analysis found in Attachment 5 to the License Amendment Request that answers this three-part interrogatory. Please reference this addendum while reviewing the summary responses provided in this interrogatory. Because the October 25, 2011 letter was more conservative than the result of the work produced to respond to this interrogatory request (see *Discussion and Conclusions* on page 7 of the aforementioned addendum), no changes will be made with respect to background seismicity, return period, peak ground acceleration (PGA) or embankment stability calculations.

a. *If an attempt is made to justify the semi-probabilistic, explain and justify the basis for using the radius of the circular area of 18.74 km in the deterministic calculations.*

**Energy*Solutions* Response:** Please refer to the first, full paragraph on page 4 of the addendum provided at the end of Attachment 5. It should be noted, that the bulk of the attached addendum compares what was deemed by AMEC a 'semi-probabilistic approach' with a 'deterministic' approach. As mentioned above, the initial approach provided by AMEC on October 25, 2011 proved to be more conservative.

b. *Decluster the earthquake catalog as is done in standard probabilistic approaches and as was done by Pechmann and Arabasz (1995) and use that catalog in any ground motion calculations.*

**Energy*Solutions* Response:** As stated in the final paragraph on page 3, the earthquake catalog was declustered as requested. The result of the deculstered catalogue was to reduce the seismic hazard level. As such, the October 25, 2011 response was more conservative.

c. *Correctly label the vertical axis in Figure 3 and correctly interpret the information presented in Figure 3 (cumulative frequency plot).*

**Energy*Solutions* Response:** As stated in the second full paragraph on Page 4, the updated Figure based on the revised, declustered earthquake catalogue includes a re-labeled supplemental vertical axis. It also points to the USGS earthquake hazard website validating the interchangeability of the terms 'Return Period' and 'Recurrence Interval'.

## 8. INTERROGATORY CAW R313-25-25(6)-19/2A: RADIATION DOSE RATE AT THE SURFACE OF THE COVER

**Division's Interrogatory Statement:** *Refer to Section 3.1.9 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

> *Please submit a Microshield output showing the dose rate at the surface of the cover, taking into account the revised cover design described in the November 29, 2011 response to Interrogatory CAW R313-25-8(1)-08/1.*

**Energy*Solutions* Response:** An updated Microshield analysis, adjusted to reflect the revised cover design described in the November 29, 2011 response to Interrogatory CAW R313-25-8(1)-08/1 has been provided in Section 3.1.9 of the revised License Amendment Request.

## 9. INTERROGATORY CAW R313-25-26(1)-20/2A: ENVIRONMENTAL MONITORING

**Division's Interrogatory Statement:** *Please revise the Environmental Monitoring Plan to include installation and operation of at least 2 additional air monitoring stations on the east side of the proposed CAW disposal embankment and west of the Vitro disposal area.*

**Energy*Solutions* Response:**

To provide an additional level of monitoring for potential VITRO property contamination from Clive disposal operations, Energy*Solutions* will install an air monitoring station (A-6) on the east side of the Class A West cell. Because of DOE's accessibility control requirements for the VITRO property, the "member of the pubic" dose limits in Utah Administrative Code Sections R313-15-301, R313-25-19 and R313-15-101(4) do not apply. As such, station A-6 will not act as a compliance monitoring point, but will be a data trending location. Station A-6 will be monitored at the same frequency and schedule as the current air monitoring compliance network.

Current air monitoring locations, expected disposal activity operations, and site-specific meteorological data were considered to determine the location and number of new stations used to monitor the Vitro property. The windrose diagram (Figure 4) below illustrates that the highest frequency wind speeds and directions generally occur from the south-southwest and from the northeast. The windrose indicates that airborne emissions from general disposal activities on the embankment are identified by the existing air monitoring network. Station A-6 was placed so that emissions generated near the VITRO fence could be identified.

**Figure 4. Windrose Data: December 1, 2010 through November 30, 2011**

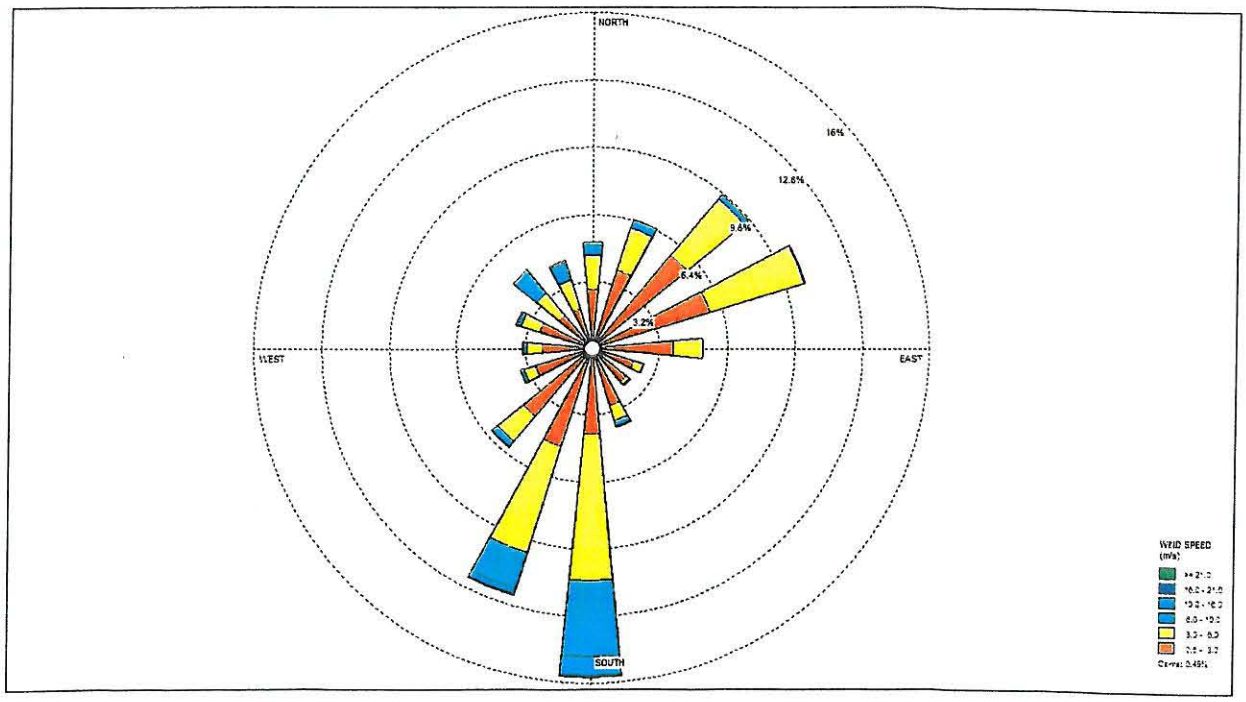
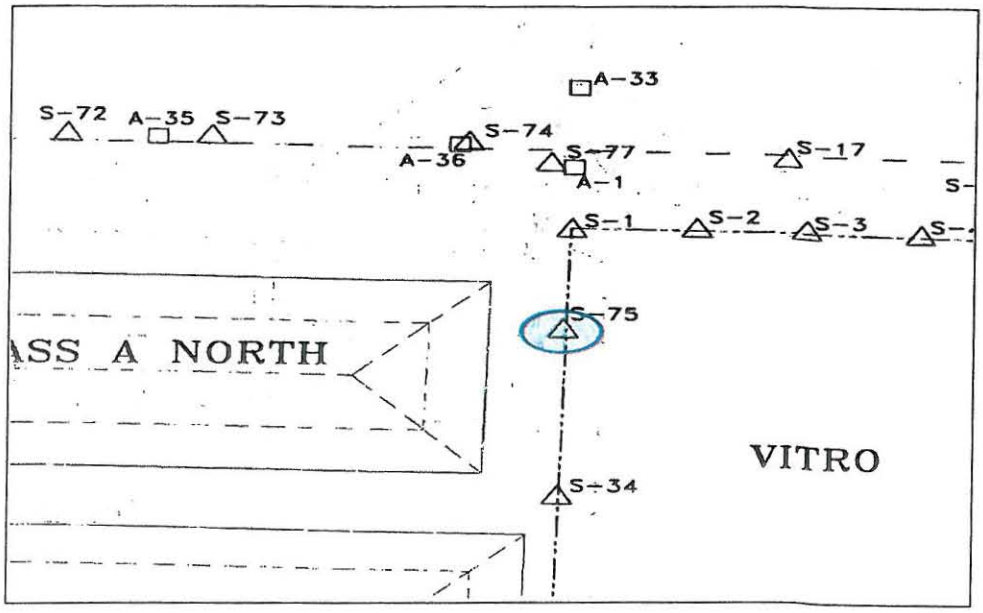


Figure 5, below, illustrates the proposed location for A-6 (highlighted oval). Further details of the station have been provided in a redline/strikeout copy of the Environmental Monitoring Program, located in Attachment 1, *Proposed Amendments*, for Division review. As Section 4.4.3 of the CAW License Amendment Request requires Energy*Solutions* to perform environmental monitoring in accordance with, "*...the current approved Environmental Monitoring Plan...*," it is not necessary to further revise the text of the License Amendment Request.

**Figure 5. Proposed location for additional air monitoring**




## 10. INTERROGATORY CAW R313-25-26 (2 AND 3)-21/2B: TECHNICAL ANALYSES - HORIZONTAL TRANSPORT AND WELL SPACING ANALYSIS INPUT PARAMETERS

**Division's Interrogatory Statement:** ***Refer to Attachment 6 (Clive Facility Well Spacing Evaluation Class A West Embankment, April 28, 2011) to the CAW LAR (EnergySolutions 2011a) and EnergySolutions' Response to this Round 1 Interrogatory (EnergySolutions 2011b):***

1. *Please provide additional information to further support selection of appropriate dispersivity values, particularly longitudinal dispersivity ($\alpha_x$) values, for use in the well spacing evaluation for the CAW Embankment (and for transport modeling). Evaluate, compare, and use, as appropriate, one or more other alternative methodologies, for estimating dispersivity values that may be appropriate for this well spacing evaluation, considering the scale of the distances involved in the well spacing evaluation and site-specific subsurface conditions. Estimate or otherwise justify that the full range of dispersivity values that may be appropriate for this evaluation have been considered. Demonstrate that the identified range of dispersivity values used bounds the uncertainties associated with available methodologies for estimating dispersivity parameters. Provide MEMO Model sensitivity analyses that incorporate the full range of inferred possible $\alpha_x$*

*and transverse dispersivity values to demonstrate that the effects of possible changes in dispersivity values on the well spacing evaluation conclusions have been characterized. Provide and compare model-predicted results including and comparing breakthrough curves for various representative radionuclides based on modeled longitudinal dispersivity values, as appropriate, to demonstrate sensitivity of model results to changes in the input dispersivity values.*

2. *Please provide additional rationale for why the Xu and Eckstein (1995) method is defensible for use as a "check" of calculated dispersivity values, despite its use of low and moderate reliability data in development of the methodology.*
3. *Provide revised Transport Model results, as required, that either (i) reflect the use of dispersivity values that are consistent with those used in the final well spacing evaluation or (ii) further justify use of different dispersivity values in these different models.*
4. *Provide information demonstrating that the retardation factor (R) values calculated for all constituents and used in MEMO Model simulations were calculated correctly. In Section of 3.2.4 the Clive Facility Well Spacing Evaluation (Attachment 6 to EnergySolutions 2011a [April 28, 2011 MEMO Model Evaluation Report]), provide a corrected version of the retardation equation that specifies the correct set of units for all variables included in the equation.*
5. *Please provide a summary of all input parameters and copies of output from any MEMO Model simulations performed.*

**Energy*Solutions* Response:**

1. Figure 6 and Table 4 provide sensitivity analysis results for the CAW well spacing analysis. The sensitivity analysis evaluated a longitudinal dispersivity range of 5 to 150 feet, variation in the ratio of transverse to longitudinal dispersivity (0.33 versus 0.1), and variation in the source width (5 feet versus 1 foot). The monitoring efficiency increases as longitudinal dispersivity increases to a range of approximately 25 to 50 feet (and transverse dispersivity increases to values of approximately 5 to 10 feet). Larger ratios of transverse to longitudinal dispersivity resulted in higher monitoring efficiencies for longitudinal dispersivity values of less than approximately 25 feet. The decrease in monitoring efficiencies exhibited for dispersivity values greater than 25 to 50 feet is assumed to be an artifact of the MEMO model solution. Figure 6 and Table 4 also indicate that varying the source width from 1 to 5 feet has relatively little effect on monitoring efficiency.
2. The equation used to calculate longitudinal dispersivity (Equation 14.b) from Xu and Eckstein (1995) included all of the data from Gelhar et al. (1992); however, high reliability data are weighed three times greater than low reliability data. The weighing scheme for Equation 14.b is 1:2:3 for low:intermediate:high reliability points.

   Equation 14.b of Xu and Eckstein (1995) along with one-tenth the plume length and one-tenth the flow path length of Pickens and Grisak (1981) are the U.S. Environmental Protection Agency (EPA) recommended options to calculate longitudinal dispersivity in the BIOCHLOR (EPA, 2000), BIOSCREEN (EPA, 1996a), and FOOTPRINT (EPA,

2008) models. Xu and Eckstein (1995) is also the recommended method of calculating dispersivity for the RT3D 3-dimensional reactive transport model (U.S. Department of Energy's Pacific Northwest National Laboratory (PNNL), 2002).

**Figure 6. Well – Spacing Efficiency Sensitivity Analysis**

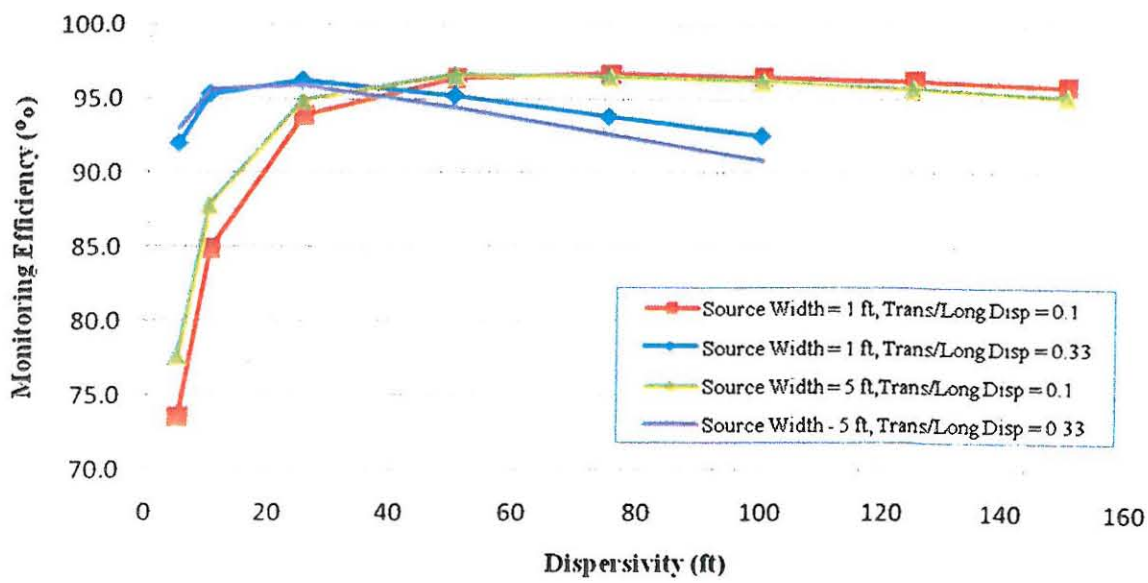



**Figure 6 - Well-Spacing Efficiency Sensitivity Analysis**

**Table 4 - Well-Spacing Efficiency Sensitivity Analysis Results**

| Longitudinal Dispersivity (ft) | Monitoring Efficiency (%) | | | |
|---|---|---|---|---|
| | Source Width = 1 ft T/L = 0.1 | Source Width = 1 ft T/L = 0.33 | Source Width = 5 ft T/L = 0.1 | Source Width = 5 ft T/L = 0.33 |
| 5 | 73.5 | 92.0 | 77.6 | 93.0 |
| 10 | 84.9 | 95.3 | 87.8 | 95.6 |
| 25 | 93.9 | 96.2 | 94.9 | 95.9 |
| 50 | 96.4 | 95.2 | 96.6 | 94.4 |
| 75 | 96.7 | 93.8 | 96.5 | 92.6 |
| 100 | 96.5 | 92.5 | 96.2 | 90.9 |
| 125 | 96.2 | NA | 95.7 | NA |
| 150 | 95.9 | NA | 95.2 | NA |

T/L = ratio of transverse to longitudinal dispersivity

NA = not analyzed

Mallants et al. (1998) of the Belgian Nuclear Research Center used only data with high and intermediate reliability to establish the relationship of longitudinal dispersivity, $\alpha_L = 0.0267x$, where x is the flow path length. For the CAW well-spacing model, with an average flow path length of 1,291 feet, this relationship yields a longitudinal dispersivity of 34.5 feet. Mallants et al. (1998) report longitudinal dispersivity is scale dependent to a flow path length of approximately 1,000 meters (3,281 feet), and thus the relationship is valid for the scale of the CAW modeling.

The modeled monitoring well network efficiency is sensitive to the value of transverse dispersivity used in the model as demonstrated in Figure 6 and Table 4. The CAW well spacing was modeled using a transverse to longitudinal dispersivity ratio of 0.1. This ratio is conservative relative to the ratio of 0.125 recommended in EPA (1996b), 0.33 recommended in EPA (1986) and ASTM (1995), and the MEMO model default ratio of 0.143 (IGWMC, 1992).

3. See response to Interrogatory CAW R313-25-8(4)-14/2B, Item #7. The transport model uses the scale-dependent relationship of longitudinal dispersivity equal to 10% of the transport distance (Pickens and Grisak, 1981; and Gelhar et al., 1992) This relationship was also used for the base case well-spacing model.

4. The correct retardation factors were used in the well-spacing model, and the correct values are listed in Tables 4 and 5 of the well-spacing report. A conversion factor was added to the equation for retardation factor given on Page 7 of the report. Corrected Pages 7 and 8 of the report are attached to this interrogatory response (see Attachment C). These corrected pages have also been updated into the well spacing report provided as Attachment 6 to the License Amendment Request.

5. MEMO modeling files for runs performed to respond to Interrogatories 1 and 2 are also provided electronically to this interrogatory response with Attachment C. All sensitivity runs were modified base-case simulations using Tc-99 (see model run CAWTc99a, Table 9 of April 28, 2011 Well Spacing Evaluation Report).

References:

American Society for Testing and Materials (ASTM), 1995, Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, ASTM E-1739-95(2010)e1, Philadelphia, PA.

Gelhar, L.W., C. Welty, and K.R. Rehfeldt (1992). A Critical Review of Data on Field-Scale Dispersion in Aquifers. *Water Resources Research*, Vol. 28, No. 7, pp. 1955-1974.

International Ground Water Modeling Center (IGWMC) (1992). MAP Monitoring Analysis Package, FOS 57, Version 1.1. Colorado School of Mines, Boulder, CO, September 1992.

Mallants, D., J. Marivoet, and G. Volckaert (1998). Review of Recent Literature on the Dispersivity Parameter for Saturated and Fractured Porous Media. Technical Note 44, Dept. W&D, SCK•CEN, Mol, Belgium.

Pacific Northwest National Laboratory (PNNL) (2002). RT3D – A Modular Computer Code for Simulating Reactive Multi-Species Transport in 3-Dimensional Groundwater Systems, Version 2.5. (Version 1.0 User's Manual, 1997, PNNL-11720). Dispersivity

recommendations provided in Frequently Asked Questions available at: http://bioprocess.pnnl.gov/rt3d.faq.htm#qid30.

Pickens, J.F. and G.E. Grisak (1981). Scale-Dependent Dispersion in a Stratified Granular Aquifer. *Water Resources Research*, Vol. 17, No. 4, pp. 1191-1211.

U.S. Environmental Protection Agency (EPA) (2008). FOOTPRINT User's Manual, Version 1.0. EPA/600/R-08/058, Center for Subsurface Modeling and Support, Ground Water and Ecosystem Restoration Division, Ada, OK, June 2008.

U.S. Environmental Protection Agency (EPA) (2000). BIOCHLOR Natural Attenuation Decision Support System, User's Manual, Version 1.0. EPA/600/R-00/008, National Risk Management Research Laboratory, Office of Research and Development, Cincinnati, OH, January 2000.

U.S. Environmental Protection Agency (EPA) (1996a). BIOSCREEN Natural Attenuation Decision Support System, User's Manual, Version 1.3. EPA/600/R-96/087, National Risk Management Research Laboratory, Office of Research and Development, Cincinnati, OH, August 1996.

U.S. Environmental Protection Agency (EPA) (1996b). Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128, Office of Solid Waste and Emergency Response, July 1996 (see Table 1 of Appendix E).

U.S. Environmental Protection Agency, 1986, Background Document for the Ground-Water Screening Procedure to Support 40 CFR Part 269 — Land Disposal. EPA/530-SW-86-047, January 1986.

Xu, M. and Y. Eckstein (1995). Use of Weighted Least-Squares Method in Evaluation of the Relationship Between Dispersivity and Field Scale. *Ground Water,* Vol. 33, No. 6, pp. 905-908.

## 11. INTERROGATORY CAW R317-6-6.4-23/2A: ISSUANCE OF DISCHARGE PERMIT: BEST AVAILABLE TECHNOLOGIES - MONITORING WELLS REQUIRING ABANDONMENT AND DECOMMISSIONING AND LYSIMETERS PROPOSED FOR ABANDONMENT

**Division's Interrogatory Statement:** *Refer to Section 1.2.3 of the Class A West (CAW) Embankment License Amendment Request (LAR) and Drawing 10014 C01 in Attachment 2 to the Round 1 Interrogatory Response submitted in support of the CAW Embankment LAR:*

1. *Please provide additional information regarding feasible systems and/or means that will be implemented for ensuring that there will be a reliable means for acquiring data on vadose zone conditions (soil moisture, pore-water chemistry) underlying the southeastern portion of the proposed CAW Embankment. Drawing 10014 C01 indicates that two existing or currently planned lysimeters (CL-W3 and CL-W4) located beneath the southeastern portion (southeastern "quadrant") of the CAW Embankment footprint are proposed to be abandoned. However, no new lysimeters or other types of vadose zone monitoring devices are proposed to be installed beneath this CAW Embankment "quadrant" area (the eastern part of the existing Class A Embankment).*

2. *Please provide information and details to demonstrate that the system and/or measures* Energy*Solutions proposes to implement will provide reliable data to aid in early warning detection of potential releases from this portion of the proposed CAW Embankment, and include means for obtaining pore-water chemistry data (e.g., to help confirm and/or characterize constituents in leachate associated with a potential release). Identify and evaluate available monitoring technologies that could be feasibly employed and used to acquire such data, including, but not limited to: (1) suction lysimeters (e.g., SoilMoisture Equipment Corporation Model 1940 Hi-Pressure/Vacuum soil water sampler) constructed and installed in angled boreholes; (2) neutron probe access tubes, possibly combined with a means of obtaining a sample of accumulated liquid present, if any, from beneath the eastern portion of the current Class A Embankment footprint portion of the CAW Embankment within the vadose zone monitored interval; or (3) other technologies, to the extent that they may be available and feasible. Demonstrate that the system and/or measures to be employed, if different than the current or planned vadose zone monitoring method, satisfy criteria for best available technologies for this type of monitoring.*

**Energy*Solutions* Response:** The proposed collection lysimeter monitoring network for the Class A West embankment is consistent with existing and prior DRC approvals of Best Available Technology (BAT) for acquiring data on vadose zone conditions immediately beneath the clay liner. Because the collection lysimeters are a BAT system, there are no design criteria and regulatory precedent is adequate for demonstrating that BAT is met.

As noted in the Basis for this interrogatory, the current approved monitoring network for the Class A portion of the Class A West embankment calls for 7 (originally 8) collection lysimeters that are roughly evenly spaced on the north and south sides of the embankment. No lysimeters are located on the east or west sides of the Class A cell. Each lysimeter is located near the breakover point between the top and side slopes, as this is considered to be a location with higher potential for failure.

Similarly, the current approved monitoring network for the Class A North embankment consists of 5 collection lysimeters. However, for Class A North the collection lysimeters are more randomly spaced, with 3 located on the north side and 1 each on the west and south sides of the embankment.

Spacing is random for collection lysimeters in the Class A North embankment because there is no design criteria for spacing. Similarly, there is no design criteria that requires collection lysimeters to be located in a particular direction relative to groundwater gradient beneath the disposal cell. Since each lysimeter is a simple pan roughly 14 feet wide by 28 feet long that is built directly beneath clay liner, it is effectively a grab sample of what, if any, leachate is percolating through the liner system. Because leachate is intercepted as it enters the vadose zone and before groundwater is reached, gradient of the aquifer is utterly irrelevant.

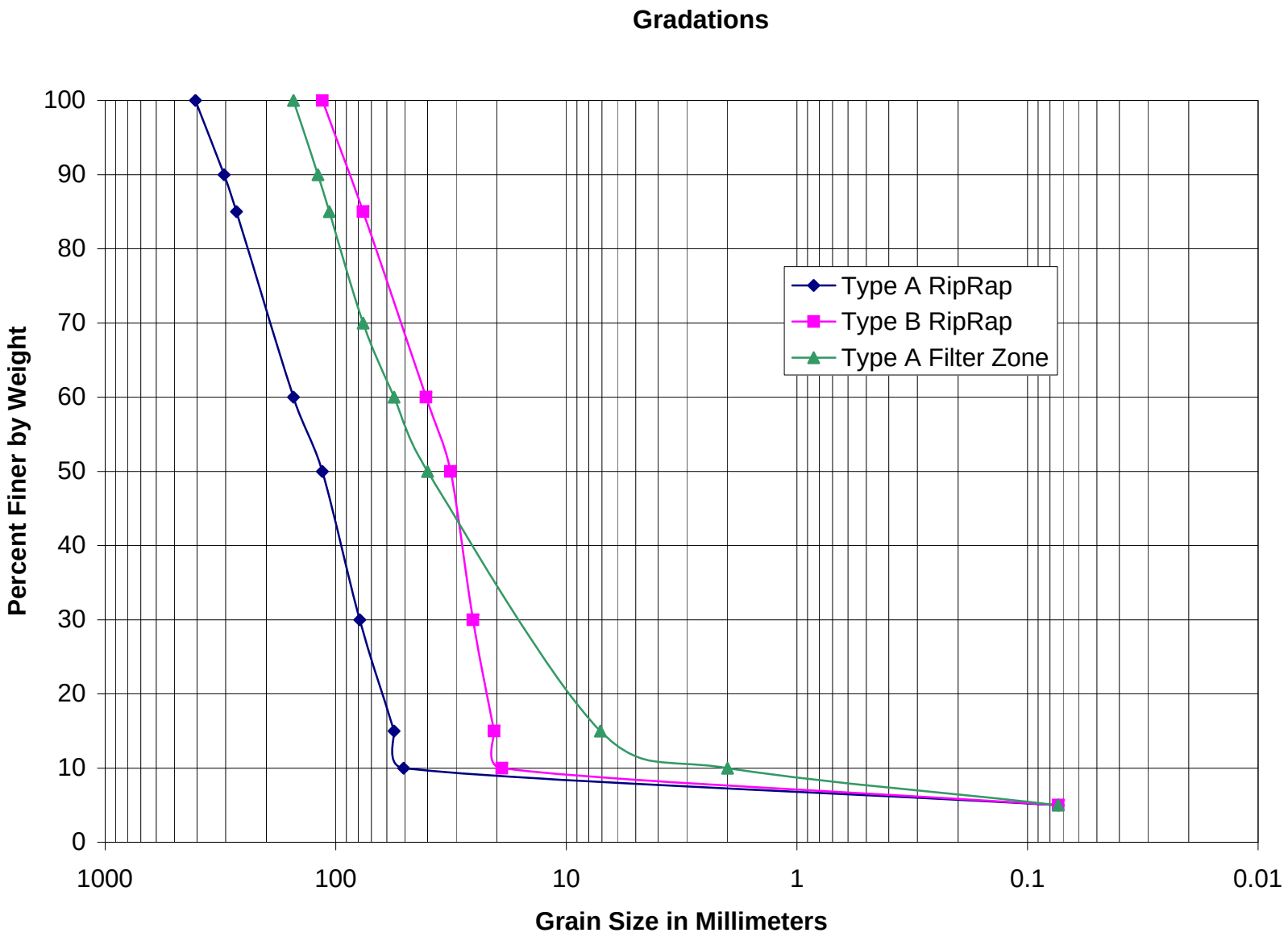
Furthermore, data provided by the collection lysimeters to date indicates that infiltration through the embankments has been over-estimated by the fate and transport models. In a report dated August 19, 2005 (CD05-0407), Energy*Solutions* (then Envirocare) summarized monitoring data to that point and found that most collection lysimeters produce no water at all. 536.5 liters were removed over a ten year period of time (March 1, 1999 through May 13, 2009) from CL-4 due to the placement of flowable fill directly above the lysimeter. 5,011.7 liters were removed from

CL-W7 in a two year period of time (March 27, 2002 through April 26, 2004) due to the placement of frozen waste directly above the collection lysimeter. 826.1 liters have been removed from CL-2 over a four year period of time (March 14, 1997 through June 1, 2001) as a result of the lysimeter being left open during the rainy season shortly after construction. Outside of the three lysimeters mentioned, no other lysimeters have produced measurable quantities of water. For those that have produced water, the volume produced is lower than that predicted by infiltration modeling. Annual update reports submitted in accordance with Part I.H.8 of the Ground Water Quality Discharge Permit (GWQDP) since the August 19, 2005 report continue to show that the lysimeter pipes remain dry. A summary report will be included with the GWQDP renewal application due in late 2012.

For Class A West, Energy*Solutions* proposes a monitoring network of 14 collection lysimeters. This provides coverage consistent with existing approvals as demonstrated in Table 1.3 of the application text. Therefore, Best Available Technology design standards required by GWQDP Part I.D.10 are maintained.

# Attachment A
# Gradation Curves

Interrogatory CAW R313-25-8(4)-11/2B: Technical Analysis - Rock Cover Design And Rock Cover Design Calculations/ Analyses


Gradations
Percent Finer by Weight
100
90
80
70
60
50
40
30
20
10
0
1000
100
10
1
0.1
0.01
Grain Size in Millimeters
Type A RipRap
Type B RipRap
Type A Filter Zone

# Attachment B
# Revised Groundwater Modeling Tables 24 and 25

Interrogatory Caw R313-25-8(4)-14/2B: Technical Analyses – Infiltration and Transport Modeling: Climate Conditions, Engineered Barrier Conditions, and Vertical Transport Distance

## *Table 24. Waste Maximum Radionuclide Source Concentrations, $K_d$s, and Fractional Release Rates, based on 0.090 cm/year Infiltration*

| | | | |
|---|---|---|---|
| Waste Characteristics: | Infiltration Rate: | 0.00090 | m/yr |
| | Waste Thickness: | 1 | m |
| | Waste Moisture Content: | 0.0501 | $cm^3/cm^3$ |
| | Waste Bulk Density: | 1.8 | $gm/cm^3$ |
| Soil Characteristics: | Soil Thickness: | 4.0725 | m |
| | Soil Moisture Content: | 0.093 | $cm^3/cm^3$ |
| | Soil Bulk Density: | 1.563 | $gm/cm^3$ |

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Actinium | Ac-227 | 7.23E+13 | 1.30E+08 | 4.5 | 1.10E-04 | 162.658 | 21.77 | y | 2.18E+01 |
| 102 | Silver | Ag-108m | 2.61E+13 | 4.69E+07 | 2.7 | 1.83E-04 | 97.995 | 418 | y | 4.18E+02 |
| 103 | Aluminum | Al-26 | 1.86E+10 | 3.35E+04 | 15 | 3.33E-05 | 539.859 | 740,000 | y | 7.40E+05 |
| 48 | Americium | Am-241 | 1.00E+04 | 1.80E-02 | 1 | 4.86E-04 | 36.924 | 432.2 | y | 4.32E+02 |
| 104 | Americium | Am-242m | 1.00E+04 | 1.80E-02 | 1 | 4.86E-04 | 36.924 | 141 | y | 1.41E+02 |
| 105 | Americium | Am-243 | 1.00E+04 | 1.80E-02 | 1 | 4.86E-04 | 36.924 | 7,370 | y | 7.37E+03 |
| 106 | Barium | Ba-133 | 2.56E+14 | 4.61E+08 | 10 | 4.99E-05 | 360.239 | 10.5 | y | 1.05E+01 |
| 107 | Beryllium | Be-10 | 2.20E+10 | 3.96E+04 | 2.5 | 1.98E-04 | 90.810 | 1,510,000 | y | 1.51E+06 |
| 108 | Bismuth | Bi-207 | 5.37E+13 | 9.66E+07 | 1 | 4.86E-04 | 36.924 | 31.55 | y | 3.16E+01 |
| 109 | Bismuth | Bi-210m | 5.68E+08 | 1.02E+03 | 1 | 4.86E-04 | 36.924 | 3,040,000 | y | 3.04E+06 |
| 110 | Berkelium | ***Bk-247*** | ***6.50E-03*** | ***1.17E-08*** | 0.001 | 1.73E-02 | 1.036 | 1,400 | y | 1.40E+03 |
| 111 | Carbon | C-14 | 5.00E+06 | 9.00E+00 | 8.52 | 5.85E-05 | 307.072 | 5,730 | y | 5.73E+03 |
| 112 | Calcium | ***Ca-41*** | ***3.53E+04*** | ***6.35E-02*** | 0.05 | 6.42E-03 | 2.796 | 103,000 | y | 1.03E+05 |
| 113 | Cadmium | Cd-113 | 4.30E-01 | 7.75E-07 | 1 | 4.86E-04 | 36.924 | 9.3.E+15 | y | 9.30E+15 |
| 114 | Cadmium | Cd-113m | 2.25E+14 | 4.04E+08 | 1 | 4.86E-04 | 36.924 | 14.1 | y | 1.41E+01 |
| 115 | Californium | Cf-249 | 1.00E+04 | 1.80E-02 | 2 | 2.47E-04 | 72.848 | 351 | y | 3.51E+02 |
| 116 | Californium | Cf-250 | 1.00E+04 | 9.00E-04 | 2 | 2.47E-04 | 72.848 | 13.08 | y | 1.31E+01 |
| 117 | Californium | Cf-251 | 1.00E+04 | 1.80E-02 | 2 | 2.47E-04 | 72.848 | 898 | y | 8.98E+02 |
| 118 | Californium | Cf-252 | 4.40E+08 | 7.92E+02 | 2 | 2.47E-04 | 72.848 | 2.65 | y | 2.65E+00 |
| 119 | Chlorine | ***Cl-36*** | ***1.59E+01*** | ***2.86E-05*** | 0.0025 | 1.65E-02 | 1.090 | 301,000 | y | 3.01E+05 |
| 120 | Curium | Cm-243 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 29 | y | 2.91E+01 |
| 50 | Curium | Cm-244 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 18 | y | 1.81E+01 |
| 121 | Curium | Cm-245 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 8,500 | y | 8.50E+03 |
| 122 | Curium | Cm-246 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 4730 | y | 4.73E+03 |
| 123 | Curium | Cm-247 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 15,600,000 | y | 1.56E+07 |
| 124 | Curium | Cm-248 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 340,000 | y | 3.40E+05 |
| 125 | Cobalt | Co-60 | 4.40E+08 | 7.92E+02 | 370 | 1.35E-06 | 13292.853 | 5 | y | 5.27E+00 |
| 126 | Cesium | Cs-135 | 1.15E+09 | 2.07E+03 | 133 | 3.76E-06 | 4778.882 | 2,300,000 | y | 2.30E+06 |
| 127 | Cesium | Cs-137 | 6.30E+05 | 1.13E+00 | 133 | 3.76E-06 | 4778.882 | 30.07 | y | 3.01E+01 |
| 128 | Europium | Eu-152 | 1.73E+14 | 3.11E+08 | 6.5 | 7.66E-05 | 234.506 | 14 | y | 1.35E+01 |
| 129 | Europium | Eu-154 | 2.70E+14 | 4.87E+08 | 6.5 | 7.66E-05 | 234.506 | 8.6 | y | 8.59E+00 |
| 130 | Europium | Eu-155 | 4.40E+08 | 7.92E+02 | 6.5 | 7.66E-05 | 234.506 | 4.76 | y | 4.76E+00 |
| 131 | Iron | Fe-55 | 4.40E+08 | 7.92E+02 | 1.4 | 3.50E-04 | 51.293 | 2.73 | y | 2.73E+00 |
| 132 | Iron | Fe-60 | 3.97E+09 | 7.15E+03 | 1.4 | 3.50E-04 | 51.293 | 1,500,000 | y | 1.50E+06 |
| 133 | Gadolinium | Gd-148 | 3.22E+13 | 5.80E+07 | 6.5 | 7.66E-05 | 234.506 | 74.6 | y | 7.46E+01 |
| 134 | Hydrogen | H-3 | 2.50E+07 | 4.50E+01 | 0.04 | 7.37E-03 | 2.437 | 12.3 | y | 1.23E+01 |
| 135 | Mercury | Hg-194 | 3.55E+12 | 6.38E+06 | 10 | 4.99E-05 | 360.239 | 444 | y | 4.44E+02 |
| 136 | Holmium | Ho-166m | 1.80E+12 | 3.24E+06 | 2.5 | 1.98E-04 | 90.810 | 1,200 | y | 1.20E+03 |
| 137 | Iodine | I-129 | 5.00E+03 | 9.00E-03 | 0.12 | 3.38E-03 | 5.311 | 15,700,000 | y | 1.57E+07 |
| 139 | Manganese | Mn-53 | 1.80E+09 | 3.24E+03 | 6.4 | 7.78E-05 | 230.913 | 3,740,000.00 | y | 3.74E+06 |
| 140 | Sodium | Na-22 | 4.40E+08 | 7.92E+02 | 1 | 4.86E-04 | 36.924 | 2.6 | y | 2.60E+00 |
| 141 | Niobium | Nb-91 | 5.78E+12 | 1.04E+07 | 1.6 | 3.07E-04 | 58.478 | 680 | y | 6.80E+02 |
| 142 | Niobium | Nb-92 | 1.12E+08 | 2.02E+02 | 1.6 | 3.07E-04 | 58.478 | 34,700,000 | y | 3.47E+07 |
| 143 | Niobium | Nb-93m | 2.63E+14 | 4.74E+08 | 1.6 | 3.07E-04 | 58.478 | 16.13 | y | 1.61E+01 |
| 144 | Niobium | Nb-94 | 1.30E+04 | 2.34E-02 | 1.6 | 3.07E-04 | 58.478 | 20,300 | y | 2.03E+04 |
| 146 | Nickel | Ni-59 | 1.40E+07 | 2.52E+01 | 10 | 4.99E-05 | 360.239 | 76,000 | y | 7.60E+04 |
| 147 | Nickel | Ni-63 | 2.20E+06 | 3.96E+00 | 10 | 4.99E-05 | 360.239 | 100.1 | y | 1.00E+02 |
| 42 | Neptunium | Np-237 | 1.00E+04 | 1.80E-02 | 3 | 1.65E-04 | 108.772 | 2,144,000 | y | 2.14E+06 |
| 148 | Osmium | Os-194 | 3.07E+14 | 5.53E+08 | 4.5 | 1.10E-04 | 162.658 | 6 | y | 6.00E+00 |
| 149 | Protactinium | Pa-231 | 4.70E+10 | 8.46E+04 | 5.5 | 9.05E-05 | 198.582 | 32,760 | y | 3.28E+04 |
| 150 | Lead | Pb-202 | 3.40E+09 | 6.12E+03 | 19 | 2.63E-05 | 683.555 | 52,500 | y | 5.25E+04 |
| 151 | Lead | Pb-210 | 7.60E+13 | 1.37E+08 | 19 | 2.63E-05 | 683.555 | 22.3 | y | 2.23E+01 |
| 152 | Palladium | Pd-107 | 5.10E+08 | 9.18E+02 | 0.55 | 8.65E-04 | 20.758 | 6,500,000 | y | 6.50E+06 |
| 153 | Promethium | Pm-145 | 1.40E+14 | 2.52E+08 | 6.5 | 7.66E-05 | 234.506 | 17.7 | y | 1.77E+01 |

## *Table 24. Waste Maximum Radionuclide Source Concentrations, Kds, and Fractional Release Rates, based on 0.090 cm/year Infiltration (Part 2)*

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 154 | Promethium | Pm-147 | 4.40E+08 | 7.92E+02 | 6.5 | 7.66E-05 | 234.506 | 2.6234 | y | 2.62E+00 |
| 155 | Polonium | Po-208 | 4.40E+08 | 7.92E+02 | 9 | 5.54E-05 | 324.315 | 2.9 | y | 2.90E+00 |
| 156 | Polonium | Po-209 | 1.68E+13 | 3.02E+07 | 9 | 5.54E-05 | 324.315 | 102 | y | 1.02E+02 |
| 157 | Platinum | Pt-193 | 3.70E+13 | 6.66E+07 | 0.9 | 5.39E-04 | 33.332 | 50 | y | 5.00E+01 |
| 158 | Plutonium | Pu-236 | 5.00E+02 | 9.00E-04 | 10 | 4.99E-05 | 360.239 | 2.86 | y | 2.86E+00 |
| 159 | Plutonium | Pu-238 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 87.7 | y | 8.77E+01 |
| 160 | Plutonium | Pu-239 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 24,110 | y | 2.41E+04 |
| 45 | Plutonium | Pu-240 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 6,564 | y | 6.56E+03 |
| 46 | Plutonium | Pu-241 | 3.50E+05 | 6.30E-01 | 10 | 4.99E-05 | 360.239 | 14.35 | y | 1.44E+01 |
| 161 | Plutonium | Pu-242 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 373,300 | y | 3.73E+05 |
| 162 | Plutonium | Pu-244 | 5.00E+02 | 9.00E-04 | 10 | 4.99E-05 | 360.239 | 80,800,000 | y | 8.08E+07 |
| 55 | Radium | Ra-226 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 1,600 | y | 1.60E+03 |
| 163 | Radium | Ra-228 | 2.72E+14 | 4.90E+08 | 10 | 4.99E-05 | 360.239 | 5.75 | y | 5.75E+00 |
| 164 | Rhenium | Re-187 | 3.80E+04 | 6.84E-02 | 0.075 | 4.86E-03 | 3.694 | 43,500,000,000 | y | 4.35E+10 |
| 165 | Selenium | Se-79 | 6.94E+10 | 1.25E+05 | 1 | 4.86E-04 | 36.924 | 65,000 | y | 6.50E+04 |
| 166 | Silicon | Si-32 | 6.50E+13 | 1.17E+08 | 0.35 | 1.32E-03 | 13.573 | 172 | y | 1.72E+02 |
| 167 | Samarium | Sm-151 | 2.63E+13 | 4.74E+07 | 2.45 | 2.02E-04 | 89.014 | 90 | y | 9.00E+01 |
| 168 | Tin | Sn-121m | 5.38E+13 | 9.68E+07 | 50 | 9.99E-06 | 1797.196 | 55 | y | 5.50E+01 |
| 169 | Tin | Sn-126 | 2.84E+10 | 5.11E+04 | 50 | 9.99E-06 | 1797.196 | 100,000 | y | 1.00E+05 |
| 170 | Strontium | Sr-90 | 2.50E+04 | 4.50E-02 | 0.05 | 6.42E-03 | 2.796 | 28.78 | y | 2.88E+01 |
| 171 | Terbium | Tb-157 | 1.50E+13 | 2.70E+07 | 6.5 | 7.66E-05 | 234.506 | 71 | y | 7.10E+01 |
| 172 | Terbium | Tb-158 | 1.50E+13 | 2.70E+07 | 6.5 | 7.66E-05 | 234.506 | 180 | y | 1.80E+02 |
| 173 | Technetium | Tc-99 | 1.88E+05 | 3.38E-01 | 0.11 | 3.63E-03 | 4.952 | 211,100 | y | 2.11E+05 |
| 174 | Tellurium | Te-123 | 2.91E+02 | 5.24E-04 | 1.25 | 3.91E-04 | 45.905 | 1E+13 | y | 1.00E+13 |
| 175 | Thorium | Th-229 | 2.13E+11 | 3.83E+05 | 10 | 4.99E-05 | 360.239 | 7,880 | y | 7.88E+03 |
| 36 | Thorium | Th-230 | 2.06E+10 | 3.71E+04 | 10 | 4.99E-05 | 360.239 | 75,380 | y | 7.54E+04 |
| 176 | Thorium | Th-232 | 1.10E+05 | 1.98E-01 | 10 | 4.99E-05 | 360.239 | 14,050,000,000 | y | 1.41E+10 |
| 177 | Titanium | Ti-44 | 1.56E+14 | 2.81E+08 | 10 | 4.99E-05 | 360.239 | 63 | y | 6.30E+01 |
| 178 | Thallium | Tl-204 | 4.40E+08 | 7.92E+02 | 0.15 | 2.81E-03 | 6.389 | 3.78 | y | 3.78E+00 |
| 179 | Thulium | Tm-170 | 4.40E+08 | 7.92E+02 | 6.5 | 7.66E-05 | 234.506 | 128.6 | d | 3.52E-01 |
| 180 | Uranium | U-232 | 2.20E+13 | 3.97E+07 | 6 | 8.29E-05 | 216.544 | 68.9 | y | 6.89E+01 |
| 181 | Uranium | U-233 | 7.50E+04 | 1.35E-01 | 6 | 8.29E-05 | 216.544 | 159,200 | y | 1.59E+05 |
| 182 | Uranium | U-234 | 6.21E+09 | 1.12E+04 | 6 | 8.29E-05 | 216.544 | 245,500 | y | 2.46E+05 |
| 183 | Uranium | U-235 | 1.55E+04 | 2.79E-02 | 6 | 8.29E-05 | 216.544 | 703,800,000 | y | 7.04E+08 |
| 40 | Uranium | U-236 | 6.47E+07 | 1.16E+02 | 6 | 8.29E-05 | 216.544 | 23,420,000 | y | 2.34E+07 |
| 41 | Uranium | U-238 | 3.36E+05 | 6.05E-01 | 6 | 8.29E-05 | 216.544 | 4,470,000,000 | y | 4.47E+09 |
| 184 | Vanadium | V-50 | 5.11E-02 | 9.20E-08 | 10 | 4.99E-05 | 360.239 | 1.4E+17 | y | 1.40E+17 |
| 185 | Zirconium | Zr-93 | 2.51E+09 | 4.53E+03 | 10 | 4.99E-05 | 360.239 | 1,530,000 | y | 1.53E+06 |
| 186 | Surrogate | Ks-20 | 4.40E+08 | 7.92E+02 | 0.001 | 1.73E-02 | 1.036 | 1 | y | 1.00E+00 |
| 187 | Surrogate | Ks-21 | 4.40E+08 | 7.92E+02 | 0.01 | 1.32E-02 | 1.359 | 1 | y | 1.00E+00 |
| 188 | Surrogate | Ks-22 | 4.40E+08 | 7.92E+02 | 0.1 | 3.91E-03 | 4.592 | 1 | y | 1.00E+00 |
| 189 | Surrogate | Ks-23 | 4.40E+08 | 7.92E+02 | 1 | 4.86E-04 | 36.924 | 1 | y | 1.00E+00 |
| 190 | Surrogate | Ks-24 | 4.40E+08 | 7.92E+02 | 50 | 9.99E-06 | 1797.196 | 4 | y | 4.00E+00 |
| 191 | Surrogate | Ks-25 | 4.40E+08 | 7.92E+02 | 100 | 5.00E-06 | 3593.393 | 4 | y | 4.00E+00 |
| 192 | Surrogate | Ks-26 | 4.40E+08 | 7.92E+02 | 1 | 4.86E-04 | 36.924 | 2 | y | 2.00E+00 |

Note: Concentrations shown in bold and italics are model-calculated concentrations that meet on GWPLs at the compliance well

## *Table 25. Waste Maximum Radionuclide Source Concentrations, $K_d$s, and Fractional Release Rates, based on 0.168 cm/year Infiltration*

| | | | |
|---|---|---|---|
| Waste Characteristics: | Infiltration Rate: | 0.00168 | m/yr |
| | Waste Thickness: | 1 | m |
| | Waste Moisture Content: | 0.054 | $cm^3/cm^3$ |
| | Waste Bulk Density: | 1.8 | $gm/cm^3$ |
| Soil Characteristics: | Soil Thickness: | 4.072 | m |
| | Soil Moisture Content: | 0.098 | $cm^3/cm^3$ |
| | Soil Bulk Density: | 1.563 | $gm/cm^3$ |

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Actinium | Ac-227 | 7.23E+13 | 1.30E+08 | 4.5 | 2.92E-04 | 142.361 | 21.77 | y | 2.18E+01 |
| 102 | Silver | Ag-108m | 2.61E+13 | 4.69E+07 | 2.7 | 4.84E-04 | 85.817 | 418 | y | 4.18E+02 |
| 103 | Aluminum | Al-26 | 1.86E+10 | 3.35E+04 | 15 | 8.80E-05 | 472.204 | 740,000 | y | 7.40E+05 |
| 48 | Americium | Am-241 | 1.00E+04 | 1.80E-02 | 1 | 1.28E-03 | 32.414 | 432.2 | y | 4.32E+02 |
| 104 | Americium | Am-242m | 1.00E+04 | 1.80E-02 | 1 | 1.28E-03 | 32.414 | 141 | y | 1.41E+02 |
| 105 | Americium | Am-243 | 1.00E+04 | 1.80E-02 | 1 | 1.28E-03 | 32.414 | 7,370 | y | 7.37E+03 |
| 106 | Barium | Ba-133 | 2.56E+14 | 4.61E+08 | 10 | 1.32E-04 | 315.136 | 10.5 | y | 1.05E+01 |
| 107 | Beryllium | Be-10 | 2.20E+10 | 3.96E+04 | 2.5 | 5.22E-04 | 79.534 | 1,510,000 | y | 1.51E+06 |
| 108 | Bismuth | Bi-207 | 5.37E+13 | 9.66E+07 | 1 | 1.28E-03 | 32.414 | 31.55 | y | 3.16E+01 |
| 109 | Bismuth | Bi-210m | 5.68E+08 | 1.02E+03 | 1 | 1.28E-03 | 32.414 | 3,040,000 | y | 3.04E+06 |
| 110 | Berkelium | Bk-247 | ***3.88E-03*** | ***6.98E-09*** | 0.001 | 4.03E-02 | 1.031 | 1,400 | y | 1.40E+03 |
| 111 | Carbon | C-14 | 5.00E+06 | 9.00E+00 | 8.52 | 1.55E-04 | 268.644 | 5,730 | y | 5.73E+03 |
| 112 | Calcium | Ca-41 | ***3.41E+01*** | ***6.14E-05*** | 0.05 | 1.62E-02 | 2.571 | 103,000 | y | 1.03E+05 |
| 113 | Cadmium | Cd-113 | 4.30E-01 | 7.75E-07 | 1 | 1.28E-03 | 32.414 | 9.3.E+15 | y | 9.30E+15 |
| 114 | Cadmium | Cd-113m | 2.25E+14 | 4.04E+08 | 1 | 1.28E-03 | 32.414 | 14.1 | y | 1.41E+01 |
| 115 | Californium | Cf-249 | 1.00E+04 | 1.80E-02 | 2 | 6.51E-04 | 63.827 | 351 | y | 3.51E+02 |
| 116 | Californium | Cf-250 | 1.00E+04 | 1.80E-02 | 2 | 6.51E-04 | 63.827 | 13.08 | y | 1.31E+01 |
| 117 | Californium | Cf-251 | 1.00E+04 | 1.80E-02 | 2 | 6.51E-04 | 63.827 | 898 | y | 8.98E+02 |
| 118 | Californium | Cf-252 | 4.40E+08 | 7.92E+02 | 2 | 6.51E-04 | 63.827 | 2.65 | y | 2.65E+00 |
| 119 | Chlorine | Cl-36 | ***9.72E+00*** | ***1.75E-05*** | 0.0025 | 3.85E-02 | 1.079 | 301,000 | y | 3.01E+05 |
| 120 | Curium | Cm-243 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 29 | y | 2.91E+01 |
| 50 | Curium | Cm-244 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 18 | y | 1.81E+01 |
| 121 | Curium | Cm-245 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 8,500 | y | 8.50E+03 |
| 122 | Curium | Cm-246 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 4730 | y | 4.73E+03 |
| 123 | Curium | Cm-247 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 15,600,000 | y | 1.56E+07 |
| 124 | Curium | Cm-248 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 340,000 | y | 3.40E+05 |
| 125 | Cobalt | Co-60 | 4.40E+08 | 7.92E+02 | 370 | 3.57E-06 | 11624.037 | 5 | y | 5.27E+00 |
| 126 | Cesium | Cs-135 | 1.15E+09 | 2.07E+03 | 133 | 9.94E-06 | 4179.010 | 2,300,000 | y | 2.30E+06 |
| 127 | Cesium | Cs-137 | 6.30E+05 | 1.13E+00 | 133 | 9.94E-06 | 4179.010 | 30.07 | y | 3.01E+01 |
| 128 | Europium | Eu-152 | 1.73E+14 | 3.11E+08 | 6.5 | 2.02E-04 | 205.188 | 14 | y | 1.35E+01 |
| 129 | Europium | Eu-154 | 2.70E+14 | 4.87E+08 | 6.5 | 2.02E-04 | 205.188 | 8.6 | y | 8.59E+00 |
| 130 | Europium | Eu-155 | 4.40E+08 | 7.92E+02 | 6.5 | 2.02E-04 | 205.188 | 4.76 | y | 4.76E+00 |
| 131 | Iron | Fe-55 | 4.40E+08 | 7.92E+02 | 1.4 | 9.23E-04 | 44.979 | 2.73 | y | 2.73E+00 |
| 132 | Iron | Fe-60 | 3.97E+09 | 7.15E+03 | 1.4 | 9.23E-04 | 44.979 | 1,500,000 | y | 1.50E+06 |
| 133 | Gadolinium | Gd-148 | 3.22E+13 | 5.80E+07 | 6.5 | 2.02E-04 | 205.188 | 74.6 | y | 7.46E+01 |
| 134 | Hydrogen | H-3 | 2.50E+07 | 4.50E+01 | 0.04 | 1.84E-02 | 2.257 | 12.3 | y | 1.23E+01 |
| 135 | Mercury | Hg-194 | 3.55E+12 | 6.38E+06 | 10 | 1.32E-04 | 315.136 | 444 | y | 4.44E+02 |
| 136 | Holmium | Ho-166m | 1.80E+12 | 3.24E+06 | 2.5 | 5.22E-04 | 79.534 | 1,200 | y | 1.20E+03 |
| 137 | Iodine | I-129 | ***2.19E+01*** | ***3.94E-05*** | 0.12 | 8.71E-03 | 4.770 | 15,700,000 | y | 1.57E+07 |
| 138 | Potassium | K-40 | 1.80E+09 | 3.24E+03 | 6.4 | 2.06E-04 | 202.047 | 1,277,000,000 | y | 1.28E+09 |
| 139 | Manganese | Mn-53 | 4.40E+08 | 7.92E+02 | 1 | 1.28E-03 | 32.414 | 3,740,000.00 | y | 3.74E+06 |
| 140 | Sodium | Na-22 | 5.78E+12 | 1.04E+07 | 1.6 | 8.10E-04 | 51.262 | 2.6 | y | 2.60E+00 |
| 141 | Niobium | Nb-91 | 1.12E+08 | 2.02E+02 | 1.6 | 8.10E-04 | 51.262 | 680 | y | 6.80E+02 |
| 142 | Niobium | Nb-92 | 2.63E+14 | 4.74E+08 | 1.6 | 8.10E-04 | 51.262 | 34,700,000 | y | 3.47E+07 |
| 143 | Niobium | Nb-93m | 1.30E+04 | 2.34E-02 | 1.6 | 8.10E-04 | 51.262 | 16.13 | y | 1.61E+01 |
| 144 | Niobium | Nb-94 | 7.23E+13 | 1.30E+08 | 10 | 1.32E-04 | 315.136 | 20,300 | y | 2.03E+04 |
| 146 | Nickel | Ni-59 | 1.40E+07 | 2.52E+01 | 10 | 1.32E-04 | 315.136 | 76,000 | y | 7.60E+04 |
| 147 | Nickel | Ni-63 | 2.20E+06 | 3.96E+00 | 3 | 4.36E-04 | 95.241 | 100.1 | y | 1.00E+02 |
| 42 | Neptunium | Np-237 | 1.00E+04 | 1.80E-02 | 4.5 | 2.92E-04 | 142.361 | 2,144,000 | y | 2.14E+06 |
| 148 | Osmium | Os-194 | 3.07E+14 | 5.53E+08 | 5.5 | 2.39E-04 | 173.775 | 6 | y | 6.00E+00 |
| 149 | Protactinium | Pa-231 | 4.70E+10 | 8.46E+04 | 19 | 6.95E-05 | 597.859 | 32,760 | y | 3.28E+04 |
| 150 | Lead | Pb-202 | 3.40E+09 | 6.12E+03 | 19 | 6.95E-05 | 597.859 | 52,500 | y | 5.25E+04 |
| 151 | Lead | Pb-210 | 7.60E+13 | 1.37E+08 | 0.55 | 2.27E-03 | 18.277 | 22.3 | y | 2.23E+01 |
| 152 | Palladium | Pd-107 | 5.10E+08 | 9.18E+02 | 6.5 | 2.02E-04 | 205.188 | 6,500,000 | y | 6.50E+06 |
| 153 | Promethium | Pm-145 | 1.40E+14 | 2.52E+08 | 6.5 | 2.02E-04 | 205.188 | 17.7 | y | 1.77E+01 |
| 154 | Promethium | Pm-147 | 4.40E+08 | 7.92E+02 | 9 | 1.46E-04 | 283.723 | 2.6234 | y | 2.62E+00 |
| 155 | Polonium | Po-208 | 4.40E+08 | 7.92E+02 | 4.5 | 2.92E-04 | 142.361 | 2.9 | y | 2.90E+00 |

### *Table 25. Waste Maximum Radionuclide Source Concentrations, Kds, and Fractional Release Rates, based on 0.168 cm/year Infiltration (Part 2)*

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 156 | Polonium | Po-209 | 1.68E+13 | 3.02E+07 | 9 | 1.46E-04 | 283.723 | 102 | y | 1.02E+02 |
| 157 | Platinum | Pt-193 | 3.70E+13 | 6.66E+07 | 0.9 | 1.42E-03 | 29.272 | 50 | y | 5.00E+01 |
| 158 | Plutonium | Pu-236 | 5.00E+02 | 9.00E-04 | 10 | 1.32E-04 | 315.136 | 2.86 | y | 2.86E+00 |
| 159 | Plutonium | Pu-238 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 87.7 | y | 8.77E+01 |
| 160 | Plutonium | Pu-239 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 24,110 | y | 2.41E+04 |
| 45 | Plutonium | Pu-240 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 6,564 | y | 6.56E+03 |
| 46 | Plutonium | Pu-241 | 3.50E+05 | 6.30E-01 | 10 | 1.32E-04 | 315.136 | 14.35 | y | 1.44E+01 |
| 161 | Plutonium | Pu-242 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 373,300 | y | 3.73E+05 |
| 162 | Plutonium | Pu-244 | 5.00E+02 | 9.00E-04 | 10 | 1.32E-04 | 315.136 | 80,800,000 | y | 8.08E+07 |
| 55 | Radium | Ra-226 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 1,600 | y | 1.60E+03 |
| 163 | Radium | Ra-228 | 2.72E+14 | 4.90E+08 | 10 | 1.32E-04 | 315.136 | 5.75 | y | 5.75E+00 |
| 164 | Rhenium | Re-187 | ***1.91E+04*** | ***3.44E-02*** | 0.075 | 1.24E-02 | 3.356 | 43,500,000,000 | y | 4.35E+10 |
| 165 | Selenium | Se-79 | 6.94E+10 | 1.25E+05 | 1 | 1.28E-03 | 32.414 | 65,000 | y | 6.50E+04 |
| 166 | Silicon | Si-32 | 9.89E+13 | 1.78E+08 | 0.35 | 3.46E-03 | 11.995 | 172 | y | 1.72E+02 |
| 167 | Samarium | Sm-151 | 2.63E+13 | 4.74E+07 | 2.45 | 5.33E-04 | 77.963 | 90 | y | 9.00E+01 |
| 168 | Tin | Sn-121m | 5.38E+13 | 9.68E+07 | 50 | 2.64E-05 | 1571.681 | 55 | y | 5.50E+01 |
| 169 | Tin | Sn-126 | 2.84E+10 | 5.11E+04 | 50 | 2.64E-05 | 1571.681 | 100,000 | y | 1.00E+05 |
| 170 | Strontium | Sr-90 | 2.50E+04 | 4.50E-02 | 0.05 | 1.62E-02 | 2.571 | 28.78 | y | 2.88E+01 |
| 171 | Terbium | Tb-157 | 1.50E+13 | 2.70E+07 | 6.5 | 2.02E-04 | 205.188 | 71 | y | 7.10E+01 |
| 172 | Terbium | Tb-158 | 1.50E+13 | 2.70E+07 | 6.5 | 2.02E-04 | 205.188 | 180 | y | 1.80E+02 |
| 173 | Technetium | Tc-99 | ***1.72E+03*** | ***3.10E-03*** | 0.11 | 9.32E-03 | 4.455 | 211,100 | y | 2.11E+05 |
| 174 | Tellurium | Te-123 | 2.91E+02 | 5.24E-04 | 1.25 | 1.03E-03 | 40.267 | 1E+13 | y | 1.00E+13 |
| 175 | Thorium | Th-229 | 2.13E+11 | 3.83E+05 | 10 | 1.32E-04 | 315.136 | 7,880 | y | 7.88E+03 |
| 36 | Thorium | Th-230 | 2.06E+10 | 3.71E+04 | 10 | 1.32E-04 | 315.136 | 75,380 | y | 7.54E+04 |
| 176 | Thorium | Th-232 | 1.10E+05 | 1.98E-01 | 10 | 1.32E-04 | 315.136 | 14,050,000,000 | y | 1.41E+10 |
| 177 | Titanium | Ti-44 | 1.56E+14 | 2.81E+08 | 10 | 1.32E-04 | 315.136 | 63 | y | 6.30E+01 |
| 178 | Thallium | Tl-204 | 4.40E+08 | 7.92E+02 | 0.15 | 7.27E-03 | 5.712 | 3.78 | y | 3.78E+00 |
| 179 | Thulium | Tm-170 | 4.40E+08 | 7.92E+02 | 6.5 | 2.02E-04 | 205.188 | 128.6 | d | 3.52E-01 |
| 180 | Uranium | U-232 | 2.20E+13 | 3.97E+07 | 6 | 2.19E-04 | 189.482 | 68.9 | y | 6.89E+01 |
| 181 | Uranium | U-233 | 7.50E+04 | 1.35E-01 | 6 | 2.19E-04 | 189.482 | 159,200 | y | 1.59E+05 |
| 182 | Uranium | U-234 | 6.21E+09 | 1.12E+04 | 6 | 2.19E-04 | 189.482 | 245,500 | y | 2.46E+05 |
| 183 | Uranium | U-235 | 1.55E+04 | 2.79E-02 | 6 | 2.19E-04 | 189.482 | 703,800,000 | y | 7.04E+08 |
| 40 | Uranium | U-236 | 6.47E+07 | 1.16E+02 | 6 | 2.19E-04 | 189.482 | 23,420,000 | y | 2.34E+07 |
| 41 | Uranium | U-238 | 3.36E+05 | 6.05E-01 | 6 | 2.19E-04 | 189.482 | 4,470,000,000 | y | 4.47E+09 |
| 184 | Vanadium | V-50 | 5.11E-02 | 9.20E-08 | 10 | 1.32E-04 | 315.136 | 1.4E+17 | y | 1.40E+17 |
| 185 | Zirconium | Zr-93 | 2.51E+09 | 4.53E+03 | 10 | 1.32E-04 | 315.136 | 1,530,000 | y | 1.53E+06 |
| 186 | Surrogate | Ks-20 | 4.40E+08 | 7.92E+02 | 0.001 | 4.03E-02 | 1.031 | 1 | y | 1.00E+00 |
| 187 | Surrogate | Ks-21 | 4.40E+08 | 7.92E+02 | 0.01 | 3.16E-02 | 1.314 | 1 | y | 1.00E+00 |
| 188 | Surrogate | Ks-22 | 4.40E+08 | 7.92E+02 | 0.1 | 1.00E-02 | 4.141 | 1 | y | 1.00E+00 |
| 189 | Surrogate | Ks-23 | 4.40E+08 | 7.92E+02 | 1 | 1.28E-03 | 32.414 | 1 | y | 1.00E+00 |
| 190 | Surrogate | Ks-24 | 4.40E+08 | 7.92E+02 | 50 | 2.64E-05 | 1571.681 | 4 | y | 4.00E+00 |
| 191 | Surrogate | Ks-25 | 4.40E+08 | 7.92E+02 | 100 | 1.32E-05 | 3142.361 | 4 | y | 4.00E+00 |
| 192 | Surrogate | Ks-26 | 4.40E+08 | 7.92E+02 | 1 | 1.28E-03 | 32.414 | 2 | y | 2.00E+00 |

Note: Concentrations shown in bold and italics are model-calculated concentrations that meet on GWPLs at the compliance well

#### *5.1.1.2 Heavy Metals Concentrations*

The starting metals concentrations in the model were determined by calculating the maximum possible metals concentration, based on the density of each metal. Those metal densities, and corresponding concentrations in $mg/m^3$ are given in Table 26. The PATHRAE model was run using these source term concentrations in the vertical (unsaturated) model domain.

# Attachment C
# Corrected Retardation Factors and Memo Files

Interrogatory CAW R313-25-26 (2 and 3)-21/2B: Technical Analyses - Horizontal Transport and Well Spacing Analysis Input Parameters

The geometric mean hydraulic conductivity of the 39 wells is $1.09 \times 10^{-3}$ centimeters per second (cm/sec) (3.10 ft/day), while the arithmetic average is $1.57 \times 10^{-3}$ cm/sec (4.46 ft/day).

As shown in Table 2, the upper 90% confidence level of the mean results in hydraulic conductivity values of $1.42 \times 10^{-3}$ cm/sec (4.02 ft/day) and 1.93xl0$^{-3}$ cm/sec (5.48 ft/day) for the geometric mean and arithmetic mean, respectively.

### *3.2.2 Hydraulic Gradient and Direction*

Using monthly groundwater elevation data from November 2009 to November 2010, the hydraulic gradient below the Class A and CAN embankments averaged $5.51 \times 10^{-4}$ and $5.63 \times 10^{-4}$ ft/ft, respectively, based on freshwater heads (Table 3). The maximum allowable gradient below the Class A and CAN embankments is $1.00 \times 10^{-3}$, as specified in the GWQDP. Both the average and GWQDP maximum gradients were used in the well spacing evaluation for the CAW embankment.

The principal direction of groundwater flow in the shallow aquifer below the proposed CAW embankment is approximately N40°E. This groundwater flow direction has been used in recent well spacing analyses for both the CAN and Mixed Waste (MW) embankments (Whetstone Associates, 2009a and 2009b). Although the MEMO model allows for changes in flow directions by defining multiple gradient zones within the model domain, the hydraulic gradient and flow direction are relatively uniform below the CAW embankment and were entered into the MEMO model as a single gradient zone. In addition to the base case (N40°E) gradient zone, sensitivity analyses were conducted using flow directions of due north (N0°E) and due east (N90°E).

### *3.2. Aquifer Porosity*

The effective porosity value of 0.29 has been used in previous modeling exercises and is regarded by Utah DEQ as a representative value.

### *3.2.4 Retardation Factor (R)*

The retardation factor is constituent-specific, and can be calculated from the sorption coefficient ($K_d$) according to the following equation:

$$R_d = 1 + \frac{\rho K_d}{\theta_e * C}$$

Where:

$Rd$ = Retardation factor
$\rho$ = Soil density (kilograms per cubic meter [kg/m$^3$])
$K_d$ = Soil-water distribution coefficient (liters per kilogram [L/kg])
$\theta_e$ = Effective soil porosity
C = Conversion factor (1,000 L/ m$^3$)

The bulk density of the aquifer materials below the CAW embankment is 1,600 kg/m3. Because the MEMO model evaluation addresses only the saturated zone, the bulk density of 1,600 kg/m3 is applicable. This bulk density value was used in the well spacing analyses for the CAN and MW embankments (Whetstone Associates, 2009a and 2009b).

The $K_d$ values for I-129 (0.12 L/kg) and Tc-99 (0.11 L/kg) are very low, indicating that these nuclides are relatively mobile. These radionuclides and $K_d$ values were used in the well spacing analyses for the CAN and MW embankments (Whetstone Associates, 2009a and 2009b). When $K_d$ values approach zero, the resulting retardation factor approaches 1.0 indicating conservative (non-retarded) transport in groundwater. The calculated retardation factors are shown in Table 4.

#### *3.2.5 Contaminant Velocity Calculation*

Contaminant velocities were calculated using the hydraulic conductivity, hydraulic gradient, porosity, and retardation coefficients described above. The calculated velocities are shown in Table 5.

The most conservative well spacing analysis uses contaminant velocities based on the maximum allowable hydraulic gradient and 90% confidence interval above the measured arithmetic mean hydraulic conductivity, and results in transport velocities of 0.0114 ft/day for I-129 and 0.0118 ft/day for Tc-99 (Table 5). More representative contaminant velocities are based on the average of the measured hydraulic gradient and the measured geometric mean hydraulic conductivity, which results in transport velocities of 0.00362 ft/day for I-129 and 0.00375 ft/day for Tc-99. A higher transport velocity results in less lateral spreading of the plume and a closer optimum well spacing. Well spacing analyses are performed using the most conservative higher transport velocities and the more representative average velocities.

### 3.3 Source Term

#### *3.3.1 Width of Line Source*

The width of the line source depends on the type of leak and on the amount of lateral spreading in the vadose zone prior to the arrival of the compound at the water table. A longer line source would result in a greater probability of plume detection. The default width of a line source in the

# Electronic MEMO Files

## MEMO Modeling Sensitivity Analysis Summary Table

| Model Run | Interrogatory Round | Longitudinal/ Transverse Dispersivity (feet) | Source Width (feet) | Upgradient Non-Arrival Zones[a] | Undetected Leaks | Monitoring Efficiency (%) |
|---|---|---|---|---|---|---|
| CAWT9a1 | 1 | 27.2 / 2.72 | 1.0 | None | 761 / 13217 | 94.2 |
| CAWT9a1a | 1 | 27.2 / 2.72 | 3.0 | None | 666 / 13217 | 95.0 |
| CAWT9R2x | 2B | 5.0 / 1.65 | 1.0 | Excluded | 998 / 12440 | 92.0 |
| CAWT9R3x | 2B | 10.0 / 3.3 | 1.0 | Excluded | 607 / 12791 | 95.3 |
| CAWT9R4x | 2B | 25.0 / 8.33 | 1.0 | Excluded | 502 / 13181 | 96.2 |
| CAWT99R5 | 2B | 50.0 / 16.5 | 1.0 | None | 641 / 13217 | 95.2 |
| CAWT99R6 | 2B | 75.0 / 24.75 | 1.0 | None | 824 / 13217 | 93.8 |
| CAWT99R7 | 2B | 100.0 / 33.0 | 1.0 | None | 991 / 13217 | 92.5 |
| CAWT99S2 | 2B | 5.0 / 0.5 | 1.0 | Included | 4070 / 13217 | 69.2 |
| CAWT9S2x | 2B | 5.0 / 0.5 | 1.0 | Excluded | 3293 / 12440 | 73.5 |
| CAWT99S3 | 2B | 10.0 / 1.0 | 1.0 | Included | 2358 / 13217 | 82.2 |
| CAWT9S3x | 2B | 10.0 / 1.0 | 1.0 | Excluded | 1932 / 12791 | 84.9 |
| CAWT99S4 | 2B | 25.0 / 2.5 | 1.0 | Included | 844 / 13217 | 93.6 |
| CAWT9S4x | 2B | 25.0 / 2.5 | 1.0 | Excluded | 808 / 13181 | 93.9 |
| CAWT99S5 | 2B | 50.0 / 5.0 | 1.0 | None | 479 / 13217 | 96.4 |
| CAWT99S6 | 2B | 75.0 / 7.5 | 1.0 | None | 442 / 13217 | 96.7 |
| CAWT99S7 | 2B | 100.0 / 10.0 | 1.0 | None | 459 / 13217 | 96.5 |
| CAWT99S8 | 2B | 125.0 / 12.5 | 1.0 | None | 505 / 13217 | 96.2 |
| CAWT99S9 | 2B | 150.0 / 15.0 | 1.0 | None | 544 / 13217 | 95.9 |
| CAWT9T2x | 2B | 5.0 / 0.5 | 5.0 | Excluded | 2781 / 12440 | 77.6 |
| CAWT9T3x | 2B | 10.0 / 1.0 | 5.0 | Excluded | 1565 / 12791 | 87.8 |
| CAWT9T4x | 2B | 25.0 / 2.5 | 5.0 | Excluded | 678 / 13181 | 94.9 |
| CAWT99T5 | 2B | 50.0 / 5.0 | 5.0 | None | 451 / 13217 | 96.6 |
| CAWT99T6 | 2B | 75.0 / 7.5 | 5.0 | None | 460 / 13217 | 96.5 |
| CAWT99T7 | 2B | 100.0 / 10.0 | 5.0 | None | 501 / 13217 | 96.2 |
| CAWT99T8 | 2B | 125.0 / 12.5 | 5.0 | None | 562 / 13217 | 95.7 |
| CAWT99T9 | 2B | 150.0 / 15.0 | 5.0 | None | 636 / 13217 | 95.2 |
| CAWT9U2x | 2B | 5.0 / 1.65 | 5.0 | Excluded | 871 / 12440 | 93.0 |
| CAWT9U3x | 2B | 10.0 / 3.3 | 5.0 | Excluded | 557 / 12791 | 95.6 |
| CAWT9U4x | 2B | 25.0 / 8.33 | 5.0 | Excluded | 536 / 13181 | 95.9 |
| CAWT99U5 | 2B | 50.0 / 16.5 | 5.0 | None | 735 / 13217 | 94.4 |
| CAWT99U6 | 2B | 75.0 / 24.75 | 5.0 | None | 980 / 13217 | 92.6 |
| CAWT99U7 | 2B | 100.0 / 33.0 | 5.0 | None | 1207 / 13217 | 90.9 |

[a] Refer to discussion in Sections 3.4 and 4.2 of Well Spacing Evaluation Report.

# MEMO MODEL INPUT/OUTPUT FILES

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 09/07/11 at 13:26:25         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       27.200000        2.720000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         761
 Monitoring efficiency = 94.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 09/07/11 at 15:55:00         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       27.200000        2.720000    9.030000E-04
        3.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         666
 Monitoring efficiency = 95.0 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 12/22/11 at 16:41:14        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10948.05       12221.01         1
  7       10957.35       12781.01         1
  8       10350.35       12785.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06        5.000000        1.650000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12440
  # of undetected leaks =         998
 Monitoring efficiency = 92.0 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 12/22/11 at 16:43:14        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10805.05       12222.03         1
  7       10811.78       12627.03         1
  8       10347.78       12630.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       10.000000        3.300000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12791
  # of undetected leaks =         607
 Monitoring efficiency = 95.3 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                   ++
++                                         ++
++     Monitoring Analysis Package         ++
++        MAP Version   1.1                ++
++                                         ++
++       GOLDER ASSOCIATES INC.            ++
++                                         ++
++    Run on 12/22/11 at 16:45:06          ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10543.05       12223.91         1
  7       10544.43       12306.91         1
  8       10342.43       12308.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       25.000000        8.330000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13181
  # of undetected leaks =         502
 Monitoring efficiency = 96.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 16:47:03         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       50.000000       16.500000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         641
 Monitoring efficiency = 95.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 16:49:06         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       75.000000       24.750000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         824
 Monitoring efficiency = 93.8 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 16:51:10         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      100.000000       33.000000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         991
 Monitoring efficiency = 92.5 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 11:47:24         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06        5.000000    5.000000E-01    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        4070
 Monitoring efficiency = 69.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 15:12:47         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10948.05       12221.01         1
  7       10957.35       12781.01         1
  8       10350.35       12785.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06        5.000000    5.000000E-01    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12440
  # of undetected leaks =        3293
 Monitoring efficiency = 73.5 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 11:50:44         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       10.000000        1.000000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        2358
 Monitoring efficiency = 82.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                   ++
++                                         ++
++     Monitoring Analysis Package         ++
++        MAP Version   1.1                ++
++                                         ++
++       GOLDER ASSOCIATES INC.            ++
++                                         ++
++    Run on 12/22/11 at 15:54:58          ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10805.05       12222.03         1
  7       10811.78       12627.03         1
  8       10347.78       12630.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       10.000000        1.000000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12791
  # of undetected leaks =        1932
 Monitoring efficiency = 84.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 12:00:30         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       25.000000        2.500000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         844
 Monitoring efficiency = 93.6 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 16:26:12         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10543.05       12223.91         1
  7       10544.43       12306.91         1
  8       10342.43       12308.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       25.000000        2.500000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13181
  # of undetected leaks =         808
 Monitoring efficiency = 93.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 12:17:44         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       50.000000        5.000000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         479
 Monitoring efficiency = 96.4 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 12:29:08         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       75.000000        7.500000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         442
 Monitoring efficiency = 96.7 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 13:14:55         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      100.000000       10.000000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         459
 Monitoring efficiency = 96.5 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 13:16:35         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      125.000000       12.500000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         505
 Monitoring efficiency = 96.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 13:18:06         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      150.000000       15.000000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         544
 Monitoring efficiency = 95.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:08:33         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10948.05       12221.01         1
  7       10957.35       12781.01         1
  8       10350.35       12785.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06        5.000000    5.000000E-01    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12440
  # of undetected leaks =        2781
 Monitoring efficiency = 77.6 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:11:11         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10805.05       12222.03         1
  7       10811.78       12627.03         1
  8       10347.78       12630.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       10.000000        1.000000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12791
  # of undetected leaks =        1565
 Monitoring efficiency = 87.8 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:13:27         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10543.05       12223.91         1
  7       10544.43       12306.91         1
  8       10342.43       12308.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       25.000000        2.500000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13181
  # of undetected leaks =         678
 Monitoring efficiency = 94.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:18:16         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       50.000000        5.000000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         451
 Monitoring efficiency = 96.6 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:21:12         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       75.000000        7.500000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         460
 Monitoring efficiency = 96.5 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:23:13         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      100.000000       10.000000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         501
 Monitoring efficiency = 96.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:24:45         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      125.000000       12.500000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         562
 Monitoring efficiency = 95.7 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 17:26:56         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      150.000000       15.000000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         636
 Monitoring efficiency = 95.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 18:05:51         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10948.05       12221.01         1
  7       10957.35       12781.01         1
  8       10350.35       12785.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06        5.000000        1.650000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12440
  # of undetected leaks =         871
 Monitoring efficiency = 93.0 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 18:07:09         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10805.05       12222.03         1
  7       10811.78       12627.03         1
  8       10347.78       12630.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       10.000000        3.300000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12791
  # of undetected leaks =         557
 Monitoring efficiency = 95.6 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 18:08:26         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10543.05       12223.91         1
  7       10544.43       12306.91         1
  8       10342.43       12308.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       25.000000        8.330000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13181
  # of undetected leaks =         536
 Monitoring efficiency = 95.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 18:10:01         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       50.000000       16.500000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         735
 Monitoring efficiency = 94.4 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 18:12:28         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06       75.000000       24.750000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         980
 Monitoring efficiency = 92.6 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 12/22/11 at 18:14:49         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------

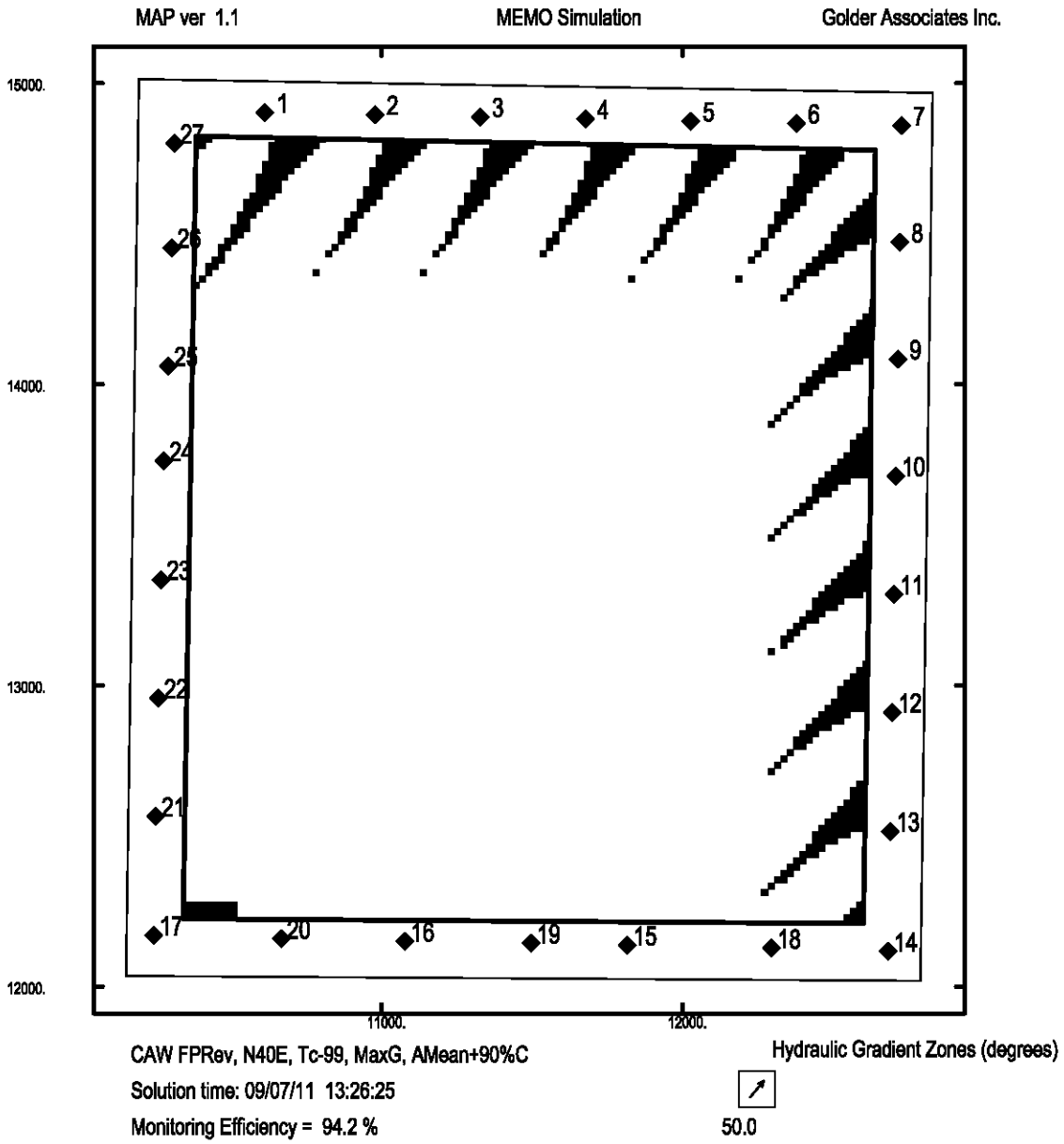


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

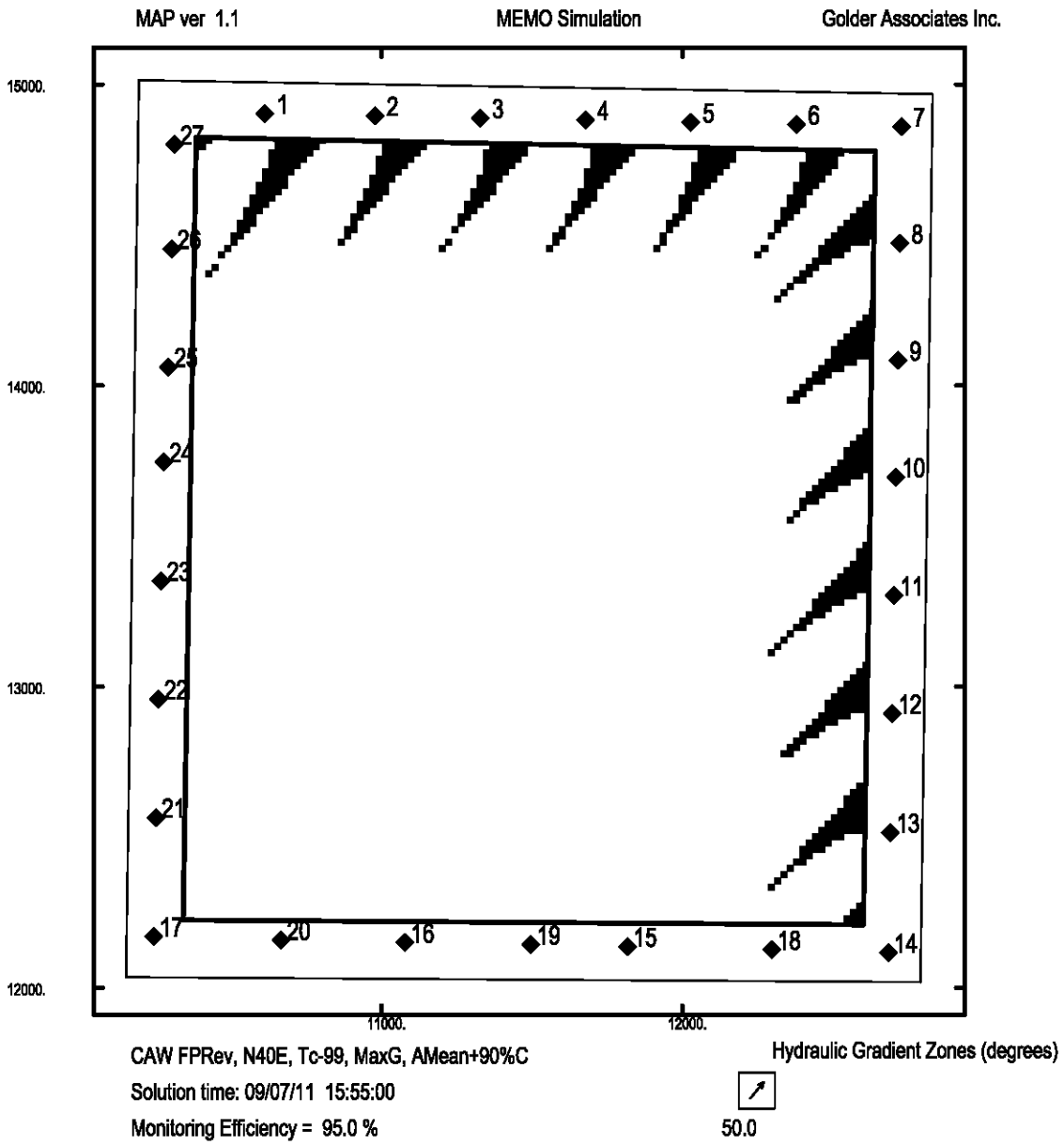
```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      100.000000       33.000000    9.030000E-04
        5.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        1207
 Monitoring efficiency = 90.9 %.
  *   END OF MAP FILE
```

# MEMO MODEL OUTPUT PLOTS

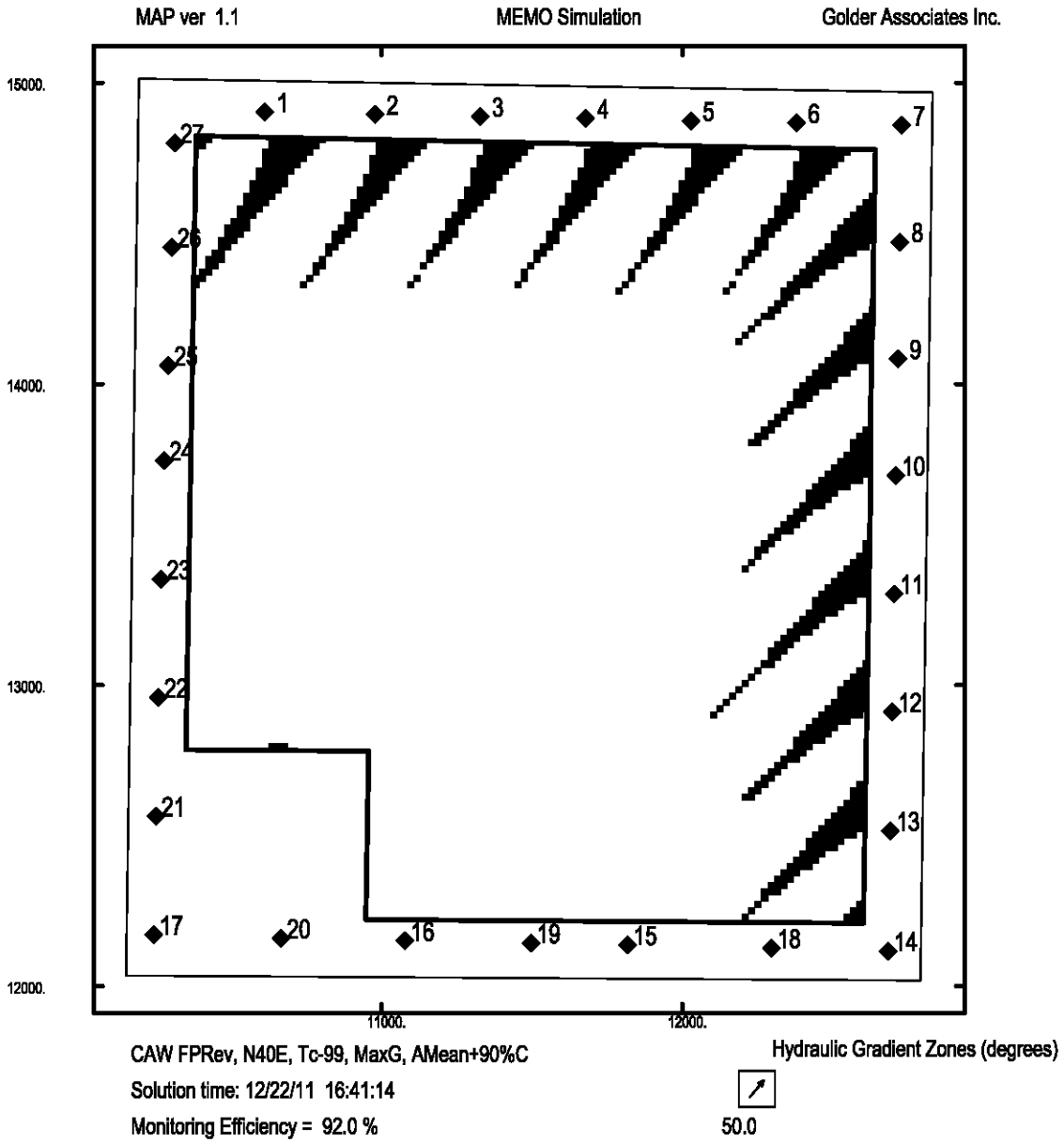
# CAWT9a1.PLT


MAP ver 1.1
MEMO Simulation
Golder Associates Inc.
15000.
14000.
13000.
12000.
11000.
12000.
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C
Solution time: 09/07/11 13:26:25
Monitoring Efficiency = 94.2 %
Hydraulic Gradient Zones (degrees)
50.0

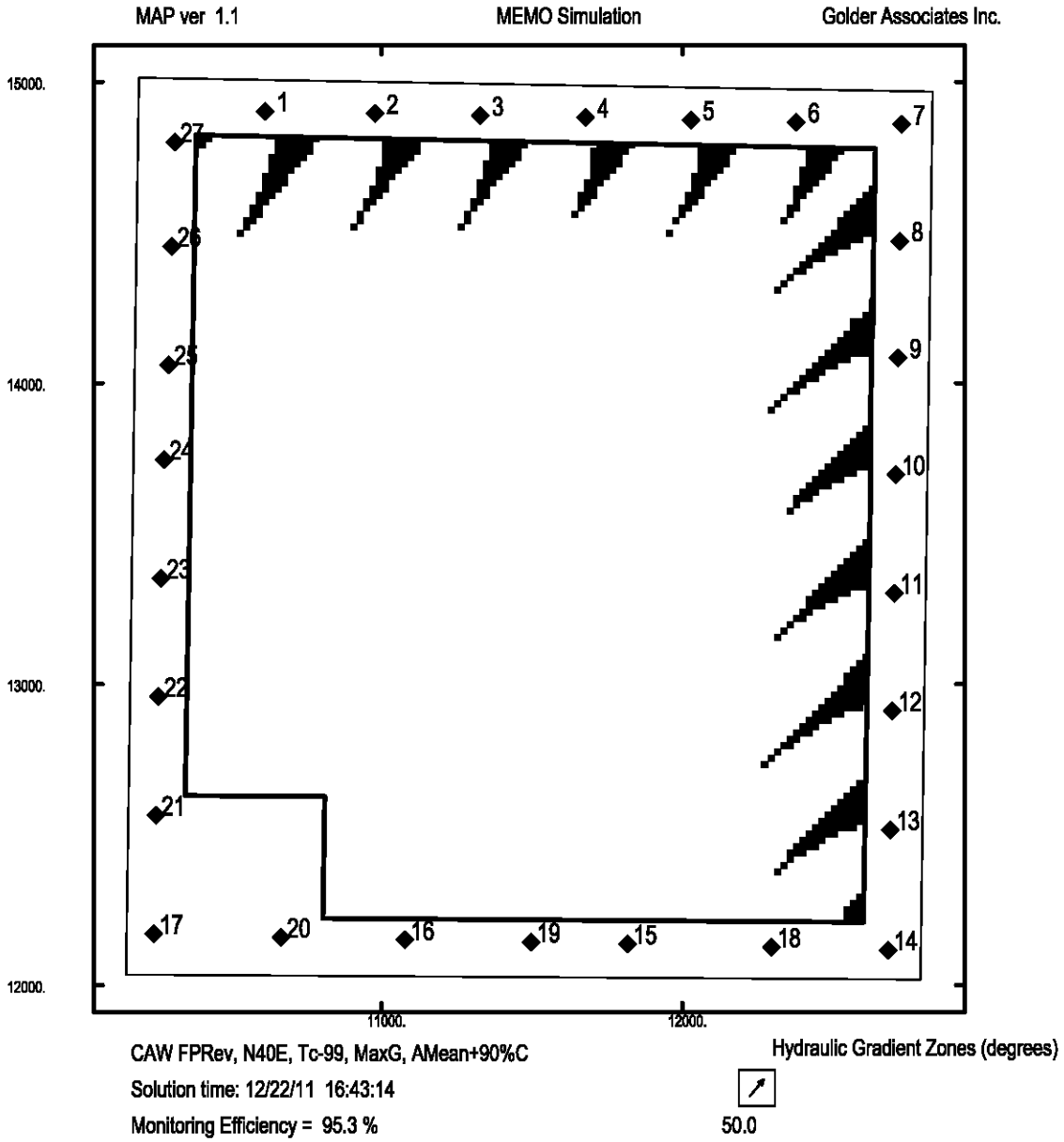
# CAWT9a1a.PLT



# CAWT9R2x.PLT



# CAWT9R3x.PLT



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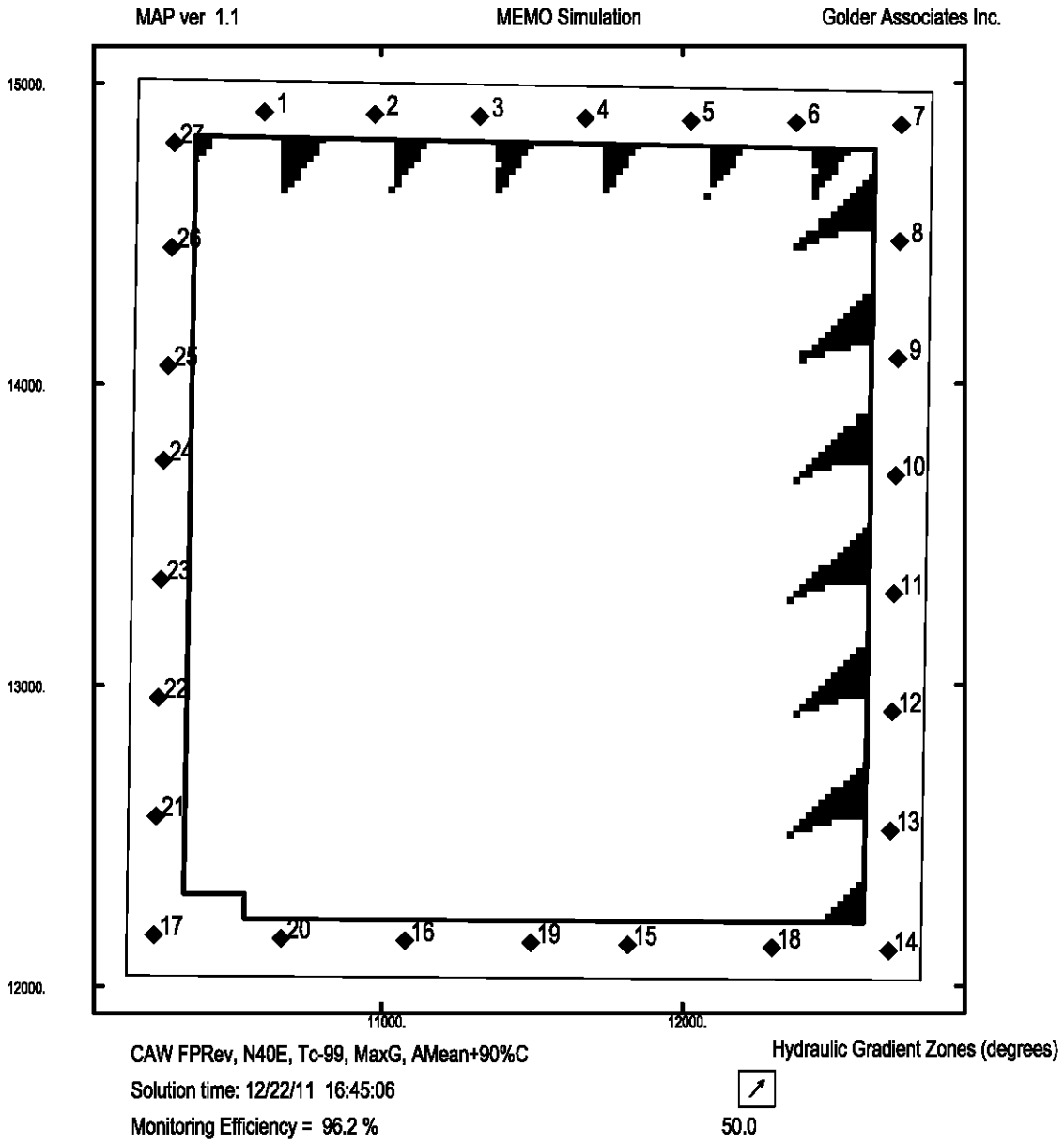

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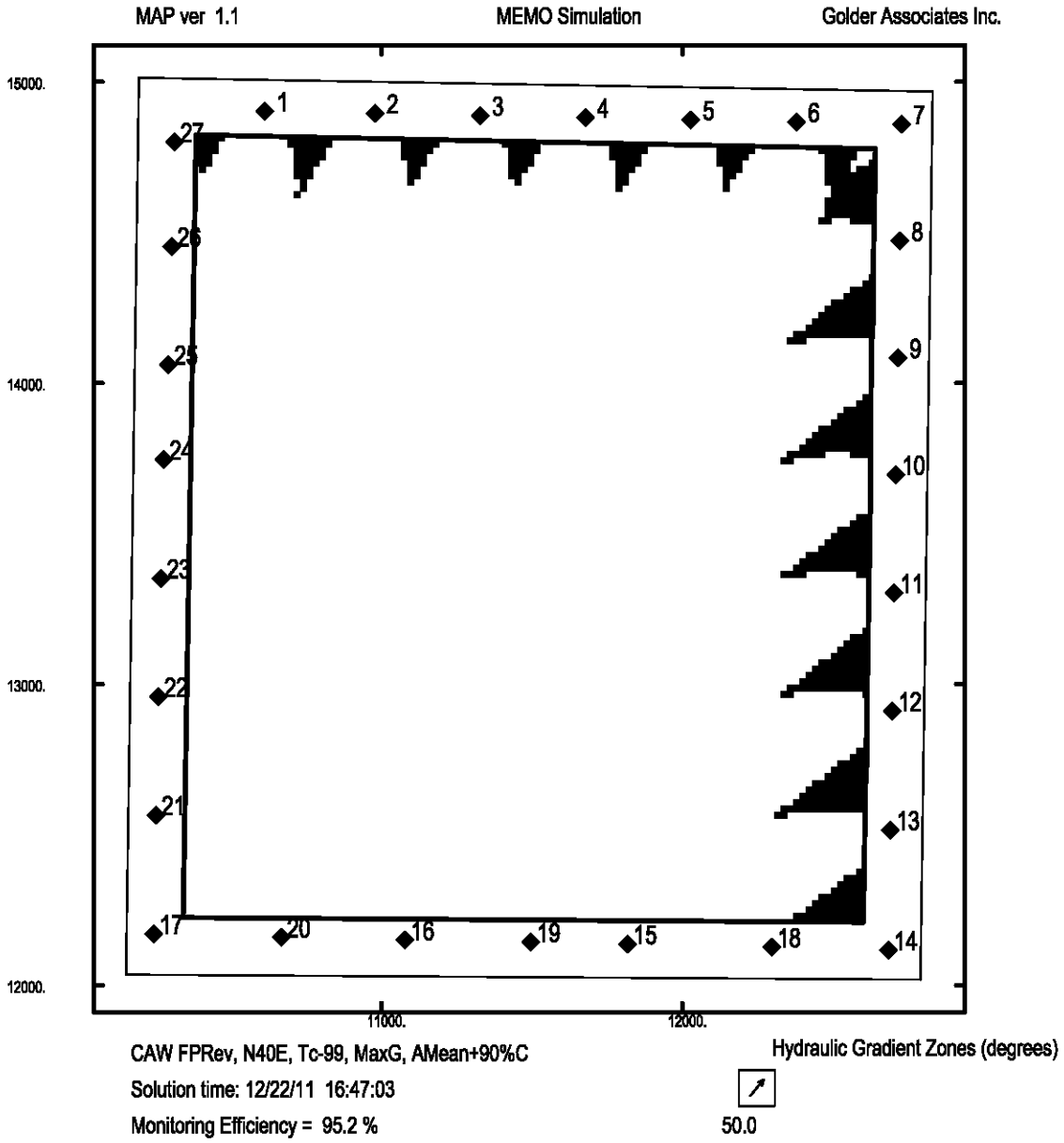

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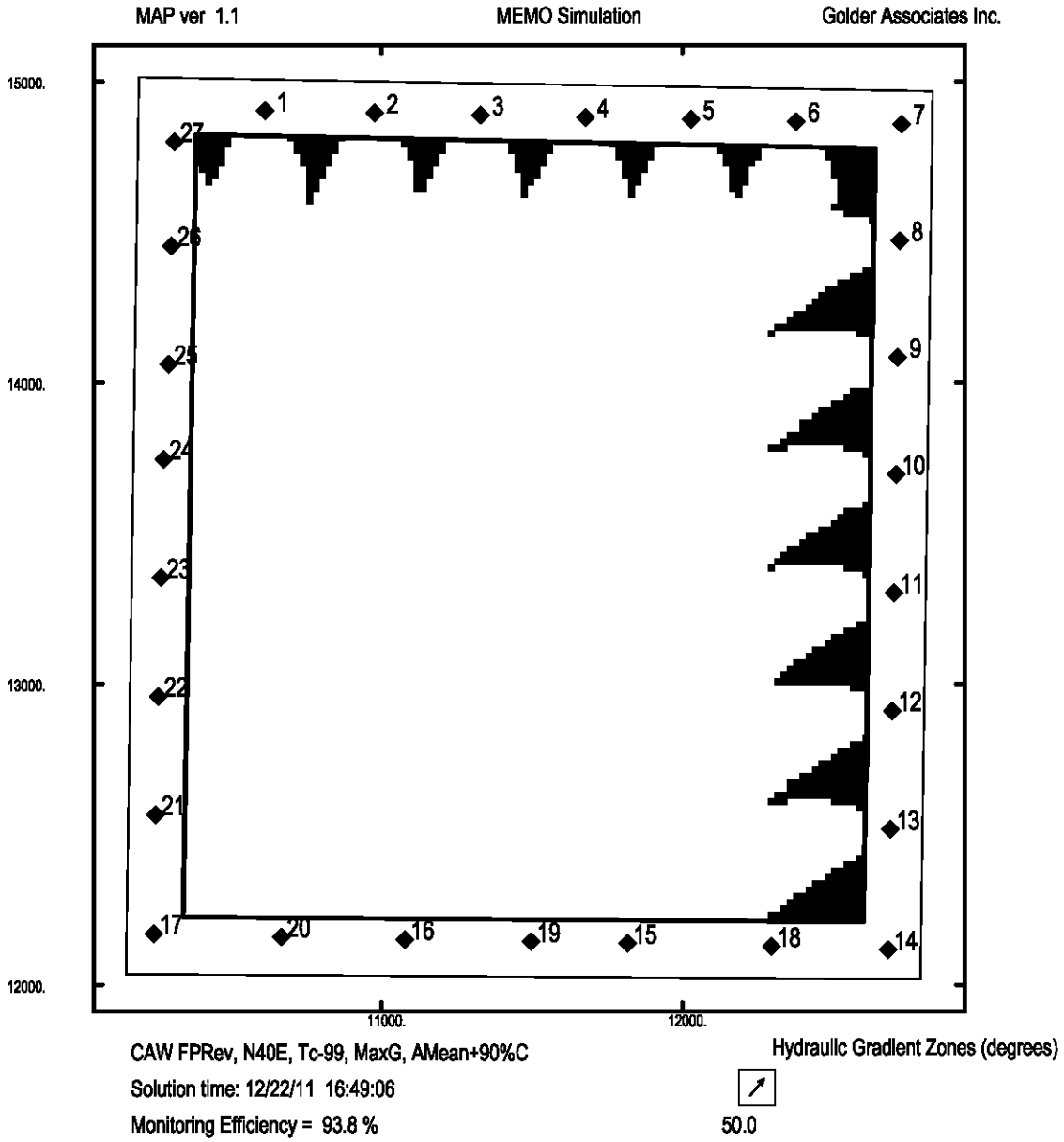

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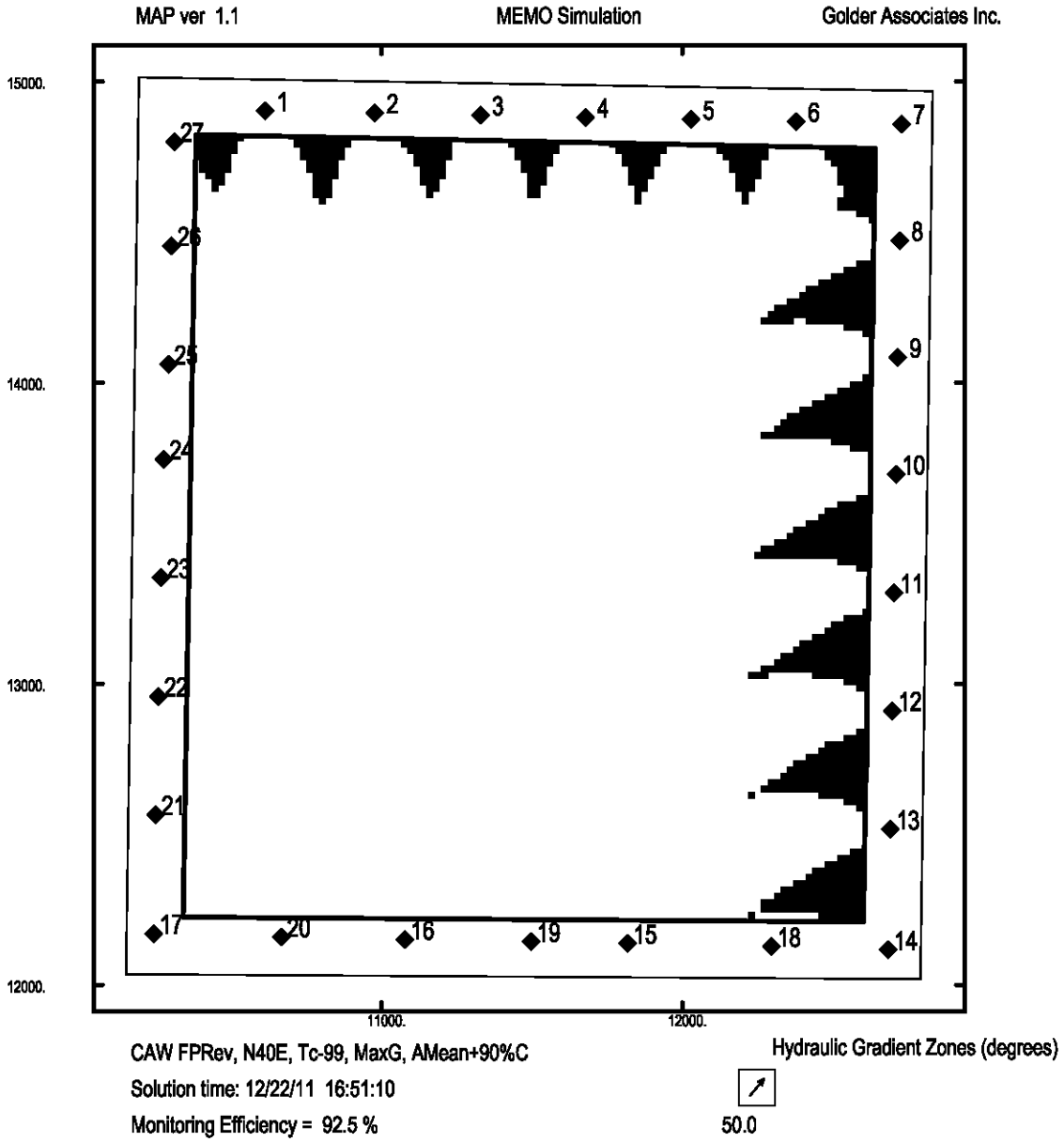

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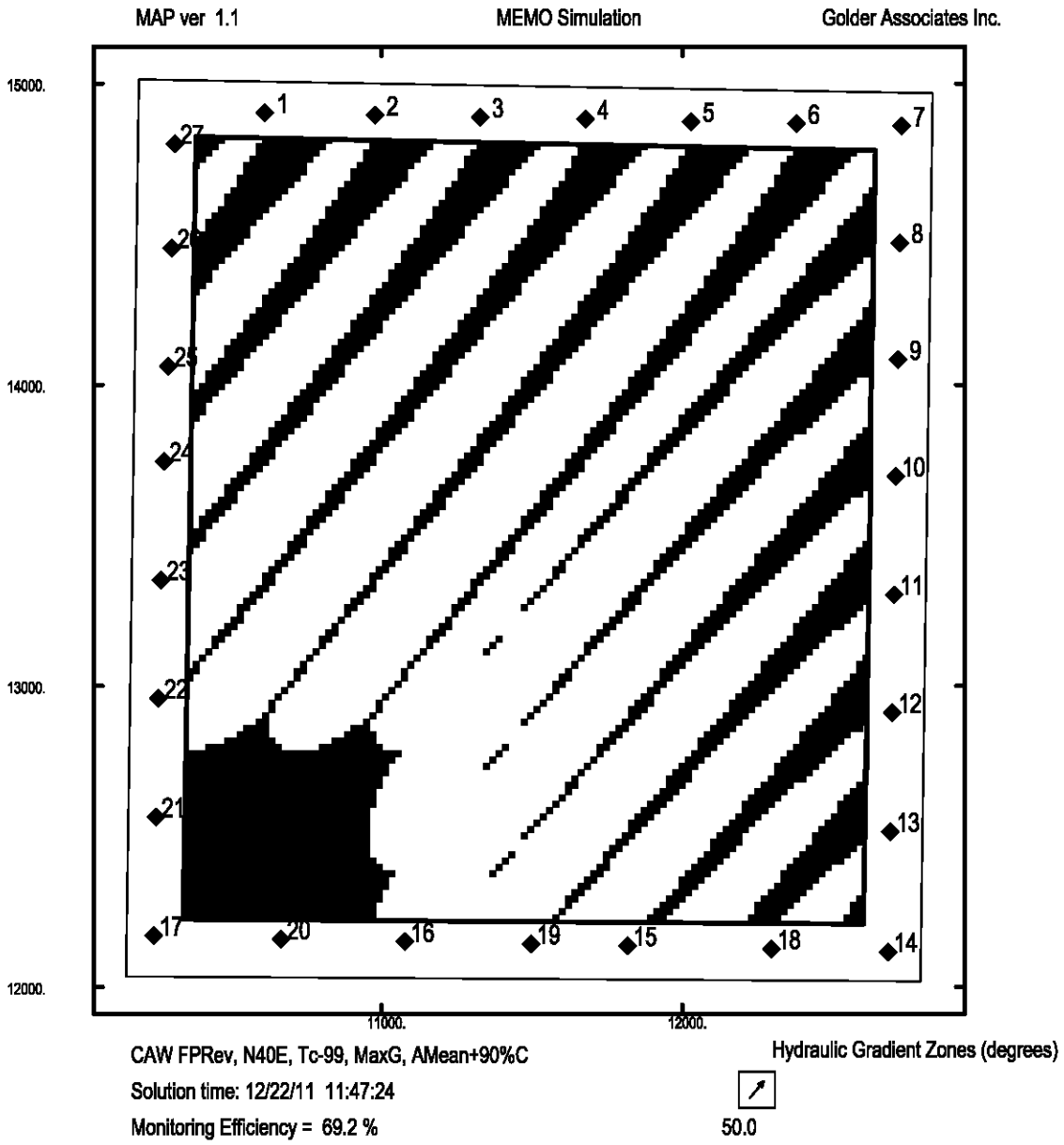

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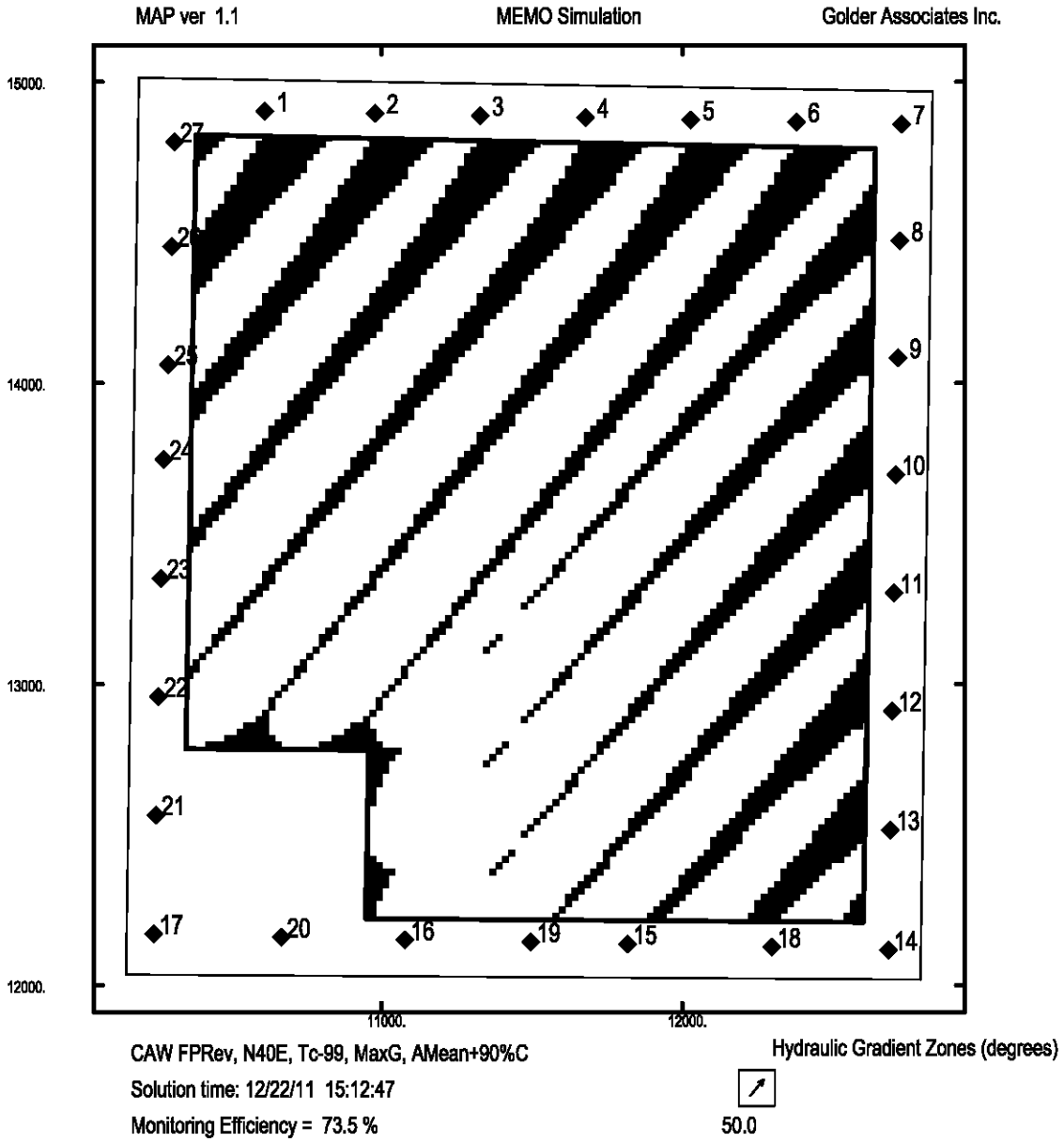

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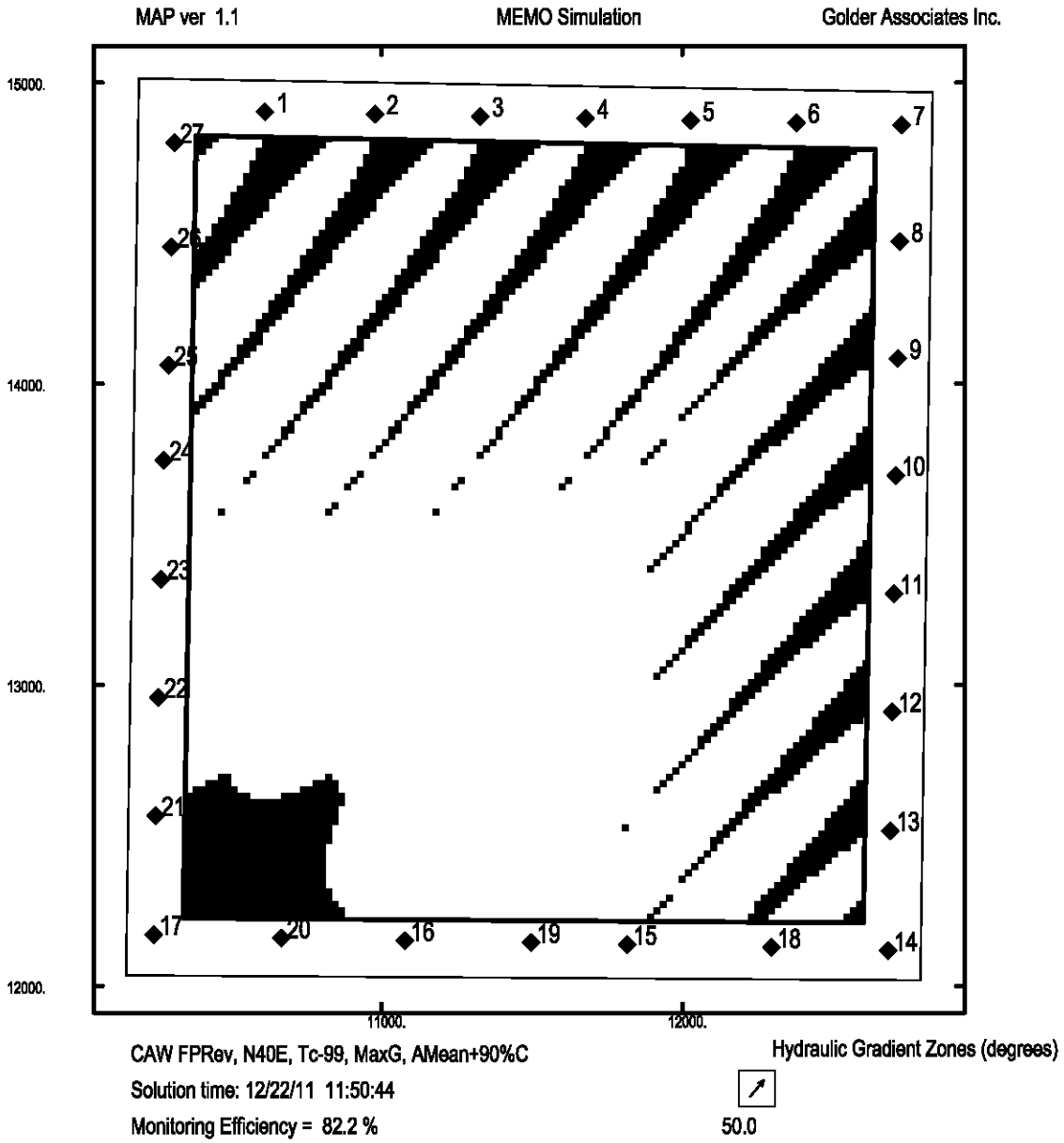

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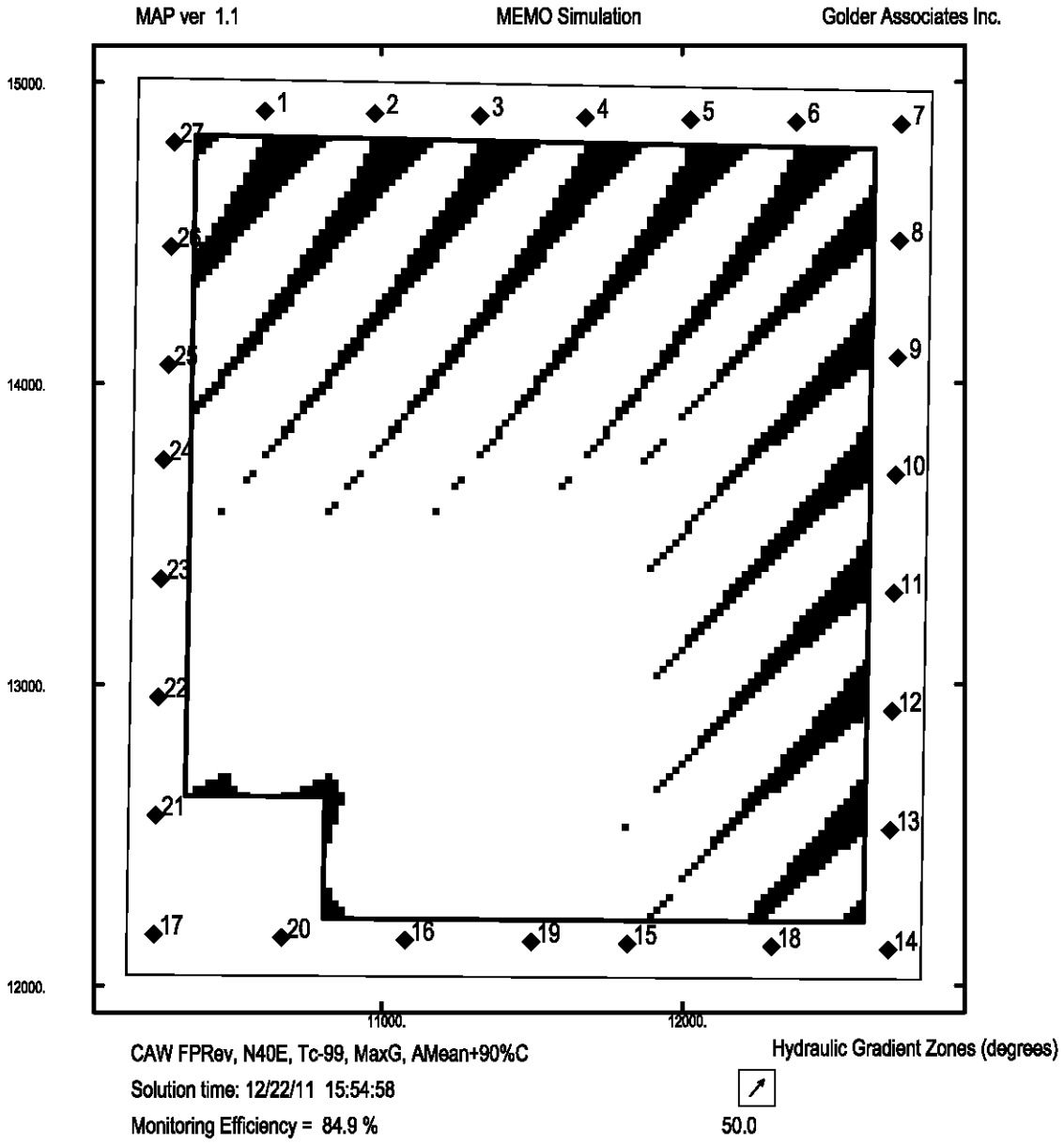

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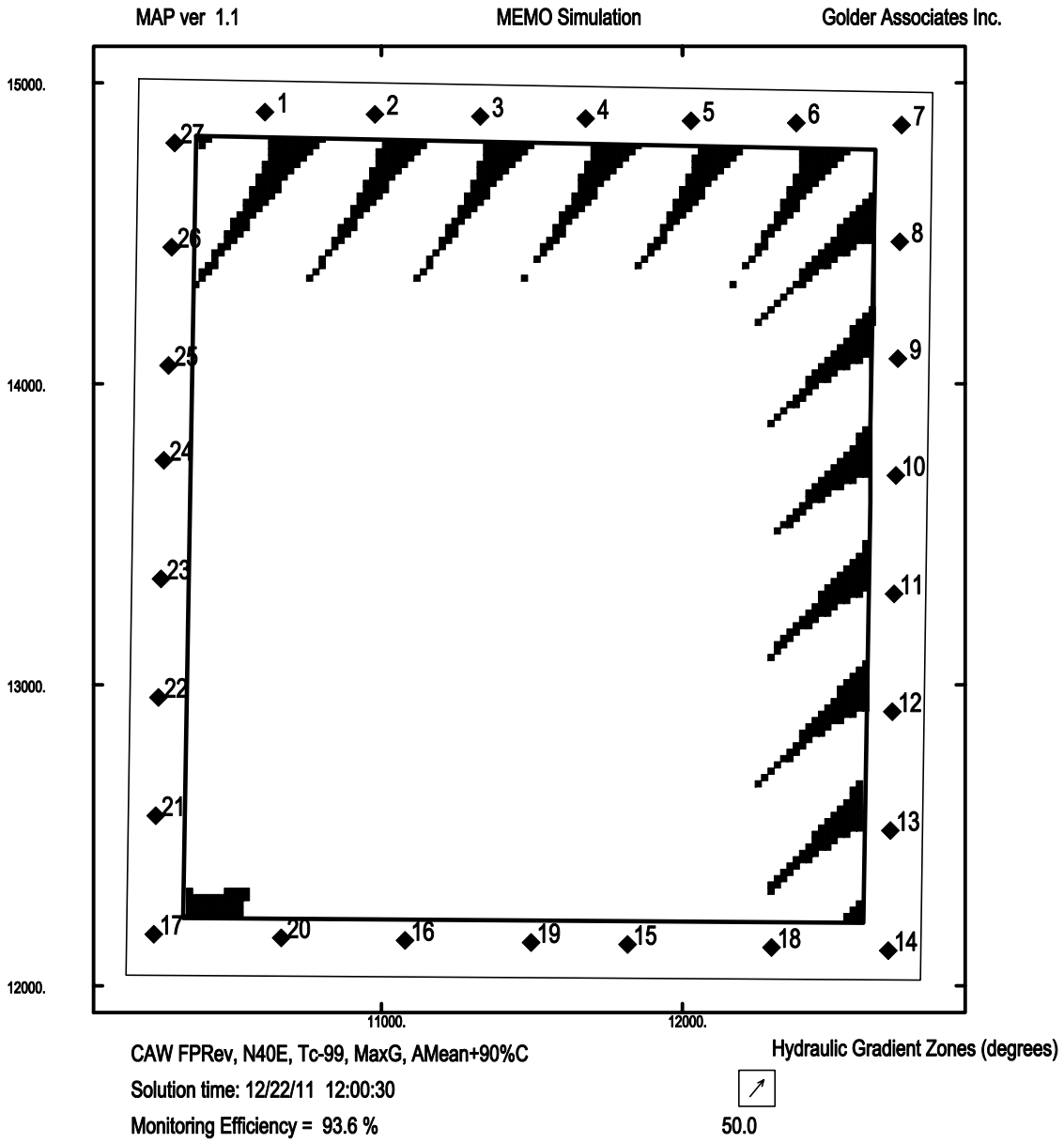

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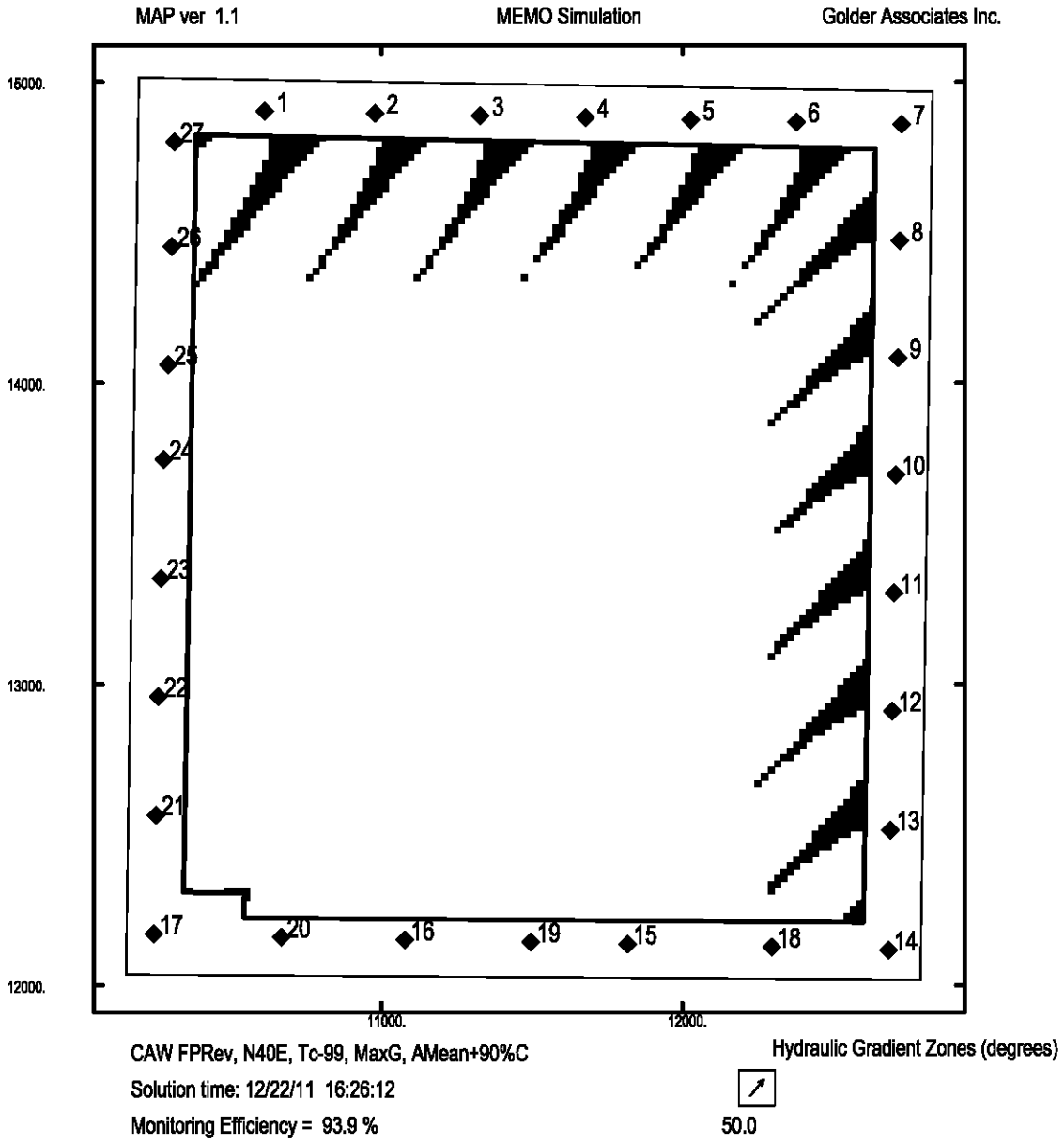

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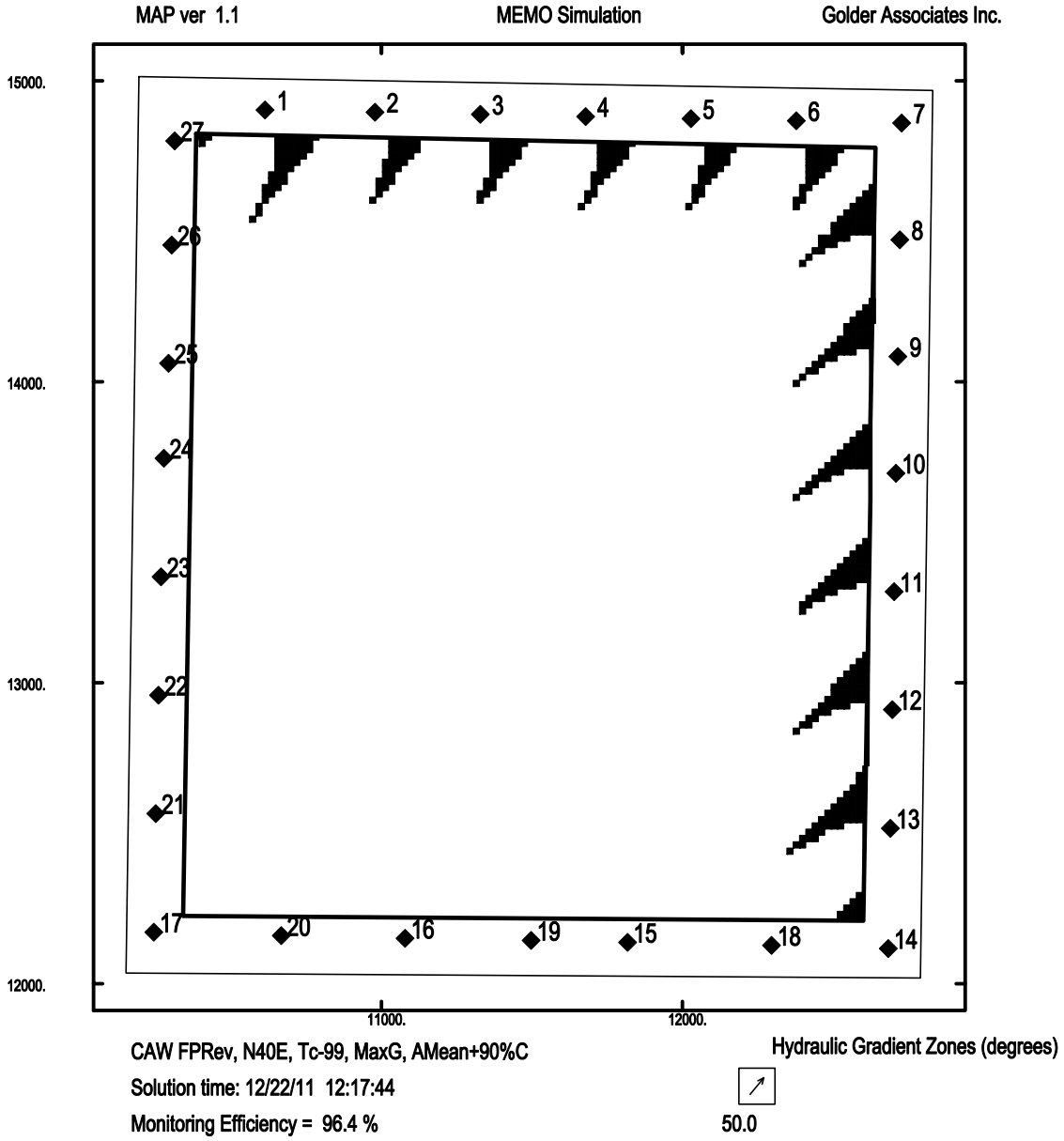

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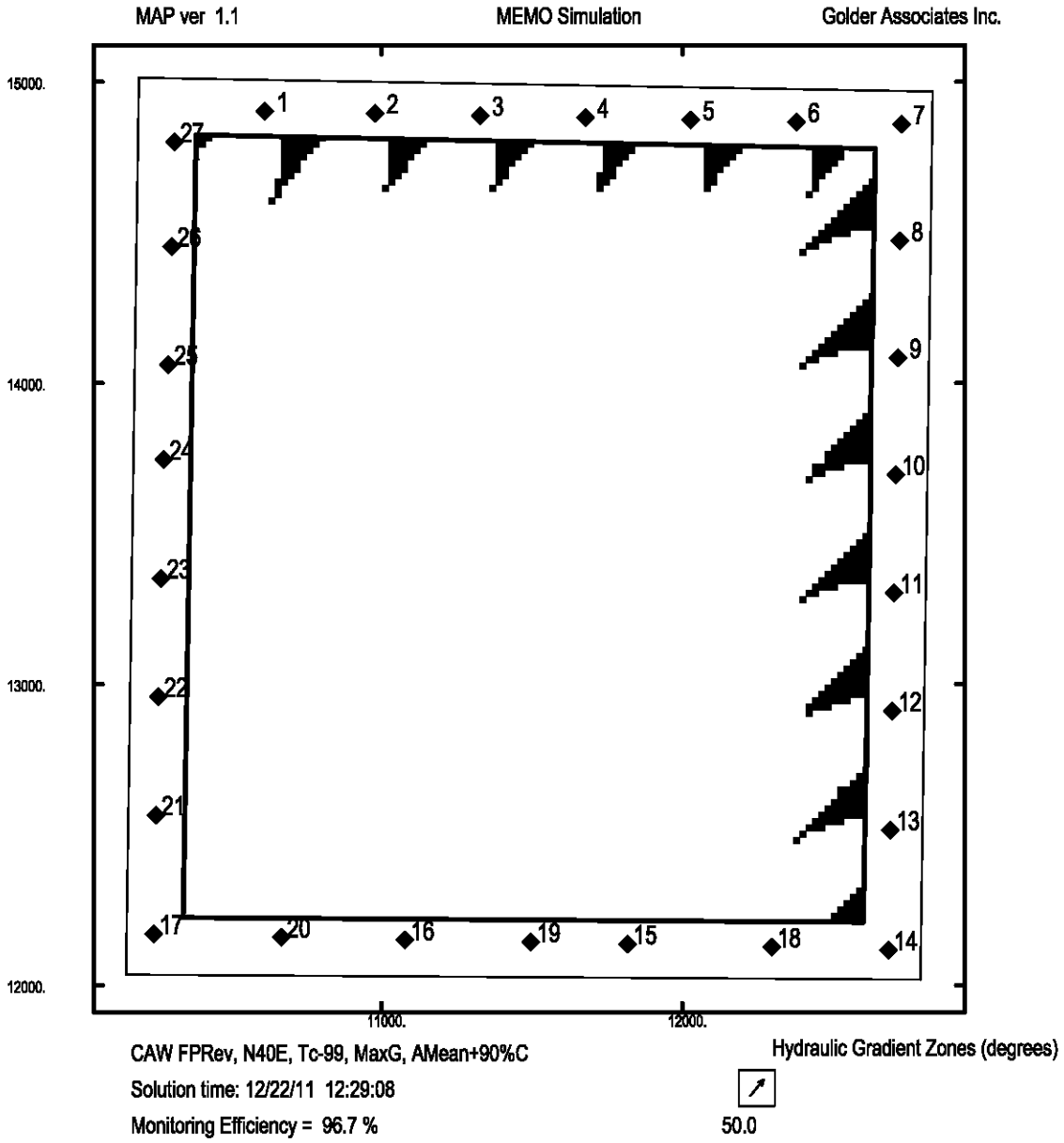

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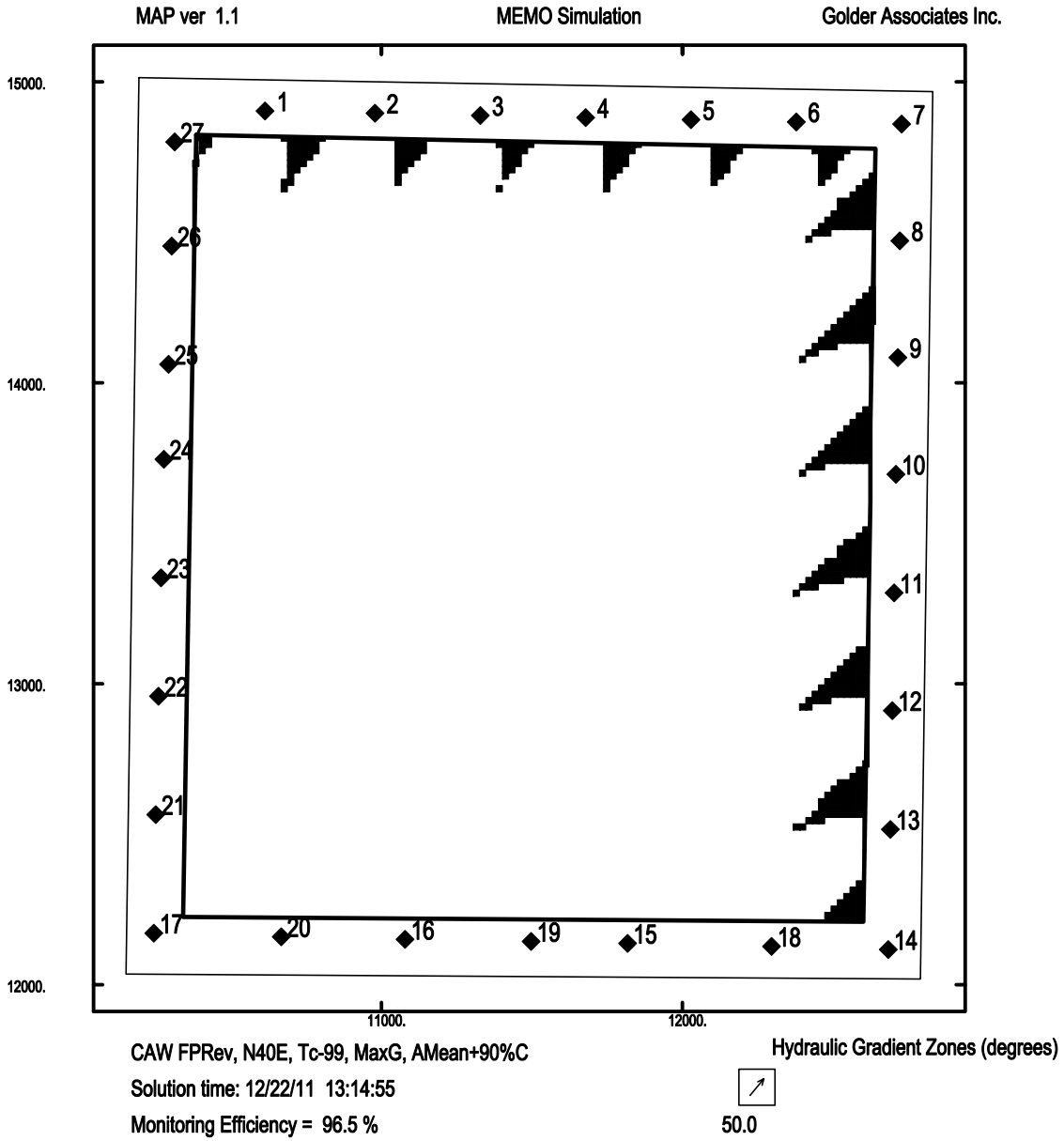

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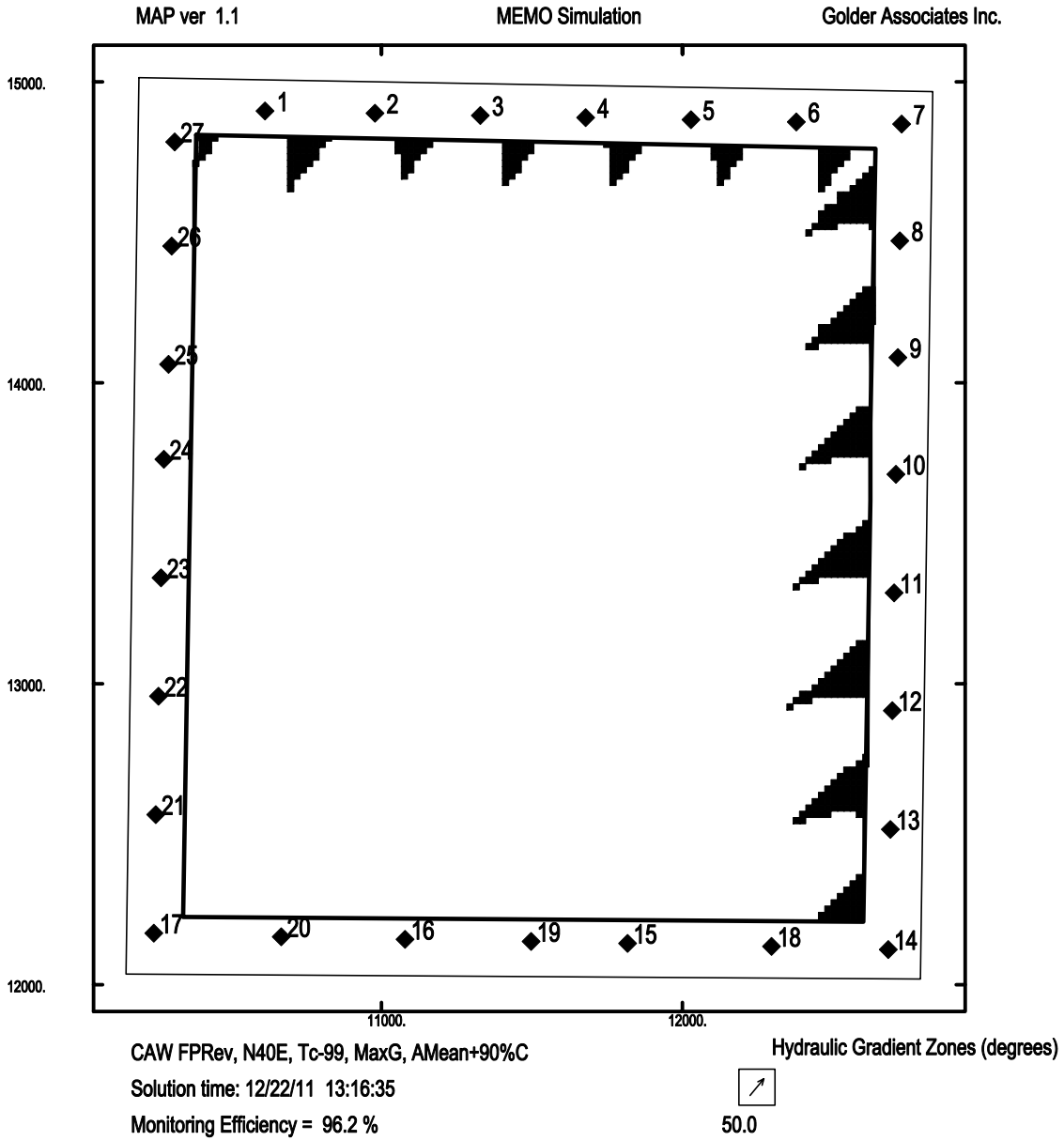

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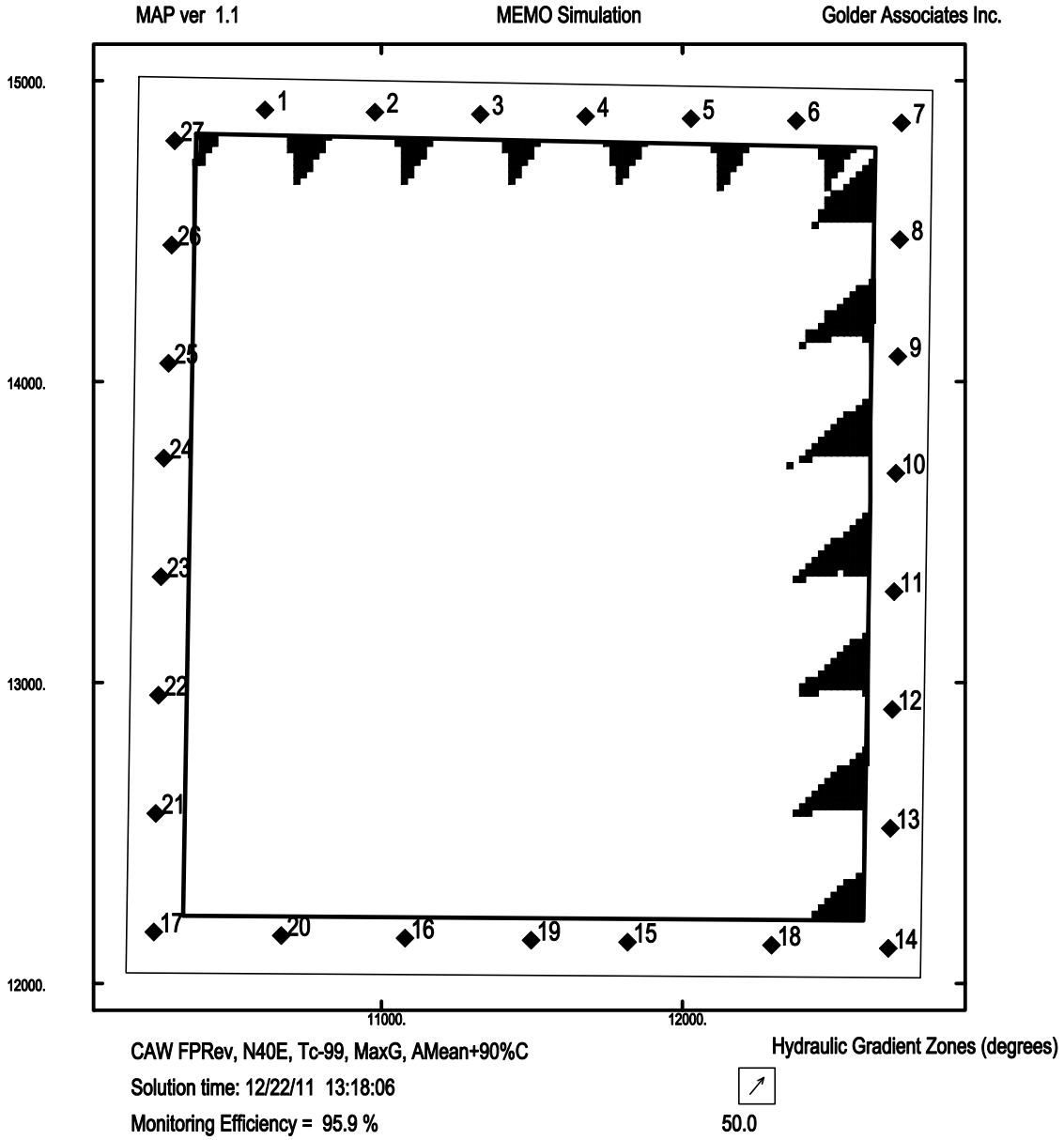

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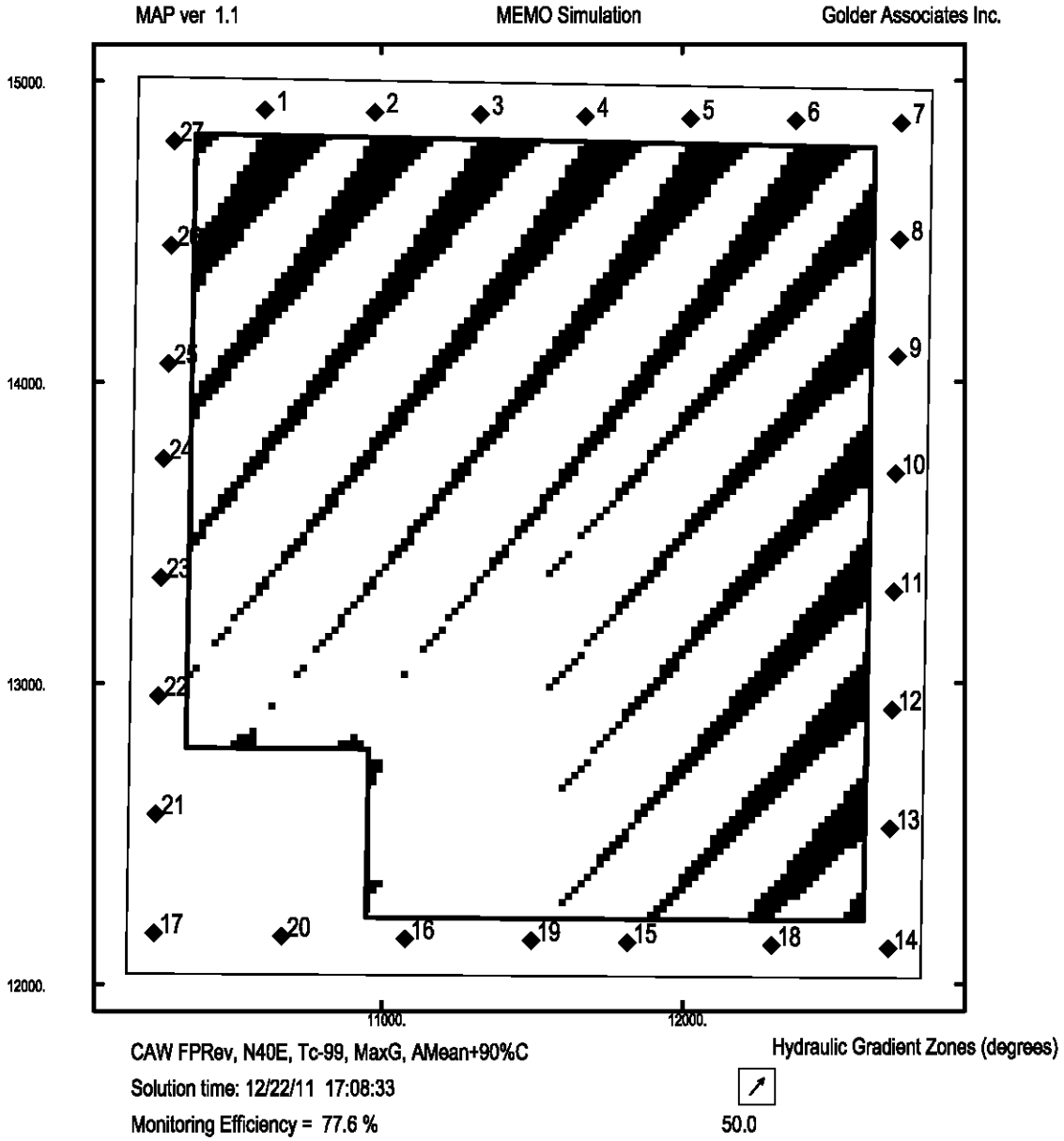

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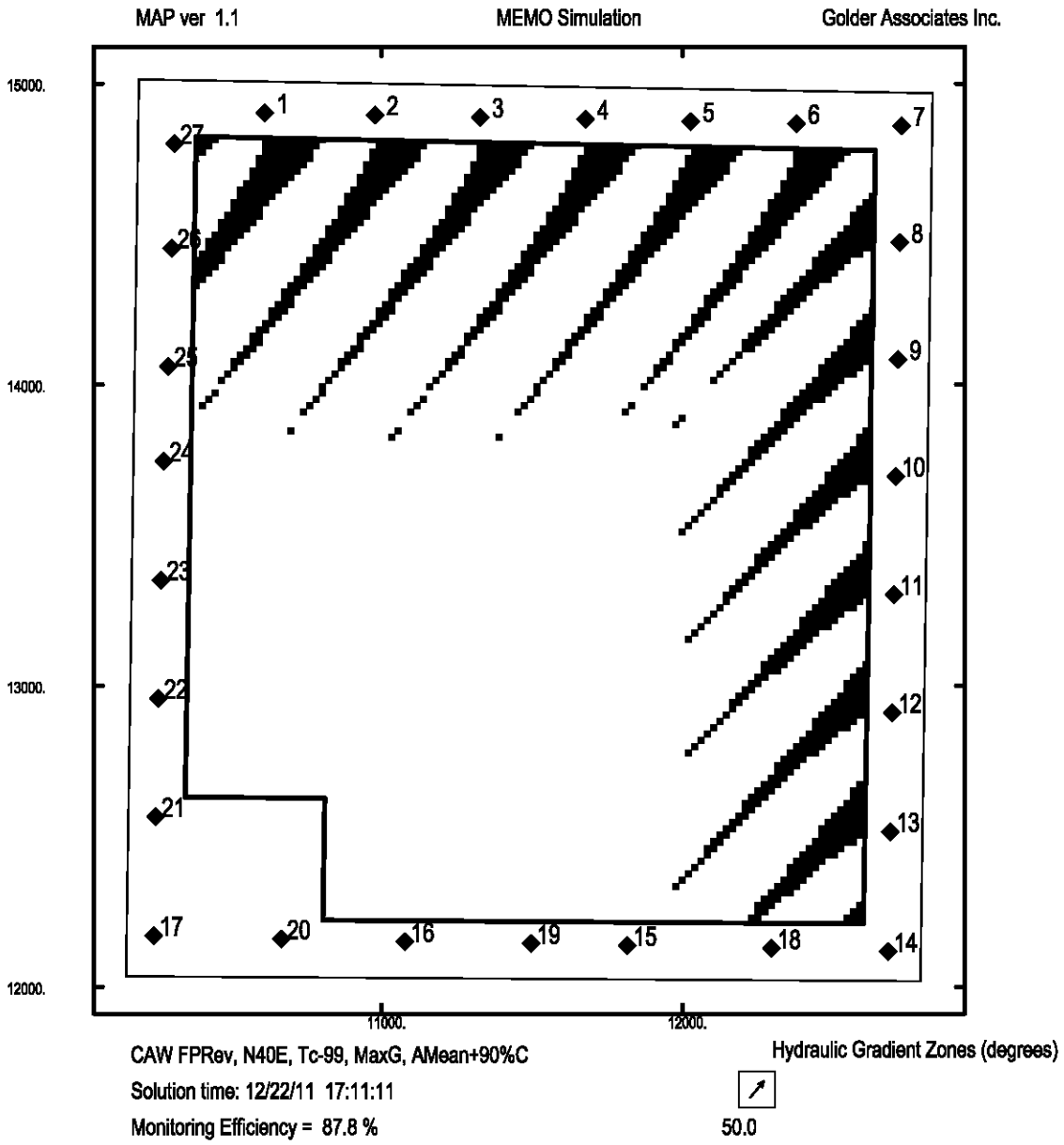

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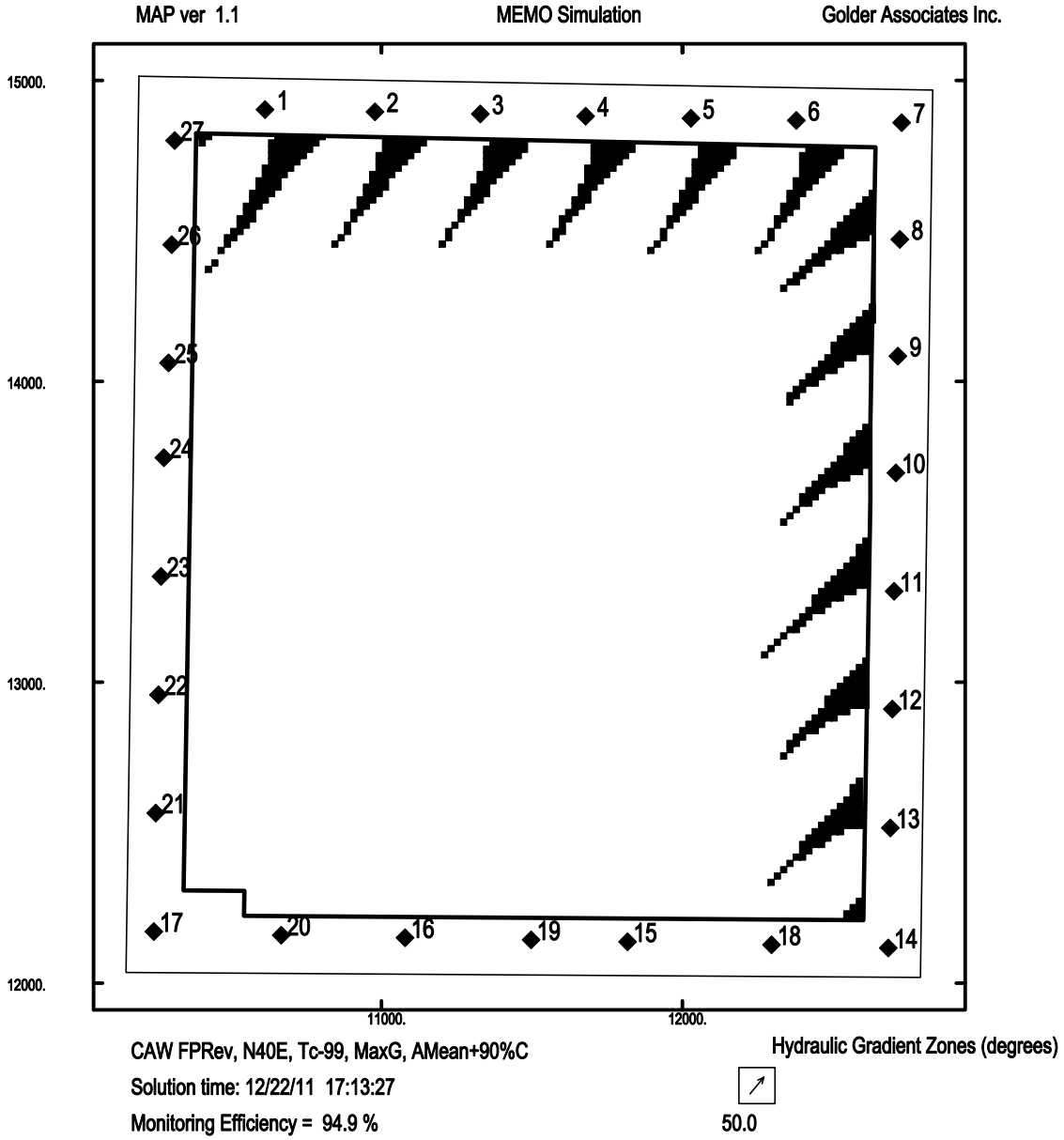

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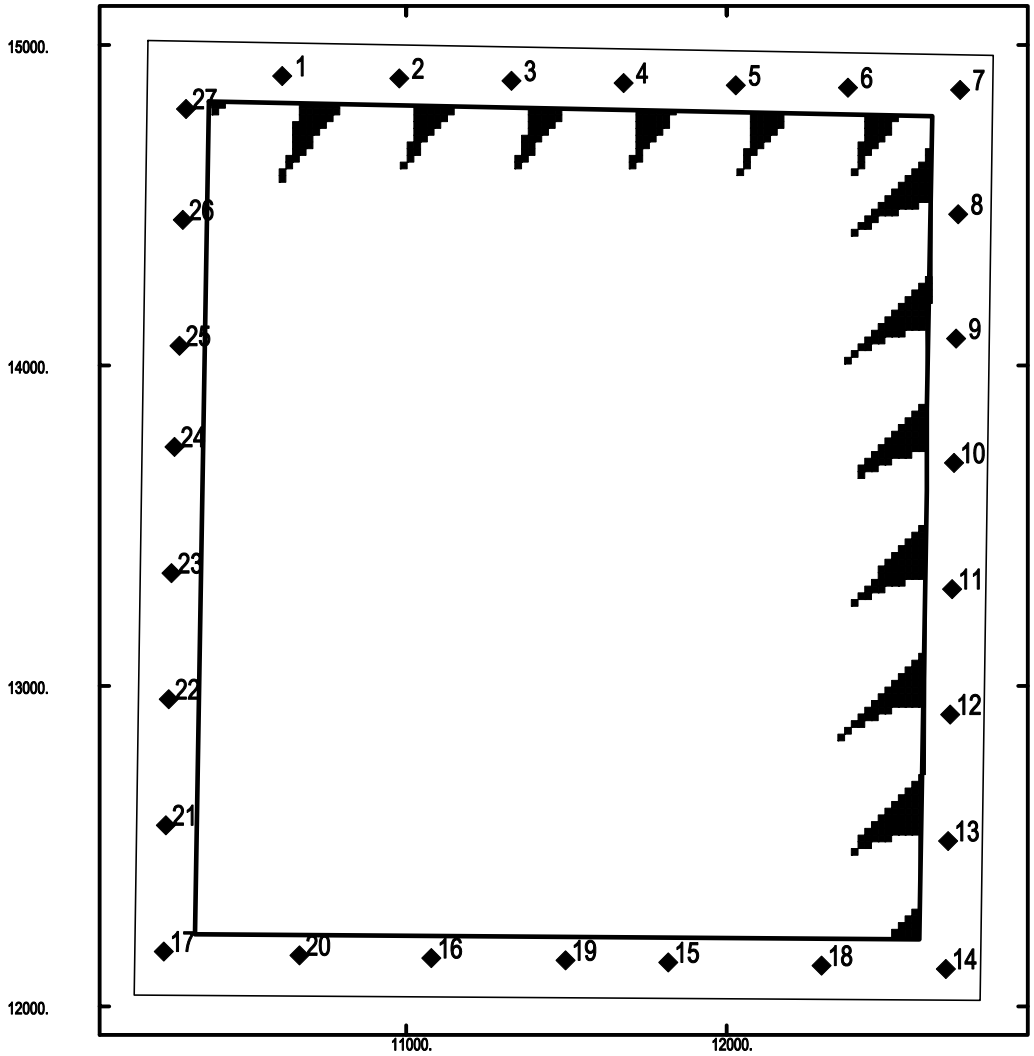


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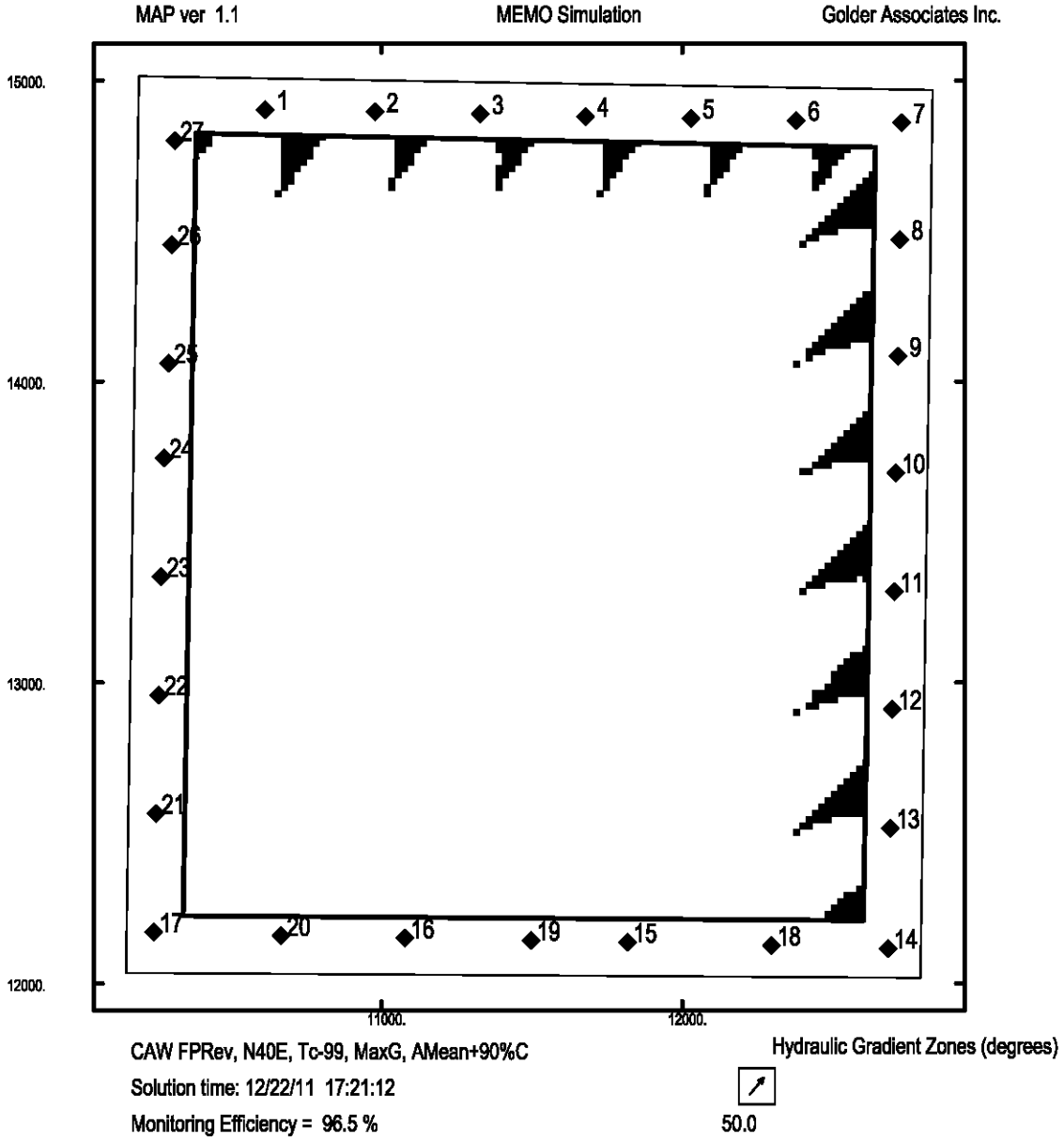

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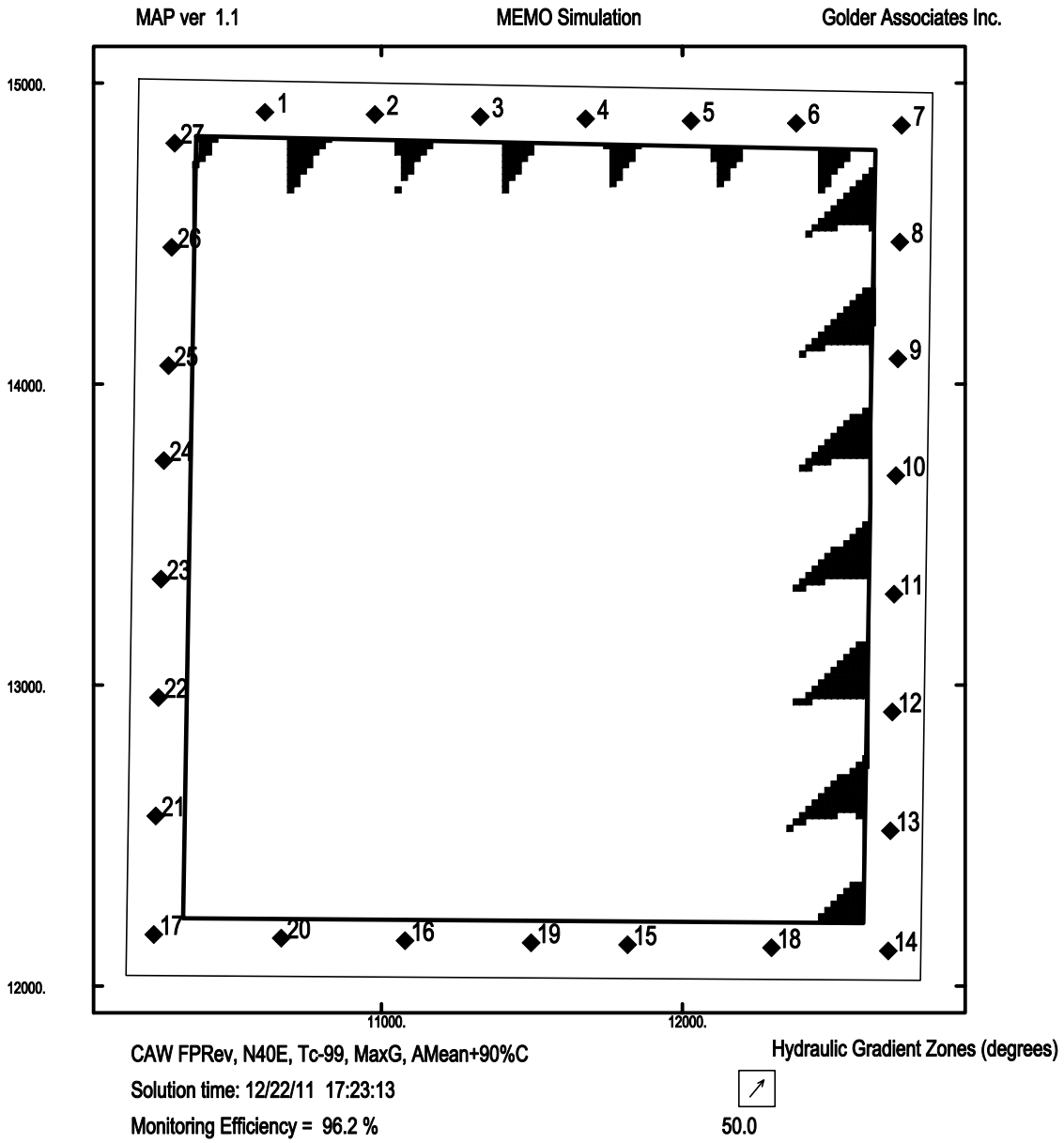

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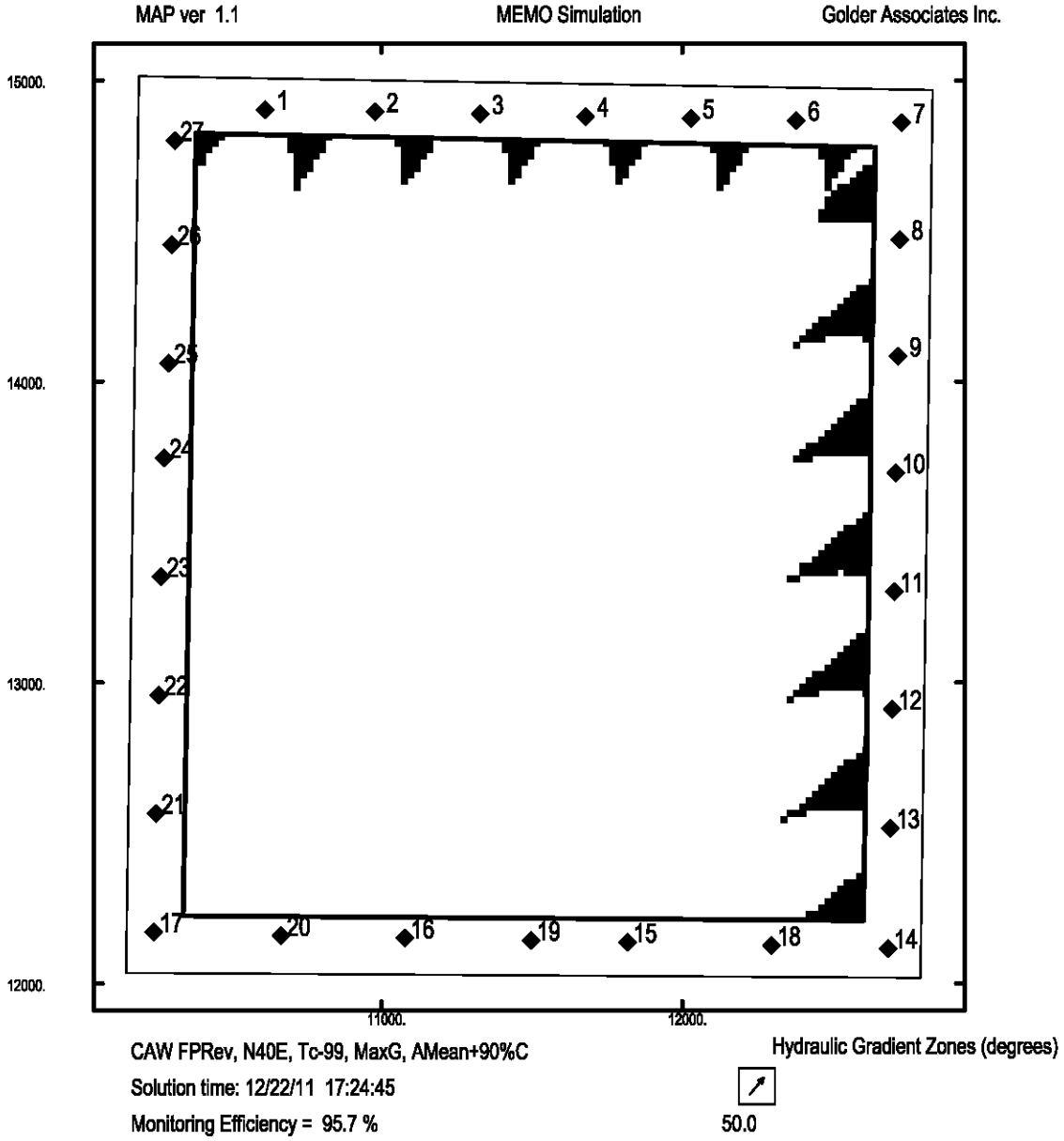

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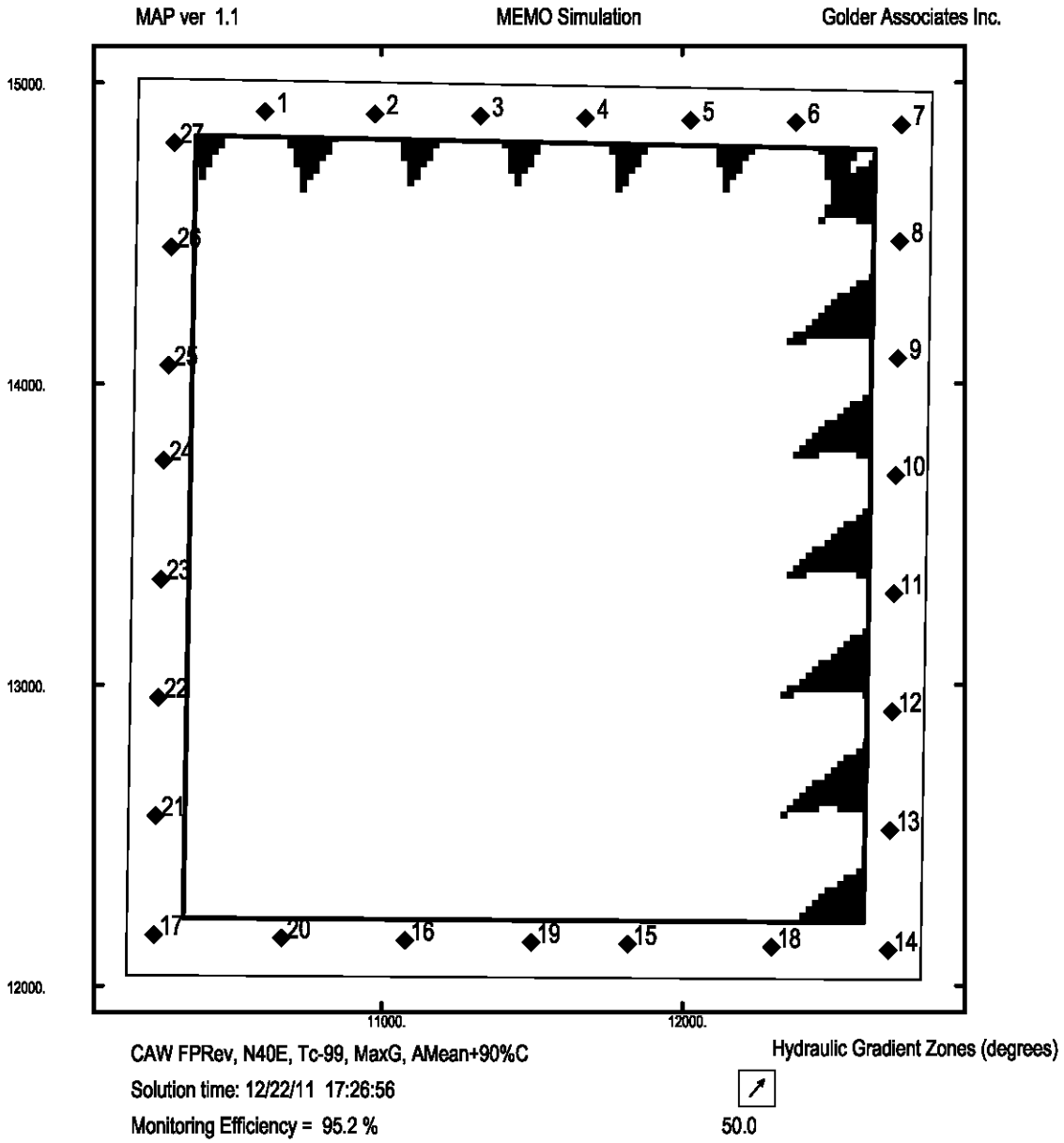

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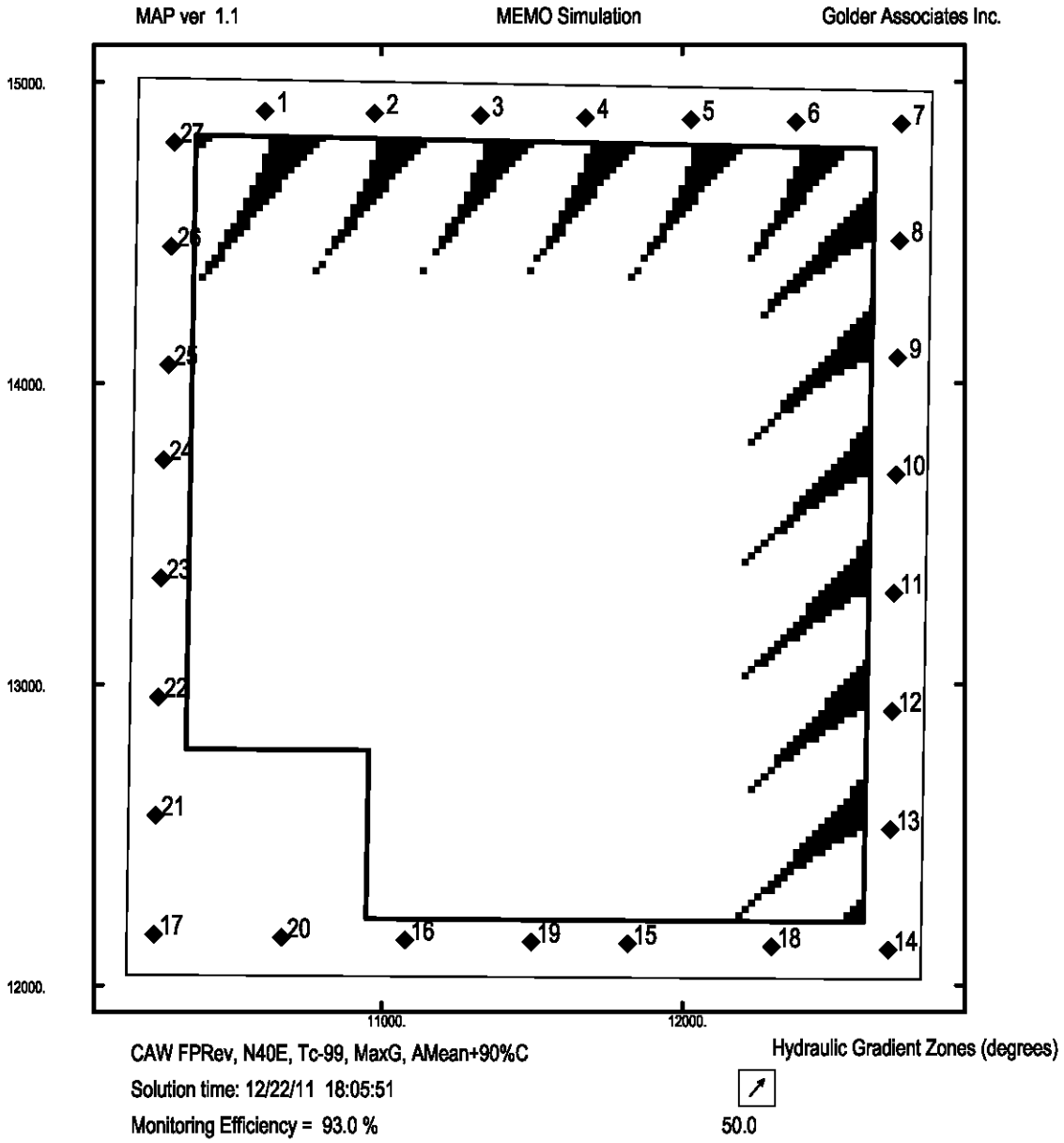

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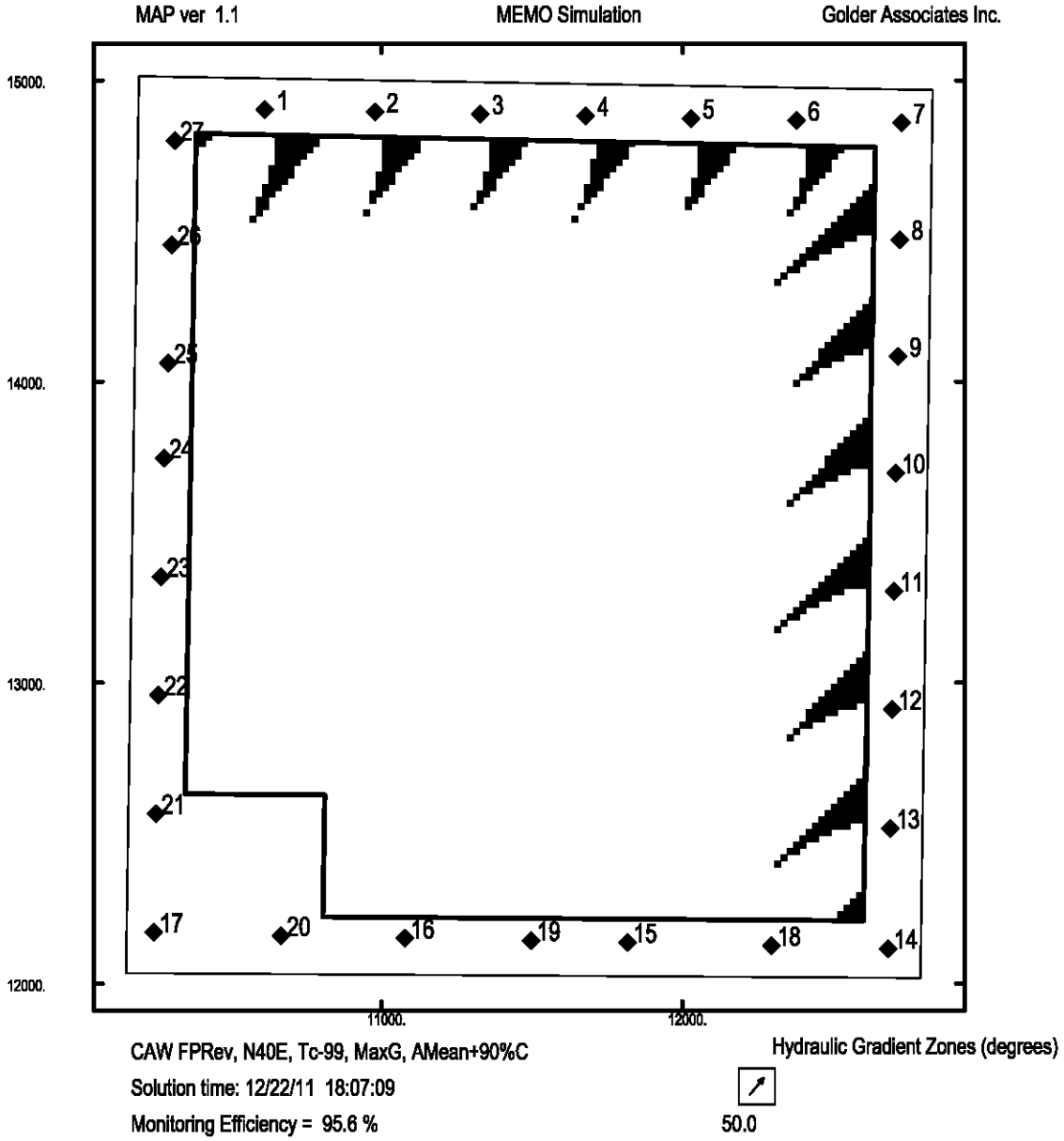

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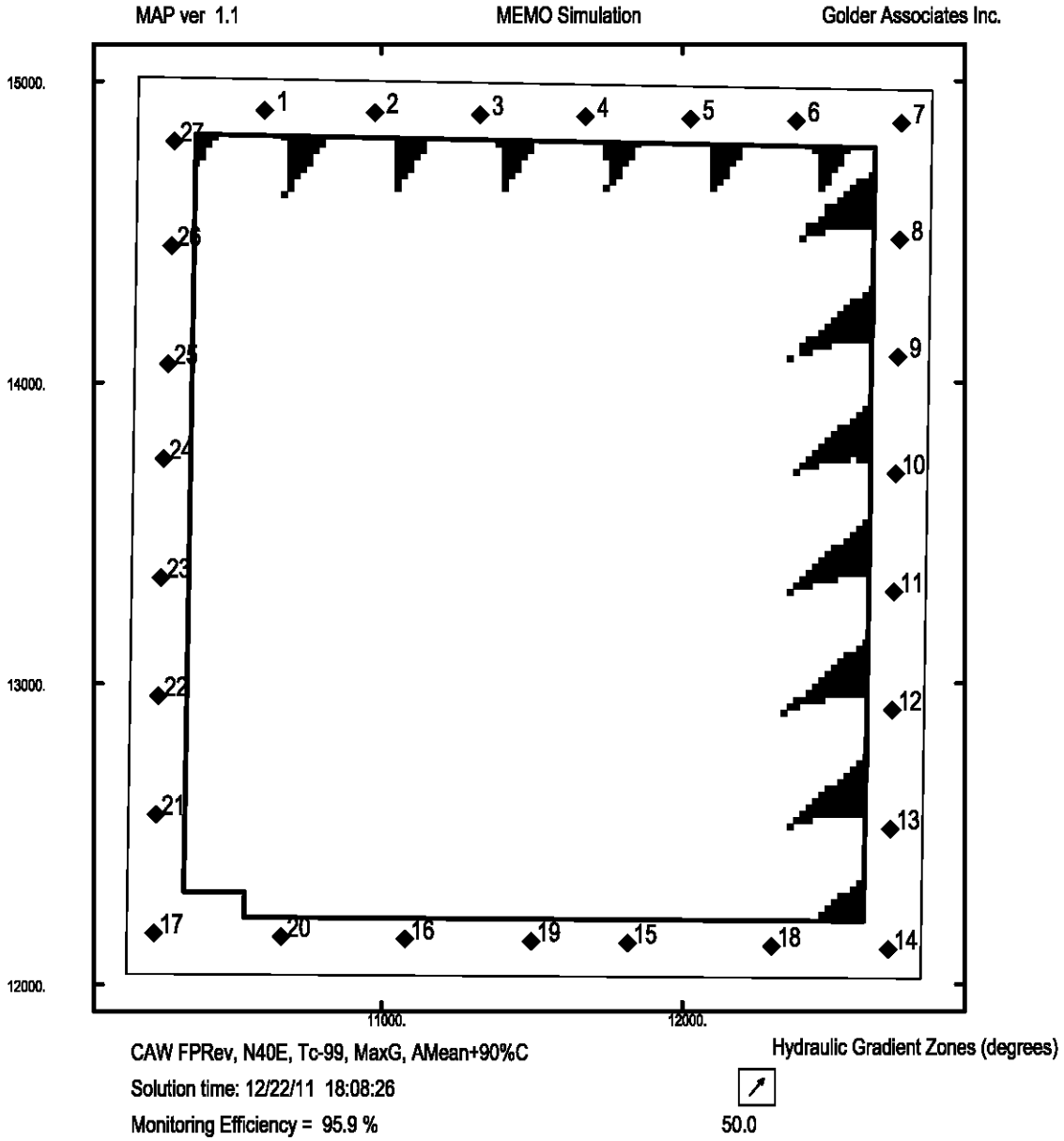

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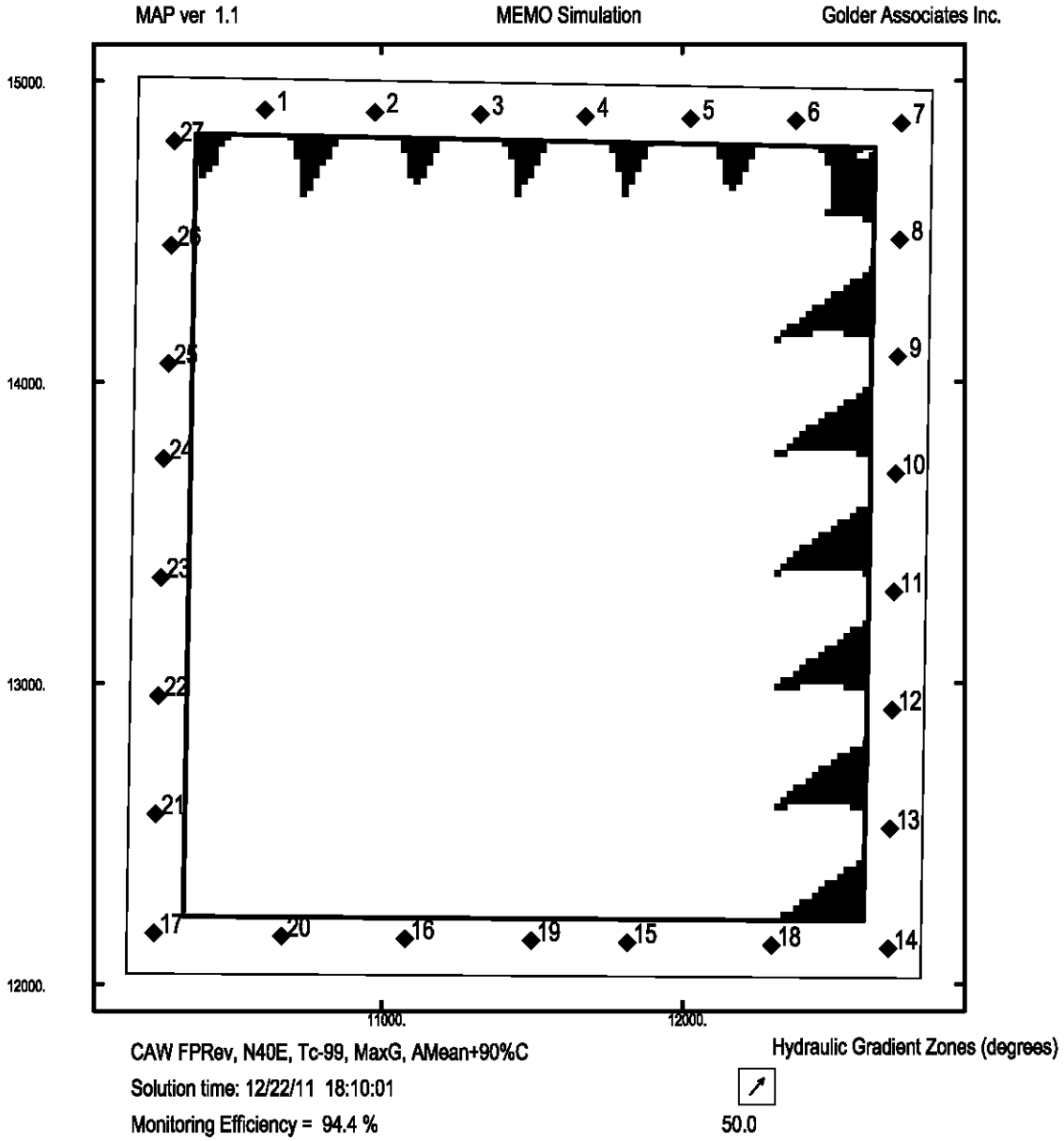

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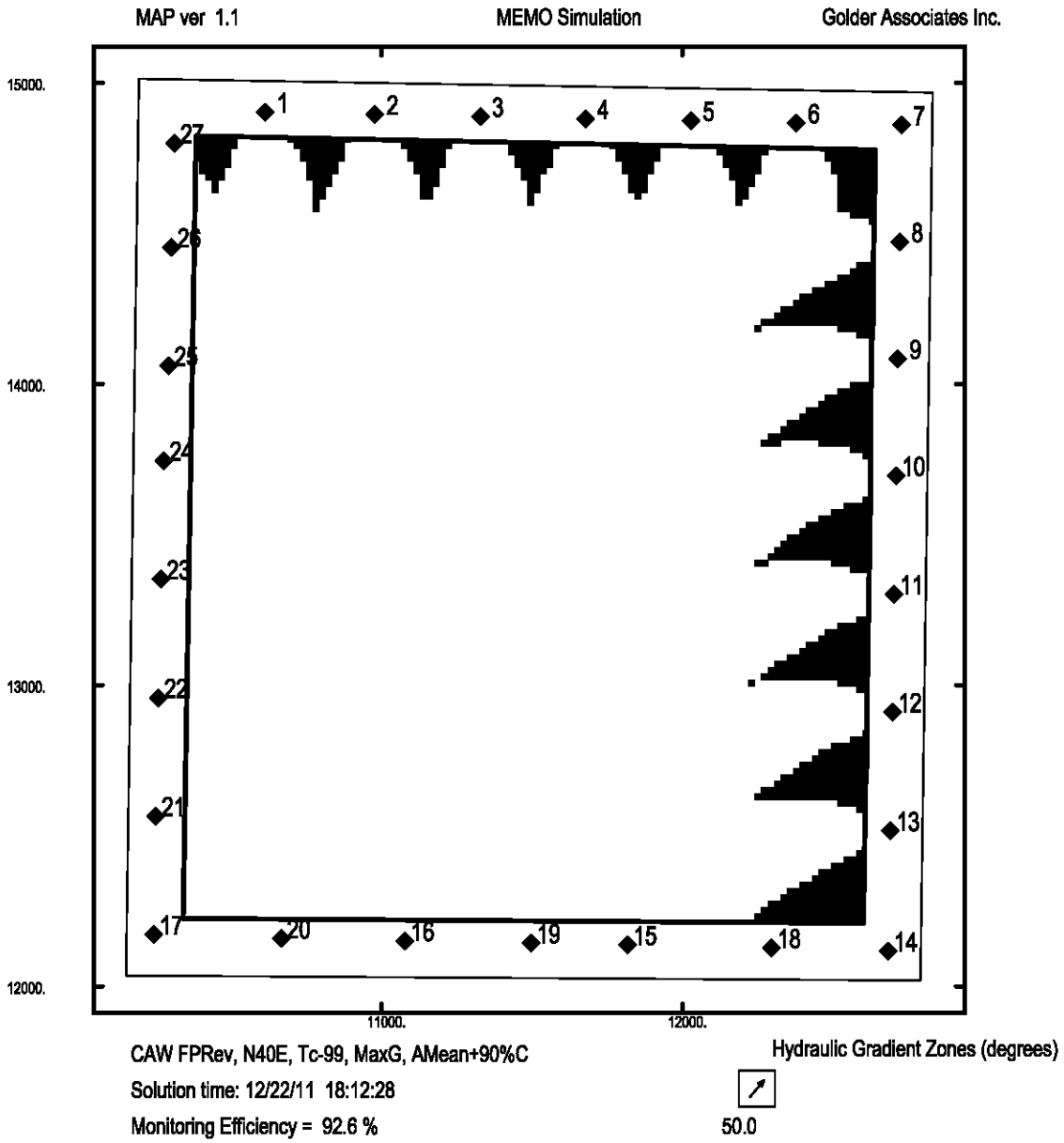

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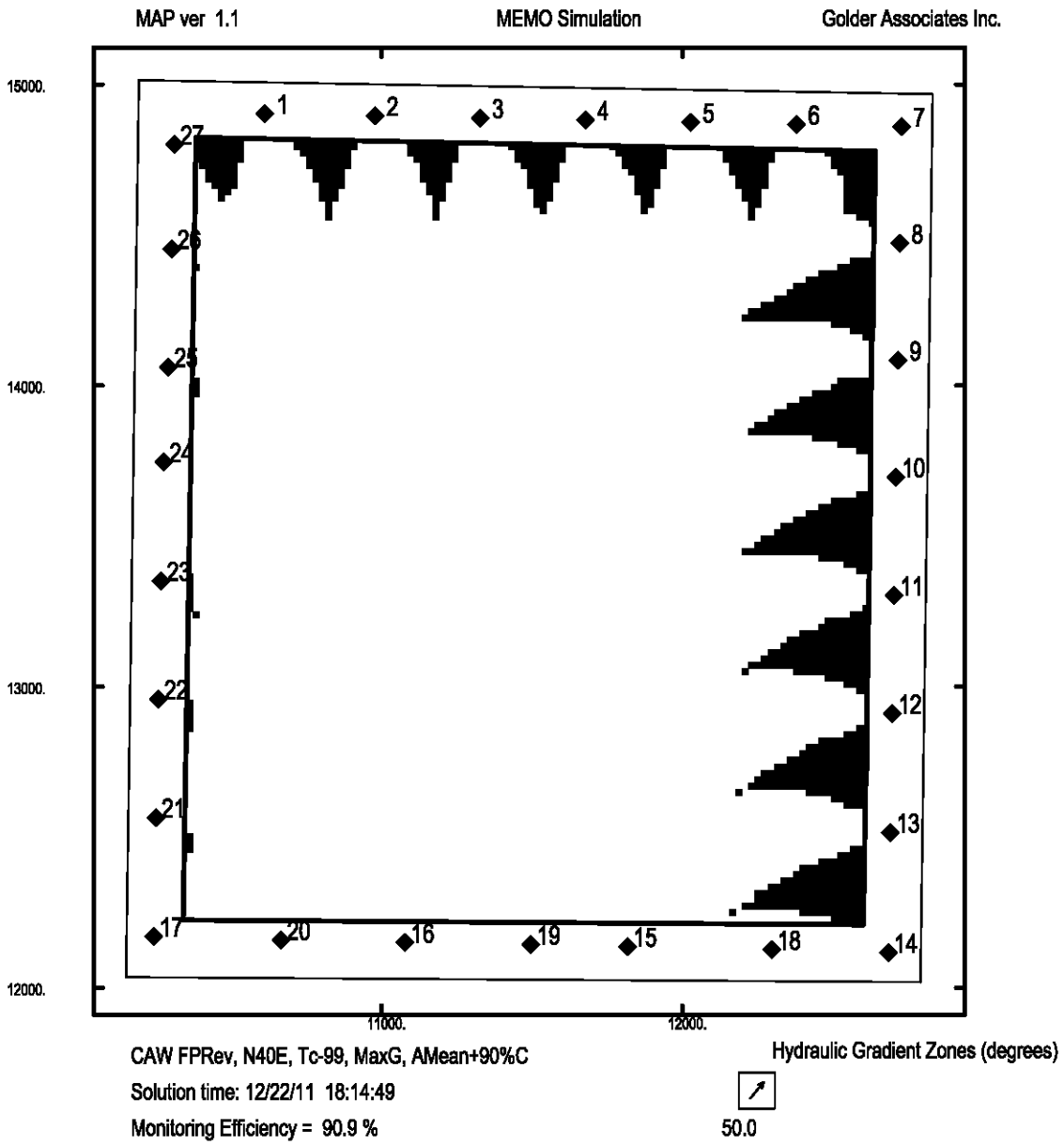

# UTAH LOW-LEVEL RADIOACTIVE WASTE DISPOSAL LICENSE AMENDMENT REQUEST (UT2300249) FOR THE CLASS A WEST EMBANKMENT

## SUPPLEMENTAL RESPONSES TO ROUND 1 INTERROGATORIES

**November 28, 2011**

**For**
**Utah Division of Radiation Control**
195 North 1950 West
Salt Lake City, UT 84114-4850

**Energy*Solutions*, LLC**
423 West 300 South, Suite 200
Salt Lake City, UT 84101

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## 8. INTERROGATORY CAW R313-25-8(1)-08/1: TECHNICAL ANALYSES; RELEASES OF RADIOACTIVITY

**Regulatory Reference:** R313-25-8(1). Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake, and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19.

**Division's Interrogatory Statement:** *Refer to Sections 6.1.3 and 6.1.5 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

1. *Summarize the results from Attachment 3 that justify the statement that the need to limit concentrations of several nuclides is eliminated. Ensure that the summary is nuclide-specific and addresses the radiological, physical, and chemical properties of the waste. Discuss the meaning of these summary results and show how the conclusion is reached.*
2. *Please state both the GW protection standard and the calculated maximum concentration for all radionuclides of concern in this table. Quantify the extent of change from values previously reported and those now reported. Explain why these changes occurred. What is the sensitivity of these results to assumed and estimated values?*

*Refer to Section 6.1.5 of and Attachment 3 to the Class A West (CAW) Embankment License Amendment Request (LAR):*

3. *Please explain the modeling results that indicate that the top slope infiltration rate (0.238 cm/yr) leads to earlier peak concentrations at the water table than the higher side slope infiltration rate (0.335 cm/yr). Also explain why the time to exceed the GWPLs at the water table is shorter for the lower infiltration top-slope case than for the side-slope case.*
4. *Please explain the modeling results for the compliance monitoring well that show the top slope infiltration rate (0.238 cm/yr) leads to earlier times to exceed the GWPLs than the higher side slope infiltration rate (0.335 cm/yr).*
5. *Please correct the vadose zone water velocities in Tables 30 and 31 of the Whetstone report (Whetstone 2011) to make them consistent with the vadose zone velocity equation given in Section 5.2.3 of the same report. Also, update the PATHRAE files and results that used the incorrect vadose zone velocities (Baird, 2011).*

**Energy*Solutions*' Response:** The revised Technical Analysis demonstrates that the general population will be protected from releases of radioactivity (Whetstone, 2011b). In addition to correction of a typographical error in the initial fate and transport report (Whetstone, 2011a), the revised technical analysis included in Attachment 3 of the Class A West License Amendment Request has been adjusted to reflect revisions in Class A West cover design and consistency in model methodology convention.

As is reflected in Tables 1 and 2, the top and side slope cover designs were altered to further minimize infiltration into the Class A West Embankment. This revised cover design reflects the following adjustments:

1) The thickness of the top slope's Type-B Rip Rap layer (Layer 1) has been increased from 18 inches to 24 inches.
2) The thickness of the side slope's Type-B Rip Rap layer (Layer 1) has been increased from 18 inches to 24 inches.
3) The thickness of the side slope's Type-B Filter (Layer 4) has been increased from 6 inches to 18 inches.

**Table 1. Revised Top Slope Design – Class A West Embankment**

| Layer | Material | Thickness (inches) | Layer Type | Material Description |
|---|---|---|---|---|
| Layer 1 | Type-B Rip Rap | 24 | vertical percolation | 1.25 inches |
| Layer 2 | Type-A Filter (upper) | 6 | vertical percolation | Coarse Sand - Fine Cobble |
| Layer 3 | Sacrificial Soil | 12 | vertical percolation | Silty Sand and Gravel |
| Layer 4 | Type-B Filter (lower) | 6 | lateral drainage | Coarse Sand -Fine Gravel |
| Layer 5 | Upper Radon Barrier | 12 | barrier soil | Clay |
| Layer 6 | Lower Radon Barrier | 12 | vertical percolation | Clay |
| Layer 7 | Waste | 100 | vertical percolation | Sand |
| Layer 8 | Clay Liner | 24 | barrier soil | Clay |

**Table 2. Revised Side Slope Design – Class A West Embankment**

| Layer | Material | Thickness (inches) | Layer Type | Material Description |
|---|---|---|---|---|
| Layer 1 | Type-A Rip Rap | 24 | vertical percolation | 12 inches |
| Layer 2 | Type-A Filter (upper) | 6 | vertical percolation | Coarse Sand - Fine Cobble |
| Layer 3 | Sacrificial Soil | 12 | vertical percolation | Silty Sand and Gravel |
| Layer 4 | Type-B Filter (lower) | 18 | lateral drainage | Coarse Sand -Fine Gravel |
| Layer 5 | Upper Radon Barrier | 12 | barrier soil | Clay |
| Layer 6 | Lower Radon Barrier | 12 | vertical percolation | Clay |
| Layer 7 | Waste (Side Slopes) | 100 | vertical percolation | Sand |
| Layer 8 | Clay Liner (Side Slope) | 24 | barrier soil | Clay |

Because of the increase in thickness to 24 inches of the top Type A- and Type B- Rip Rap layers, the modeled evaporative zone depth (EZD) was increased from 18 inches to 20 inches. HELP infiltration modeling remains conservative with this EZD increase because: 1) it has been well demonstrated that the HELP model overestimates infiltration in an arid environment, 2) it is dramatically smaller than regional pan evaporation rates, and 3) a 20-inch EZD allows water evaporation only from the rip rap layer. These lines of evidence are summarized below and in further detail in Whetstone, 2011b.

Researchers have documented that HELP underestimates evapotranspiration (ET) and overestimates infiltration in arid and semi-arid climates (DRI, 2002; Dwyer, 2003). This is partly because HELP does not account for the influence of matric potential gradients on water movement such as water moving upward toward the surface in response to surface evaporation. Peer evaluations of the HELP model indicate that "an evaporative zone depth of 100 cm [39 inches] may be used for bare soil because no transpiration occurs and HELP computes an internal value for the soil evaporative depth" (Berger, 2002) based on soil material properties. In fact, numerical modeling of six similar test cells in New Mexico used a maximum evaporative zone depth of 100 cm (39 inches) (Dwyer, 2003).

The *Engineering Documentation for Version 3* of HELP provides nation-wide maps of default minimum and maximum EZD values (EPA, 1994). For the region that includes the Clive facility (most of Utah, most of Idaho, western Wyoming, and eastern Washington), the default EZD ranges from 16 to 48 inches, with the minimum value appropriate for bare cover material and the maximum for vegetated covers. Considering

the variability of pan evaporation rates for this region, an EZD of 20 inches is conservatively within this interval and is appropriate for the Clive facility. For example, annual pan evaporation rates for stations in Idaho range from 17.17 to 66.04 inches per year, and the average of all Idaho stations is 42.26 inches per year (WRCC, 2011). By comparison, the 16-year average pan evaporation rate for Clive is 52.52 inches per year (Meteorological Solutions Inc., February 2011). It is reasonable that the EZD for Clive is 12.5% greater than the bare cover default minimum, given the pan evaporation rate in comparison to rates for other locations within the HELP default EZD region.

Once constructed, water is evaporated from the cover's rip rap layer where dry air is in contact with wet or moist surfaces of the cobbles. Water that adheres to the surfaces of the rip rap will is evaporated whenever the vapor pressure of the interstitial air is less than the saturated vapor pressure. These conditions allow evaporation from nearly all rip rap interstices. In fact, Corey and Kemper (1968) state that "if gravel is at the surface…water transferred upward through the gravel layer is by vapor diffusion." This process will remove moisture from the surfaces of cobbles, particularly during low intensity storm events.

Furthermore, the rate of evaporation is controlled by the available energy at the evaporating surface and the ease with which water vapor diffuses into the atmosphere (Shuttleworth, 1993). If water molecules that vaporize from the rip rap surface can diffuse away, then the interstitial vapor pressure remain low and evaporation from the rip rap continues. In evaluation of the impact of diffusive mechanisms, it is important to note that turbulent diffusion is a much more efficient transport method than molecular diffusion (Shuttleworth, 1993) and occurs where wind blowing horizontally over natural surfaces is retarded by its interaction with the ground surface. This mechanism plays a substantial role in diffusing water vapor from the upper portion of the rip rap cover and is indicative of the conditions that exist at the Clive facility. 18-year windspeed averages indicate that calm winds occur only 1.4% of the time, per year (Meteorological Solutions Inc., February 2011).

Additionally, the site is located in an area of groundwater discharge to evapotranspiration (Harrill et al, 1988 ). Evaporation and transpiration are drawing water from depths down to saturated depths at the site. Although the material properties for the engineered cover differ from those of native soils and plants at the site, the meteorologic properties that contribute to the site being a groundwater discharge zone are identical. The potential evaporation is high in this area of the Great Salt Lake Desert.

Finally, the 20-inch EZD is considered conservative when combined with the hydraulic properties of the rip rap used in the current modeling. The HELP model water balance indicates that over 1.5 inches of water percolate through the base of the rip rap on average annually. However, background conditions at the Clive site indicate that net infiltration is zero (or negative) for undisturbed native soils (Harrill, et al, 1988 ).

Therefore, the 1.5+ inches that percolate downward through the rip rap in the model are significantly higher than in natural background conditions.

The HELP infiltration model's evaluation of the revised top slope cover design and evaporative zone depth estimates that an average of 0.035 inches/year (0.090 cm/year) will infiltrate through the Class A West Embankment top slope under long-term quasi-steady state conditions. Similarly, the HELP infiltration model's evaluation of the revised side slope cover design and evaporative zone depth estimates that an average of 0.066 inches/year (0.168 cm/year) would infiltrate through the side slope cover. The side slope infiltration rate includes the impact of the run-on from the filter layers in the top slope.

The fate and transport methodology uses these HELP-calculated infiltration rates as input to the UNSAT-H model to estimate the impact of the revised cover design on the quasi-steady-state moisture content in the radon barrier, waste, clay liner, and Unit 3 sand and Unit 2 clay to the top of the aquifer. The final average moisture content for each modeled material is summarized in Table 3.

**Table 3. Revised Average Moisture Content in Waste, Clay Liner, and Units 2 and 3**

| | | Average Moisture Content (v/v) | | | | |
|---|---|---|---|---|---|---|
| Description | Infiltration (cm/yr) | Radon Barrier (Upper) | Radon Barrier (Lower) | Waste | Clay Liner | Units 2 and 3 |
| Top Slope | 0.090 | 0.4204 | 0.4211 | 0.0501 | 0.4157 | 0.0362 |
| Side Slope | 0.168 | 0.4229 | 0.4225 | 0.0541 | 0.4173 | 0.0420 |

The HELP-calculated infiltration rates and UNSAT-H-projected layer moisture contents are used by the fate and transport methodology as inputs to the PATHRAE code to model contaminant migration away from the proposed Class A West Embankment. The PATHRAE code includes a variety of scenarios and pathways through which contaminant conveyance can be modeled. Of particular concern to Energy*Solutions* for demonstration of continued regulatory compliance are those pathways associated with the groundwater migration of leached contamination. As part of its revised fate and transport modeling efforts, Energy*Solutions* has altered some of its scenario parameters to be more in line with common industry-practices for analyzing contaminant interaction with uncontaminated aquifer flows.

Prior to the formation of the NRC in 1975, a total of six shallow-burial low-level radioactive waste disposal facilities were licensed and operated to dispose of the Nation's commercial low-level radioactive waste. Most of these facilities were located within the boundaries of or adjacent to a much larger Federal reservation operated by the Atomic Energy Commission. Four of the disposal sites - Beatty, Barnwell, Maxey Flats, and West Valley -- were licensed by their respective host states through the Agreement State

program with the Atomic Energy Commission under Section 274 of the Atomic Energy Act (Ryan, 2007).

Since its initial efforts to assemble and evaluate the background information used to promulgate original low-level radioactive waste regulations, NRC has considered that an "*. . . event which deserves attention is the use of contaminated groundwater from the aquifer immediately below the site,"* through the evaluation of a scenario modeling the "*. . . ingestion of water from a well dug by a reclaimer"* (Adam and Rogers, 1978). While no credible drinking water scenario exists for the Clive site, down-gradient groundwater wells have been modeled for the Class A North, Class A, Mixed Waste, and Low Activity Radioactive Waste embankments.

Common low-level radioactive waste deterministic fate and transport models, such as PATHRAE and RESRAD, include assessment of the aquifer-to-groundwater-well scenarios by projecting precipitation that infiltrates through an embankment cover, comingles with waste, and then travels downward through an embankment liner, the unsaturated region beneath the embankment, to the saturated aquifer region. Once in the aquifer, the leached contaminants are predicted to be transported horizontally to a down-gradient well. Deterministic modeling of contaminant transportation includes advection and dispersion influences in the groundwater system.

In analysis of the aquifer-to-groundwater-well pathway, most common deterministic fate and transport models utilize parameters such as breakthrough time, rise time, and dilution factor. The breakthrough time is the time from a radionuclide's release into infiltrating water at the contaminated zone until its detection at the point of withdrawal. The rise time is the time from initial detection until the concentration reaches a maximum value. As is illustrated in Figure 1, the dilution factor is the steady-state ratio of the concentration a radionuclide at the point of withdrawal to the concentration of the same radionuclide in infiltrating water as it leaves the contaminated zone.

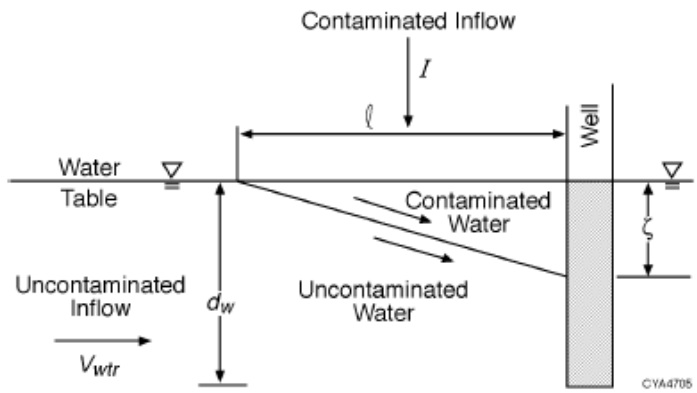


**Figure 1. Dilution of Contaminated Inflow by Uncontaminated Inflow for a Well Adjacent to the Class A West Embankment (Yu, 2001).**

For a well conservatively located down-gradient from the Class A West Embankment, the dilution factor is given by the formula,

$$f_d = \frac{\zeta}{d_w} \tag{1}$$

where

$f_d$ = dilution factor, or the steady-state ratio of the concentration a radionuclide at the point of withdrawal to the concentration of the same radionuclide in infiltrating water as it leaves the contaminated zone.

$\zeta$ = distance from the water table to the lower boundary of contamination in the aquifer at the down-gradient well (m).

$$= \left(\frac{I}{V_{wfr}}\right)\ell \tag{2}$$

$I$ = infiltration rate (m/year).

$V_{wfr}$ = water flow rate per unit cross-sectional area in the saturated zone (m/year).

$\ell$ = length from the far most edge of the contaminated zone to the discharge well, parallel to the hydraulic gradient (m).

$d_w$ = screened depth/interval of the well intake below the water table (m).

The aquifer-to-groundwater-well scenario and associated dilution factor are routinely used to demonstrate regulatory compliance for the disposal of radioactive wastes. Examples of the consideration of the aquifer-to-groundwater-well scenario in other applications (conducted by entities other than Energy*Solutions*) include,

- Performance assessment conducted for the North Carolina Department of Health, North Carolina Low-Level Radioactive Waste (LLW) Disposal Facility, Raleigh, North Carolina.
- Performance assessment conducted for the California Department of Health Services, California LLW Disposal Facility License Application Review, Sacramento, California.
- Risk assessment conducted for the Texas Low-Level Radioactive Waste Disposal Authority, Radiological Performance Assessment for a Low-Level Radioactive Waste Disposal Facility, Austin, Texas.
- Risk assessments conducted in support of the regulatory program for the low-level radioactive waste disposal facility in Harrisburg, Pennsylvania, Commonwealth of Pennsylvania.
- Risk assessment conducted to evaluate the environmental impacts at the Savannah River Plant, Savannah River, South Carolina.
- Risk and performance assessments conducted for a proposed low-level radioactive waste disposal facility, Albany, New York, New York Low-Level Radioactive Waste Siting Commission.
- Performance assessment conducted for Hanford Environmental Restoration Disposal Facility, modeling ongoing low-level waste disposal on the Hanford Reservation.
- Performance assessment conducted for Low-Level Waste and Byproduct Material at the proposed WCS low-level and byproduct disposal facilities in Texas.
- Dose assessments conducted for Disposal Area G at Los Alamos National Laboratory.
- Risk assessment conducted for Naturally Occurring Radioactive Materials at the Sierrita Open Pit Copper Mine in Green Valley, Arizona.
- Risk Assessments conducted for EPA's evaluation of naturally occurring radioactive materials.
- Risk and performance assessment conducted for proposed CERCLA Waste Disposal Facility, Oak Ridge, Tennessee.
- Performance assessment conducted in support of High-Level Waste Regulations in 40 CFR 191.
- Risk assessments conducted in support of Proposed Regulations in 40 CFR 193.
- Performance assessments conducted for the Hanford Site, INL, LANL, NTS, ORR, and SRP DOE Sites.
- Risk assessment conducted for the management of greater than Class C radioactive waste in the State of Connecticut.

Aquifer dilution is highly dependent upon site-specific, geohydrologic, and other scenario parameters. An example of inclusion of aquifer-to-groundwater-well dilution in an arid

environment can be found in a risk assessment recently conducted in support of a commercial low-level radioactive waste disposal site in the State of Texas (URS, 2007), in which an aquifer-to-groundwater-well dilution factor of 1:159 was calculated by the RESRAD model. Similar application of this methodology for the Class A West Embankment results in a dramatically smaller aquifer-to-groundwater-well dilution of 1:50.

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# UTAH LOW-LEVEL RADIOACTIVE WASTE DISPOSAL LICENSE AMENDMENT REQUEST (UT2300249) FOR THE CLASS A WEST EMBANKMENT

## RESPONSES TO ROUND 1 INTERROGATORIES

**October 28, 2011**

**For**
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Salt Lake City, UT 84114-4850

**Energy*Solutions*, LLC**
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## 1. INTERROGATORY CAW R313-25-6(3)-01/1: DESCRIPTION OF FACILITY

**Regulatory Reference:** R313-25-6(3). A description of:

(a) the location of the proposed disposal site;
(b) the general character of the proposed activities;
(c) the types and quantities of waste to be received, possessed, and disposed of;
(d) plans for use of the land disposal facility for purposes other than disposal of wastes;
(e) the proposed facilities and equipment

**Division's Interrogatory Statement**: *Refer to Sections1.2.2.12 and 3.3.1.6 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

1. *Provide the updated site layout, referred to as "Figure 1" and revise references to the Figure 1 actually provided "MicroShield® Case Title – Class A West Cover".*

**Energy*Solutions*' Response:** References in Sections 1.2.2.12 and 3.3.1.6 corrected.

**Division's Interrogatory Statement:**

2. *Describe the proposed use of concrete (CLSM) in the CAW and explain any differences from its previously approved use in the Class A and Class A North embankments.*

**Energy*Solutions*' Response:** While the Division's interrogatory statement points to Section 3.3.1.6 of the LAR, it should be noted that Section 3.3.1.6 discusses closure of individual disposal units.

Please refer to Section 3.3.1.4 for the discussion on the proposed use of concrete and CLSM in the Class A West Embankment design. The following text was added to this section: "There are no proposed differences between CLSM usage in the Class A West Embankment and CLSM usage in the Class A or Class A North embankments."

## 2. INTERROGATORY CAWR313-25-7(1)-02/1: SPECIFIC TECHNICAL INFORMATION – GROUNDWATER ELEVATION VALUE(S) USED IN ANALYSES

**Regulatory Reference:** R313-25-7. The application shall include certain technical information…. (1) A description of the natural and demographic disposal site characteristics shall be based on and determined by disposal site selection and characterization activities. The description shall include geologic, geochemical, geotechnical, hydrologic, ecologic, archaeologic, meteorologic, climatologic, and biotic features of the disposal site and vicinity.

**Division's Interrogatory Statement:** *Refer to Sections 2.4.2 and 3.1.1 of the Class A West (CAW) Embankment License Amendment request (LAR): Please provide a clear reference or documentation for the statement that the highest recorded elevation of the upper unconfined aquifer is 4255 feet above sea level.*

**Energy*Solutions*' Response:** As is referenced in the Groundwater Reports submitted by Energy*Solutions* to the Utah Division of Water Quality from 1993 to present, the elevation cited in Sections 2.4.2 and 3.1.1 is conservatively higher than the maximum value for wells surrounding Class A and Class A North areas (maximum is 4,251.3 ft amsl; average is 4,249.7 ft amsl - for the period of observation of August 1993 to the most recently available of May 2011). Section 3.1.1 of the Class A West License Amendment Request has been revised to provide the observed maximum groundwater elevation of 4,251.3 ft amsl.

**Division's Interrogatory Statement:** *Describe how the historical groundwater data set from which this value was derived (and other historical groundwater elevation information, as applicable) were considered when selecting groundwater elevation data used in analyses (geotechnical stability analysis, contaminant transport analysis) that were performed by Energy Solutions and included in the CAW LAR and its attachments (see also Interrogatories R313-25-8(4)-06/1: Technical Analyses – Infiltration and Transport Modeling: Climate Conditions, Engineered Barrier Conditions, and Vertical Transport Distance and R313-25-8(4)-07/1 Technical Analysis-Groundwater Depth in Geotechnical Stability Analysis below).*

**Energy*Solutions*' Response:** As is referenced in the Groundwater Reports submitted by Energy*Solutions* to the Utah Division of Water Quality from 1993 to present, the average groundwater elevation in the shallow water-bearing zone beneath the Class A West Embankment footprint is 4,249.7 ft amsl, based on the most recent 17 years of data. The infiltration and transport model of Attachment 3 used an average of 4,249.6 ft amsl. This value is sufficiently close to the long-term average.

The updated geotechnical stability analysis cites depth to water data (26 ft) from Cone Penetrometer Testing (CPT) locations along the north side of Class A North (Figure 3A of Attachment 5 to the Class A West License Amendment Request). The average ground surface elevation for the closest wells to the CPT locations (GW-108 to GW-116) is 4,275.4 ft amsl (Envirocare, 2004). Using the depth of 26 ft reported in Attachment 5 to the Class A West License Amendment Request and the average ground surface elevation, the "representative" groundwater elevation presented in the geotechnical analysis in Attachment 5 is approximately 4,249.4 ft amsl. Based on this information, the average and "representative" groundwater elevations used in Class A West modeling and geotechnical analysis, respectively, are consistent with each other and the 17-year observed average.

**Division's Interrogatory Statement:** *Explain and justify differences between assumed elevation values used in different analyses and the historically highest groundwater elevation value mentioned in Section 3.1.1 of the CAW LAR.*

**Energy*Solutions*' Response:** References to groundwater elevation quoted in Section 3.3.1 of the Class A West License Amendment Request have been revised to the observed 17 years maximum value of 4,251.3 ft amsl. References have also been expanded to note that:

1) The infiltration and transport modeling uses an average groundwater elevation of 4,249.6 ft amsl. However, when the height of the capillary zone calculated by UNSAT-H (2.04 ft) is included in the calculation of the thickness of the unsaturated zone, it conservatively reduces the thickness of the unsaturated zone used in modeling more than using the 17-year maximum observed groundwater elevation in modeling, which is 1.6 feet higher than the 17-year average elevation (4,251.3 - 4,249.7 ft amsl = 1.6 ft). Thus although the infiltration and transport modeling uses an average groundwater elevation, the calculation of the vertical pathway thickness is still conservative with respect to groundwater elevation.
2) The geotechnical stability uses a conservative groundwater elevation of approximately 4,253.4 ft amsl. This value is approximately 2 feet greater than the 17-year maximum observed groundwater elevation of 4,251.3 ft amsl for the Class A West Embankment footprint.

Both models are conservative with respect to groundwater elevation and thickness of the unsaturated zone.

## 3. INTERROGATORY CAW R313-25-7(2)-03/1: SPECIFIC TECHNICAL INFORMATION – BUFFER ZONE

**Regulatory Reference:** R313-25-25(8).A buffer zone of land shall be maintained between any buried waste and the disposal site boundary and beneath the disposed waste. The buffer zone shall be of adequate dimensions to carry out environmental monitoring activities specified in R313-25-26(4) and take mitigative measures if needed.

**Division's Interrogatory Statement:** *Refer to Sections1.2.2.2 and 4.3.6 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

*1. Please explain how EnergySolutions allowed the buffer zone east of the Class A embankment to be constructed so that less than 94 feet were provided. Identify the root causes of this discrepancy. Explain what actions will be or have been taken to ensure that similar discrepancies in other locations do not occur in the future.*

**Energy*Solutions*' Response:** The discrepancy lays with the approved design drawings for the Class A Embankment. Those drawings establish a design toe of waste at the southeast corner that is 92.7' west of the property boundary and at the northeast corner that is 95.4' west of the property boundary, as indicated in Figure A of Attachment 9 to the revised Class A West License Amendment Request. The root cause of this design discrepancy is unknown. However, the Section 32 survey rotational error that was identified and corrected in 2009 (RML Amendment 5) is a likely source. The corrected

section and property survey information has been added to the engineering design data base and all known incorrect survey information has been purged. This action should prevent similar future discrepancies in other locations at the facility.

**Division's Interrogatory Statement:**

2. *Describe in detail how waste disposal has encroached upon the bounds of buffer zones defined by Tables 3 and 7 of the Groundwater Quality Discharge Permit. Provide detail demonstrating how the configuration of the constructed disposal unit departs from the proposed and approved configuration.*

**Energy*Solutions*' Response:** As stated in Response 1 above, the design waste limits do not allow for a 94 ft buffer zone along the east side of the Class A Embankment. However, due to LLRW Embankment construction specifications (LLRW and 11e.(2) CQA/QC Manual, Revision 23 and earlier) imposed at the time of construction, the actual toe of waste was held back a minimum of 5 ft from the design waste limits to accommodate 1 ft of temporary cover. Although the design drawings and specifications for temporary cover were revised in 2009 (LLRW and 11e.(2) CQA/QC Manual, Revision 24E) to allow waste to be placed to the design limits, Energy*Solutions* has not placed (and will not place) any waste within the 5 ft offset from the design limits—soil material within that offset is clean native material previously placed as temporary cover. Therefore, as shown on Figure A of Attachment 9 to the revised Class A West License Amendment Request, there is a minimum of 97.7 ft from the toe of actual waste to the property boundary, thus allowing for a minimum 94 ft buffer zone. The design drawings for the Class A West Embankment, refer to Attachment 2 of the revised Class A West License Amendment Request, have been revised to identify a waste restricted area to prevent future placement of waste within the buffer zone. With this additional construction restriction and establishing the buffer zone limits along the Vitro property boundary (as shown on Drawing U01), a minimum buffer zone of 97.7 ft is established along the east side of the Class A West Embankment.

**Division's Interrogatory Statement:**

3. *Justify the statement that "This discrepancy in the buffer zone for the eastern waste limit of the Class A embankment does not compromise the facility's ability to comply with the well network early warning requirement at Part I.F.1(f) of the GWQPD."*

*Present evidence to demonstrate that the ability "to carry out environmental monitoring activities . . . and take mitigative measures if needed" is preserved, despite this discrepancy, as required by R313-25-25(8). That is, present evidence to demonstrate that adequate time exists, not only to detect a contaminant release, but also to take mitigative measures throughout the entire buffer zone east of the Class A embankment, if they were required.*

*In providing this evidence, identify and discuss what mitigative measures could be implemented timely to preclude release of contaminant through the buffer zones.*

**Energy*Solutions*' Response:** Evidence that adequate time exists to detect a contaminant release in the smaller buffer zone at the southeast corner of the Class A West Embankment is provided by the well spacing analysis, included as Attachment 6 to the Class A West License Amendment Request. This analysis relies upon the actual installed locations of existing wells to the east of the Embankment, specifically, GW-88, GW-89, GW-90, GW-91, and GW-92. As provided in Table 1.2 in Section 1.2.2.2 of the Class A West License Amendment Request, the minimum distance between these wells and the Vitro property line is 6.0 feet. Given these actual well locations, the analysis demonstrates that the evaluated well network will provide leak detection with greater than 95% efficiency for the Class A West Embankment.

Table 1.2 has been updated to add wells GW-92 and GW-24, as the drawings and further evaluation called for under item 4 of this interrogatory has revealed an area of concern for the Vitro buffer at the northeast corner of waste placement for the 11e.(2) Embankment. A concern is also identified and discussed regarding the 300 foot Tooele County buffer to the outside property line, at the southwest corner of the 11e.(2) Embankment.

Section 1.2.2.2 has also been revised accordingly.

**Division's Interrogatory Statement:**

4. *Provide a drawing(s) clearly showing the locations of ". . . the closest edge of any embankment (i.e., toe of waste) and the outside site boundary or property line." Ensure that other symbols do not obscure the symbol denoting the outside site boundary or property line. Indicate on the drawing(s) the minimum distances between the toe of waste for each embankment (whether existing or proposed) and the outside site boundary or property line. If any such minimum distance is less than 300 feet, identify what actions will be taken to remedy the discrepancy and to preclude occurrence of similar situations in the future. Provide evidence to demonstrate that adequate time exists, not only to detect a contaminant release, but also to take mitigative measures, if they are required.*

**Energy*Solutions*' Response:** Figures A, B and C provided in Attachment 9 to the Class A West License Amendment Request show the relationship between each Embankment (Class A West, Class A, Class A North, 11e.(2), LARW and Mixed Waste) and the property boundaries.

Figure A shows that the Class A West, Class A and Class A North embankments are all offset at least 300 ft from the external (north, west and south) property boundaries per the Tooele County CUP requirement. The discrepancy for the 94 ft buffer zone along the east perimeter of the Class A Embankment is discussed in Items 1 and 2 above.

Figure B shows two discrepancies for the 11e.(2) Embankment. One (along the south end of the west side), is for the 300 ft Tooele County CUP buffer zone requirement and the other (near the NE corner) is for the radioactive material license 94 ft buffer zone requirement. Both of these discrepancies are clearly detailed on Figure B. The discrepancy for the 300 ft buffer zone requirement will be resolved by revising the design waste limits in the SW corner; by relocating the SW corner to a point along the current south limits a distance of 300 ft from the property boundary. Waste has not yet been placed near this location; and will not be in the near future as the 2000 Pond would first need to be decommissioned. This will be done under a separate amendment request for the 11e.(2) license, RML #UT 2300478.

Section 1.2.2.2 has been updated accordingly.

**Division's Interrogatory Statement:** *Provide similar drawings to demonstrate that the width of no buffer zone between disposal embankments, other than those east of the Class A embankment, is less than 94 feet.*

**Energy*Solutions*' Response:** Figure C demonstrates that both the LARW and Mixed Waste embankments meet both the Tooele County CUP buffer zone requirement (300 ft) and the Ground Water Quality Discharge Permit buffer zone requirement (94 ft).

**Division's Interrogatory Statement:**

*5. Correctly state the dimension of the buffer zones surrounding the CAW.*

**Energy*Solutions*' Response:** Additional dimensions and information have been added to Drawing U01, Revision 1 to clearly show the dimensions of the buffer zone around the Class A West Embankment.

**Division's Interrogatory Statement:**

*6. Please correctly label the exterior boundaries of the CAW waste limits and break-lines on drawing sheet C05, and redraw as needed.*

**Energy*Solutions*' Response:** The requested changes are completed and included in Revision 1 of Drawing C05.

## 4. INTERROGATORY CAW R313-25-7(3)-04/1: SPECIFIC TECHNICAL INFORMATION – DESIGN CRITERION FOR DISTORTION OF LINER AND CLAY COVER COMPONENTS

**Regulatory Reference:** R313-25-7. The application shall include certain technical information…. (3) Descriptions of the principal design criteria and their relationship to the performance objectives.

**Division's Interrogatory Statement:** *Refer to Table 3-2 and Sections 1, 4, and 5 of Attachment 5 (Geotechnical Update Report, EnergySolutions Clive Facility Class A West Embankment, Clive, Toole County, Utah, February 15, 2011) to the Class A West (CAW) Embankment License Amendment request (LAR):Please provide additional documentary evidence (beyond that presented in a letter report from October 2000 [AMEC 2000] and referenced in analyses that were performed in 2005 ([AMEC 2005]), if such evidence is available and applicable, of the basis for choosing 0.02 as the design criterion for evaluating allowable distortion of the liner and clay components of the CAW Embankment cover.*

**Energy*Solutions*' Response:** While no basis for concern is provided over the cited reference, failure of landfill covers due to excessive differential settlement from linear elastic fracture mechanics has been long known to be problematic in landfill performance integrity. The deformation behavior of clay barriers at the onset of continuous differential settlements has been analyzed analytically, in full-scale field tests, and through reduced-scale laboratory testing (Viswanadham, 2009).

Several studies employing a variety of testing techniques have been conducted since AMEC's initial 2000 analysis. Viswanadham (2002) presented results conducted on less dense clays (with slightly higher liquid limits than those native to Energy*Solutions*' Clive site) in small-centrifuge laboratory tests, with maximum tensile strains ranging from 0.7% to 1.3%. Wang (2007) utilized an improved 3-point bending beam loading assembly to measure fracture resistance in clays used in earth-rock fill dams of Western China (maximum tensile strength of 0.5%). Wang's clays exhibited a lower plasticity index and liquid limit than those native to Energy*Solutions*' Clive site. Le (2009) used a Discrete Element Method to measure maximum tensile strengths for generic clays between 2.5% and 4.7%. Following his analysis in 2002, Viswanadham (2009) again used his centrifuge model to measure a maximum tensile strain of 0.7% for similar clays of those native to Energy*Solutions*' Clive site. Camp (2010) utilized a 4-point bending test protocol to measure maximum tensile strains of 0.2% to 0.6% for Aptien clays (similar to those native to Energy*Solutions*' Clive site). Subsequently, Gourc (2010) used fill-scale and centrifuge tests again on Aptien clays to observe maximum tensile strains of 0.3% to 0.9%. Finally, Rajesh (2010) utilized a hydraulic trap-door centrifuge system on clays used on Bombay, India landfills (which are also similar to those native to Energy*Solutions*' Clive site) to observe maximum tensile strains of 2.8% to 3.0%.

These references further substantiate LaGatta's (1997) demonstration of the relationship between differential settlement, tensile strain, and angular distortion, noting that at very small values of angular distortion, clay tensile strains are also very small. Table 1 summarizes the available data sets which were used to evaluate the validity of AMEC reference (2000) longevity. From these references, the selection of a maximum tensile strain of 0.2% is demonstrated to be a very conservative lower bound. At such a small tensile strain, LaGatta estimates an angular distortion of 0.06 (providing basis for the selected design criterion of 0.02 for allowable distortion of the liner and clay components of the Class A West Embankment cover).

**Table 1 – Summary of Maximum Tensile Strain Studies for Clay Barriers**

| | Reference | Plasticity Index (%) | Liquid Limit (%) | Maximum Dry Density (pcf) | Maximum Tensile Strain (%) |
|---|---|---|---|---|---|
| **Energy*Solutions*' Clay** | AMEX, 2000 | 10 - 25 avg 16 | 36 | 97 - 106 | 0.8 |
| **Speswhite Kaolin Clay** | Viswanadham, 2002 | 16.5 | 44.5 | 87.1 - 102.9 | 0.7 - 1.3 |
| **Nuozhadu Dam** | Wang, 2007 | 8.9 | 29.1 | 99.9 - 109.9 | 0.5 |
| **Generic Clay** | Le, 2009 | | | | 2.5 - 4.7 |
| **Model Clay (80% Kaolin, 20% sand)** | Viswanadham, 2009 | 16 | 38 | 101.3 | 0.7 |
| **Aube, France (Aptien Clays)** | Camp, 2010 | 22 | 44 | 47.1 - 115.3 | 0.2 - 0.6 |
| **Aube, France (Aptien Clays)** | Gourc, 2010 | 16-22 | 38 - 44 | 101.3 - 110.8 | 0.3 - 0.9 |
| **Landfill Barriers** | Rajesh, 2010 | 16 | 38 | 101.3 | 2.8-3.0 |

**Division's Interrogatory Statement:** *Demonstrate whether, based upon a reasonable degree of research of more recent published literature and guidance pertaining to the matter of recommended allowable angular distortions for compacted clay engineered barriers, any revision is warranted to the maximum allowable angular distortion criterion value of 0.02 that was used in analyses done to support this CAW LAR.*

**Energy*Solutions*' Response:** As is demonstrated in the research summarized in Table 1, no revision is warranted to the maximum allowable angular distortion criterion value of 0.02 that was used in analysis done to support this Class A West License Amendment Request.

**Division's Interrogatory Statement:** *To the extent applicable, include consideration of how this criterion value relates to criteria typically used for other types of structures.*

**Energy*Solutions*' Response:** References cited in Table 1 address application of typical criteria for various types of structures, substantiating its use in the Class A West License Amendment Request.

**Division's Interrogatory Statement:** *Justify whether the choice of 0.02 continues to be appropriate for evaluating the compacted clay components in the CAW Embankment with respect to protecting the integrity of both the liner and the clay components of the embankment cover from potential future differential settlement-induced damage.*

**Energy*Solutions*' Response:** References cited in Table 1 demonstrate that a conservative value for maximum allowable distortion is much higher than the 0.02 value selected, which continues to be demonstrated as incorporating "considerable conservatism."

**Division's Interrogatory Statement:** *Verify that this criterion value remains consistent with current engineering practices for compacted clay layers or similar structures.*

**Energy*Solutions*' Response:** References cited in Table 1 demonstrate that consideration of this criterion in Energy*Solutions*' Class A West License Amendment Request remains consistent with current engineering practices for compact clay layers and similar structures.

**Division's Interrogatory Statement:** *Present information and revised analyses or findings, if applicable, based on considering any revised distortion criterion value that may be recommended.*

**Energy*Solutions*' Response:** While references cited in Table 1 support the use of higher allowable maximum distortion design criterion, Energy*Solutions*' use of a maximum allowable distortion of 0.02 remains conservative.

## 5. INTERROGATORY CAW R313-25-7(7)-05/1: SPECIFIC TECHNICAL INFORMATION -- CLOSURE PLAN

**Regulatory Reference:** R313-25-7. The application shall include certain technical information….(7) A description of the disposal site closure plan, including those design features which are intended to facilitate disposal site closures and to eliminate the need for active maintenance after closure.

**Division's Interrogatory Statement:** *Sections 1.3.1, 1.3.2, and 1.3.3, 3.1.6, 3.2.6, 3.3.1.6, 4.3.5, and 5.0 of the Class A West (CAW) Embankment License Amendment request (LAR), and Attachment 1 (Proposed Amendments ["RML Revisions and GWQDP Revisions"]), and Attachment 2 ("CAW License-Permit Drawings") of the CAW LAR:*

1. *Provide information on proposed staging of closure of the embankment in closure phases, as applicable. Provide a schedule for commencing and completing each identified phase of closure. Demonstrate that the timing of any such phase of final closure will be integrated with timing of settlement monitoring activities and with distortion analysis determinations based on acquired settlement monitoring data for any areas to be closed. Provide information that adequately demonstrates that the proposed plan for phased closure and for integrating the various closed phases will result in an effective, continuous closure cover and drainage system installation. Evaluate and address the need for further revisions, if any, to RML and/or GWQDP conditions, as appropriate.*

   **Energy*Solutions*' Response:** Sections 1.3.3, 3.2.6, and 3.3.1 have been revised to clarify embankment closure.

**Division's Interrogatory Statement:** *Refer to Section 2.5.4 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

2. *Please provide fully checked and QA'd analyses of clay borrow and rock borrow (also referred to as "erosion materials" in Table 2.2) volumes, with references to engineering drawings as needed to establish the inputs for each calculation.*

   **Energy*Solutions*' Response:** Detailed, peer reviewed quantity calculations (included as Attachments 9 and 10 of the Class A West License Amendment Request) for clay liner, liner protective cover, temporary cover, radon barrier and the various cover erosion layers for the Class A West Embankment have been completed and are attached. In addition, Tables 2.1 and 2.2 have been updated to include the results of the more detailed calculations. Similar calculations were performed for the 11e.(2) and Mixed Waste embankments to determine the total borrow needs for all disposal embankments.

   Table 2.1: First, an error in Table 2.1 was identified and corrected—a thickness of 4.5 ft was used instead of the design 3.5 ft in the calculation of the "Erosion Materials (rock)" for the Side Slope of the Class A West design. In addition to this correction, the areas for the Class A West were updated to reflect the more accurate calculations referenced above, and the thickness for the "outer Ditch Slope Area" erosion materials was increased to 2.0 ft per the results of Interrogatory R313-25-8(4)-13/1. Last, clay borrow needs for liner and liner protective cover were added to the table. Table 2.2 has also been updated to reflect more detailed and accurate calculations for clay and rock borrow quantities for all embankments.

**Division's Interrogatory Statement:**

3. *Please provide affirmative evidence that adequate supplies of clay borrow and rock borrow materials will be available at a unit cost no greater than that assumed in closure cost estimates, to accomplish closure activities (insofar as these materials are involved) at a cost no greater than estimated is surety cost estimates. Identify each source beyond those already owned by or under contract to EnergySolutions.*

**Energy*Solutions*' Response:** Clay borrow (required for liner, liner protective cover, temporary cover and radon barrier) is available on Energy*Solutions* property. Rock, sand and gravel borrow material (needed for the filter, sacrificial soil and riprap cover layers) is available on BLM land in the Grayback Hills north of the facility.

Clay Borrow: Figure D of Attachment 9 to the Class A West License Amendment Request shows four potential borrow areas located within Section 29 of Energy*Solutions* property. Additionally, the calculations attached therein conservatively estimate 2.3 million cubic yards of suitable clay within these 4 areas, with a potential of nearly 3.2 million cubic yards. The clay resource in these areas is 1.2 to 1.7 times (respectively) more than the 1.9 million cubic yards (as summarized in Table 2.2) required for construction of clay liner, liner protective cover, temporary cover and radon barrier.

Rock Borrow: The total rock, sand and gravel borrow requirements for the Class A West, 11e.(2) and Mixed Waste embankments is calculated to be approximately 1.53 million cubic yards (refer to Table 2.2 for a summary of the calculations). Energy*Solutions* has previously demonstrated (through the annual surety review process) that there is a resource of at least 1.1 million cubic yards of suitable rock borrow within Energy*Solutions*' contract area of BLM Community Pit 24 (62744) located in the Grayback Hills north of the Clive facility. In review, provided as Attachment 9 to the Class A West License Amendment Request is an excerpt from a report prepared by PEPG Engineering, L.L.C. (2004) that summarizes exploratory digging and evaluation of Site C3, which is the Energy*Solutions* contract area of Pit 24. Per the report (refer to page 2) there is a proven and probable 1.1 million cubic yards of material within the pit with a possible additional 660,000 cubic yards.

The Figure entitled, "Central Grayback 24 CP 62744" of Attachment 9 to the Class A West License Amendment Request shows the community pit boundaries and the Energy*Solutions* contract area there within. No material has been removed from the contract area since the PEPG exploration was performed. Energy*Solutions* recently requested the BLM to provide an estimate of the resource available within the entire community pit. In response, the BLM has verbally confirmed that there is a resource of at least 1.6 million cubic yards within Community Pit 24 (Garahana, 2011, letter provided in Attachment 9 of the Class A West License Amendment Request). Last, in response to a request for information from the Division to demonstrate that the material within Community Pit 24 is suitable for cover materials, Energy*Solutions* has provided in

Attachment 9 a letter from John Garr, Montgomery Watson Harza. The attached letter confirms that the rock material within Pit 24 is the same type of material as that from previously approved borrow pits located on the south end of the Grayback Hills.

## 6. INTERROGATORY CAW R313-25-7(9)-06/1: SPECIFIC TECHNICAL INFORMATION – QUANTITIES OF RADIOACTIVE MATERIALS

**Regulatory Reference:** R313-25-7(9). The application shall include certain technical information. The following information is needed to determine whether or not the applicant can meet the performance objectives and the applicable technical requirements of R313-25: Descriptions of the kind, amount, classification and specifications of the radioactive material proposed to be received, possessed, and disposed of at the land disposal facility.

**Division's Interrogatory Statement:** *Refer to Sections 6.1.1 and 7.2 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

*(1) Correctly state in Section 6.1.1 the nature and extent of the change in quantities of waste expected to be disposed of in the proposed CAW.*

*(2) Correctly state in Section 7.2 the increase in quantity of LLRW to be disposed of in the proposed CAW and the effects such increases will have on the need for radiation protection.*

**Energy*Solutions*' Response:** The referenced sections are not incorrect. Although total licensed capacity, and thus waste volume, will increase with the proposed Class A West Embankment, the types of waste to be received and annual receipts are not projected to change. The referenced sections of the 2005 License Renewal Application develop annual waste projections of up to 11 million cubic feet received per year. This rate continues to bound recent history and current projected waste volumes per year. In fact, waste received for disposal in the Class A and Class A North cells has averaged 4 million cubic feet per year for the last 4 years. Nonetheless, to clarify this point these sections have been revised.

**Division's Interrogatory Statement:** *Refer to Attachment 3 to the Class A West (CAW) Embankment License Amendment Request (LAR):*

*(3) Please explain why many of the radionuclide concentrations in the modeling report (Whetstone 2011) are below the Class A upper limits.*

**Energy*Solutions*' Response:** The correct concentrations were used in the modeling. The maximum concentrations listed in Table 22 in units of $Ci/m^3$ were converted incorrectly using a bulk density of 1.11 $gm/cm^3$ rather than 1.8 $gm/cm^3$. Table 22 has been corrected and will be submitted under separate cover, at a later date.

## 7. INTERROGATORY CAW R313-25-7(10)-07/1: SPECIFIC TECHNICAL INFORMATION – CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL MANUAL

**Regulatory Reference:** Refer to R313-25-7. The application shall include certain technical information….(10)Descriptions of quality assurance programs, tailored to low-level waste disposal, including audit and managerial controls, for the determination of natural disposal site characteristics and for quality control during the design, construction, operation, and closure of the land disposal facility and the receipt, handling, and emplacement of waste.

**Division's Interrogatory Statement:** *Refer to Sections 1.3, 3.1.6, 3.2.6, 3.3.1.6 of the Class A West (CAW) Embankment License Amendment request (LAR), and Attachment 1 (Proposed Amendments ["RML Revisions and GWQDP Revisions"]) of the CAW LAR: Please provide revised and additional information in the CAW LAR and a revised version of Attachment 1 to the CAW LAR, as appropriate, to address specific procedures, methods, testing frequencies, and/or schedules for completing testing or other activities that apply to CQA/QC activities that would be performed at the proposed CAW Embankment.*

*Provide a revised Construction Quality Assurance/Quality Control (CQA/QC) Manual that incorporates changes to all Work Elements of the currently approved CQA/QC Manual, as needed, to address these procedures, methods, schedules, etc…Include revised information pertaining to: (1) open-cell timeframe for the CAW Embankment; (2) proposed timetables for placing Temporary Cover and for completing related settlement monitoring and distortion analyses (e.g., by phase/area) at the CAW Embankment, if applicable; (3) schedules for conducting CQA/QC activities in conjunction with any proposed phasing/staging of partial closure activities that would be performed at the CAW Embankment; and (4) other items as needed.*

*Provide information demonstrating that any proposed staging for phased closure of the CAW Embankment will be integrated with timing of settlement monitoring activities and with distortion analysis determinations in any areas to be closed.*

**Energy*Solutions*' Response:** Most of the speculated subjects within the Radioactive Material License, Ground Water Quality Discharge Permit, or CQA/QC Manual do not require further revision. Each is discussed below:

1. Open cell timeframe: Revision 25d of the CQA/QC Manual was approved on April 4, 2011. The reference provided in rev. 0 of the amendment request was outdated. Revision 25d updates the open cell timeframes for cover construction, within interim deadlines for temporary cover. No further changes are needed for the Class A West Embankment. See also the response to interrogatory 5 and the revisions to sections 1.3.3 and 3.3.1.6 of the amendment request.
2. Timetables for temporary cover, settlement monitoring, and distortion analysis: As with the open cell timeframe, these timetables were updated in revision 25d of the CQA/QC Manual approved on April 4, 2011. No further changes are needed

for the Class A West Embankment. See also the response to interrogatory 5 and the revisions to sections 1.3.3 and 3.3.1.6 of the amendment request.

3. Schedules affected by partial closure: Existing CQA/QC Manual controls adequately address construction of liner and cover over multiple staged projects. This approach has successfully been applied throughout the life of the facility and no revisions are needed. No further changes are needed for the Class A West Embankment. See also the response to interrogatory 5 and the revisions to sections 1.3.3 and 3.3.1.6 of the amendment request.
4. Other items as needed: Revision 26a of the CQA/QC Manual has been prepared to update applicable "Scope" specifications within each work element to replace references to the Class A and Class A North Embankment with reference to the Class A West Embankment. Similarly, Figures 2 and 6 of the CQA/QC Manual provide settlement monument locations for the Class A and Class A North embankments, respectively. These will be replaced with a revised Figure 2, and affected CQA/QC references to these figures updated accordingly. Forms provided in Appendix A of the CQA/QC Manual are also updated.

Reviewers will also note the following text has been deleted at work element – Interim Rad Cover Placement and Monitoring, specification "Interim Rad Cover Material": "This work element shall have an effective date one year following Division approval of its inclusion in the LLRW and 11e.(2) CQA/QC Manual." Work element – Interim Rad Cover Placement and Monitoring was first included in the CQA/QC manual at revision 23d, approved November 19, 2008. Accordingly, the effective date is now in force and the text is removed from the CQA/QC manual to prevent potential confusion. Revised pages resulting in 26a of the CQA/QC Manual have been provided as Attachment 8 to the amendment request.

The interrogatory basis goes on to state that "…Energy*Solutions* should clearly identify, evaluate, and discuss all particular features, attributes, etc… of the proposed Class A West Embankment that might impact one or more items or conditions in the currently approved Radioactive Materials [sic] License and/or Groundwater Quality Discharge Permit (GWQDP). For example, one such item is the open cell time limitation prescribed in Part I.E of the GWQDP." As discussed above, the open cell time limit and associated changes have already been set as separate licensing actions. No changes to the open cell time limit or other implementing controls are needed or requested associated with the Class A West Embankment.

In preparing rev. 0 of the amendment request, Energy*Solutions* already evaluated and discussed changes to the RML and GWQDP. No further changes, beyond the minor revision to the CQA/QC Manual (provided as Attachment 8 to the Class A West License Amendment Request), are needed.

## 8. INTERROGATORY CAW R313-25-8(1)-08/1: TECHNICAL ANALYSES; RELEASES OF RADIOACTIVITY

**Regulatory Reference:** R313-25-8(1). Analyses demonstrating that the general population will be protected from releases of radioactivity shall consider the pathways of air, soil, ground water, surface water, plant uptake, and exhumation by burrowing animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate a reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in R313-25-19.

**Division's Interrogatory Statement:** *Refer to Sections 6.1.3 and 6.1.5 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

1. *Summarize the results from Attachment 3 that justify the statement that the need to limit concentrations of several nuclides is eliminated. Ensure that the summary is nuclide-specific and addresses the radiological, physical, and chemical properties of the waste. Discuss the meaning of these summary results and show how the conclusion is reached.*
2. *Please state both the GW protection standard and the calculated maximum concentration for all radionuclides of concern in this table. Quantify the extent of change from values previously reported and those now reported. Explain why these changes occurred. What is the sensitivity of these results to assumed and estimated values?*

*Refer to Section 6.1.5 of and Attachment 3 to the Class A West (CAW) Embankment License Amendment Request (LAR):*

3. *Please explain the modeling results that indicate that the top slope infiltration rate (0.238 cm/yr) leads to earlier peak concentrations at the water table than the higher side slope infiltration rate (0.335 cm/yr). Also explain why the time to exceed the GWPLs at the water table is shorter for the lower infiltration top-slope case than for the side-slope case.*
4. *Please explain the modeling results for the compliance monitoring well that show the top slope infiltration rate (0.238 cm/yr) leads to earlier times to exceed the GWPLs than the higher side slope infiltration rate (0.335 cm/yr).*
5. *Please correct the vadose zone water velocities in Tables 30 and 31 of the Whetstone report (Whetstone 2011) to make them consistent with the vadose zone velocity equation given in Section 5.2.3 of the same report. Also, update the PATHRAE files and results that used the incorrect vadose zone velocities (Baird, 2011).*

**Energy*Solutions*' Response:** The Technical Analysis demonstrating that the general population will be protected from releases of radioactivity is under revision and will be submitted under separate cover, at a later date.

## 9. INTERROGATORY CAW R313-25-8(2)-09/1: TECHNICAL ANALYSES; PROTECTION OF INADVERTENT INTRUDERS

**Regulatory Reference:** R313-25-8(2). Analyses of the protection of inadvertent intruders shall demonstrate a reasonable assurance that the waste classification and segregation requirements will be met and that adequate barriers to inadvertent intrusion will be provided.

**Division's Interrogatory Statement:** *Refer to Section 6.2 of the Class A West (CAW) Embankment License Amendment Request (LAR): Please provide a dose analysis for an inadvertent intruder scenario.*

**Energy*Solutions*' Response:** The request for an inadvertent intruder dose assessment is contrary to the licensing basis for the facility. No new waste types or characteristics are requested specifically for the Class A West Embankment; therefore, there is no reason to overturn the existing license basis. Additional discussion justifying the lack of an inadvertent intruder dose assessment has been added to section 6.2 (with additional references incorporated to section 11).

## 10. INTERROGATORY CAW R313-25-8(4)-10/1: TECHNICAL ANALYSIS – DESIGN SAFETY FACTORS

**Regulatory Reference:** R313-25-8(4). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:** *Refer to Sections 3.0, 3.1.7 and Tables 3-2 and 3-4 of the Class A West (CAW) Embankment License Amendment request (LAR), and Drawings 10014 C01 and 10014 C04 of the CAW LAR:*

1. *Please provide a clear, consistent, and appropriately referenced discussion of the approach used for selecting various minimum acceptable safety factors for evaluating the adequacy of design of different elements of the CAW Embankment.*

   *Indicate how different minimum acceptable safety factors apply to different design features based on the precise characteristics of the materials that comprise them, the intended use of those materials and the features, and established and accepted Best Practices and published standards or guidelines, etc…*

   *Indicate, if applicable, that in no case was a minimum safety factor of less than 1.0 assumed for the design of any principal design feature or principal design aspect, or justify why a minimum safety factor of 1.0 would be adequate for design.*

*Rectify discrepancies that currently exist in Table 3-4 with respect to Safety factors listed as having been calculated for certain features (e.g., Static Safety Factor ≥ 2.1 vs. ≥ 2.3 for "Waste Placement and Backfill").*

*Clearly reference guidelines and standards that support the minimum safety factors that were used to which the computed factors of safety were compared when evaluating adequacy of the design feature and design criteria.*

*Explain the appropriateness of computed factors of safety and their physical significance in the context of the analysis methods used.*

*Explain the effects of assumptions inherent in the method of analysis used on the resulting margins of safety.*

2. *Provide revised Tables 3-2 and 3-4 to include revised safety factor information and/or revised values under the "Design Criteria" column (Table 3-2) and "Design Criteria", "Projected Performance", and "Safety Factor" columns (Table 3-4) that: (1) are consistent throughout the tables; and (2) contain or clearly reference, in all cases, explanatory text describing what each calculated safety factor value (Table 3-4) represents, both in terms of the specific parameters included in the safety factor ratio and the physical meaning/significance associated with each resulting safety factor value presented; and (3) provide information that is currently missing (e.g., empty cells in Table 3-4 under "Safety Factor" column for the Required Function "Ensure Structural Stability" of the "Cover" Principal Design Feature. Provide additional explanation(s) in the CAW LAR text as necessary to describe the safety factor information provided in Tables 3-2 and 3-4.*

**Energy*Solutions*' Response:** The Division has accepted the approach and minimum factors of safety reported in Table 3-4 over Energy*Solutions*' multiple licensing actions (since the 2000 Class B& C License Application). The safety factor against frost penetration, under abnormal conditions, has been reported as 1.03 since that time. Thus, the allegation that "…a factor of safety of 1.0 is not considered to be conservative…" is contrary to the accepted licensing basis for the facility. Furthermore, in the case of the frost penetration analysis, the evaluation that leads to the factor of safety of 1.03 considers temperatures that are considerably lower than the published 500-year return minimum average temperatures (see 2005 License Application Renewal, section 3.3.3.1.4). Energy*Solutions* notes that a less-conservative way of calculating frost depth would inflate the factor of safety that could be reported in table 3.4; however, the issue does not impact the ability of the embankment to withstand frost penetration under reasonably-foreseeable worst case conditions throughout the period of performance.

Information has been updated in Table 3-4 for the Required Function "Ensure Structural Stability" of the "Cover" Principal Design Feature.

## 11. INTERROGATORY CAW R313-25-8(4)-11/1: TECHNICAL ANALYSIS - ROCK COVER DESIGN AND ROCK COVER DESIGN CALCULATIONS/ ANALYSES

**Regulatory Reference:** R313-25-8(4). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:**

1. *Refer to Sections 3.0, 3.1.2, 3.2.2, and Tables 3-2 through 3-4 of the Class A West (CAW) Embankment License Amendment Request (LAR), and Drawings 10014 C01 and 10014 C04 of the CAW LAR: To account for the longer top-slope and side-slope lengths of the proposed CAW Embankment compared to those in the current Class A and Class A North Embankment, the LLRW Embankment, and the "Western LARW Cell", and to account for information contained in recently published studies on the performance of rounded riprap vs. angular riprap under overtopping conditions, please provide a revised set of Rock Cover Design Calculations that are specific to the currently proposed cover system for the Class A West Embankment that demonstrate conformance of the CAW Embankment cover system design with applicable design criteria contained in NUREG-1623 (NRC 2002) and NUREG/CR-4620 (Nelson et al. 1986) and in documents referenced therein and in other recently issued, relevant information (e.g., Abt et al. 2008; Tamagni 2010) that builds on the guidance provided in NUREG-1623 and NUREG/CR-4620*

**Energy*Solutions*' Response:** Rock Cover Design Calculations (included as Attachment 10 of the Class A West License Amendment Request) have been made using the method described in NUREG-1623. Additional analyses for rounded rock have been made using the equations in Abt (2008). These calculations are provided in "Class A West (CAW) Rock Cover Design Calculations" dated October 19, 2011, included as Attachment 10 to the Amendment Request.

**Division's Interrogatory Statement:** *Provide updated calculations that:*

- *Clearly describe the degree of roundness or angularity and the coefficient of uniformity of the rock materials (esp. for round-shaped riprap) to be used in constructing the riprap and granular filter layer material layers in the CAW Embankment cover as shown on Drawings 10014 C01 and 10014 C04 of the CAW LAR*

**Energy*Solutions*' Response:** The coefficient of uniformity is addressed in the Rock Cover Design Calculations. In accordance with Abt (2008), the degree of roundness is a qualitative parameter and is addressed using the coefficient of uniformity in the revised calculations for rounded rock

**Division's Interrogatory Statement:**

- *Explicitly and quantitatively account for the specific dimensions, slope inclinations, and granular size, angularity or roundness, as applicable, and coefficient of uniformity of any round-shaped materials to be used in these proposed cover system layers.*

**Energy*Solutions*' Response:** The Rock Cover Design Calculations explicitly incorporate the Class A West dimensions, slopes, material gradations and coefficients of uniformity.

**Division's Interrogatory Statement:** *Demonstrate that the most appropriate methodology (e.g., Leps 1973; Abt et al. 1991) is used for estimating interstitial velocities within the Type A Filter Zone layer for assessing the potential for internal erosion (e.g., erosion of the underlying sacrificial soil layer materials) that considers the final proposed gradation of the Type A Filter Zone layer material (e.g., that may categorize the material as a rock fill material rather than an earthen fill material (based on criteria presented in Leps 1973 as discussed in Nelson et al. 1986 and referenced in Section 2.1 of Appendix D of NUREG-1623 (NRC 2002))*

**Energy*Solutions*' Response:** Section 3.0 of the Rock Cover Design Calculations describes an analysis of interstitial velocities in the Type A Filter Zone using the Leps 1973 method - as described in NUREG/CR-4620. The conservative nature of this analysis belies the need to examine further methodologies. The Leps calculation provides a worst-case turbulent flow in the rock at the surface of the sacrificial soil; the fact that the rock may be more of an earthen fill material means that the interstitial velocity will be less than this worst-case turbulent flow condition.

**Division's Interrogatory Statement:**

- *Demonstrate that the most appropriate methodology (e.g., Equation D-1 in Appendix D of NRC 2002 rather than Equation 4.44 of Nelson et al. 1986) is used for estimating the time of concentration for use in estimating the rainfall intensity and rainfall depths for the proposed final rock riprap layer material, and*

**Energy*Solutions*' Response:** Equation D-1 in Appendix D of NUREG-1623 has been used in the Rock Cover Design Calculations.

**Division's Interrogatory Statement:**

- *Discuss and justify the need to oversize rock to be used for constructing the riprap layer based on its degree of roundness, taking into account recently published information.*

**Energy*Solutions*' Response:** The Rock Cover Design Calculations confirm that the rock meets the criterion of the guidance document, even considering rounding of the rock; therefore, no oversizing is necessary.

**Division's Interrogatory Statement:**

2. *Refer to 3.0, 3.1.2, 3.2.2, and Tables 3-2 through 3-4 of the Class A West (CAW) Embankment License Amendment Request (LAR), and Drawing 10014 C04 of the CAW LAR:*

- *Please provide additional information to justify the adequacy of the proposed thickness of 6 inches for the Type A Filter Zone Layer underlying the proposed 18-inch-thick riprap layer in the CAW Embankment cover. Discuss and justify the proposed 6 inch-thickness relative to the criteria provided in NUREG/CR-4620 (Nelson et al. 1986) that such a filter "should not be less than 6 to 9 inches thick…[with] filter thicknesses one-half the riprap layer thickness recommended".*

**Energy*Solutions*' Response:** As stated in the interrogatory, the guidance document states that the filter layer "should not be less than 6 to 9 inches thick." The design Type A Filter Layer, placed at a thickness of 6-inches, meets this criteria. The test of the applicability of the filter material is with the $D_{15}/D_{85}$ ratios as described in Section 4.4 of NUREG/CR-4620. In general, the suggested criteria is that the $D_{15}$(riprap) to $D_{85}$(filter/base) be less than five. From the information provided in the Rock Cover Design Calculations, this ratio is 0.52 for the top slope and 0.19 for the side slope, yielding safety factors of 9.6 and 26.3 when compared with the ratio criteria of five. Furthermore, the Type A Filter Layer has a maximum size of 6-inches, exceeding the recommended maximum size of 3-inches; thereby providing a more stable base (however, the maximum 3-inch size is recommended in order to minimize segregation and bridging of large particles during placement of the rock – proper Quality Control testing of the placed rock found in the CQA/QC, Work Element – Filter Zone, Specification "Placement" obviates the need for that recommendation). Due to the high safety factor of the gradation ratios and the larger rock size, the 6-inch thick filter layer is adequate for stability of the rock cover and it is not necessary to meet the further recommendation that the filter layer thickness be half the riprap layer thickness.

**Division's Interrogatory Statement:**

- *Revise the design of the ditch outer slope (Detail 3 on Sheet C04) to be compatible with the specified gradation of the Type A riprap materials and to be consistent with guidance provided in NUREG-1623 (NRC 2002). Revise the design of the side-slope (detail 1), top slope (detail 2), and shoulder (detail 4) and the ditch outer slope (detail 3) to be consistent with guidance provided in NUREG-1623 (NRC 2002). Detail 3 shows a 12-inch thick layer of "Type A" riprap on the ditch outer slopes whereas the D100 of the Type A Riprap is*

*specified to be 16 inches. Details 1, 2, 3, and 4 show a 6-inch-thick "Type A" filter zone layer on the cover side-slope, top slope, ditch outer slope, and shoulder, respectively, where the D100 of the "Type A filter zone" material is specified to be 6 inches. Revise the design of these layers as needed (or, alternatively, provide justification to support otherwise) to be consistent with NRC 2002 guidance (Section 3.2.4 of Appendix F) which recommends that: (1) no individual piece of riprap be greater in size than 90 percent of the riprap layer thickness; (2) filter zone material used as bedding material beneath a riprap layer typically have a D100 of approximately 3 inches; and (3) Riprap having a D100 of 16 inches (i.e., the proposed "Type A Riprap" for the CAW Embankment) be instead referred to as a "Type D" riprap rather than as a "Type A" riprap.*

**Energy*Solutions*' Response:** Based on the discussions above as well as the results within the Rock Cover Design Calculations, no re-design is necessary for the top slope, side slope, or shoulder of the Class A West Embankment. The outer slope of the drainage ditch is being re-designed to a Type A riprap thickness of 18-inches. This is shown in drawing 10014-C04, revision 1.

The riprap maximum size guidance within Section 3.2.4 of NUREG-1623 conflicts with the guidance given in Section 2.1.2 of that document which allows a minimum layer thickness up to the maximum size of the stone ($D_{100}$). Energy*Solutions* uses this latter criterion in the design of the riprap.

NUREG-1623 suggests that the bedding material beneath the riprap layer have a $D_{100}$ of 3-inches. The basis for this recommendation is so that segregation and bridging of large particles is minimized during placement of the material. Quality control requirements in Work Element – Filter Zone, Specification "Placement" of the CQA/QC provide for inspection of placed rock material that ensures the placed rock will be uniform, without segregation and bridging of large particles. Therefore, the basis for the recommendation is satisfied.

The designation of the Type A riprap material is local and consistent with other embankments and design information at Clive. It would be confusing and is not necessary to change this designation to match guidance document designations as long as it is clearly defined.

## 12. INTERROGATORY CAW R313-25-8(4)-12/1: TECHNICAL ANALYSIS - FILTER STABILITY/ FILTER PERMEABILITY CRITERIA

**Regulatory Reference:** R313-25-8(4). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:** *Refer to Sections 3.0, 3.1.2, 3.2.2, and Tables 3-2 through 3-4 of the Class A West (CAW) Embankment License Amendment Request (LAR), Attachment 3 (Class A West Disposal Cell Infiltration and Transport Report, April 19, 2011), to the CAW LAR, and Drawing 10014 C04 of the CAW LAR:*

1. *To account for the longer top-slope and side-slope lengths of the proposed CAW Embankment compared to those in the current Class A and Class A North Embankment, the LLRW Embankment, and the "Western LARW Cell", and to account for changes in cover material characteristics, as applicable, resulting from additional analyses performed in response to other interrogatory items in these Round 1 Interrogatories (e.g., see also Interrogatory CAW R313-25-8(4)-11/1: Technical Analysis - Rock Cover Design and rock cover design Calculations/ Analyses), provide an appropriate calculation to demonstrate that any granular layers in the proposed final cover system that have a relatively high assumed steady-state saturated hydraulic conductivity (permeability) value or for which infiltration simulation results suggest that the layer is acting as a lateral drainage layer satisfy pertinent filter design criteria (e.g., Bertram 1940; NRCS 1994[e.g., Table 26-3]). Include in the calculation applicable filter design criteria related to permeability for ensuring that the layer(s) will retain sufficient permeability over the long term following facility closure and stabilization to prevent development of large seepage forces and hydrostatic pressures in the layer(s).*

**Energy*Solutions*' Response:** Section 4.0 within the Rock Cover Design Calculations (Attachment 10 of the Amendment Request) describes gradation criteria for the lateral drainage layer (Type B Filter Layer). Refer to that document for specific information. The Type B Filter and Sacrificial Soil Layer design specifications described on drawing 10014-C04 ensure that these gradation criteria will be met and that the lateral drainage layer will not be compromised throughout the life of the Class A West Embankment.

**Division's Interrogatory Statement:**

2. *Provide a set of calculations to demonstrate, for the proposed final layer materials and material properties for the cover system layers that final gradations proposed for the various adjacent layers meet all applicable published recommended filter stability requirements. Include consideration of filter criteria for preventing migration of granular materials into an adjacent coarser grained granular layer (e.g., Nelson et al. 1986, Equation 4.35); for preventing piping of finer grained cohesionless soil particles*

*into an adjacent coarser-grained material layer (e.g., Cedegren 1989, Equation 5.3); and for preventing erosion of a finer-grained material layer from occurring over the long term as a result of flows in an adjacent coarser (filter zone) layer (e.g., Nelson et al. 1986, Equation 4.36). Include consideration of different specific filter stability criteria (e.g., NRCS 1994, Tables 26-1 and 26-2) for determining the maximum allowable D15 of a granular filter layer material for preventing erosion of any adjacent layer (e.g., sacrificial soil layer) consisting of fine-grained/finer-grained particles, as a function of soil type. Account for changes, if any, in any proposed material gradations that may result from analyses performed in response to other interrogatory items in these Round 1 Interrogatories, as appropriate.*

**Energy*Solutions*' Response:** The Rock Cover Design Calculations included as Attachment 10 to the Class A West License Amendment Request demonstrate that final gradations proposed for the final cover system meet applicable published recommended filter stability requirements.

## 13. INTERROGATORY CAW R313-25-8(4)-13/1: TECHNICAL ANALYSES-PERIMETER DRAINAGE DITCH CALCULATIONS

**Regulatory Reference:** R313-25-8(4). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:** *Refer To Sections 3.0, 3.1.5, 3.2.5, and Tables 3-2 through 3-4 of the Class A West (CAW) Embankment License Amendment Request (LAR), Attachment 4 (Clive Facility Total Ditch Flow Calculations) to the CAW LAR, and Drawing 10014 C03 of the CAW LAR:*

1. *Please provide a revised "Clive Facility Total Ditch Flow Calculations" package that calculates the 25-year and 100-year peak flow rates using the Rational Method or another standard engineering methodology. If the Rational Method is used please follow standard methodology:*
    a. *The rational formula is correctly referenced on Page 28 of 30 as Q=CiA*
    b. *Delineate watershed area (A); this seems to have been calculated correctly in Section 5 but for the Rational Method the area (A) should use acres for units instead of square feet.*
    c. *Calculate the time of concentration for each watershed using any of the standard time of concentration methods applicable.*
    d. *Using the time of concentration and the recurrence interval (i.e. 25-year or 100-year). Look up the intensity on a table, interpolate values as necessary. NOAA Atlas 14 intensity values can be found using the latitude and longitude for the site at this*

*website http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ut. The units for intensity for this method are inches/hour. Use NOAA Atlas 14 as the reference source since NOAA Atlas 14 supersedes and replaces NOAA Atlas 2.*

*e. The C value can be looked up in a table as was done on Page 8 of 30.*

**Energy*Solutions*' Response:** Revised Drainage Ditch Calculations dated October 18, 2011 are provided in Attachment 4 of the Amendment Request. The revised calculations utilize the methodology presented in NUREG-1623 and NUREG/CR-4620. All items within this interrogatory statement are addressed in these revised calculations. Section 3.2.5 of the Amendment Request has been revised as a result of the calculations provided in Attachment 4.

**Division's Interrogatory Statement:**

*2. Please provide a revised "Clive Facility Total Ditch Flow Calculations" package that calculates the capacity of the ditches to safely pass the 25-year and 100-year peak flow rates using the Manning's Equation or another standard methodology. Use the correct trapezoidal geometry of the ditch including the 15.3' minimum bottom width referenced on Drawing 10014-C03. Check the water surface elevations and freeboard in the ditches around the 90 degree bends, water may superelevate and increase water surface elevations. Please provide a determination of the required riprap sizes for the drainage ditches, completed in accordance with the methods recommended in NUREG-1623 (NRC 2002). Provide calculations that demonstrate that rock sizes in the rock riprap materials lining the perimeter drainage ditches will be adequate to withstand anticipated peak flood-flow-induced shear stresses. Provide information that demonstrates that the specific rock riprap materials proposed for use in the drainage ditches and in any other "critical areas" as defined in Section 7.2 of Appendix D of NUREG-1623 will satisfy minimum recommended rock quality criteria for such materials (refer also to Items 2 and 3 in Interrogatory CAW R313-25-7(7)-05/1: Specific Technical Information -- Closure Plan with regard to rock borrow sources)*

**Energy*Solutions*' Response:** The noted 15.3 foot dimension is the minimum distance from the toe of waste to the centerline of the ditch, not necessarily the minimum bottom width of the ditch. Revision 1 of drawing 10014C03 details the ditch minimum bottom width dimensions as 14 feet. The revised Drainage Ditch Calculations dated October 18, 2011 in Attachment 4 uses the minimum 14 foot base trapezoidal geometry throughout. Super-elevation of the water around bends has been calculated in these revised calculations. The revised calculations also determine the appropriate size of riprap necessary to adequately armor the ditches. Shear stresses within the ditches have been calculated and are provided as well.

Regarding the rock quality criteria, Section 7.2.2 of Appendix D of NUREG-1623 defines "critical areas" as "frequently saturated areas, all channels, poorly-drained toes and aprons, control structures, and energy dissipation areas." The guidance also defines

non-critical areas as "occasionally-saturated areas, top slopes, side slopes, and well-drained toes and aprons." As the ditches surrounding the embankments rarely maintain water for extended periods of time, they fit into the "occasionally saturated areas" and/or "well-drained toes and aprons" definitions and may therefore be considered non-critical areas. The guidance document states that non-critical areas require a rock score of at least 50 to be acceptable. Within the CQA/QC Plan, Work Element - Rock Erosion Barrier, Specification "Quality of Rock", states that the rock must have a "Rock Quality" score of at least 50 to be acceptable. Therefore, the rock meets the criterion discussed in the guidance.

Additionally, the guidance of NUREG-1623 suggests that the rock be oversized by the percentage difference between the actual rock score and 80. This would mean that the rock would need to be able to be oversized by at least 30% (80-50) from the calculated required rock size. As calculated in the revised Drainage Ditch Calculations, the worst-case required rock size is a $d_{50}$ of approximately 0.7 inches and the actual design rock has a $d_{50}$ of 4.5 inches. Therefore, the necessary over sizing is already inherent in the design of the rock.

**Division's Interrogatory Statement:**

3. *Please provide information that supports the appropriateness of using the Abt et al. 1988 equation in Section 1 for computation of the Manning's n value for the various ditches (for comparing with the literature-based value of n chosen for use in this calculation package) and using Eq. 4.44 from NUREG/CR-4620 (Nelson et al. 1986) for calculating the time of concentration (tc) values in Section 7 (Peak Run-off Rate) for the different sections of the various embankment ditches. Alternatively, provide revised calculations using recommended alternative methods.*

**Energy*Solutions*' Response:** More appropriate equations have been used and referenced in the revised Drainage Ditch Calculations (provided as Attachment 4 to the Amendment Request).

**Division's Interrogatory Statement:**

4. *Please provide information demonstrating that rock riprap sizes at ditch corners will be adequate to withstand possibly higher peak flood flow-induced shear forces that may occur at those locations, as per the guidance provided in NUREG-1623.*

**Energy*Solutions*' Response:** An analysis of shear stresses around corners has been completed in the revised Drainage Ditch Calculations (provided as Attachment 4 to the Amendment Request). The required size of the riprap rock has been calculated based on these shear stresses.

**Division's Interrogatory Statement:**

5. *Please provide a revised Drawing 10014 C03, as required, showing the final riprap size requirements for the perimeter ditches.*

**Energy*Solutions*' Response:** As demonstrated in the Drainage Ditch Calculations, the currently designed riprap meets all criteria; therefore, redesign of this element is not necessary.

**Division's Interrogatory Statement:**

6. *In Section 3.2.5, please correct what appears to be a typographical error (reference to Attachment 45) or provide Attachment 45. Explain why the values reported for the Class A embankment are relevant to the request to construct and operate the CAW.*

**Energy*Solutions*' Response:** The Attachment 45 reference was a typographical error. The reader of the Class A West License Amendment Request should have been directed to Attachment 4. Section 3.2.5 has been changed accordingly.

With respect to answering the Division's interrogatory requiring Energy*Solutions* to explain, "why the values reported for the Class A Embankment are relevant to the request to construct and operate the CAW," it should be noted that referencing Section 3.1.4 of Energy*Solutions*' 2005 Radioactive Material License Renewal Application (LRA) does not compare drainage values of the Class A Embankment to values generated for the Class A West Embankment. Rather, this reference sets forth the following design criteria (not design values) for the drainage system:

1) Facilitate flow of precipitation away from the embankment;
2) Minimize infiltration under flood conditions; and,
3) Ensure ditch integrity.

The values generated in Attachment 4 of Class A West License Amendment Request seek to ensure that the design criteria above are met. These design criteria are pertinent to the Class A West design and have been evaluated specific to this design.

In order to eliminate the potential for confusion, reference to Section 3.1.4 of the 2005 LRA has been deleted from Section 3.2.5 of the Amendment Request.

## 14. INTERROGATORY CAW R313-25-8(4)-14/1: TECHNICAL ANALYSES – INFILTRATION AND TRANSPORT MODELING: CLIMATE CONDITIONS, ENGINEERED BARRIER CONDITIONS, AND VERTICAL TRANSPORT DISTANCE

**Regulatory Reference:** R313-25-8(5). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:** *Reference Sections 3.1.1, 3.1.2, 3.2.1, and 3.2.2 and Tables 3.2 through 3.4 of the CAW LAR, and Section3.2 and Table 14 of the April 19, 2011 (Whetstone Associates 2011) CAW Cell Infiltration and Transport Modeling Report:*

1. *Provide additional information and rationale to support the selection of a range of climate conditions (e.g., precipitation conditions) to demonstrate that the climatic regime(s) used for modeling infiltration through the cover system bounds the range of uncertainties associated with potential climatic conditions that may occur over the CAW Embankment's performance period.*

   *Provide a revised vertical fate and transport discussion and findings as needed based on the final selected range of climate conditions. Include sensitivity analyses, as appropriate, to demonstrate the sensitivity of infiltration results to changes in the input climate parameters.*

2. *Provide a discussion, with supporting rationale, regarding potentially degraded conditions in the engineered barrier(s), including the radon barrier layer, in the CAW Embankment cover system that are important to the long-term performance of the CAW Embankment.*

   *Provide results of infiltration performance analyses incorporating such degraded conditions into the modeling simulations. Alternatively, provide detailed justification why consideration of such degraded engineered barrier conditions in the infiltration simulations is not required.*

**Energy*Solutions*' Response:** Please refer to sensitivity analyses performed as part of previous infiltration and transportation modeling (Adrian Brown Consultants, 1997).

The following sensitivity analyses have been performed for infiltration and transporting modeling of existing and proposed Clive facility embankments:

1) HELP infiltration model sensitivity analysis of wind speed, evaporative zone depth (EZD), increased precipitation, upper radon barrier thickness, freeze/thaw (sacrificial) layer thickness, waste layer thickness, and filter layer hydraulic conductivity. - Final Report on LARW Infiltration Modeling Input Parameters and Results (Adrian Brown Consultants, 1997).
2) Infiltration rate sensitivity analysis of the effect of varying the EZD and degrading the upper radon barrier - 11e.(2) Disposal Cell Infiltration Modeling Input Parameters and Results (Adrian Brown Consultants, August 20, 1997).
3) Infiltration rate sensitivity analysis of the impact of precipitation variation and a 100-fold increase in side-slope cover permeability - Revised Western LARW Cell Infiltration and Transport Modeling (Whetstone Associates, 2000a).
4) Sensitivity of infiltration rates to the variation in precipitation rates - Class A, B, & C Cell Infiltration and Transport Modeling (Whetstone Associates, 2000b) and

11e.(2) Disposal Cell Infiltration and Transport Modeling Report (Whetstone Associates, 2001).

5) Sensitivity of infiltration rates to variation in the thickness of the Type B filter layer in the cover - Class A Combined (CAC) Disposal Cell Infiltration and Transport Modeling Report (Whetstone Associates, May 2006) and Class A South Cell Infiltration and Transportation Modeling (Whetstone Associates, December 7, 2007).

Because these sensitivity analyses all inform the modeling approach employed and have been accepted by the Division, it is not necessary to repeat these sensitivity analyses in the Class A West modeling.

**Division's Interrogatory Statement:**

*3. Provide an explanation, with supporting rationale, for selecting an appropriately conservative (i.e. shallow) average elevation of the groundwater surface beneath the CAW Embankment footprint for use in the infiltration and transport calculations/modeling.*

**Energy*Solutions*' Response:** Please see the response to Interrogatory R313-25-7(1)-02/1

**Division's Interrogatory Statement:** *Demonstrate how historical fluctuations in the freshwater head levels in groundwater, in response to historical changes in weather conditions, were taken into consideration in the selection of the groundwater elevation used for calculating the vertical distance between the base of the clay liner and the groundwater surface (See also Interrogatory R313-25-7(1)-01/1: Specific Technical Information – Groundwater Elevation Value(s) used in Analyses, and Interrogatory R313-25-8(4)-07/1: Technical Analyses – Groundwater Depth in Geotechnical Stability Analysis ). Provide information on the relationship of changes in climate conditions (e.g., precipitation levels) to groundwater recharge and resulting groundwater elevations over the same periods of time in the area of the CAW cell.*

**Energy*Solutions*' Response:** Measured pan evaporation rates for Clive, 16-year average of 52.52 inches per year greatly exceed the 16-year average precipitation rates of 8.56 inches per year (Meteorological Solutions Inc, 2011). Per Gates (1984), direct recharge by infiltration of precipitation in low-lying basin areas is probably minor because evapotranspiration consumes the precipitation. As stated in response to Interrogatory R313-25-7(1)-02/1, both the infiltration and transport modeling and geotechnical stability analysis are conservative with respect to groundwater elevation.

**Division's Interrogatory Statement:** *Demonstrate that the average groundwater elevation selected is representative of anticipated future conditions during the required performance period of the CAW Embankment and/or provide a range of average*

*groundwater elevation values that bounds the range of uncertainties associated with potential groundwater fluctuations over the performance period.*

**Energy*Solutions*' Response:** See response above. Also, see the response to Interrogatory R313-25-7(1)-02/1 - adding the capillary fringe (2.04 ft) to the average groundwater elevation conservatively decreases the vertical transport distance by 0.44 ft more than using the maximum observed groundwater elevation for wells associated with the Class A and Class A North embankments.

**Division's Interrogatory Statement:** *Provide a revised vertical fate and transport discussion and findings as needed based on the final selected average groundwater elevation. Include sensitivity analyses, as appropriate, to demonstrate the sensitivity of transport results (e.g., travel time) to changes in the average groundwater elevation.*

**Energy*Solutions*' Response:** Not necessary, vertical transport is conservative with respect to vertical transport distance and travel time.

## 15. INTERROGATORY CAW R313-25-8(4)-15/1: TECHNICAL ANALYSES – GROUNDWATER DEPTH IN GEOTECHNICAL STABILITY ANALYSIS

**Regulatory Reference:** R313-25-8(5). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:** *Reference Sections 3.1.1 of the CAW LAR, and Section 2.2.3 of Attachment 5 (Geotechnical Update Report, EnergySolutions Clive Facility Class A West Embankment (AMEC 2011): Please provide the following:*

1. *Provide a revised stability analysis as needed to reflect the results of additional evaluations and analyses performed in response to other interrogatory items in these Round 1 Interrogatories (see Interrogatories R313-25-7(1)-01/1: Specific Technical Information – Groundwater Elevation Value(s) used in Analyses, and R313-25-8(4)-06/1: Technical Analyses – Infiltration and Transport Modeling: Climate Conditions, Engineered Barrier Conditions, and Vertical Transport Distance). Demonstrate that the average groundwater elevation selected for use in this analysis is representative of anticipated future conditions during the required performance period of the CAW Embankment and/or provide a range of average groundwater elevation values that bounds the range of uncertainties associated with potential groundwater fluctuations over the performance period. Provide a revised stability analysis as needed based on the final selected average groundwater elevation. Include sensitivity analyses, as*

*appropriate, to demonstrate the sensitivity of the stability analysis results to changes in the average groundwater elevation.*

**Energy*Solutions*' Response:** See responses to Interrogatories R313-25-7(1)-02/1 and R313-25-8(4)-14/1. A revised analysis is not needed.

**16. INTERROGATORY CAW R313-25-8(4)-16/1: SEISMIC HAZARD EVALUATION / SEISMIC STABILITY ANALYSIS UPDATE**

**Regulatory Reference:** R313-25-8(5). Analyses of the long-term stability of the disposal site shall be based upon analyses of active natural processes including erosion, mass wasting, slope failure, settlement of wastes and backfill, infiltration through covers over disposal areas and adjacent soils, and surface drainage of the disposal site. The analyses shall provide reasonable assurance that there will not be a need for ongoing active maintenance of the disposal site following closure.

**Division's Interrogatory Statement:**

1. *Refer to Sections 2.3.2, 3.1.3, 3.2.3, and 6.3.2 of the Class A West (CAW) Embankment License Amendment Request (LAR); Sections 2.1, 3.3, 4.5, and 5 of Attachment 5 (Geotechnical Update Report, EnergySolutions Clive Facility Class A West Embankment, Clive, Toole County, Utah, February 15, 2011) to the CAW LAR; and Appendix A (Update of Seismic Design Parameters for Envirocare of Utah Facility) to Attachment 5:*
   - *Please update the information, analyses, and results related to the selection of appropriate seismic design criteria, the seismic hazard evaluation, and seismic stability analysis results as presented in these CAW LAR sections and Attachment 5 and Appendix A to relevant information contained in several updated published articles and reports regarding seismic hazard evaluation methodologies, fault data, ground-motion prediction models (including Next Generation of Attenuation [NGA] relations), and other parameters that are relevant the analyses presented and described in Attachment 5 and Appendix A thereto. See "Basis for Interrogatory" below for a further discussion of selected relevant updated information that should be reviewed and applied as appropriate to the subject CAW LAR evaluations and analyses.*

**Energy*Solutions*' Response:** Information has been reviewed and an analysis performed. The results of said analysis are provided as an addendum to Attachment 5 of the Amendment Request. No technical changes were required as a result of the analysis performed.

**Division's Interrogatory Statement:**

- *Please provide a description of the location(s) and characteristics of any recently discovered faults in the region, such as the Carrington fault, that were not*

*considered in the AMEC 2011 Geotechnical Update Report, and discuss the affect, if any, of such fault(s) on the updated seismic hazard evaluation results.*

**Energy*Solutions*' Response:** Descriptions of locations and characteristics of faults in the region, such as the Carrington fault, have been provided in Appendix A of Attachment 5 to the Amendment Request.

**Division's Interrogatory Statement:**

2. *Refer to Sections 2.1, 2.2, and Appendix A of Attachment 5 (Geotechnical Update Report, EnergySolutions Clive Facility Class A West Embankment, Clive, Toole County, Utah, February 15, 2011) to the CAW LAR; and Appendix A (Update of Seismic Design Parameters for Envirocare of Utah Facility) to Attachment 5:*
   - *Please also revise Attachment 5 of the Geotechnical Update Report, EnergySolutions Clive Facility Class A West Embankment, Clive, Toole County, Utah, February 15, 2011 to reflect the following apparent errors and/or inconsistencies:*
     - ✓ *In reference to page 5, paragraph 2, last line states "recurrence interval". Please change to "return period".*

**Energy*Solutions*' Response:** Requested change has been made.

**Division's Interrogatory Statement:**

- ✓ *Page 7, paragraph 1, line 7, please revise "20,000 years" to "30,000 years"*

**Energy*Solutions*' Response:** Discussion of 20,000 years has been clarified.

**Division's Interrogatory Statement:**

- ✓ *Page 7, paragraph 1, line 9, states that the deposits of Unit 1 are "pre-Pleistocene". These deposits are not pre-Pleistocene and are likely associated with or are contemporaneous with the Little Valley Lake Cycle. Please correct as appropriate*

**Energy*Solutions*' Response:** Description of Unit 1 has been updated.

**Division's Interrogatory Statement:**

- ✓ *Notable references are missing from the reference list for this section. Please provide any missing references as necessary (e.g., Doelling et al., 1994, Panckow and Pechmann, 2004; and Swan et al., 2004)*

**Energy*Solutions*' Response:** Necessary references have been added to Appendix A.

**Division's Interrogatory Statement:**

- ✓ *In reference to Appendix A, page A-2, paragraph 1, the use of "line sources" should be referred to as "planes", since the USGS models faults as planes*

**Energy*Solutions*' Response:** Source geometry discussed in Appendix A has been clarified.

**Division's Interrogatory Statement:**

- ✓ *In Appendix A, revise Table A-2 or paragraph 3 on page A-7 or both to make them consistent. Several of the magnitude and ground motion values stated in the text do not match those listed in Table A-2 (e.g., M 7.1 for Skull Valley fault in text versus M 6.5 and M 6.8 in the table).*

**Energy*Solutions*' Response:** Table A-2 and Appendix A text has been revised.

## 17. INTERROGATORY CAW R313-25-24(1 THROUGH 3)-17/1: DISPOSAL SITE DESIGN FOR NEAR-SURFACE DISPOSAL - LINER DESIGN AND CONSTRUCTION

**Regulatory Reference:** R313-25-24(1) through (3):
(1) Site design features shall be directed toward long-term isolation and avoidance of the need for continuing active maintenance after site closure.
(2) The disposal site design and operation shall be compatible with the disposal site closure and stabilization plan and lead to disposal site closure that provides reasonable assurance that the performance objectives will be met.
(3) The disposal site shall be designed to complement and improve, where appropriate, the ability of the disposal site's natural characteristics to assure that the performance objectives will be met.

**Division's Interrogatory Statement:** *Refer to Section 1.3.1 of the CAW LAR and Drawings 10014 C01, 10014 C02 and 10014 C09 of the CAW LAR: Provide details defining how the liners under the Class A and Class A North Embankments will be joined , for both the clay subliner and the clay liner protective cover layers. Using engineering drawings, show limits and dimensions of existing liners and limits and dimensions of the proposed extended liner section between the existing embankments and north of the Class A North embankment. Define work processes that will be implemented in preparing the new liner location and in constructing the extended liner section and completing connections to the existing liners. Provide information on procedures and equipment to be used for removing overlying material as needed to uncover the existing liners, criteria that will be used to determine whether over excavation of any portion of the existing liners would be required prior to constructing the connecting liner extension and whether overlapping of compact clay layer material will be required at the liner junctures, information on proposed verification/testing methods to be used to demonstrate that the extended liner section has been bonded effectively and continuously to the existing liners to meet specified permeability*

*requirements along the length and margins of the liner connections, and procedures and equipment to be used for covering and protection of the connected liner sections until covered by additional materials. Provide additional information regarding the staging of and timeframes for placing protective cover materials over joined liner sections in proximity to ongoing waste disposal operations. Revise the CQA/CQC Manual as needed to incorporate additional information developed regarding the joining of these liner and liner protection systems.*

**Energy*Solutions*' Response:** Figure E has been developed and provided in Attachment 9 to the Class A West License Amendment Request to show the extents of completed Class A and Class A North liner, Class A West liner design limits, and areas where liner will need to be constructed. Reference to this Figure has been included in section 1.3.1 of the Class A West License Amendment Request. The construction of the remaining liner will be performed in multiple phases in the same manner as liner already completed in the Class A and Class A North embankments.

The logistics and method for constructing clay liner between the Class A and Class A North embankments and around the perimeter of the Class A North Embankment will be no different than that practiced over the last 10 years and as specified in the LLRW and 11e.(2) CQA/QC Manual. The clay liner constructed in the Class A and Class A North embankments has been completed through multiple phases of construction which have included and satisfied all of the elements identified in the interrogatory.

The current version (as well as the proposed revision; no changes are needed or proposed to CQA/QC specifications associated with this discussion) of the CQA/QC Manual contains specifications for preparing an area for liner construction (Work Element – Foundation Preparation) and clay liner construction (Work Element – Clay Liner Placement). The work element for clay liner placement includes specifications for connecting to existing liner (Specification "Keying-In"), protection of clay liner (Specification "Liner Drying Prevention"), and construction of liner protective cover (Specification "Liner Protective Cover").

## 18. INTERROGATORY CAW R313-25-24(5)-18/1: DISPOSAL SITE DESIGN FOR NEAR-SURFACE DISPOSAL - DRAINAGE JUNCTURE AND DRAINAGE OUTLET DESIGN FOR PERIMETER DRAINAGE DITCH SYSTEM

**Regulatory Reference:** R313-25-24(5). Surface features shall direct surface water drainage away from disposal units at velocities and gradients which will not result in erosion that will require ongoing active maintenance in the future.

**Division's Interrogatory Statement:** *Refer to Attachment 4 (Clive Facility Total Ditch Flow Calculations) to the CAW LAR, and Drawing 10014 C01 of the CAW LAR:*

1. *Please provide information and calculations that demonstrate that the surface water in the perimeter drainages surrounding the CAW Embankment will be conveyed and merge with the surface water flows in the 11e.(2) drainage ditch at the location shown on Drawing 10014 C01, and that surface water conveyed by the entire conceptual perimeter drainage ditch system shown in Figure 1 of the Clive Facility Total Perimeter Ditch Flow Capacity" calculation package will be discharged in such a way that during operations, and after closure, discharge velocities and gradients will not cause excessive erosion to the drainage system components, or otherwise result in erosion that would require ongoing active maintenance in the future.*

2. *Please provide detailed drawings (plan sections and details) showing the design of the drainage juncture at the southeast corner of CAW Embankment and the design of the ultimate drainage outlet (drainage culvert, discharge apron, etc...) at the point of discharge of the perimeter drainage ditch system.*

**Energy*Solutions*' Response:**
Since the southwest corner of the 11e.(2) requires adjustment and two differing designs for the discharge at the southwest corner have been identified during a document search performed to prepare a response., the final design of the 11e.(2) culvert and its associated outlet at the southwest corner of Section 32 will be completed as part of the 11e.(2) redesign which is forthcoming in response to Interrogatory CAW R313-25-7(2)-03/1, Item 4. The revised Drainage Ditch Calculations (Attachment 4 to the Amendment Request) demonstrates design feasibility by computing the required culvert size to accommodate peak runoff from the facility. As this component is not completely designed yet, rock layering of the outlet channel, and erosion calculations have not been performed at this time. The drawing and erosion calculations will be completed, and provided to the Division of Radiation Control for review and approval, prior to construction of the final outlet culvert.

Details of the drainage juncture (culvert) between the Class A West and 11e.(2) drainage systems are provided in Drawing 10014 C03, Revision 1 (See Attachment 2 to the Amendment Request). Flow calculations to ensure the design will accommodate the peak runoff from the Class A West drainage area are provided in the revised Drainage Ditch Calculations dated October 18, 2011 (Attachment 4 of the Class A West License Amendment Request).

**Division's Interrogatory Statement:** *Demonstrate that the ditch design ensures that any concentrated, severe peak storm-induced flows from runoff from the CAW Embankment will be accommodated by the receiving 11.e(2) ditch segment without damage to these ditch systems.*

**Energy*Solutions*' Response:** The Drainage Ditch Calculations in Attachment 4 to the Class A West License Amendment Request demonstrate that the ditch design ensures that

severe peak storm-induced flows will be accommodated by the receiving 11e.(2) ditch segment without damage.

**Division's Interrogatory Statement:** *Demonstrate that an appropriately sized culvert (if required) and appropriately designed rock discharge apron are included at the ultimate outlet of the entire drainage system to prevent damage to the native ground surface and the outlet structures through scour, long-term headward gullying, or other erosion processes.*

**Energy*Solutions*' Response:** As described above, the final 11e.(2) outlet culvert design has not been completed yet; but will be included in a future submittal. As the design has not been completed yet, culvert sizing and outlet erosion calculations could not be completed at this time. Complete calculations will be provided to the Division of Radiation Control, for review and approval, prior to construction of the final outlet culvert.

## 19. INTERROGATORY CAW R313-25-25(6)-19/1: RADIATION DOSE RATE AT THE SURFACE OF THE COVER

**Regulatory Reference:** R313-25-25(6). Waste shall be placed and covered in a manner that limits the radiation dose rate at the surface of the cover to levels that at a minimum will permit the licensee to comply with all provisions of R313-15-105 at the time the license is transferred pursuant to R313-25-16.

**Division's Interrogatory Statement:** *Refer to Section 3.1.9 and Figure 1 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

1. *Confirm/revise and provide justification for the following parameter values used in MicroShield analyses:*
   - ✓ *Height and radius of 55-gallon drum*
   - ✓ *Dose points X, Y, and Z*
   - ✓ *Source dimension of 7.589 $ft^3$*
   - ✓ *Composition of Shield 3 (being clay and rock and not concrete as indicated)*
2. *Justify the choice of 11 Ci of Co-60 as the radioactive inventory of the 55-gallon drum modeled in the case reported.*
3. *Identify source conditions that would be required to produce MicroShield-projected dose rates at the cover surface that exceed stated regulatory limits.*
4. *Submit details of MicroShield analyses (revised, if necessary), including determinations of input parameter values.*

**Energy*Solutions*' Response:** UAC R313-15-301 requires that the dose rate at the surface of the completed embankment shall be less than 100 mrem total effective dose equivalent (TEDE) per year and ALARA. Abnormal conditions modeled in Section 3.1.9 consider effects of having a gamma source with a total activity of 11 curies (0.4 TBq) of

Co-60 at the top of the waste column. This activity was selected from DOT limits on package activity at 49CFR173.431 and the Table of A1 and A2 values for radionuclides at 49CFR173.435 (with the A2 value of 10.8 curie for Co-60 conservatively rounded upward). The A2 value represents an activity limit for DOT Type A packages; materials with higher activity would require special transportation equipment, such as shielded casks, etc.

Evaluation of an accident condition for reducing exposure to the general public is not addressed in Section 3.2 of NUREG-1199 (Nuclear Regulatory Commission, 1991). There is not a credible accident scenario that would cause exposure to the general public in excess of the evaluated abnormal condition. Normal conditions for this required function and design criteria were not assessed because the performance is bounded by the abnormal conditions analysis.

Potential external dose rates from gamma radiation were evaluated using the MicroShield® computer code. A generic 55-gallon drum (consistent with the numerous dimensions of 55-gallon drums currently in use for waste storage and disposal) containing a total activity of 11 curies was assumed to be placed on its side at top of waste, just below the Class A West cover. The cover consists of:

- Temporary cover – 1 foot depth
- 1E-6 radon barrier – 1 foot depth
- 5E-8 radon barrier – 1 foot depth
- Filter layer – 0.5 feet depth
- Sacrificial soil layer – 1 foot depth
- Filter layer – 0.5 feet depth
- Rip rap cover – 1.5 feet depth
- Total depth – 6.5 feet

An effective density of 1.6 g/cm$^3$ with a consistency and mineralogy of low density concrete was assumed. This density is conservative considering that each cover layer of cover will be compacted to greater than 95% standard Proctor density, as per the CQA/QC Manual. MicroShield® projected a contact dose rate on top of the completed cover of 3.75E-4 mR/hr. Multiplied over an entire year, this yields a dose rate of approximately 3 mrem.

## 20. INTERROGATORY CAW R313-25-26(1)-20/1: ENVIRONMENTAL MONITORING

**Regulatory Reference:** R313-25-26(1). During the land disposal facility site construction and operation, the licensee shall maintain an environmental monitoring program. Measurements and observations shall be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation of long-term effects and need for mitigative measures. The monitoring system shall be capable of providing early warning of releases of waste from the disposal site before they leave the site boundary.

**Division's Interrogatory Statement:** *Refer to Sections4.4.3 and 7.3.4 of the Class A West (CAW) Embankment License Amendment Request (LAR):*

1. *Justify the assertion that no additional monitoring of airborne radioactive materials is required to ensure adequate protection against the increased volume of LLRW proposed to be disposed of.*
2. *Update the Environmental Monitoring Plan (or Program) to reflect changes that will result from granting the requested CAW amendment request.*

**Energy*Solutions*' Response:** The following assumptions are used to justify the assertion that the current number of air monitoring stations is adequate to perform environmental monitoring for the Class A West Embankment:

1. The current, approved Environmental Monitoring Plan (EMP) is rigorous enough to monitor airborne dispersion from the Class A (CA) and Class A North (CAN) footprints; and,
2. EnergySolutions is not requesting an increase to the operating open cell areas provided at License Condition 11.

Please refer to Figure 1 below throughout the rest of this discussion. Figure 1 superimposes wind speed and direction data obtained from Energy*Solutions'* Clive-site weather station over the last 18 years, over the location proposed for the Class A West Embankment.

Given the predominant wind direction, any amount of airborne, radioactive particulate matter is expected to travel to the north, northeast. Air monitoring stations A-30, A-35, A-36 and A-1 are positioned to intercept airborne contamination that could potentially result from operations in the Class A West Embankment.

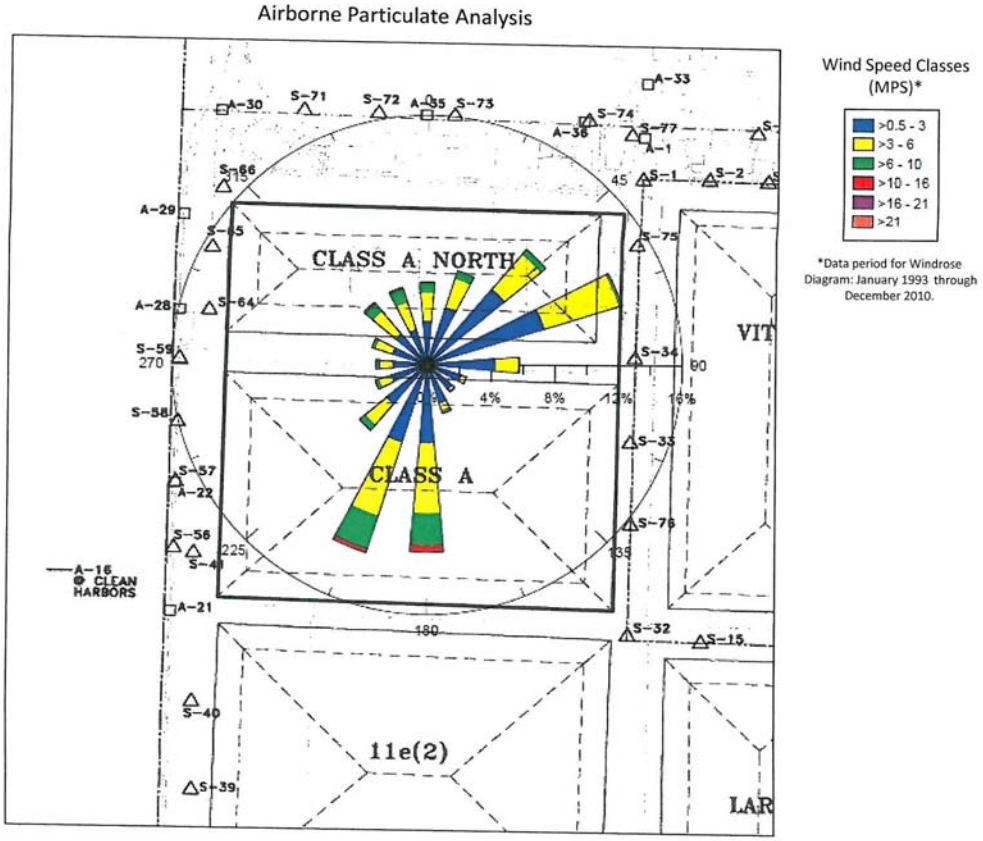


**Figure 1. Airborne Particulate Analysis**

Airborne contamination could reach the western fence line in any of the minor windrose directions despite the low wind velocities and infrequent occurrences; particularly if waste placement operations were occurring on the western edge of the Class A West Embankment. Under these circumstances, west-side placement of air stations A-29, A-28, and A-22 would intercept and alert environmental staff should airborne contamination be present. It should be noted that any contamination moving over the Class A Embankment or coming from the southern top slope of the proposed Class A West Embankment from the northeast, will be intercepted by A-22 and A-21.

The 35 mile-per-hour (mph), or 15.6 meters-per-second (mps), shut down requirement found in License Condition 53.D further supports the current EMP configuration for air monitoring. As detailed in License Condition 53.D, bulk waste handling ceases at the Clive facility when the 5-minute average wind speed reaches 35 mph.

There are no short or intermediate-term changes that need to be made to Energy*Solutions*' air monitoring network. As such, no revised EMP will be submitted at this time.

## 21. INTERROGATORY CAW R313-25-26 (2 AND 3)-21/1: TECHNICAL ANALYSES - HORIZONTAL TRANSPORT AND WELL SPACING ANALYSIS INPUT PARAMETERS

**Regulatory Reference:** R313-25-26(2). During the land disposal facility site construction and operation, the licensee shall maintain an environmental monitoring program. Measurements and observations shall be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation of long-term effects and need for mitigative measures. The monitoring system shall be capable of providing early warning of releases of waste from the disposal site before they leave the site boundary.

R313-25-26(3). After the disposal site is closed, the licensee responsible for post-operational surveillance of the disposal site shall maintain a monitoring system based on the operating history and the closure and stabilization of the disposal site. The monitoring system shall be capable of providing early warning of releases of waste from the disposal site before they leave the site boundary.

**Division's Interrogatory Statement:** *Refer to Sections 2.2, 3.1.1, and 4.4.3of the Class A West (CAW) Embankment License Amendment Request (LAR); Sections 3.5 and 6.2 of the April 19, 2011 (Whetstone Associates 2011) CAW Cell Infiltration and Transport Modeling Report,and Sections 3.1, 3.2, and 3.3 and Figure 1 of Attachment 6 (Clive Facility Well Spacing Evaluation Class A West Embankment, April 28, 2011) to the CAW LAR:*

1. *Provide information to justify the use of a 90 % confidence level hydraulic conductivity value in the MEMO Model in the Well Spacing Evaluation Report that is based on slug test data from wells that are completed (only) in the Unit 2 clay, in contrast to using a 90% confidence level hydraulic conductivity value in the horizontal transport analysis section of the Whetstone Associates (2011) CAW Cell Infiltration and Transport Modeling Report that is based on slug test data from well completed in the Unit 3 Sand.*

**Energy*Solutions*' Response:** All wells associated with the Class A and Class A North embankments screened at the water table in the shallow water-bearing zone were used in the statistical calculation of the hydraulic conductivity values used in the Class A West well spacing evaluation. There was no attempt to bias the calculation to a particular hydrostratigraphic unit.

The hydrostratigraphic units dip to the west, whereas the groundwater table dips more gradually to the east. As a result, the water table on west side of the Class A West footprint is within Unit 3 and within Unit 2 on the east side (refer to Hydrogeologic Cross Sections A-A', B-B', and G-G' of the Revised Hydrogeologic Report [Envirocare, 2004] for illustration).

Section 6.2.1 of the infiltration and transportation modeling report will be revised to correctly state that hydraulic conductivity used in the modeling was calculated from data

for Hydrostratigraphic Units 2 and 3. Hydraulic conductivity data from all water-table wells at the facility are used in the statistical calculation of hydraulic conductivity for the Class A West modeling. Data were not biased to a particular hydrostratigraphic unit.

**Division's Interrogatory Statement:** *Also provide information to the explain and justify the difference between each of these derived 90 % hydraulic conductivity values and the 90% confidence level aggregate hydraulic conductivity value that was used in a prior analysis (Whetstone Associates 2009 Well Spacing Evaluation for the EnergySolutions Class North Embankment) that was based on slug test data from wells completed in both the Unit 3 Sand and the Unit 2 Clay.*

**Energy*Solutions*' Response:** As stated above, the Class A West well spacing evaluation used all water-table wells associated with the Class A and Class A North Embankments for the calculation of hydraulic conductivity statistics. The well spacing evaluation for Class A North (Whetstone, 2009a) used all water-table wells associated with the Class A North Embankment. The Class A West well spacing evaluation followed the convention of the approved Class A North and Mixed Waste well spacing evaluations by using hydraulic conductivity data from all water-table wells associated with the embankment or proposed embankment. Thus, minor differences in hydraulic conductivity values used in each analysis reflect the specific water-table wells associated with each embankment evaluated.

**Division's Interrogatory Statement:** *Indicate, if applicable, why different assumptions would be warranted in these three different analyses, or alternatively, revise the two current analyses to use a consistent methodology and consistent assumptions, and provide justification for the final selected approach and final adopted hydraulic conductivity input value (or different values, if justified)for use in the analyses.*

**Energy*Solutions*' Response:** As stated above, the infiltration and transport model used data from all water-table wells at the facility, while the well spacing evaluation used data from water-table wells associated with the Class A and Class A North Embankments.

The average linear groundwater velocity for horizontal transport in the Class A West infiltration and transport modeling is 2.6E-06 cm/s (0.82 m/yr). The average linear velocity for horizontal transport in the Class A West well spacing evaluation ranged from 2.1E-06 to 6.7E-06 cm/s (0.67 to 2.1 m/yr) (Table 5). The velocities used for horizontal transport in the infiltration and transport model and in the well spacing evaluation base case are conservative. For this reason, differences in the hydraulic conductivity values are inconsequential. Please note, the low end of the average linear velocity range used in the well spacing evaluation approximates more realistic conditions for sensitivity analysis.

**Division's Interrogatory Statement:** *Include a summary of monitoring well completion details, information on the distribution of hydrogeologic units in relation to the expected groundwater flow paths involved in the analyses, and other information as needed to support and justify the appropriateness of the final hydraulic conductivity model input data.*

**Energy*Solutions*' Response:** This is beyond the scope of the analysis and not necessary given the discussion above. All wells used are water-table wells screening in the shallow water-bearing zone.

**Division's Interrogatory Statement:**

2. *Provide a revised Well Spacing Evaluation Report and/or revised CAW Cell Infiltration and Transport Modeling Report, as appropriate, reflecting use of the final selected approach and final adopted hydraulic conductivity input value(s).*

**Energy*Solutions*' Response:** Not necessary, see responses above.

**Division's Interrogatory Statement:**

3. *Provide a revised approach for estimating longitudinal dispersivity that is more in keeping with supporting information and available published data and interpretations.*

**Energy*Solutions*' Response:** Longitudinal dispersivity has been defined as 0.1 times the average horizontal transport distance in the following well spacing evaluations approved by the Division: 1) LARW Embankment (Adrian Brown Consultants, 1998), 2) Mixed Waste Embankment (Whetstone Associates, 2009a), and 3) Class A North Embankment (Whetstone Associates, 2009b). The Class A West well spacing evaluation did not repeat the details of dispersivity selection, since it was provided in the earlier approved reports.

Technical discussion of the relationship between flow path length, longitudinal dispersivity, and transverse dispersivity are provided by Gelhar (1992), Gelhar (1986), and Fetter (1993).

**Division's Interrogatory Statement:** *Derive, defend, and incorporate a revised longitudinal dispersivity (and revised transverse dispersivity) value into the well spacing evaluation.*

**Energy*Solutions*' Response:** Conservatism is built into the well spacing evaluation. A sensitivity analysis was performed using more realistic groundwater velocities. Because dispersion is a function of groundwater velocity, dispersion is less in the sensitivity analysis runs compared to the base case. Also, setting the source width at 1.0 foot is a very conservative assumption because any release from the bottom of the liner will tend to disperse laterally as it migrates vertically through the vadose zone to the water table.

As a check on well spacing sensitivity to dispersivity, the technetium-99 base case well spacing evaluation for the full Class A West footprint was re-run using a longitudinal dispersivity of 27.2 feet and a transverse dispersivity of 2.72 feet. The longitudinal dispersivity was calculated from an equation provided by Xu, and Eckstein, (1995). Their method applies a weighting scheme, based on reliability, to the field data reviewed by Gelhar et al. (1992). The base case monitoring efficiency was 96.3% (see Table 9). When the dispersivities were changed to those listed above, the monitoring efficiency was 94.2%. This sensitivity run was then modified further by changing the source width from 1 foot to 3 feet, and the resulting monitoring efficiency was 95.0%.

**Division's Interrogatory Statement:** *Alternatively, provide sensitivity analyses that incorporate a range of possible αx and transverse dispersivity values, to bound the uncertainties associated with the methodology used for estimating the αx parameter for use in the well spacing evaluation, to assess the sensitivity of the modeling results to changes in these dispersivity values.*

**Energy*Solutions*' Response:** Please see the response immediately above.

**Division's Interrogatory Statement:**

4. *Provide rationale for assuming a single location below the center of the top slope of the CAW Embankment for determining the distance to the nearest compliance well as a basis for estimating an appropriate value of longitudinal dispersivity for the well spacing evaluation.*

**Energy*Solutions*' Response:** The center of the top slope is an approximate average path length from the embankment to the compliance wells. This approach follows that of previous approved well spacing evaluations. For potential release points that are located closer to the compliance wells, dispersion will be less than for longer flow paths regardless of what value of longitudinal dispersion is used in the modeling.

**Division's Interrogatory Statement:**

5. *Demonstrate that why such an assumption would be conservative, e.g., rather than assuming another potential origin points within the CAW Embankment footprint for a potential release that would be located closer to the compliance monitoring wells and consequently exhibit less dispersion at the locations of some or all compliance monitoring wells. Demonstrate that the well spacing analysis approach and assumptions result in a reasonably representative estimation of αx and transverse dispersivity values for assessing the adequacy of the well spacing intervals.*

**Energy*Solutions*' Response:** For potential release points that are located closer to the compliance wells, dispersion will be less than for longer flow paths regardless of what value of longitudinal dispersion is used in the modeling.

**22. INTERROGATORY CAW R313-25-33(1)-22/1: RECORDS**

**Regulatory Reference:** R313-25033(1). Licensees shall maintain records and make reports in connection with the licensed activities as may be required by the conditions of the license or by the rules and orders of the Executive Secretary.

**Division's Interrogatory Statement:** *Refer to Section 4.2 of the Class A West (CAW) Embankment License Amendment Request (LAR):Explain how the management of waste-related data for waste disposed of in the CAW will differ from that of waste disposed of in the Class A and Class A North embankments.*

**Energy*Solutions*' Response:** Section 4.2 has been revised to state that there will be no changes associated with records management for purposes of constructing the Class A West Embankment.

**23. INTERROGATORY CAW R317-6-6.4-23/1: ISSUANCE OF DISCHARGE PERMIT: BEST AVAILABLE TECHNOLOGIES - MONITORING WELLS REQUIRING ABANDONMENT AND DECOMMISSIONING AND LYSIMETERS PROPOSED FOR ABANDONMENT**

**Regulatory Reference:** R317-6-6.4(A). The Executive Secretary may issue a ground water discharge permit for a new facility if the Executive Secretary determines, after reviewing the information provided under R317-6-6.3, that: …2. the monitoring plan, sampling and reporting requirements are adequate to determine compliance with applicable requirements; 3. the applicant is using best available technology to minimize the discharge of any pollutant;…".

**Division's Interrogatory Statement:**

1. *Refer to Section 4.4.3 of the Class A West (CAW) Embankment License Amendment Request (LAR) and Drawing10014 U02 of the CAW LAR: Drawing 10014 U02 indicates that the locations of several existing monitoring wells (e.g., GW-81, -82, -83, -84, -85, -86, -109, -110, -111, -112, -137, -138, -140, and -141) would be covered by CAW Embankment (and also covered by waste). Please submit a well plugging and abandonment (well decommissioning) plan and well decommissioning schedule for sealing and decommissioning all existing monitoring wells prior to construction of the CAW over them.*

   *Include information demonstrating that the plugging/sealing or other well abandonment technologies used to plug and decommission these wells represent BATs and will not compromise the long-term performance requirements for the CAW.*

2. *Refer to Section 4.4.3 of the Class A West (CAW) Embankment License Amendment Request (LAR) and Drawing 10014 C01 of the CAW LAR: Drawing 10014 C01 indicates that four existing or currently planned lysimeters (CL-W2, CL-W3, CL-W4, and CL-N5) beneath the Class A and Class A North Embankments are proposed to be abandoned (as they would be covered by CAW Embankment, and also covered by waste). Please provide*

*additional information and details regarding systems and measures that EnergySolutions proposes to implement to retain the ability to acquire data that would have been provided by these four lysimeters if they were not abandoned.*

*Demonstrate that the level and quality of vadose zone data will be equivalent to that obtainable from these four lysimeters once such systems and measures have been implemented.*

*Demonstrate that the systems and measures to be employed, if different than those current or planned, satisfy criteria for best available technologies for this type of monitoring.*

**Energy*Solutions*' Response:**

1. Monitoring well abandonment: Monitoring well abandonment procedures are regulated at UAC R655-4-14. These regulations specify the materials and methods used to abandon wells. Prior Division notification and approval of well abandonment is required at Part IV.C.4 of the GWQDP. Obviously, well abandonment will need to be completed prior to clay liner construction. Thus, no more detailed schedule is required.
2. Collection lysimeter closure: On June 27, 2011, the Division approved a revision to Appendix C of the GWQDP, including the Collection Lysimeter Operation, Maintenance, and Closure Plan. Section 4 of this plan was updated to discuss notification requirements, abandonment procedures, and contamination control requirements applicable to this activity. Section 1.2.3 of the amendment request already addresses replacement of the lysimeters to be abandoned; including a demonstration of adequate lysimeter coverage with the replacement network. A reference to this discussion is added to section 4.4.3. The interrogatory is incorrect in asserting that "…no equivalent replacement monitoring devices… are proposed to take their place."

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# License Amendment Request: Class A West Embankment, Revision 4

February 23, 2012

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## ATTACHMENTS

1. Proposed License/Permit Changes
    a. Proposed Redline/Strikeout Changes to Radioactive Material License #UT 2300249
    b. Proposed Redline/Strikeout Changes to Ground Water Quality Discharge Permit No. UGW450005
2. Proposed Embankment Design (Engineering Drawing Series 10014)
3. Whetstone November 28, 2011 Report, "EnergySolutions Class A West Disposal Cell Infiltration and Transport Modeling."
4. Class A West Drainage Ditch Calculations.
5. AMEC Earth & Environmental, Inc Report, 2011
6. Class A West Well Spacing Analysis
7. Clive Radiation Safety Committee ALARA Evaluation
8. LLRW and 11e.(2) Construction Quality Assurance and Quality Control Manual (CQA/QC Manual) – Proposed Changes
9. Material Quantity Calculations and Borrow Information
10. Class A West Rock Cover Design Calculations

# 1.0 GENERAL INFORMATION

## 1.1 INTRODUCTION

Energy*Solutions*, LLC (Energy*Solutions*) requests that the Utah Division of Radiation Control (DRC) review and approve a design change to the Class A North and Class A disposal embankments. This design change constitutes an amendment to both Radioactive Material License (RML) # UT 2300249 (Energy*Solutions*, 2008), the Class A Low Level Radioactive Waste license) and Ground Water Quality Discharge Permit No. UGW450005 (Energy*Solutions*, 2005). Proposed changes to these documents are provided in redline/strikeout format as Attachment 1a and 1b to this Amendment Request.

This amendment would combine the Class A and Class A North disposal cells into one embankment with a moderate increase to the overall height of the proposed embankment. Combining these two embankments into one allows Energy*Solutions* to more effectively utilize the space on Section 32 for LLRW disposal. Engineering Drawing Series 10014 provided in Attachment 2 illustrates the proposed embankment design. It should be noted that drawings from this series have been used to replace other drawings in the GWQDP (see Attachment 1b). Overall, the Class A North embankment footprint will be extended by approximately 110 feet to the north to make productive use of open ground between the rail facilities and the embankment. The heights from top of clay liner to top of waste at the shoulder and crest (peak) of the completed embankment are 37.6 feet and 75.3 feet respectively (see Engineering Drawings 10014-C01 and C02). The final heights of the completed embankment from native grade to top of final cover will range from approximately 34 ft to 38 ft at the shoulder and 71 ft to 76 ft at the crest (peak).

The Class A West embankment is similar in concept to the Class A Combined (CAC) embankment requested in 2005 (Energy*Solutions*, 2005). Key parameters are summarized in Table 1.1 below. Although the Class A West embankment builds on analyses performed in support of the previous CAC design, all analyses have been updated to the specific Class A West geometry.

Table 1.1: Comparison of Class A West and CAC embankments

| | | | | |
|---|---|---|---|---|
| **Shoulder Height (ft)*** | 37.6 | 50 | 35.7 | 32 |
| **Peak Height (ft)*** | 75.3 | 85.2 | 42.5 | 53.6 |
| **Side Slope Length (ft)**** | 188 | 250 | 178.5 | 160 |
| **Top Slope Length (ft)**** | 942 | 880 | 225.5 | 540 |

* Measured from the top of clay liner (EL 4265') to the top of waste.
Class A: Add 6.5' for top of cover height. Subtract ~9' for average height above natural grade.
Class A North: Add 6.5' for top of cover height. Subtract ~10' for average height above natural grade.
Class A West: Add 7' and 8' for top of cover height at peak and at shoulder repectively. Subtract ~9.5' for average height above natural grade.

Upon approval of this amendment request, the Class A and Class A North embankments would be re-designated as the Class A West (CAW) embankment. Engineering and construction practices with respect to waste placement would continue as specified in Energy*Solutions*' existing LLRW and 11e.(2) Construction Quality Assurance and Quality Control Manual (CQA/QC Manual) and in accordance with practices currently performed in the Class A and Class A North embankments The CQA/QC Manual

requires modification to the specification "Scope" for a number of work elements to replace former references to the Class A and Class A North embankments with reference to the Class A West embankment. No further revisions are proposed or required in order to license and construct the Class A West embankment. Revision 26a of the CQA/QC Manual is provided as Attachment 8 to this amendment request.

Overall height of the embankment will increase by approximately 22 feet at the peak. The increased height allows Energy*Solutions* to effectively combine both embankments into one while maintaining compliance with top slope and slide slope requirements established in the permit.

As waste placement in the existing Class A embankment nears completion, LLRW waste disposal operations will move north and encompass the unutilized area that currently exists between Class A and Class A North.

In order to evaluate potential groundwater impacts from the Class A West embankment, a study was performed titled, "Energy*Solutions* Class A West Disposal Cell Infiltration and Transport Modeling," dated November 28, 2011 (Whetstone, 2011). This report was prepared by Whetstone Associates consistent with previous groundwater modeling performed for embankments at the Clive facility and has been provided as Attachment 3 to this License Amendment Request.

### 1.1.1 IDENTITY OF APPLICANT

Energy*Solutions*, LLC is a Utah limited liability corporation with its principal place of business located at the Clive disposal facility, described in Section 1.2 below. Corporate headquarters are located at 423 West 300 South, Suite 200, Salt Lake City, UT 84101.

Energy*Solutions*' directors are as follows:

Val J. Christensen
President, Chief Executive Officer
423 West 300 South, Suite 200
Salt Lake City, UT 84101

Board Members/Managers:

Steven R. Rogel
Chairman
423 W 300 S, Suite 200
Salt Lake City, Utah 84101

J.I. Everest II
Director
423 West 300 South, Suite 200
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David B. Winder
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1st Floor, Stella Building
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Whitehill Way
Swindon
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UK

### 1.1.2 QUALIFICATIONS OF APPLICANT

#### 1.1.2.1 TECHNICAL QUALIFICATIONS

As a facility, the Energy*Solutions* Clive site has more than 20 years of experience with the design, construction, management, engineering, and operation of radioactive waste disposal embankments. Since receiving its first radioactive material license in 1988, Energy*Solutions*, formerly Envirocare of Utah, has constructed a naturally occurring radioactive material (NORM) disposal embankment, a low-activity radioactive waste (LARW) disposal embankment, a RCRA mixed radioactive and hazardous waste disposal (Mixed Waste) embankment, the Class A and Class A North disposal embankments, and a uranium- and thorium-mill radioactive tailings 11e.(2) disposal embankment.

There will be no change to the waste types received, waste placement procedures, or basic embankment design systems; therefore, Energy*Solutions*' past experience translates directly to the construction of the Class A West embankment.

1.1.2.2 FINANCIAL QUALIFICATIONS

Energy*Solutions*, LLC is a subsidiary of Energy*Solutions*, Inc. a publicly held corporation. In accordance with Utah Administrative Code (UAC) R313-25-33(6), Energy*Solutions* is required to submit a financial statement annually to DRC. These financial statements demonstrate on an ongoing basis that Energy*Solutions* is financially qualified to carry out licensed activities.

In addition, Energy*Solutions* maintains comprehensive sureties. These sureties are calculated to ensure that all costs associated with facility closure and post-closure monitoring are accounted for, thereby protecting the State of Utah against any default by the Company.

As detailed in Section 10 below, Energy*Solutions* will fund existing surety instruments in an amount adequate to close the Class A West embankment in compliance with the approved design specifications; therefore, existing information regarding financial qualifications is adequate for the Class A West embankment.

1.1.3 ORGANIZATIONAL STRUCTURE

Detailed requirements and qualifications for significant organizational positions are described in Energy*Solutions'* Class A LLRW license, Condition 32, Appendix I (currently approved revision is Rev. 22, August 2, 2010).

There will be no changes to the organization for purposes of constructing the Class A West embankment.

## 1.2 GENERAL FACILITY DESCRIPTION

Operations are conducted in Section 32, Township 1 South, Range 11 West, SLBM, Tooele County, Utah. This location is known as Clive, Utah (also referred to as South Clive). Energy*Solutions'* Clive disposal facility will be referred to herein as the facility. Engineering Drawing 0801-G03, *Site Layout and Facility Legend*, has been provided for reference in Attachment 2. The Class A West embankment will be located completely within Section 32. Engineering Drawing 10014-U01 illustrates the location of the Class A West embankment in relation to other site facilities.

Energy*Solutions'* Class A LLRW RML and 11e.(2) RML allow for the disposal of specified radioactive wastes in accordance with specified conditions and restrictions. Waste receipt, management, and disposal operations of LLRW waste at the proposed Class A West embankment will be conducted in accordance with the Class A RML.

Aside from the combination of the Class A and Class A North embankments into the Class A West embankment, there will be no change to existing facilities as part of this amendment request.

1.2.1 LAND USE

Most of the land within a 10-mile radius of the site is public domain administered by the Bureau of Land Management. Information with respect to and use near the site is located

in Section 1.2.2 of the 2005 Class A LLRW RML License Renewal Application (June 20, 2005; hereafter referred to as the 2005 LRA). Figure 1a (Section 1.2) of the 2005 LRA delineates the property owned by Energy*Solutions*.

Land use in the immediate vicinity of the site will not be affected by the Class A West embankment, since the embankment is located entirely within the licensed area of Section 32.

### 1.2.2 PRINCIPLE FEATURES

#### 1.2.2.1 RESTRICTED AREAS

Any area utilized for waste unloading, hauling/handling, and placement in the Class A West embankment will be considered a restricted (or controlled) area as defined in 10 CFR 20.3(a)(14). Any person working within the restricted area is assigned, and must wear, a personnel monitoring badge to measure their exposure to radiation.

The fence is conspicuously posted with "Caution -- Radioactive Materials" signs bearing the standard radiation symbol. Other signs are posted as appropriate. In accordance with the existing Clive Radiation Protection Program document, Revision 3, June 25, 2007, the restricted area boundary may change as waste placement proceeds in the Class A West embankment. There will not, however, be any changes to the requirements for control of the restricted areas as a result of the Class A West embankment, nor will there be any added waste handling facilities as a result of the Class A West embankment.

#### 1.2.2.2 SITE BOUNDARY AND BUFFER ZONE

Energy*Solutions* controls, through fences, gates, and security monitoring, all access to property at the Clive facility. In addition, all restricted/controlled areas are fenced. Upon completion of the embankment, it will be permanently fenced and posted, leaving a minimum 94 feet of buffer zone between the toe of waste and the fence. This allows room inside of the fence for an inspection roadway and groundwater monitoring wells.

A buffer zone of at least 300 feet is maintained between the closest edge of any embankment (i.e., toe of waste) and the outside site boundary or property line. This 300 foot buffer zone is a requirement of the facility's Conditional Use Permit issued by Tooele County, reported here for informational purposes.

Drawing 10014, Figures A, B and C (provided in Attachment 9) show the relationship between each embankment (Class A West, Class A, Class A North, 11e.(2), LARW and Mixed Waste) and the property boundaries. In preparation of the engineering drawings for this amendment request, a discrepancy was identified between the intended and actual buffer zone coordinates for the Class A and 11e.(2) embankments. The discrepancy lays with the approved design drawings for the Class A embankment. Those drawings establish a design toe of waste at the southeast corner that is 92.7' west of the property boundary and at the northeast corner that is 95.4' west of the property boundary as indicated in Figure A of Attachment 9). The root cause of this design discrepancy is unknown. However, the Section 32 survey rotational error that was identified and corrected in 2009 (Radioactive Material License Amendment 5) is a likely source. The corrected section and property survey information has been added to the engineering design data base and all known incorrect survey information has been purged. This action should prevent similar future discrepancies in other locations at the facility.

As stated above, the design waste limits do not allow for a 94 ft buffer zone along the east side of the Class A embankment. However, due to LLRW embankment construction specifications (LLRW & 11e.(2) CQA/QC Manual, Revision 23 and earlier) imposed at the time of construction, the actual toe of waste was held back a minimum of 5 ft from the design waste limits to accommodate 1 ft of temporary cover. Temporary cover was required at the time of placement to be non-contaminated native soil. Although the design drawings and specifications for temporary cover were revised in 2009 (LLRW & 11e.(2) CQA/QC Manual, Revision 24E) to allow waste to be placed to the design limits, EnergySolutions has not placed (and will not place) any waste within the 5 ft offset from the design limits along the east boundary of the Class A cell footprint, since this area is already built out —soil material within that offset is clean native material previously placed as temporary cover. Therefore, as shown on Figure A (Attachment 9), there is a minimum of 97.7 ft from the toe of actual waste to the property boundary, thus allowing for a minimum 94 ft buffer zone. The design drawings for the Class A West embankment, refer to Drawing C01 (Attachment 2), identify a waste restricted area to prevent future placement of waste within the buffer zone. With this additional construction restriction and establishing the buffer zone limits along the Vitro property boundary, refer to Drawing U01 (Attachment 2), a minimum buffer zone of 97.7 ft is established along the east side of the Class A West embankment.

Figure B (Attachment 9) shows two discrepancies for the 11e.(2) embankment. One (along the south end of the west side), is for the 300 ft Tooele County CUP buffer zone requirement and the other (near the NE corner) is for the LLRW license 94 ft buffer zone requirement. Both of these discrepancies are clearly detailed on Figure B. The discrepancy for the 300 ft buffer zone requirement will be resolved by revising the design waste limits in the SW corner; by relocating the SW corner to a point along the current south limits a distance of 300 ft from the property boundary.

Figure C (Attachment 9) demonstrates that both the LARW and Mixed Waste embankments meet both the Tooele County CUP buffer zone requirement (300 ft) and the LLRW Groundwater Discharge Permit buffer zone requirement (94 ft).

A buffer zone of at least 90.9 feet is maintained between the closest waste placement of any embankment and the Vitro property line. Although previous submittals reported the buffer zone to the Vitro property line as being a minimum of 100 feet, it was discovered in preparation of the design drawings for the Class A West embankment that the approved eastern waste limit for the Class A embankment ranges from 95 feet 4 inches in the northeast corner to 92 feet 8 inches in the southeast corner. Similarly, the northeast corner of waste placement for the 11e.(2) embankment is 90.9 feet from the Vitro property line.

Waste has already been placed along the entire eastern waste limit for the Class A embankment; however, the last vertical foot of the waste column was specified by the CQA/QC Manual at the time of placement to consist of non-waste native soil. Given the 5:1 side slope, the last vertical foot translates to an offset of at least 5 feet horizontally. In other words, although the original design coordinates for the southeast corner of waste placement in the Class A embankment are only 92.7 feet from the Vitro property line, actual waste placement at that location is at least 5 feet further (or 97.7 feet) from the property line. That is, the distance from emplaced waste to the Vitro property line for the east side of the Class A embankment does continue to meet a minimum of 94 feet. The

reported 90.9 feet from the northeast corner of the 11e.(2) embankment is the distance to actual toe of waste. Control points have been added for the eastern waste limit of the Class A West embankment to restore the buffer zone to 100 feet for future waste placement.

This discrepancy in the buffer zone for the eastern waste limit of the Class A embankment and the northeastern corner of the 11e.(2) embankment does not compromise the facility's ability to comply with the well network early warning requirement at Part I.F.1(f) of the GWQDP. Part I.F.1(f) requires that the monitoring well network be adequately spaced to provide early warning of a contaminant release from a waste embankment before the contaminant leaves the buffer zone. Exact distances for groundwater wells on the east side of the Class A embankment are provided in Table 1.2 below.

Table 1.2: Groundwater well and buffer zone distances

| Well Number | Distance from waste limit | Distance from property line |
|---|---|---|
| GW-88 | 85.0 | 12 |
| GW-89 | 84.0 | 11 |
| GW-90 | 85.0 | 9 |
| GW-91 | 85.5 | 8 |
| GW-92 | 123 (Class A); 128 (11e.(2)) | 6 |
| GW-24 | 204 (11e.(2)) | 10 |

Note: Distances to the nearest 0.5 foot. GW-88 distance is from Class A West waste limit; which is closer than its distance to the Class A waste limit.

Evidence that adequate time exists to detect a contaminant release in the smaller buffer zone at the southeast corner of the Class A West embankment is provided by the well spacing analysis provided as Attachment 6 to this amendment request. This analysis relies upon the actual installed locations of existing wells to the east of the embankment, specifically, GW-88, GW-89, GW-90, GW-91, and GW-92. Given these actual well locations, the analysis demonstrates that the evaluated well network will provide leak detection with greater than 95% efficiency for the Class A West embankment.

The minimum distance between these wells and the property line is 6.0 feet at GW-92. However, GW-92 is cross-gradient to the Class A West embankment and downgradient of the 11e.(2) embankment. Therefore, for evaluation of the Class A West embankment GW-91 is considered. Groundwater travels no more than 2.7 feet per year (section 6.2.4 of Whetstone, 2011), therefore there would be at least 3 years' time to detect and respond to a release upgradient of that well. Similarly, at GW-92 there would be at least 2 years' time to detect and respond to a release from the upgradient 11e.(2) embankment. Accordingly, there remains adequate time to detect a contaminant release before the contaminant leaves the buffer zone.

As for the amount of space required to respond to a contaminant release, potential response strategies may be considered:

1. Monitored Natural Attenuation: Energy*Solutions* could demonstrate that, since there are no users of the groundwater (DOE does not perform groundwater monitoring for the Vitro disposal facility for this reason), there is no exposure pathway to the public. Additional wells may be needed to characterize and

monitor the plume under this scenario, which would require only enough space for the drilling rig to access the desired well location(s).

2. Pump and Treat: Operational experience at the facility shows that groundwater extraction is feasible via the 2" diameter monitoring well. Larger-diameter extraction wells do not require larger surface completions than the 4' x 4' pad typically used at the Clive facility; and can be drilled from the embankment side of the buffer zone.

Therefore, adequate space exists to respond to a contaminant release detected at wells within as little as 6 feet of the Vitro property line.

Regarding the 300 foot buffer to the nearest outside property line, drawing 10014 Figure B of Attachment 9 identifies that the southwest corner of the 11e.(2) embankment encroaches 5.4 feet into this buffer. There is currently no liner constructed nor waste placed in this area. A separate submittal will be provided to DRC in order to revise 11e.(2) coordinates and correct the situation.

With the exception discussed above, Class A West and 11e.(2) embankment buffer zones are consistent with buffer zone dimensions approved for the current LARW, Class A, Class A North, Mixed Waste, and 11e.(2) embankments.

#### 1.2.2.3 GROUNDWATER USERS

No domestic water use occurs within 10 km of the facility.

#### 1.2.2.4 UTILITY SUPPLIES AND SYSTEMS

Utility information was provided in the 2005 LRA (Section 1.2.3.4).

#### 1.2.2.5 CLASS A WEST EMBANKMENT

The proposed embankment design is shown in detail in engineering drawing series 10014. The construction materials are comprised of native clays mined on Sections 5 and 29, located directly south and north of Section 32; and native rock from a local quarry.

#### 1.2.2.6 COVERS

Cover design for the Class A West embankment is detailed on Drawing 10014-C03.

The cover for the Class A West embankment will have identical components, specifications, and construction procedures to the currently approved Class A and Class A North embankment cover, with the exceptions that the Type A and Type B Rip Rap layers will be 2 ft thick and the Type B Filter layer on the side slopes (only) will be 1.5 ft thick. These exceptions will not adversely affect the construction of the final cover. The CQA/QC Manual does not prescribe layer thicknesses. Quality control/quality assurance requirements do not need to be changed to accommodate the revised layer thicknesses. Therefore, this design change does not trigger additional revisions to the CQA/QC Manual.

#### 1.2.2.7 SURFACE WATER CONTROL FEATURES

During construction, the Class A West embankment will be surrounded by run-on and run-off berms. Run-on berms are designed to prevent stormwater run-on, from ambient precipitation in the vicinity of the facility, into the emplaced waste before final cover is built.

Run-off berms are used during operation of the facility to ensure that precipitation that falls on emplaced waste is collected and does not carry contamination off of the site. Because run-off berm locations necessarily move as new portions of the disposal embankment are opened for waste placement, these operational features are necessarily not depicted on facility design drawings. These surface water controls have been successfully utilized at the Clive facility for over 20 years.

#### 1.2.2.8 INTRUDER BARRIERS

This topic is addressed in the 2005 LRA (Section 1.2.3.8). Upon completion, permanent fencing will surround the facility. Further details are provided in Sections 3.1.8 and 3.2.8 below.

#### 1.2.2.9 MARKERS

Permanent granite markers will be placed at the facility to identify the location and type of disposal material as described in the 2005 LRA (Section 1.2.3.9). These markers are similar to those markers currently marking the Vitro embankment located at the site.

#### 1.2.2.10 BOUNDARIES AND MARKERS

This topic is addressed in the 2005 LRA (Section 1.2.3.10). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 1.2.2.11 SURVEY CONTROL PROGRAM

This topic is addressed in the 2005 LRA (Section 1.2.3.11). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 1.2.2.12 SITE UTILIZATION PLAN

A current site layout is provided on drawing 0801-G03 in Attachment 2. Engineering Drawing 10014-U01 illustrates the location of the Class A West embankment in relation to other site facilities. Various lysimeters and groundwater monitoring wells will be impacted by the Class A West embankment footprint; also, as discussed in the introduction to this document, this License Amendment Request also proposes combining the Class A and Class A north embankments into one embankment. As such, those two facilities will also be impacted by this submittal. The rest of this document will describe in further detail how these changes are to be integrated in the overall design of the facility.

Waste placement will generally progress from the southern boundary of the existing Class A footprint to the north, with large component and Containerized Waste Facility disposal areas developed separately prior to being enveloped by bulk waste placement. This is consistent with current approved practices.

#### 1.2.2.13 SUPPORT FACILITIES

This topic is addressed in the 2005 LRA (Section 1.2.3.13). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. No new facilities are proposed to specifically support this embankment.

#### 1.2.2.14 ADMINISTRATION BUILDINGS

This topic is addressed in the 2005 LRA (Section 1.2.3.14). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 1.2.2.15 STORAGE AND WASTE HANDLING AREAS

This topic is addressed in the 2005 LRA (Section 1.2.3.15). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Since the 2005 LRA, additional storage and waste handling areas have been permitted, constructed, and placed into operation; including the Shredder Facility and the Rotary Dump Facility. Design and operation of these facilities will be unaffected by the Class A West embankment.

#### 1.2.2.16 DECONTAMINATION AREAS

This topic is addressed in the 2005 LRA (Section 1.2.3.16). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Since the 2005 LRA, additional decontamination and wastewater management facilities have been permitted, constructed, and placed into operation; including the Intermodal Container Wash Building, East Side Drainage and Gray Water System, and Northwest Corner Evaporation Pond. Design and operation of these facilities will be unaffected by the Class A West embankment.

#### 1.2.2.17 PHYSICAL SECURITY

Site security procedures for the Clive facility are provided in the Site Radiological Security Plan (LLRW RML Condition 54, currently approved as revision 3, May 5, 2008). Because the plan requirements are general and do not specify particular embankment designs or waste placement locations, there will be no changes to the Site Radiological Security Plan for construction of the Class A West embankment.

#### 1.2.2.18 EQUIPMENT AND EQUIPMENT STORAGE

This topic is addressed in the 2005 LRA (Section 1.2.3.18). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 1.2.2.19 EXCAVATED MATERIALS AREA

This topic is addressed in the 2005 LRA (Section 1.2.3.19). There will be no change in management of excavated materials for the Class A West embankment.

### 1.2.3 CURRENT EMBANKMENT CONDITIONS

Drawing 10014-C01 provides an overlay of the proposed Class A West embankment design. From this figure, it is evident that the proposed embankment will completely overlay the existing Class A and Class A North embankments. As evidenced from the drawing, existing collection lysimeters CL-W-3, CL-W4 and CL-N5 would need to be removed from service following approval of the Class A West embankment amendment request and prior to constructing liner at these locations.

In accordance with Part IV.C.4 of the GWQDP, prior Executive Secretary approval will be required before abandoning these collection lysimeters. Further details on collection lysimeter closure are provided in Appendix C to the GWQDP, Collection Lysimeter

Operation, Maintenance, and Closure Plan (June 27, 2011), section 4. Similarly, in accordance with Part II.M of the GWQDP, an abandonment report will be required within 60 days of completion. Planned collection lysimeter CL-W2 was not constructed, with DRC approval. Locations for an additional 9 collection lysimeters are proposed on drawing 10014-C01, to provide comparable coverage to the approved networks for the Class A and Class A North cells. Table 1.3 below compares acres/lysimeter for the embankments.

Table 1.3: Acres per Collection Lysimeter

| Embankment | Acres | # of Lysimeters | Acres/Lysimeter |
|---|---|---|---|
| Class A | 73 | 7 | 10 |
| Class A North | 39 | 5 | 8 |
| Class A West | 133 | 14 | 9.5 |

## 1.3 SCHEDULES

Energy*Solutions* has conducted NORM waste disposal operations at the Clive facility since 1988. LLRW disposal operations began in 1991. Mixed waste disposal operations have been conducted since 1992. Construction activities necessary to combine the Class A and Class A North embankments into the Class A West embankment will begin immediately after approval of the amendment request. Waste placement to the increased shoulder height will begin on the south half of the existing Class A embankment, proceeding north.

### 1.3.1 CONSTRUCTION

Much of the liner for the Class A West embankment has already been constructed, including all of the existing Class A embankment and much of the Class A North embankment. Liner will need to be constructed in the area between the Class A and Class A North embankments (see Figure E, provided in Attachment 9). Construction of this liner could begin as early as the first construction season following approval of this amendment request. Conversely, liner construction could wait one or more years. Regardless, DRC will be notified of construction activities in order to facilitate inspection. In accordance with the CQA/QC Manual, work element – General Requirements, specification “Weekly Construction Schedule”, Energy*Solutions* must provide DRC with detailed weekly construction schedules during clay liner and embankment cover construction projects.

Cover has not yet been constructed over any waste in the Class A or Class A North embankments.

### 1.3.2 OPERATIONS

Energy*Solutions* estimates that disposal operations in the Class A West embankment may continue for up to 20 years.

### 1.3.3 CLOSURE

Closure of the Class A West embankment will take place during normal operations. As new areas are constructed, the filled areas will be covered to meet final design specifications before being closed. Closure activities will include a settlement monitoring program prior to cover construction as provided in the LLRW and 11e.(2) CQA/QC Manual, work element - Temporary Cover Placement and Monitoring. The settlement

monitoring program includes a requirement that temporary cover be placed and monitored for at least one year prior to final cover construction, with evaluation of differential settlement. If differential settlement exceeds or is projected to exceed the established criteria, surcharging of affected areas will be required. This program will continue unchanged for the Class A West embankment.

Cover construction is expected to begin no later than 2016 for the area comprising the southeast corner of the current Class A embankment. This timing is driven by the open cell time limit provided at Part I.E.6 of the Ground Water Quality Discharge Permit. The open cell time limit requires that final cover be complete on or before the end of 18 years after the date of initial placement of the first lift of LLWR waste in that portion of the open cell.

The date of initial waste placement in some areas of the Class A embankment was as early as October, 2000; therefore, final cover for these areas must be complete by October, 2018. In order to ensure compliance with this deadline, the CQA/QC Manual requires that temporary cover, the initial step of cover construction, be placed within 15 years of the date of initial waste placement on each lift area. Temporary cover is then monitored for total and differential settlement for at least one year. Settlement monitoring data is compiled, evaluated, and reported to DRC before cover construction begins (CQA/QC Manual, work element – Temporary Cover Placement and Monitoring, specifications "Temporary Cover Placement" and "Transition to Final Cover").

Thus, for waste areas opened in 2000, cover construction is expected to begin no later than 2016. If waste placement and settlement monitoring are completed earlier, cover construction could proceed earlier. Regardless, DRC will be notified of construction activities in order to facilitate inspection. In accordance with the CQA/QC Manual, work element – General Requirements, specification "Weekly Construction Schedule", Energy*Solutions* must provide DRC with detailed weekly construction schedules during clay liner and embankment cover construction projects.

Please see also section 3.3.1.6 below for discussion of cover construction phasing.

Upon final closure of all disposal embankments, the site will be decommissioned and the long-term surveillance period will begin. Please see section 5.0 below for information about overall site closure.

## 1.4 INSTITUTIONAL INFORMATION

In accordance with a letter dated November 18, 1987, from the Director of the Bureau of Radiation Control (the agency has since been named the Division of Radiation Control), and in accordance with R447-25-9(2) an exemption was granted, allowing for disposal activities on privately owned land at Clive. A supplemental exemption was granted on March 8, 1991. These exemptions were not specific to a particular disposal embankment or land area. On March 16, 1993, Envirocare and the Utah Department of Environmental Quality entered into an Agreement Establishing Covenants and Restrictions related to LLRW disposal activities on privately owned land. This Agreement specifically applies to all of Section 32, less the defined property of the Vitro embankment. Energy*Solutions* continues to be bound by this Agreement.

Accordingly, since it will be located entirely within Section 32, the Class A West embankment is addressed by the existing land ownership exemption for LLRW management and disposal.

For the Class A disposal cells, Energy*Solutions* will retain ownership of the land, and will be responsible for site closure, as well as the long-term maintenance and monitoring of the disposal site. In accordance with 10 CFR Part 40.28, the ownership of the 11e.(2) disposal facility will be transferred to the Department of Energy (DOE), another Federal Agency designated by the President, or the State of Utah. The land will be transferred at no cost to the DOE. The DOE or other designated agency will be responsible under the general license for custody of and long-term care of the site, including monitoring, maintenance, and emergency measures necessary to protect the public health and safety and other actions necessary to comply with the standards. It is anticipated that the State of Utah will retain a function in the post-closure activities at the site in an oversight role.

Funds for the closure, remediation and long-term surveillance of the facility are discussed in Section 10 below. Upon State of Utah request to draw upon the irrevocable letter of credit established at Zions First National Bank, funds are maintained in trust for the benefit of the State of Utah with Wells Fargo Bank. Furthermore, the State of Utah has established a Perpetual Care Fund with a target initial minimum balance of $100 million at the conclusion of the post-closure monitoring period (i.e., year 101 after site closure). The Perpetual Care Fund is funded by an annual payment and earnings accrued to the fund cash balance with an irrevocable letter of credit bringing the value to $13 million.

## 1.5 MATERIALS INCORPORATED BY REFERENCE

Energy*Solutions* has summarized the references listed in each Section as Section 11 of this License Amendment Request.

## 1.6 CONFORMANCE TO REGULATORY GUIDES

To the extent practicable, the information presented in this amendment request conforms to the recommendations provided in "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility" (NUREG-1199, USNRC, January 1991).

A complete list of regulatory guides applied to facility design is included in Section 1.6 of the 2005 LRA.

## 1.7 SUMMARY OF PRINCIPLE REVIEW MATTERS

Energy*Solutions* requests that DRC issue a license amendment for the proposed Class A West embankment.

Energy*Solutions* has reviewed LLRW RML #UT 2300249, and GWQDP No. UGW450005, as well as supporting documents for each. The embankment liner, waste placement, and cover systems for LLRW are identical to the existing Class A and Class A North embankments; therefore, many RML and GWQDP conditions and supporting documents are unaffected by the proposed Class A West embankment.

Revisions to the LLRW RML and GWQDP are provided in redline/strikeout format in Attachment 1a and 1b respectively.

# 2.0 SITE CHARACTERISTICS

Site characteristics of the Clive site have been the subject of many investigations and regulatory reviews. Because this basic information about the site is not affected by the Class A West embankment, the most recent summary found in section 2 of the 2005 LRA is incorporated by reference.

## 2.1 GEOGRAPHY, DEMOGRAPHY, AND FUTURE DEVELOPMENTS

### 2.1.1 SITE LOCATION AND DESCRIPTION

#### 2.1.1.1 LOCATION OF THE FACILITY

The Clive site is on the eastern edge of the Great Salt Lake Desert, 3 miles west of the Cedar Mountains, 2.5 miles south of Interstate 80, and 1 mile south of a switch point called Clive on the tracks of the Union Pacific Railroad system. The facility is located at approximate latitude 40$^{o}$ 41' 18" North, longitude 113$^{o}$ 06' 54" West.

The licensed disposal area is a parcel of land consisting of Section 32 of T1S, R11W, in Tooele County, Utah, with the exception of approximately 100 acres used in the Vitro Remedial Action project. The DOE owns the 100 acres used in the Vitro Remedial Action project. The Class A West embankment will be located entirely within Section 32.

#### 2.1.1.2 NEARBY FACILITIES

This topic is addressed in the 2005 LRA (Section 2.1.1.2). Since there are not any new facilities in the area since that submittal, this discussion will be unaffected by the Class A West embankment.

### 2.1.2 POPULATION DISTRIBUTION

This topic is addressed in the 2005 LRA (Section 2.1.3). This information is unaffected by the Class A West embankment.

## 2.2 METEOROLOGY AND CLIMATOLOGY

Energy*Solutions* has operated a weather station at Clive since April 1992. The station monitors wind speed and direction, 2-m and 9-m temperatures, precipitation, pan evaporation and solar radiation. An 18-year summary report from January 1, 1993 through December 31, 2010 was provided to the Utah Water Quality Board on February 15, 2011 (CD11-0035). Since the Class A West embankment will be located entirely within Section 32, this information adequately characterizes the site. See also Section 2.3 of the 2005 LRA.

## 2.3 GEOLOGY AND SEISMOLOGY

### 2.3.1 REGIONAL and SITE GEOLOGY

This topic is addressed in the 2005 LRA (Section 2.4.1). This discussion is unaffected by the Class A West embankment.

### 2.3.2 SEISMOLOGY

This topic is addressed in the 2005 LRA (Section 2.4.2); and has been independently reviewed and updated by AMEC Earth & Environmental in the course of licensing the

CAC embankment in 2005-2006. References for the AMEC update report and interrogatory responses are provided below. Since this information applies to Section 32 as a whole, this discussion will be unaffected by the Class A West embankment.

- AMEC, "Report: Combined Embankment Study, Envirocare," December 13, 2005
- AMEC, "Round 2 Interrogatories and Response, Class A Embankment Height Study, Energy*Solutions* Facility Near Clive, Utah," April 28, 2006
- AMEC, "Interrogatory Statement and Response, AMEC Interrogatory Response Letter Dated April 28, 2006, Class A Embankment Height Study, Energy*Solutions* Facility Near Clive, Utah," May 22, 2006
- AMEC, "Response to interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation, Energy*Solutions* Clive Facility," October 25, 2011

The 2005 LRA summarizes work dating back to 1985, during the initial site investigation for the Vitro disposal cell. These investigations developed seismic design values for a Maximum Credible Earthquake of 6.5 with peak acceleration of 0.37g. The previously submitted CAC cell geometry was evaluated against this design value and found to meet acceptable safety factors. The Class A West cell geometry is essentially unchanged from the CAC embankment, except that the height of the Class A West embankment at its peak is lower by about 7 feet.

In reviewing the historical seismic design value work, AMEC found that it was both poorly-documented and conservative by current standards. Therefore, the seismic hazard was updated based on more current knowledge and information. The updated seismic hazard develops a design maximum earthquake of 7.1 with peak acceleration of 0.24g. These higher values were used in analysis of the CAC embankment in 2005-2006 and continue to be used in the analysis of the Class A West embankment.

## 2.4 HYDROLOGY

### 2.4.1 SURFACE WATER HYDROLOGY

This topic is addressed in the 2005 LRA (Section 2.5). Since surface water hydrology was characterized for all of Section 32, this information is applicable to the Class A West embankment.

### 2.4.2 GROUNDWATER CHARACTERIZATION

This topic is addressed in groundwater reports that have been submitted to the Utah Division of Water Quality since 1993. Since groundwater was characterized for all of Section 32, this information is applicable to the Class A West embankment.

## 2.5 GEOTECHNICAL CHARACTERISTICS

### 2.5.1 FIELD INVESTIGATIONS

This topic is addressed in the 2005 LRA (Section 2.8.1). Since no new field investigations have been completed since that time, this discussion will be unaffected by the Class A West embankment.

### 2.5.2 FIELD AND LABORATORY TESTING AND ENGINEERING PROPERTIES

This topic is addressed in the 2005 LRA (Section 2.8.2). Since no new field investigations have been completed since that time, this discussion will be unaffected by the Class A West embankment.

### 2.5.3 GROUNDWATER CONDITIONS

A significant amount of water quality data and geochemical information has been developed for the subsurface soil and groundwater below Section 32. This information was submitted to DRC on September 1, 2004, as a Comprehensive Groundwater Quality Evaluation Report (CD04-0405). Since groundwater quality was characterized for all of Section 32, this information is applicable to the Class A West embankment.

### 2.5.4 BORROW MATERIALS

This topic is addressed in the 2005 LRA (Section 2.8.4). A supplemental evaluation of the change in borrow material volumes associated with the requested design change follows and is supported by calculations provided in Attachment 9.

Energy*Solutions* estimated the difference in material quantities for the redesigned embankment compared with material needs for the Class A and Class A North embankments. Table 2.1 summarizes these estimates. The quantity of clay material required for the Class A West embankment is increased by approximately 177,390 cubic yards, since the design of the Class A West embankment encompasses the area between the Class A and Class A North embankments. The rock materials needed to construct the Class A West cover system will increase by approximately 333,781 cubic yards for the same reason. The total volume of clay borrow and rock borrow materials needed for remaining cover construction for the entire site is estimated at 1,900,952 and 1,740,813 cubic yards respectively, as summarized in Table 2.2.

Drawing 10014, Figure D (provided in Attachment 9) shows four potential borrow areas located within Section 29 of EnergySolutions property. The attached calculations (CAW: Clay Resource) conservatively estimate 2.3 million cubic yards of suitable clay within these 4 areas, with a potential of nearly 3.2 million cubic yards. The clay resource in these areas is 1.2 to 1.7 times (respectively) more than the 1.9 million cubic yards (as summarized in Table 2.2) required for construction of clay liner, liner protective cover, temporary cover and radon barrier. A volume of at least 1.6 million cubic yards of mineral materials are available in S1/2SW1/4 per a letter dated October 11, 2011 from the U.S. Bureau of Land Management (BLM) to EnergySolutions (see Attachment 9).

In a letter to DRC dated November 21, 2007 (CD07-0373), Energy*Solutions* provided an independent assessment of the volume and type of rock available at the Grayback Hills gravel pit 24. This is one of several pits in the region; and Energy*Solutions*' contract area alone contains approximately 1.1 million cubic yards of proven rock materials. The adjoining pit areas contain several hundred thousand additional cubic yards of material. The economic cost associated with using pit 24 for cover rock is currently incorporated into the LLRW and 11e.(2) sureties.

Table 2.1: Additional Borrow Material for Class A West

| COVER MATERIALS | CLASS A WEST AREA (ft2) | CLASS A WEST THICKNESS (ft) | CLASS A WEST VOLUME (yd3) | CLASS A AREA (ft2) | CLASS A THICKNESS (ft) | CLASS A VOLUME (yd3) | CLASS A NORTH AREA (ft2) | CLASS A NORTH THICKNESS (ft) | CLASS A NORTH VOLUME (yd3) |
|---|---|---|---|---|---|---|---|---|---|
| Waste Footprint Area | 5,801,781 | | | 3,164,247 | | | 1,713,768 | | |
| Waste Cover Area (to ditch centerline) | 5,950,435 | | | 3,336,590 | | | 1,853,267 | | |
| Total Cover Area (to ditch outside limits) | 6,147,578 | | | | | | | | |
| Top Slope | 4,131,394 | | | 2,095,395 | | | 795,564 | | |
| Temporary Cover (clay) | | 1.0 | 153,015 | | 1.0 | 77,607 | | 1.0 | 29,465 |
| Radon Barrier (clay) | | 2.0 | 306,029 | | 2.0 | 155,214 | | 2.0 | 58,931 |
| Erosion Materials (rock) | | 4.0 | 612,058 | | 3.5 | 271,625 | | 3.5 | 103,129 |
| Side Slope (to ditch centerline) | 1,858,426 | | | 1,241,195 | | | 1,057,703 | | |
| Temporary Cover (clay) | | 1.0 | 68,831 | | 1.0 | 45,970 | | 1.0 | 39,174 |
| Radon Barrier (clay) | | 2.0 | 137,661 | | 2.0 | 91,940 | | 2.0 | 78,348 |
| Erosion Materials (rock) | | 5.0 | 344,153 | | 3.5 | 160,896 | | 3.5 | 137,110 |
| Outer Ditch Slope Area (2 layers) | 201,046 | | | 154,230 | | | 124,399 | | |
| Erosion Materials (rock) | | 2.0 | 14,892 | | 1.5 | 8,568 | | 1.5 | 6,911 |
| Remaining Liner to be Built | 1,085,701 | 2.0 | 80,422 | - | 2.0 | - | 289,151 | 2.0 | 21,419 |
| Remaining Liner Protective Cover to be Built | 1,085,701 | 1.0 | 40,211 | - | 1.0 | - | 289,151 | 1.0 | 10,709 |
| **TOTAL CLAY MATERIAL (BORROW)** | | | **786,169** | | | **370,732** | | | **238,046** |
| TOTAL SAND & GRAVEL PRODUCTS | | | 971,104 | | | 441,089 | | | 247,149 |
| BORROW FACTOR | | | 1.18 | | | 1.18 | | | 1.18 |
| **TOTAL SAND & GRAVEL BORROW** | | | **1,145,902** | | | **520,485** | | | **291,636** |
| **CAW ADDITIONAL CLAY RESOURCE REQUIRED** | | | **177,390** | yd3 | | | | | |
| **CAW ADDITIONAL SAND & GRAVEL RESOURCE REQUIRED** | | | **333,781** | yd3 | | | | | |

Updated 11/4/11.

Table 2.2: Total Cover Construction Material Requirements

| Embankments | Temp Cover | Radon Barrier | Clay Liner | Liner Protective Cover | Total Clay Borrow | Erosion Materials Placed | Erosion Materials Borrow |
|---|---|---|---|---|---|---|---|
| Class A West | | | | | | | |
| Subtotal | 221,845 | 443,690 | 80,422 | 40,211 | 786,169 | 971,104 | 1,145,902 |
| | | | | | | | |
| Mixed Waste (w/ expansion) | | | | | | | |
| Subtotal | 52,479 | 108,910 | 27,403 | 36,538 | 225,331 | 214,723 | 253,373 |
| | | | | | | | |
| 11e.(2) | | | | | | | |
| Subtotal | 130,177 | 502,081 | 171,463 | 85,731 | 889,452 | 289,439 | 341,538 |
| | | | | | | | |
| **TOTALS** | | | | | **1,900,952** | | **1,740,813** |

Notes:

1. All volumes are reported in cubic yards.
2. A borrow factor of 1.18 is applied to the erosion materials to account excess raw material needed to produce the various cover products.
3. "Subtotal" accounts for all materials over the embankment extending to the drainage ditch outer slope.

Updated 11/4/11

### 2.5.5 STRATIGRAPHY AND DESIGN PARAMETERS

This topic is addressed in the 2005 LRA (Section 2.8.5). This discussion will be unaffected by the Class A West embankment.

## 2.6 GROUNDWATER HYDROLOGY

### 2.6.1 HYDROGEOLOGY

Site hydrogeology has been characterized in a Revised Hydrogeologic Report submitted to the DRC on September 1, 2004 (CD04-0404), and a Comprehensive Groundwater Quality Evaluation Report, submitted September 1, 2004 (CD04-0405). Since site hydrogeology was characterized for all of Section 32, this information is unaffected by the Class A West embankment.

### 2.6.2 GROUNDWATER MODELING

Groundwater modeling was conducted for the Class A West embankment and is provided as Attachment 3 to this License Amendment Request. The purpose of conducting this modeling was to simulate flow in the unsaturated and saturated zones to aid in understanding infiltration and groundwater flow below and adjacent to the Clive site.

## 2.7 GROUNDWATER QUALITY AND GEOCHEMICAL CHARACTERISTICS

A significant amount of water quality data and geochemical information has been developed for the subsurface soil and groundwater below Section 32. This information was submitted to DRC on September 1, 2004, as a Comprehensive Groundwater Quality Evaluation Report (CD04-0405). Since groundwater quality was characterized for all of Section 32, this information is applicable to the Class A West embankment.

## 2.8 NATURAL RESOURCES

### 2.8.1 GEOLOGICAL RESOURCES

This topic is addressed in the 2005 LRA (Section 2.9.1). Since geological resources were characterized for all of Section 32, this information is applicable to the Class A West embankment.

### 2.8.2 WATER RESOURCES

This topic is addressed in the 2005 LRA (Section 2.9.2). Since water resources were characterized for all of Section 32, this information is applicable to the Class A West embankment.

## 2.9 BIOTIC FEATURES

### 2.9.1 VEGETATION

Regional vegetation is characterized in the 11-Year Meteorological Summary Report submitted to the DRC on January 12, 2004 (CD04-0016). This information is applicable to the Class A West embankment. Further discussion of this topic is addressed in the 2005 LRA (Section 2.10.1). Since vegetation was characterized for all of Section 32, this information is applicable to the Class A West embankment.

### 2.9.2 TERRESTRIAL LIFE

This topic is addressed in the 2005 LRA (Section 2.10.2). Since terrestrial life was characterized for all of Section 32, this information is applicable to the Class A West embankment.

### 2.9.3 AQUATIC BIOTA

Aquatic ecosystems do not occur on or near the South Clive site.

### 2.9.4 ENDANGERED AND THREATENED SPECIES

This topic is addressed in the 2005 LRA (Section 2.10.4). Since endangered and threatened species were characterized for all of Section 32, this information is applicable to the Class A West embankment.

## 2.10 PREOPERATIONAL ENVIRONMENTAL MONITORING

This topic is addressed in the 2005 LRA (Section 2.11). Since preoperational environmental monitoring was characterized for all of Section 32, this information is applicable to the Class A West embankment.

# 3.0 FACILITY DESIGN AND CONSTRUCTION

Coordinates for the Class A West embankment and buffer zone are provided on Drawing 10014-U01.

For waste placement, Energy*Solutions* will utilize construction specifications that have already been approved and successfully implemented for the Class A embankments. No novel engineering designs or construction methods will be implemented for the Class A West embankment, nor will the waste disposed in the Class A West embankment differ from waste currently being disposed in the Class A and Class A North embankments in regards to radioactivity, physical form, or potential hazard.

Energy*Solutions* will construct the Class A West embankment in accordance with the waste placement, design and construction procedures and specifications found in the current LLRW and 11e.(2) CQA/QC Manual. Therefore, the engineering analyses performed for existing waste disposal practices at the Class A disposal embankments are also valid for the Class A West embankment. Similar information for other embankment features is provided in Tables 3.2, 3.3, and 3.4 of the 2005 LRA. Updated copies of those tables for the Class A West embankment are provided below. Detailed explanations of waste placement specifications and supporting documentation are located in the 2005 LRA (Section 3). Details for the factor of safety calculations are also included in the 2005 LRA; the approach approved therein is unchanged for the Class A West embankment.

In NUREG-1199 (section 6.3.2), NRC contemplates evaluation of design against a factor of safety only in the area of slope stability analysis. In the context of embankment retention systems at uranium recovery facilities, Regulatory Guide 3.11 (Revision 3, November 2008) elaborates on the factors of safety considered in slope stability analysis. Importantly, Regulatory Guide 3.11 defines allowable minimum factors of safety for earthquake and liquefaction analyses as being 1.0. As with previous licensing actions that consider embankment performance against various design criteria, a minimum factor of safety of 1.0 is applied to the Class A West embankment.

Although factors of safety are not required by NRC to be developed for each aspect of the design, a factor of safety is calculated in Table 3.4 for each design criteria where supporting analyses provides a value for comparison. This approach is consistent with major licensing actions and Radioactive Material License renewals dating to the 2000 Class B & C license application. Thus, only the slope stability analysis has a regulatory basis for the minimum factor of safety evaluation; other factors of safety provide information about relative robustness of the design. In each case, cited references should be consulted in order to understand and evaluate the basis for the reported safety factor.

Table 3.2: Design Criteria of the Principle Design Features

| Principal Design Feature | Required Function | Complementary Aspects | Design Criteria | Design Criteria Justification | Conditions | |
|---|---|---|---|---|---|---|
| Liner | Minimize contact of wastes with standing water | Minimize contact of wastes with standing water during operations | Permeability $\leq 1 \times 10^{-4}$ cm/sec | Prevent contact of water with waste. Operational experience shows that $10^{-4}$ cm/sec permeability promotes runoff and allows accumulation of water to occur. Water is then removed by pumping. | normal | 25 yr. 24 hr. storm |
| | | | | | abnormal | 100 yr. 24 hr. storm |
| | | | | | accident | Heavy equipment damage to liner |
| | | Minimize contact of wastes with standing water after closure | Liner permeability $\geq$ cover permeability | Inflow into embankment < outflow out of embankment. | normal | Liner and cover retain design permeability over time |
| | | | | | abnormal | Degraded cover |
| | | | | | accident | Not required per NUREG-1199 |
| | Ensure cover integrity | Mitigate differential settlement | Maximum allowable distortion in cover = 0.02 | AMEC, October 4, 2000. "Allowable Differential Settlement and Distortion of Liner and Cover Materials." AMEC, May 27, 2005. "Geotechnical Study: Increase in Height and Footprint." | normal | Settlement completed during operations |
| | | | | | abnormal | One area to cover height with adjacent area less than 25 feet high |
| | | | | | accident | Not required per NUREG-1199 |
| Waste Placement and Backfill | Ensure cover integrity | Mitigate differential settlement | Maximum allowable distortion in cover = 0.02 | AMEC, October 4, 2000. "Allowable Differential Settlement and Distortion of Liner and Cover Materials." AMEC, May 27, 2005. "Geotechnical Study: Increase in Height and Footprint." | normal | All primary and portion of secondary settlement in soil layers complete during construction and 100-year institutional control period |
| | | | | | abnormal | Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period. |
| | | | | | accident | Not required per NUREG-1199 |
| | Ensure structural stability | Maintain slope stability | Static safety factor $\geq$ 1.5 Seismic safety factor $\geq$ 1.2 | State of Utah Statutes and Administrative Rules for Dam Safety, Rule R625-11-6 | normal | Static conditions |
| | | | | | abnormal | Earthquake |
| | | | | | accident | Not required per NUREG-1199 |
| ` Cover | Minimize infiltration | Minimize infiltration | Average Infiltration $\leq$ 0.036 inches/year (0.09 cm/year) top slope0.066 inches/year (0.168 cm/year) side slope | HELP model parameter that achieved performance based standards. Whetstone Associates, Inc., November, 2011. "Energy*Solutions* Class A West (CAW) Disposal Cell Infiltration and Transport Modeling." | normal | Average annual precipitation (7.92 ") |
| | | | | | abnormal | All abnormal conditions related to the Complementary Aspects of "Encourage Runoff", "Desiccation", "Frost Penetration", and "Biointrusion". |
| | | | | | accident | Not required per NUREG-1199 |
| | | Encourage runoff | Maintain positive drainage; Maximum design velocity within drainage layer > calculated drainage velocities; Do not allow water accumulation | Drainage (flow) needs to be maintained under all conditions | normal | 100 yr. 24 hr. storm |
| | | | | | abnormal | PMP (1-hour = 6.1 inches) |
| | | | | | accident | Downstream blockage |
| | | Prevent desiccation | No desiccation cracking in Radon Barrier Clay | Ensure infiltration design criteria is attained | normal | Historic weather patterns |
| | | | | | abnormal | Drought |
| | | | | | accident | NA |
| | | | | | normal | Historic weather patterns |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Limit frost penetration | Thickness of rock/filter/sacrificial soil zones ≥ maximum depth of frost (3 feet) | Ensure infiltration design criteria is attained | abnormal | Monthly average minimum temperatures below those predicted by the 500 year return frequency |
| | | | | | accident | Not required per NUREG-1199 |
| | | Limit biointrusion | Biointrusion shall be discouraged and shall not cause increased infiltration | Ensure infiltration design criteria is attained | normal | Desert plant growth (shallow rooted) |
| | | | | | abnormal | Desert plant growth (deep rooted) |
| | | | | | accident | Not required per NUREG-1199 |
| | Reduce Exposures | Surface dose rates | 100 mrem TEDE | R313-15-301 | normal | Low to moderate gamma emitters |
| | | | | | abnormal | High gamma emitter at top of waste |
| | | | | | accident | NA |
| Cover | Ensure Cover Integrity | Mitigate Differential Settlement | Maximum Allowable Distortion = 0.02 | AMEC, October 4, 2000. "Allowable Differential Settlement and Distortion of Liner and Cover Materials." AMEC, May 27, 2005. "Geotechnical Study: Increase in Height and Footprint." | normal | All primary and portion of secondary settlement in soil layers complete, no container deterioration up to 100 years |
| | | | | | abnormal | Container deterioration after 100 years, allowing creep of compressible waste and additional secondary settlement of soils. Earthquake. |
| | | | | | accident | Not Required per NUREG-1199 |
| | Ensure Cover Integrity | Prevent Internal Erosion | Water velocity < 5.41 ft/sec on Radon Barrier Clay | NUREG/CR-4620 | normal | 100 yr. 24 hr. storm |
| | | | | | abnormal | PMP (1-hour = 6.1 inches) |
| | | | | | accident | Not Required per NUREG-1199 |
| | | | Prevent Piping: $D_{15}$(filter)/$D_{85}$(soil) ≤ 5 AND $D_{50}$(filter)/$D_{50}$(soil) ≤ 25<br><br>Prevent Upward Migration of Fines $D_{15}$(Lower Layer)/$D_{85}$(Upper Layer) ≤ 4 | Reduce plugging of lower filter layer. Cedergren, H.R., (1977), "Seepage, Drainage, and Flow Nets" second edition, John Wiley & Sons, New York, pp. 178-182.<br><br>DOE, 1989. Technical Approach Document, Revision II, UMTRA-DOE/AI 050425.0002, pp. 82-83 | normal | Performance calculations are developed for saturated conditions within dams. Conditions at Envirocare are much less severe.<br><br>DOE ratios have been developed for abnormal saturated conditions within an UMTRA embankment. |
| | | | | | abnormal | |
| | | | | | accident | |
| | | Material Stability / Endure Weathering, External Erosion | 1000 year life | NUREG-1623<br>NUREG/CR-4620 | normal | Historic Weather Patterns |
| | | | | | abnormal | PMP (1-hour = 6.1 inches) |
| | | | | | accident | Not Required per NUREG-1199 |
| | Ensure Structural Stability | Settlement | Long Term Cover Drainage (No Slope Reversal) | Minimize Ponding | normal | Evenly Distributed Weight Loading |
| | | | | | abnormal | Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period. |
| | | | | | accident | Not Required per NUREG-1199 |
| | | | Maximum Total Settlement ≤ 15% of Embankment Height<br>LARW – 8.4 feet<br>Class A – 9.2 feet | Highway embankments and major waste storage embankments have settled up to 15% of their height and performed adequately | normal | Evenly Distributed Weight Loading |
| | | | | | abnormal | Creep of compressible waste and additional secondary settlement of soils after 100-year institutional control period. |
| | | | | | accident | Not Required per NUREG-1199 |
| | | Maintain Slope Stability | Static Safety Factor ≥ 1.5<br>Seismic Safety Factor ≥ 1.2 | State of Utah Statutes and Administrative Rules for Dam Safety, Rule R625-11-6 | normal | Static Conditions |
| | | | | | abnormal | Earthquake |
| | | | | | accident | Not Required per NUREG-1199 |
| Drainage Systems | Provide Site Drainage | Facilitate flow away from the embankment | Depth of water < depth of ditch. Promote free flowing conditions. Freeboard ≥ 0.5 foot under normal conditions. | Minimize potential infiltration into the waste. | normal | 25 yr. 24 hr. storm |
| | | | | | abnormal | 100 yr. 24 hr. storm |
| | | | | | accident | Downstream Blockage |
| | | Minimize Infiltration under flood conditions | Flood water shall dissipate faster than water travels through the cover system. | Ponded flood water would promote infiltration. So long as flood water drains or evaporates faster than the travel time through the cover, increased infiltration will be minimized. | normal | 100 year flood (3,802 cfs) |
| | | | | | abnormal | PMF (48,500 cfs) |
| | | | | | accident | Downstream Blockage |
| | Ensure Ditch Integrity | Prevent Internal Erosion | Size of rock able to handle stresses related to flow | NUREG/CR-4620<br>NUREG-1623 | normal | 25 yr. 24 hr. storm |
| | | | | | abnormal | 100 yr. 24 hr. storm |
| | | | | | accident | Not Required per NUREG-1199 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Buffer Zone | Provide Site Monitoring | Not applicable | Sized adequate for monitoring and corrective measures | Compliance monitoring | normal | No releases |
| | | | | | abnormal | Contaminant releases |
| | | | | | accident | Not Required per NUREG-1199 |

Table 3.3: Pertinent Characteristics of the Principle Design Features

| Principal Design Feature | Principal Design Element | Pertinent Characteristics | References |
|---|---|---|---|
| Liner | Clay Liner under Embankment | 2 feet thick<br>Permeability ≤ 1 x $10^{-6}$ cm/sec<br><br>Compacted to 95% of a standard proctor<br>Moisture between optimum and optimum +5%<br>85% fines (<0.075 mm)<br>10 < plasticity index < 25<br>30 < liquid limit < 50 | Thickness, permeability: GWQDP Condition I.D.4.(c)<br><br>Compaction and Moisture in Work Element - Clay Liner Placement; Compaction specification;<br>Fines, plasticity index, and liquid limit in Work Element - Clay Liner Borrow Material, Material specification. |
| Bulk Waste Placement | Bulk Waste Placement | Compacted waste average lift thickness ≤ 24 inches<br>Compacted with at least 4 machine passes of a CAT 826 compactor, and must meet CAES acceptance criteria.<br>First one foot of material above liner debris-free native soil<br>Last one foot before radon barrier debris-free<br>Compressible debris ≤ 50% of uncompacted lift volume<br>Incompressible debris ≤ 50% of uncompacted lift volume | CQA/QC Manual, Attachment II-A, Work Element – Waste Placement With Compactor |
| Cover | Clay Radon Barrier | 1 foot of 1 x $10^{-6}$ cm/sec clay<br>1 foot of 5 x $10^{-8}$ cm/sec clay<br><br>85% fines (<0.075 mm)<br>10 < plasticity index < 25<br>30 < liquid limit < 50<br><br>Compacted to 95% of a standard proctor<br>Moisture between optimum and optimum + 5%<br><br>Top Slope: 2-4%<br>Side Slope: 20% | Thickness, permeability, slope: GWQDP Condition I.D.4.a(5)<br><br>Compaction and Moisture in CQA/QC Manual Attachment II-A, Work Element - Radon Barrier Placement, Compaction specification<br><br>Fines, plasticity index, and liquid limit in CQA/QC Manual, Attachment II-A, Work Element - Clay Liner Borrow Material, Material specification. |
| | Lower Filter Zone<br>Type B Filter | 6 inches thick on the top slope and 18 inches thick on the side slopes<br><br>Permeability ≥ 3.5 cm/sec<br><br>Type B filter and Sacrificial Soil gradations must meet specified ratios<br><br>Rock Scoring Test > 50 | Thickness, permeability: GWQDP Condition I.D.4.a(4)<br><br>Gradation criteria on drawing 10014-C04<br><br>Rock Scoring Criteria in CQA/QC Manual, Appendix D and Attachment II-A, Work Element - Filter Zone, Quality of Rock specification |

| | | | |
|---|---|---|---|
| Cover | Sacrificial Soil | 12 inches thick<br><br>Residual moisture content ≥ 3.5%<br><br>Type B filter and Sacrificial Soil gradations must meet specified ratios | GWQDP Condition I.D.4.a(3)<br><br>Gradation criteria on drawing 10014-C04 |
| | Upper Filter Zone<br>Type A Filter | 6 inches thick<br><br>D100 ≤ 6 inches<br>D70 ≤ 3 inches<br>D50 ≤ 1.57 inch (40 mm)<br>D15 ≤ 0.85 inch (22 mm)<br>D10 ≥ No. 10 Sieve (2.0 mm)<br>D5 ≥ No. 200 Sieve (~ 0.075 mm)<br><br>Rock Scoring Test > 50 | Thickness, gradation: GWQDP Condition I.D.4.a(2)<br><br>Rock Scoring Criteria in CQA/QC Manual, Appendix D and Attachment II-A, Work Element - Filter Zone, Quality of Rock specification |
| | Erosion Barrier | 24 inches thick<br><br>Top Cover (Type B riprap):<br>D100 ≤ 4.5 inches<br>D50 ≥ 1.25 inches<br>D10 ≥ 0.75 inch<br>D5 ≥ No. 200 Sieve (~ 0.075 mm)<br><br>Side Cover (Type A riprap):<br>D100 ≤ 16 inch<br>D90 ≤ 12 inch<br>D50 ≥ 4.5 inch<br>D10 ≥ 2 inch<br>D5 ≥ No. 200 Sieve (~ 0.075 mm)<br><br>Rock Scoring Test > 50 | Thickness, gradation: GWQDP Condition I.D.4.a(1)<br><br>Rock Scoring Criteria in CQA/QC Manual, Appendix D and Attachment II-A, Work Element - Filter Zone, Quality of Rock specification |
| Drainage Systems | Drainage Ditches | 4 feet deep<br>"Irregular quadrilateral" with a 2% bottom slope and 5:1 (H:V) sides slopes<br>Borrow Material = CL or ML soils<br>Natural Ground or Imported Borrow Material Compacted to 95% of a Standard proctor<br>6 inches of Type A filter material<br>18 inches of Type A riprap material | Drawing 10014-C03<br><br>Borrow Material in CQA/QC Manual, Attachment II-A, Work Element - Drainage Ditch Imported Borrow, Material specification |

| | | | |
|---|---|---|---|
| Buffer Zone | Buffer Zone | 94 feet from toe of waste to fence<br><90 feet from toe of waste to compliance well<br>300 feet from toe of waste to property line<br>97.7 feet from toe of waste to Vitro property line | Section 1.2.2.2 of this report |

Table 3.4: Projected Performance of the Principle Design Features

| Principal Design Feature | Required Function | Complementary Aspects | Design Criteria | Projected Performance | Performance Reference | Safety Factor |
|---|---|---|---|---|---|---|
| Liner | Minimize contact of waste with standing water | Minimize contact of wastes with standing water during operations | Permeability $\leq 1 \times 10^{-4}$ cm/sec | Design permeability = $1 \times 10^{-6}$ cm/sec | CQA/QC Manual | 100 (all conditions) |
| | | Minimize contact of wastes with standing water after closure | Liner Permeability $\geq$ Cover Permeability | Liner design permeability = $1 \times 10^{-6}$ cm/sec<br>Cover design permeability = $5 \times 10^{-8}$ cm/sec | CQA/QC Manual | 20 (all conditions) |
| | Ensure Cover Integrity | Mitigate Differential Settlement | Maximum Allowable Distortion in Cover = 0.02 | Normal maximum distortion = 0.001<br>Abnormal maximum distortion = 0.007 | AGRA, 2000<br>AMEC, 2000<br>AMEC, 2005<br>AMEC, 2011 | Normal = 20<br>Abnormal = 2.86 |
| Waste Placement and Backfill | Ensure Cover Integrity | Mitigate Differential Settlement | Maximum Allowable Distortion in Cover = 0.02 | Maximum differential settlement (distortion) calculated at 0.01 for bulk waste facility under abnormal conditions | AGRA, 2000<br>AMEC, 2005<br>AMEC, 2011 | Abnormal: 2.0 |
| | Ensure Structural Stability | Maintain Slope Stability | Static Safety Factor $\geq$ 1.5<br>Seismic Safety Factor $\geq$ 1.2 | Static Safety Factor $\geq$ 2.1<br><br>Seismic Safety Factor = 1.2 | AGRA, 1996<br>AGRA, 1999<br>AMEC, 2000<br>AMEC, 2005<br>AMEC, 2011 | Static $\geq$ 2.5 (exceeds design criteria of 1.5)<br>Seismic = 1.2 (meets design criteria of 1.2) |
| Cover | Minimize Infiltration | Minimize Infiltration | Average infiltration $\leq$ 0.036 inches/year (0.090 cm/year) top slope<br>0.066 inches/year (0.168 cm/year) side slope | Infiltration meets performance criteria of transport to monitoring wells for at least 500 years. | Whetstone, 2011 | Not applicable |
| | | Encourage Runoff | Maintain positive drainage; Maximum design velocity within drainage layer > drainage velocities;<br><br>Do not allow water accumulation | Cover design slope = 4%. See also Section 1.3.3.4.1.<br>Maximum theoretical velocities:<br>$3.45 \times 10^{-3}$ ft/sec (top slope)<br>$2.30 \times 10^{-2}$ ft/sec (side slope)<br>Maximum drainage velocities during PMP:<br>$8.6 \times 10^{-4}$ ft/sec (top slope)<br>$8.0 \times 10^{-4}$ ft/sec (side slope) | Whetstone, 2005<br><br>Envirocare, 2005, section 3.3.3.1.2 | Top Slope: 4.01<br><br>Side Slope: 28.75 |
| | | Prevent Desiccation | No desiccation cracking in Radon Barrier Clay | UNSAT-H modeling establishes that the steady-state moisture content of the clay radon barrier will remain constant through all conditions throughout the life of the embankment. | Whetstone, 2011 | 1.91 (all conditions) |
| | | Limit Frost Penetration | Thickness of rock/filter/sacrificial soil zones (3.5 ft) $\geq$ maximum depth of frost | Top Slope frost depth = 3.4 feet<br>Side Slope frost depth = 3.2 feet | Montgomery Watson, 1998<br>Montgomery Watson, 2000<br>Western Regional Climate Center, 2000<br>Envirocare, 2005, section 3.3.3.1.4 | Top > 1.03<br>Sides > 1.09<br>(abnormal condition) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Cover | Minimize Infiltration | Limit Biointrusion | Biointrusion shall be discouraged and shall not cause increased infiltration | Due to increased evapotranspiration, vegetation decreases infiltration through the cover under both the normal and the abnormal conditions.<br>Infiltration (normal) = 0.065 cm/sec<br>Infiltration (abnormal) = 0.071 cm/sec | SWCA, 2000<br>Whetstone, 2005 | Normal = 2.60<br><br>Abnormal = 1.86 |
| | Reduce Exposure | Surface Dose Rates | 100 mrem TEDE | 3 mrem/year through cover using abnormal event of high-gamma source at the top of waste. | Energy*Solutions*, 2011 | 100/3 = 33.33<br>(abnormal condition) |
| | Ensure Cover Integrity | Mitigate Differential Settlement | Maximum Allowable Distortion = 0.02 | Maximum differential settlement (distortion) calculated at 0.01 for bulk waste facility under abnormal conditions | AGRA, 2000<br>AMEC, 2005<br>AMEC, 2011 | Abnormal: 2.0 |
| | | Prevent Internal Erosion | Water velocity < 5.41 ft/sec on Radon Barrier Clay | Interstitial Velocities at Radon Barrier/Filter Zone Interface:<br>Based on approximate size of filter rock:<br>Top Slope ~ 0.12 ft/sec<br>Side Slope ~ 0.055 ft/sec | Energy*Solutions*, 2011 | Top ~ 98<br>Side ~ 45<br>(all conditions) |
| | | | Prevent Piping:<br>D15(filter)/D85(soil) ≤ 5 AND D50(filter)/D50(soil) ≤ 25<br><br>Prevent Upward Migration of Fines<br>$D_{15}$(Lower Layer) / $D_{85}$(Upper Layer) ≤ 4 | Incorporated as construction specification on drawing 10014-C04<br><br>Top Slope: Type A Filter $D_{15}$/Type B riprap $D_{85}$ = 0.19<br>Side Slope: Type A Filter $D_{15}$/Type A riprap $D_{85}$ = 0.52 | Energy*Solutions*, 2011 | Not applicable<br><br>Top = 26.3<br>Side = 9.6<br>(all conditions) |
| | | Material Stability / External Erosion | 1000 year life | Design riprap D50:<br>Top Slope = 1.25 inches<br>Side Slopes = 4.5 inches | Envirocare, 2011 | Top = 1.13<br>Side = 1.21<br>(abnormal condition) |
| | | | | Weighted average quality scoring for specific gravity, absorption, sodium soundness, and L.A. abrasion.<br>Reject rock with quality scoring < 50 | CQA/QC Manual<br><br>NUREG-1623 | Not applicable |
| | Ensure Structural Stability | Settlement | Long Term Cover Drainage (No Slope Reversal) | Even if the total potential settlement were focused at the crest of the embankment, the drop in elevation from the crest to the shoulder (37.7 feet) eliminates the potential for slope reversal. | AMEC, 2011<br>(sections 4.2.3 and 4.4) | 37.7/3.95 = 9.54 |
| | | | Maximum Total Settlement ≤ 15% of Embankment Height (12.6 feet for 84 foot embankment crest) | Primary foundation settlement 1.25 feet<br>Secondary foundation settlement 2.0 feet<br>Waste settlement after cover construction 0.7 feet<br>Total 3.95 feet<br>Embankment height at crest 84 feet | AMEC, 2011<br>(sections 4.2.3 and 4.4) | 12.3/3.95 = 3.20 |
| | | Maintain Slope Stability | Static Safety Factor ≥ 1.5<br>Seismic Safety Factor ≥ 1.2 | Static Safety Factor ≥ 2.5<br><br>Seismic Safety Factor = 1.2 | AGRA, 1996<br>AGRA, 1999<br>AMEC, 2000<br>AMEC, 2005<br>AMEC, 2011 | Static ≥ 2.5 (exceeds design criteria of 1.5)<br>Seismic = 1.2 (meets design criteria of 1.2) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Drainage System | Provide Site Drainage | Facilitate flow of precipitation away from the embankment | Depth of water < depth of ditch.<br>Freeboard ≥ 0.5 foot under normal conditions. | Design ditch height = 4 feet.<br>Max height of water during normal event = 2.07 feet at downstream limit of ditch system.<br>Max height of water during abnormal event = 2.47 feet at downstream limit of ditch system.<br>Downstream blockage improves post-closure performance | Energy*Solutions,* 2011 | Downstream:<br>Normal SF = 1.69<br>Abnormal SF = 1.62 |
| | | Minimize Infiltration under flood conditions | Flood water shall dissipate faster than water travels through the cover system. | Maximum depth of PMF is approximately one foot across the site. This depth would last about 15 hours. Water travel time through the cover system is over 89 years. | Bingham, 1996<br><br>Whetstone, 2001 | Abnormal SF > 50,000 |
| | Ensure Ditch Integrity | Prevent Internal Erosion | Size of rock able to handle stresses related to flow | The type A riprap in the ditches is adequately sized with a D50 of 4.5 inches. | Energy*Solutions*, 2011 | Normal = 7.65<br>Abnormal = 6.40 |
| Buffer Zone | Provide Site Monitoring | NA | Sized adequate for monitoring and corrective measures | No contaminants will reach the monitoring wells located approximately 90 feet from the edge of waste, within the buffer zone boundary of 94 feet) within 500 years. | Whetstone, 2011 | Not applicable |

## 3.1 PRINCIPLE DESIGN FEATURES

### 3.1.1 WATER INFILTRATION

The Class A West embankment cover has been designed to direct ambient precipitation away from the disposal unit. Cover design is detailed in Drawings 10014-C02 and 10014-C03.

Flow from offsite precipitation is controlled during disposal operations by run-on berms that completely surround the disposal unit. Construction specifications for run-on berms are provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification "Run-on Control During Project". No revision to this specification will be needed for construction of the Class A West embankment. Groundwater does not need to be directed away from the disposal cell, since the lowest top of liner elevation is more than 13 feet above the highest recorded elevation for the upper, unconfined aquifer. The lowest top of liner elevation will be at approximately 4265 feet above sea level (see Drawing 10014-C01); the highest recorded elevation for the upper, unconfined aquifer, based on available data from the 17 most recent years for wells surrounding the Class A and Class A North embankments, is 4,251.3 feet above sea level.

The post-closure drainage system surrounding the Class A West embankment has been designed to direct flow from ambient precipitation away from the disposal unit. The current drainage system routes the flows from the Class A and Class A North embankments beginning from a high point at the north west corner, around both sides, to the south east corner. From that point, the combined flow runs south to the westward flowing ditch that runs along the south boundary of Section 32. That south ditch currently carries stormwater from all embankments in Section 32. The revised drainage system depicted on the drawings will isolate stormwater flows from the Class A West embankment and route them to the southwest corner of the Class A West embankment, then southward along the west edge of the 11e(2) embankment, where the flow will discharge at the southwest corner of Section 32.

Drainage system design for the Class A West embankment is detailed in Drawings 10014-C01, 10014-C02, and 10014-C03. Because the overall footprint of the Class A West embankment is slightly larger than the combined Class A and Class A North footprints, a site drainage evaluation was performed and total ditch flow calculations have been included with this License Amendment Request (LAR) as Attachment 4.

The ditch flow calculations provided in Attachment 4 were devised to determine whether ditch designs associated with the Class A West embankment were rigorous enough to withstand both the normal (25 year, 24 hour) and abnormal (100 year, 24 hour) storm conditions. Flow calculations were also performed for the 11e.(2) drainage ditch system as water for all of the embankments will flow through the 11e.(2) drainage ditches before reaching the drainage system outlet.

Flow velocities for the Class A West and 11e.(2) drainage ditches were calculated based on the drawings provided in Attachment 2 to this LAR (particularly 10014-C01 and 10014-C03). Upon obtaining flow velocities, storm events were calculated using isopluvial maps and calculations provided by the National Oceanic and Atmospheric

Administration (NOAA, Atlas 14, Volume 1, Version 5). Drainage areas were calculated for all designed embankments at the Clive facility, including the Class A West embankment. These drainage areas, and ditch volume equations were used to ascertain whether upstream storage would cause ditch overflow given the normal (25 year, 24 hour) and abnormal (100 year, 24 hour) storm conditions.

Drainage calculations were performed first for the Class A West ditches and then second for the 11e.(2) ditches (as a representation of total site drainage). These calculations illustrate that current ditch designs meet drainage systems design criterion for the Class A West embankment (described in Table 3.2), and are adequate to handle site-wide flows associated with both the normal and abnormal storm events during operations.

### 3.1.2 DISPOSAL UNIT COVER INTEGRITY

The cover system for the Class A West embankment consists of the same layers and material specifications as the existing Class A embankments. To date, no cover has been constructed over waste placed in either the Class A or Class A North embankment. Therefore, the cover's ability to perform for the required period of time and to avoid the need for continuing active maintenance has been assessed previously in permitting the Class A and Class A North embankments.

A comprehensive summary of cover integrity design criteria for the Class A embankment is provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA; performance assessments against these design criteria are discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. The scope of these assessments include differential settlement, internal erosion, and material stability/external erosion. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5. The cover's ability to resist degradation by biotic activity is addressed in Sections 3.1.3.1.5 and 3.3.3.1.5 of the 2005 LRA.

### 3.1.3 STRUCTURAL STABILITY

Waste placement in the Class A West embankment will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. No changes to waste placement specifications and controls will be necessary for the Class A West embankment. Structural stability has been assessed previously in permitting the Class A embankment. A comprehensive summary of structural stability design criteria for the Class A embankment is provided in Sections 3.1.2.2 and 3.1.3.4 of the 2005 LRA; performance assessments against these design criteria are discussed in Sections 3.3.2.2 and 3.3.3.4 of that document. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5.

### 3.1.4 CONTACT WITH STANDING WATER

The Class A West embankment will be subject to identical stormwater management requirements during operations as the existing Class A embankment. See Condition I.E.7 of GWQDP UGW450005 as well as design criteria presented in Section 3.1.1.1.1 of the 2005 LRA; performance assessments against these design criteria are discussed in Section 3.3.1.1.1 of that document. Contact with standing water after closure will be controlled using the post-closure drainage ditch system; see Section 3.1.1 above and 3.1.5 below.

### 3.1.5 SITE DRAINAGE

There are no surface water features within 5 miles of Section 32, as established in Section (x) and Appendix J of "Pre-licensing Plan Approval Application" dated March 15, 2000. Therefore, site drainage is addressed in terms of direct precipitation runoff and sheet flow associated with the Probable Maximum Flood event. The post-closure drainage system surrounding the Class A West embankment has been designed to direct water from precipitation or sheet flow away from the disposal unit. Drainage system design for the Class A West embankment is detailed in Drawings 10014-C01, 10014-C02, and 10014-C03, and are included with this LAR as Attachment 2.

### 3.1.6 SITE CLOSURE AND STABILIZATION

Long-term isolation of the waste in the Class A West embankment will be ensured consistent with cover design features and waste placement specifications in place for the existing Class A and Class A North embankments. Preventing the need for active maintenance is addressed within the analyses referenced in Sections 3.1.1 and 3.1.2 above. A cover system designed to minimize infiltration without the need for active maintenance is considered a complementary feature that has improved the site's natural characteristics.

### 3.1.7 LONG-TERM MAINTENANCE

Preventing the need for active maintenance is addressed within the analyses referenced in Sections 3.1.1 and 3.1.2 above. Design criteria for the various elements of the liner, waste placement, and cover systems have been set to incorporate a factor of safety of at least 1.0 against failure under normal, abnormal, and accident conditions. See section 3.0 above for additional discussion of factors of safety. Tables 3.2 and 3.4 of the 2005 LRA provide a comprehensive discussion of embankment design criteria, their basis, conditions evaluated, and projected performance for the Class A embankment. This discussion is applicable to the Class A West embankment because liner, waste placement, and cover specifications are the same for each embankment.

### 3.1.8 INADVERTENT INTRUDER BARRIER

Both during site operations and after closure, barriers are maintained to prevent inadvertent intrusion to LLRW. The barrier consists of chain link fencing. Post-closure fencing shall be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – Permanent Chain Link Fences. In addition, the embankment cover system provides a further barrier to inadvertent intrusion, with 3.5 feet of rock layers plus 2 feet of clay and 1 foot of non-contaminated native soil "temporary cover" material above the waste.

### 3.1.9 DOSE AFTER CLOSURE

Energy*Solutions* performed MicroShield® calculations to determine the Total Effective Dose Equivalent (TEDE) for the completed CAW embankment and ensure that it was less than the 100 mrem TEDE specified in UAC R313-15-301 (Energy*Solutions*, 2011). See Figure 1, below, for details.

An abnormal condition involving a 55-galon drum containing a total activity of 11 curies was assumed to be placed on its side at top of waste, just below the Class A West cover. MicroShield® projected a contact dose rate on top of the completed cover of approximately 3 mrem, well within the regulatory requirement of 100 mrem.

Figure 1: MicroShield® Case Title – Class A West Cover

| **MicroShield 8.03<br>EnergySolutions (8.03-0000)** | | | |
|---|---|---|---|
| **Date** | **By** | **Checked** | |
| | | | |
| **Filename** | **Run Date** | **Run Time** | **Duration** |
| CAW cover.MSD | December 19, 2011 | 3:00:16 PM | 00:00:00 |
| **Project Info** | | | |
| Case Title | Class A West Cover | | |
| Description | Cover Contact with 55-gallon Drum Below | | |
| Geometry | 7 - Cylinder Volume - Side Shields | | |
| **Source Dimensions** | | | |
| Height | 76.0 cm (2 ft 5.9 in) | | |
| Radius | 30.0 cm (11.8 in) | | |
| **Dose Points** | | | |
| **A** | **X** | **Y** | **Z** |
| #1 | 244.36 cm (8 ft 0.2 in) | 38.0 cm (1 ft 3.0 in) | 0.0 cm (0 in) |
| **Shields** | | | |
| **Shield N** | **Dimension** | **Material** | **Density** |
| Source | 1.31e+04 in³ | Concrete | 1.6 |
| Transition | | Air | 0.00122 |
| Shield 2 | 84.0 in | Concrete | 1.6 |
| Air Gap | | Air | 0.00122 |
| **Source Input: Grouping Method - Actual Photon Energies** | | | |
| **Nuclide** | **Ci** | **Bq** | **µCi/cm³** | **Bq/cm³** |
| Co-60 | 1.0000e+001 | 3.7000e+011 | 4.6537e+001 | 1.7219e+006 |
| **Buildup: The material reference is Shield 2<br>Integration Parameters** | | | |
| Radial | | | 10 |
| Circumferential | | | 10 |

| MicroShield 8.03<br>EnergySolutions (8.03-0000) | | | | | |
|---|---|---|---|---|---|
| Y Direction (axial) | | | | | 20 |
| **Results** | | | | | |
| **Energy (MeV)** | **Activity (Photons/sec)** | **Fluence Rate MeV/cm²/sec No Buildup** | **Fluence Rate MeV/cm²/sec With Buildup** | **Exposure Rate mR/hr No Buildup** | **Exposure Rate mR/hr With Buildup** |
| 0.6938 | 6.035e+07 | 5.176e-11 | 7.863e-09 | 9.994e-14 | 1.518e-11 |
| 1.1732 | 3.700e+11 | 2.197e-04 | 1.109e-02 | 3.927e-07 | 1.983e-05 |
| 1.3325 | 3.700e+11 | 9.392e-04 | 3.724e-02 | 1.629e-06 | 6.460e-05 |
| **Totals** | **7.401e+11** | **1.159e-03** | **4.833e-02** | **2.022e-06** | **8.443e-05** |

### 3.1.10 SITE MONITORING

Operational environmental monitoring is addressed in Section 4.4 of this document. Post-operational environmental monitoring is addressed in Section 5.3 of this document.

### 3.1.11 BUFFER ZONE

Buffer zone coordinates for the Class A West embankment are provided on Drawing 10014-U01. A discussion of the design criteria and projected performance of the buffer zone is located in the 2005 LRA, Sections 3.1.5 and 3.3.5, respectively. See also Section 1.2.2.2 of this document.

### 3.1.12 OCCUPATIONAL EXPOSURE

Occupational exposure is discussed in Section 7 of this LAR.

## 3.2 DESIGN CONSIDERATIONS FOR NORMAL/ABNORMAL/ACCIDENT CONDITIONS

Principal design criteria applicable to the Class A West embankment are located in the 2005 LRA, Section 3.0. Specifically, design criteria of the principal design features are summarized in Table 3.2 of that document. Projected performance against these design criteria are summarized in Table 3.4 of that document. The 2005 LRA focuses on the Class A embankment; this discussion is generally applicable to the Class A West embankment because the liner, waste placement, and cover systems are identical for both embankments. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 of this document.

### 3.2.1 WATER INFILTRATION

Water infiltration is evaluated through infiltration and transport modeling in support of the groundwater model (described in Section 2.6.2), documented under separate cover. The groundwater model estimates an average of 0.036 in/yr (0.090 cm/yr) will infiltrate through the Class A West embankment top slope cover. Similarly, the groundwater model estimates average of 0.066 in/yr (0.168 cm/yr) would infiltrate through the side slope cover. These infiltration rates are affected by the slope lengths, low precipitation, and cover system lateral drainage layers.

### 3.2.2 DISPOSAL UNIT COVER INTEGRITY

Design criteria for protecting the disposal unit cover against internal and external erosion are provided in Sections 3.1.3.3.2 and 3.1.3.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria is provided in Sections 3.3.3.3.2 and 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A West embankment because the cover materials and specifications are essentially identical to that of the Class A embankment.

Design criteria for settlement and subsidence are provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria is discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5. Additionally, rock cover design calculations have been completed for the specific geometry of the Class A West

embankment. These calculations are provided in Attachment 10. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above to this document.

### 3.2.3 STRUCTURAL STABILITY

Evaluations of structural stability in terms of settlement and differential settlement are discussed in Section 3.2.2, above. Design criteria for ensuring structural stability are provided in Sections 3.1.2.2 and 3.1.3.4 of the 2005 LRA. Projected performance of the cover system against these design criteria is provided in Sections 3.3.2.2 and 3.3.3.4 of the 2005 LRA. These assessments have been updated by AMEC Earth & Environmental, Inc. (AMEC 2011) and the revised assessment is presented in Attachment 5. See also Section 2.3.2 above. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above to this document.

### 3.2.4 CONTACT WITH STANDING WATER

Design criteria for preventing contact of waste with standing water are provided in Section 3.1.1.1 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.1.1 of the 2005 LRA. These analyses are applicable to the Class A West embankment because the liner materials and material specifications are identical to that of the Class A embankment.

### 3.2.5 SITE DRAINAGE

In contrast to the embankment, which is designed for a 1,000-year lifetime, the drainage ditch system is only operational during the active life of the facility; approximately 25 years. Site drainage is evaluated based on a normal condition of the 25-year, 24-hour storm event and the abnormal condition of the 100 year, 24-hour storm. These storm events are described in the Drainage Ditch Calculations provided in Attachment 4. The required function of facilitating flow away from the embankment is met by minimizing standing water surrounding the embankments; therefore, the design criteria is to ensure water from these events is maintained within the drainage ditch system. The calculations within Attachment 4 demonstrate that the ditch systems are adequately designed to contain all water from the drainage area during both the normal and abnormal storm events. These calculations are summarized in Table 3.4 of this document.

The complementary aspect of minimizing infiltration under flood conditions is discussed in Section 3.1.4.1.2 of the 2005 LRA. The performance is described in Section 3.3.4.2.1 of the 2005 LRA and reiterated in Table 3.4.

The required function of ensuring ditch integrity is accomplished through an examination of the stresses upon the rock lining the ditch. Based upon the stresses exhibited by the flow during the normal and abnormal storm events, the size of rock required to manage that flow can be calculated. These calculated rock sizes and associated safety factors are provided in the drainage ditch calculations of Attachment 4. The performance information is summarized in Table 3.4 of this document.

### 3.2.6 SITE CLOSURE AND STABILIZATION

Closure of the Class A West embankment will be accomplished by construction of final cover as areas of the embankment reach their design height (see Section 1.3.3 above). Accordingly, all of the principal design criteria discussed herein are applicable to site closure and stabilization, as these criteria affect embankment construction. Each of the

performance assessments referenced herein includes analysis of the effects of design-basis abnormal events.

### 3.2.7 LONG-TERM MAINTENANCE

Design criteria for anticipated material durability to prevent the need for long-term maintenance is evaluated for the Class A embankment in Section 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A West embankment because the erosion barrier materials and specifications are identical to that of the Class A embankment.

Design criteria for anticipated erosion effects to prevent the need for long-term maintenance is evaluated for the Class A embankment in Sections 3.1.3.3.2 and 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Sections 3.3.3.3.2 and 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A West embankment because the erosion barrier materials and material specifications are identical to that of the Class A embankment.

The potential effects of design-basis abnormal events on long-term maintenance requirements are addressed concurrent with projected performance under normal, abnormal, and accident conditions for each design feature. A factor of safety of at least 1.0 against failure is maintained under normal, abnormal, and accident conditions. Tables 3.2 and 3.4 of the 2005 LRA provide a comprehensive discussion of embankment design criteria, their basis, conditions evaluated, and projected performance for the Class A embankment. This discussion is applicable to the Class A West embankment because liner, waste placement, and cover specifications are the same for each embankment.

### 3.2.8 INADVERTENT INTRUDER BARRIER

Both during site operations and after closure, a barrier is maintained to prevent inadvertent intrusion to LLRW. During site operations, the barrier consists of chain link fencing. Post-closure fencing shall be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – Permanent Chain Link Fences. The embankment cover system provides the long-term barrier to inadvertent intrusion, with 3.5 feet of rock layers plus 2 feet of clay plus one foot of non-contaminated native soil "temporary cover" above the waste. Material stability of cover rock layers is evaluated for the Class A embankment in Section 3.1.3.3.3 of the 2005 LRA. Projected performance against these design criteria is provided in Section 3.3.3.3.3 of the 2005 LRA. These analyses are applicable to the Class A West embankment because the erosion barrier materials and material specifications are identical to that of the Class A embankment.

### 3.2.9 OCCUPATIONAL EXPOSURE

Occupational Exposure Standard requirements for receiving, inspection, handling, storage, and disposal areas are discussed in Section 7, below. Wastes received at the Class A West embankment will be identical to those approved under the current license for the Class A and Class A North embankments; therefore, there is no need to evaluate required shielding for higher activity wastes. Energy*Solutions'* procedures for handling the accidental rupture of nonstable waste containers are discussed in Section 4.5, below.

#### 3.2.10 SITE MONITORING

Monitoring systems will be inspected for degradation as a component of each sampling event. Long-term monitoring systems include the groundwater monitoring wells and settlement monitoring plates as discussed in Section 5.3 of this document.

#### 3.2.11 BUFFER ZONE

A discussion of the design criteria and projected performance of the buffer zone is located in the 2005 LRA, Sections 3.1.5 and 3.3.5, respectively. See also section 1.2.2.2 above.

#### 3.2.12 STRUCTURAL DESIGN FOR BELOW-GROUND VAULTS AND EARTH MOUNDED CONCRETE BUNKERS

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete lined trenches with compartmental separation for different waste classes. Energy*Solutions* does not perform either of these types of disposal and therefore this topic is not applicable to the Class A West embankment.

## 3.3 CONSTRUCTION CONSIDERATIONS

Storm Water Management General Requirements: Temporary runoff control berms will be constructed around the waste placement areas in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Element – General Requirements, specification "Runoff Control During Project". The waste will be placed to divert storm water runoff away from the waste and to the toe of the cells.

### 3.3.1 CONSTRUCTION METHODS AND FEATURES

Construction methods for the Class A West embankment will be unchanged from current approved practices as provided in the LLRW and 11e.(2) CQA/QC Manual.

#### 3.3.1.1 SITE PREPARATION AND CURRENT CONDITIONS

Site preparation requirements for the Class A West embankment are provided in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Foundation Preparation. Because these specifications are identical to those of the Class A and Class A North embankments, no technical revision to the LLRW and 11e.(2) CQA/QC Manual is needed. As discussed in section 1.1 above, editorial changes to reference the Class A West embankment are provided as Attachment 8 to this amendment request. The existing surface as of April, 2011 includes areas of approved clay liner, areas excavated to near-foundation elevation; and areas that have been disturbed but remain at or near the original native elevation. As indicated on Drawing 10014-U02, existing groundwater wells GW-81 through GW-86, GW-109 through GW-117, and GW-140 and 141 are located within the embankment footprint and will be abandoned prior to liner construction. Collection lysimeters CL-W3, CL-W4, and CL-N5 will also need to be abandoned and relocated prior to liner construction. See also Section 1.2.3 above.

#### 3.3.1.2 CONTROL AND DIVERSION OF WATER

Surface water is controlled by a system of run-on and run-off berms. A comprehensive discussion of berm systems for the Class A embankment is provided in Section 3.4.4 of the 2005 LRA. This discussion is applicable to the Class A West embankment because berm requirements will be identical for the Class A and the Class A West embankments.

As discussed in section 3.1.1 above, the highest groundwater elevation is more than 13 feet below the top of liner elevation; therefore, groundwater control will not be necessary.

#### 3.3.1.3 CONSTRUCTION OF DISPOSAL UNITS

The Class A West embankment will be constructed to the existing liner, waste placement, and cover requirements of the LLRW and 11e.(2) CQA/QC Manual. See also engineering drawing series 10014.

#### 3.3.1.4 CONCRETE AND STEEL CONSTRUCTION

One aspect of disposal at the Class A West embankment will incorporate concrete as a component of disposal facility construction: Controlled Low-Strength Material (CLSM) used to fill voids in debris placement. CLSM use will be controlled in accordance with existing requirements applicable to disposal in the Class A embankment. CLSM requirements are located in the LLRW and 11e.(2) CQA/QC Manual, Work Element – Waste Placement, specification "CLSM Pours". CLSM is a low-strength void filling material; no reinforcing steel is used. There are no proposed differences between CLSM usage in the CAW embankment to CLSM usage in the Class A or Class A North embankments.

#### 3.3.1.5 BACKFILLING

Waste placement in the Class A West embankment will be controlled in accordance with the LLRW CQA/QC Manual, Work Element – Waste Placement. No changes to existing approved waste placement methods are requested.

#### 3.3.1.6 CLOSURE OF INDIVIDUAL DISPOSAL UNITS

The cover over the Class A West embankment will be constructed in accordance with the LLRW and 11e.(2) CQA/QC Manual, Work Elements – Temporary Cover Placement and Monitoring, Radon Barrier Borrow Material, Radon Barrier Test Pad, Radon Barrier Placement, Filter Zone, Sacrificial Soil Placement, and Rock Erosion Barrier. See also drawing series 10014.

As discussed in section 1.3.3 above, timing for different areas of cover construction is ultimately controlled by the open cell time limit provided at Part I.E.6 of the Ground Water Quality Discharge Permit. The open cell time limit requires that final cover be complete on or before the end of 18 years after the date of initial placement of the first lift of LLWR waste in that portion of the open cell. Dates of initial waste placement range from October, 2000 through July, 2011 for various lift areas within the proposed Class A West embankment.

Accordingly, cover construction will proceed in stages. Considerations that will affect the timing and areas to be covered in a particular construction project include:

1. Open cell time limit: If an area of waste placement is reaching its deadline, it will be a compliance requirement to complete cover construction.
2. Maintaining continuous progression of cover: Cover should progress in a contiguous manner. In other words, "islands" of cover surrounded by active waste placement; or conversely "islands" of waste placement surrounded by cover should be avoided.
3. Scale of construction projects: A number of factors affect the area of cover that can be physically completed within a construction season. These include the

weather, size and experience of the construction crew, and when in the construction season the project begins.

4. Time required to complete waste placement to the design elevations, slopes, and grades: Cover construction cannot begin before placement of the waste column is complete for a lift area, with adjacent lift areas also at or near top of waste.

Accordingly, it is not feasible at this time to provide a more detailed schedule for cover construction over the Class A West embankment; nor is there a regulatory basis to require one. The staged approach to liner and cover construction has been standard practice at the Clive facility since its inception, and dozens of liner and cover construction projects have been successfully completed. The CQA/QC Manual provides controls for ensuring sections of liner and radon barrier constructed at different times will perform seamlessly. See work element – Clay Liner Placement, specifications "Keying-In", "Cold Weather Placement of Clay Liner", and "Spring Start-Up" as well as work element – Radon Barrier Placement, specifications "Keying-In", "Cold Weather Placement of Radon Barrier", and "Spring Start-Up".

#### 3.3.1.7 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

Applicable codes and standards are discussed concurrent with establishment of design criteria for each of the principal design features, as referenced above. In addition, ASTM standards applicable to construction of the Class A West embankment are listed in Appendix B of the LLRW and 11e.(2) CQA/QC Manual and referenced in individual specifications as appropriate.

#### 3.3.1.8 CONSTRUCTION MATERIALS AND QUALITY ASSURANCE

Construction materials for the Class A West embankment will consist of native soils and rock. Specifications for each component are provided as discussed above. Quality assurance and quality control measures required for construction are provided in the LLRW and 11e.(2) CQA/QC Manual. All construction materials and procedures for the Class A West embankment will be identical to those currently approved for the Class A embankment.

#### 3.3.1.9 SITE PLANS, ENGINEERING DRAWINGS, AND CONSTRUCTION SPECIFICATIONS

Engineering drawing series 10014 details the Class A West embankment and is provided as Attachment 2 to this amendment request. In accordance with Condition I.H.6 of the GWQDP, Energy*Solutions* is required to provide an annual as-built report and drawing set documenting embankment construction.

### 3.3.2 CONSTRUCTION EQUIPMENT

Construction equipment will consist of standard heavy construction and earth-moving equipment. Equipment used to construct the Class A West embankment will be equal to that used in construction of the Class A embankment.

### 3.3.3 CONSTRUCTION AND OPERATION CONSIDERATIONS FOR BELOW-GROUND VAULTS AND EARTH MOUNDED CONCRETE BUNKERS

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete lined trenches with compartmental separation

for different waste classes. Energy*Solutions* does not perform either of these types of disposal and therefore this topic is not applicable to the Class A West embankment.

## 3.4 DESIGN OF AUXILARY SYSTEMS AND FACILITIES

### 3.4.1 UTILITY SYSTEMS

A discussion of site utility systems is located in the 2005 LRA, Section 3.4.1. This discussion is applicable to the Class A West embankment because no additional utility systems will be needed for the embankment.

### 3.4.2 AUXILIARY FACILITIES

A discussion of auxiliary facilities is located in the 2005 LRA, Section 3.4.2. This discussion is applicable to the Class A West embankment because no additional auxiliary facilities will be needed for the embankment. Since the 2005 LRA, new facilities including the Northwest Corner Pond, Rotary Dump Facility, and Shredder Facility have been permitted, constructed, and placed into operation in the northwest portion of Section 32; however, the Class A West embankment has been sized and located to prevent any impact to these facilities.

### 3.4.3 FIRE PROTECTION SYSTEM

A discussion of the fire protection system is located in the 2005 License Renewal Application, Section 3.4.3. This discussion is applicable to the Class A West embankment because no additional fire protection system will be needed for the embankment.

### 3.4.4 EROSION AND FLOOD CONTROL SYSTEM

For information regarding site drainage and flood protection following closure, please refer to Sections 3.1.5 and 3.2.5, above. A discussion of operational erosion and flood control is located in the 2005 LRA, Section 3.4.4. This discussion is applicable to the Class A West embankment because Energy*Solutions* will implement identical run-on and run-off control berms around the Class A West embankment.

# 4.0 FACILITY OPERATIONS

## 4.1 RECEIPT AND INSPECTION OF WASTE

Incoming shipments of Class A wastes will be inspected and received in accordance with the LLRW Waste Characterization Plan (RML condition 58, current approved revision date October 8, 2009). There will be no changes to this requirement for purposes of constructing the Class A West embankment.

### 4.1.1 PROCEDURE FOR VISUAL EXAMINATION OF SHIPPING DOCUMENTS

This topic is addressed in the LLRW Waste Characterization Plan, Step 3. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 4.1.2 PROCEDURE FOR VISUAL EXAMINATION OF WASTE PACKAGES

This topic is addressed in the Waste Characterization Plan, Step 3. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.1.3 PROCEDURE FOR VERIFICATION SURVEYS

This topic is addressed in the 2005 LRA (Section 4.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.1.4 PROCEDURE ON VERIFYING WASTE CLASS

This topic is addressed in the current Waste Characterization Plan, Step 2. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.1.5 PROCEDURE FOR ANALYTICALLY VERIFYING WASTE CHARACTERISTICS AND FORM

This topic is addressed in the current Waste Characterization Plan, Step 2. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.1.6 OTHER PROCEDURES TO ENSURE WASTE ACCEPTANCE CRITERIA ARE MET

This topic is addressed in the current Waste Characterization Plan. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 4.2 WASTE HANDLING AND INTERIM STORAGE

Waste handling and interim storage will be managed in accordance with existing controls and at existing facilities provided by the RML and the GWQDP, according to the waste type being managed. There will be no changes to these requirements for purposes of constructing the Class A West embankment.

All wastes received at the Clive facility are entered into and tracked with the Electronic Waste Information System (EWIS). EWIS is an electronic record-keeping system used to track waste type, volume, activity, and placement location within the disposal embankments. EWIS also contains waste profile information and provides automated compliance checks of the waste shipments against license limits, sampling frequency, etc. Furthermore, all waste containers received are labeled as to waste type, generator, receipt date, and disposal cell. This prevents inadvertent cross-contamination of waste types. There will be no changes to these practices for purposes of constructing the Class A West embankment.

## 4.3 WASTE DISPOSAL OPERATIONS

Waste disposal operations will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. As bulk waste placement in the existing Class A embankment is completed, bulk Class A waste disposal operations will move to the north eventually filling in the space between the Class A and Class A north embankments. There will be no changes to waste placement, testing, and documentation requirements for purposes of constructing the Class A West embankment.

#### 4.3.1 WASTE EMPLACEMENT

Waste placement will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. It is anticipated that bulk Class A waste placement in the Class A West embankment will proceed northward as the Class A embankment reaches capacity. The

exact sequence will necessarily depend on timing and volumes of bulk Class A waste receipts.

#### 4.3.2 FILLING OF VOID SPACES

The LLRW and 11e.(2) CQA/QC Manual provides controls for filling void spaces. Since there is no change in waste placement procedures for the Class A West embankment, these controls are unaffected.

#### 4.3.3 WASTE COVERING

Waste covering operations will be controlled in accordance with the LLRW and 11e.(2) CQA/QC Manual. As discussed in Section 3 above, cover system specifications and construction procedures will be identical to that approved for the existing Class A embankment.

#### 4.3.4 LOCATION DISPOSAL UNITS AND BOUNDARY MARKERS

This topic is addressed in the 2005 LRA (Section 4.3.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.3.5 DISPOSAL UNIT CLOSURE AND STABILIZATION

This topic is addressed in the 2005 LRA (Section 4.3.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.3.6 BUFFER ZONE

Please refer to Section 1.2.2.2 of this license amendment request for a detailed discussion on buffer zone.

## 4.4 OPERATIONAL ENVIRONMENTAL MONITORING AND SURVEILLANCE

#### 4.4.1 REVIEW AND AUDIT OF FACILITY OPERATIONS

Energy*Solutions*' program for facility review and audit is provided in the 2005 LRA, Appendix V, Quality Assurance Manual. Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A West embankment.

#### 4.4.2 FACILITY ADMINISTRATION AND OPERATING PROCEDURES

This topic is addressed in the 2005 LRA (Section 4.8). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

#### 4.4.3 ENVIRONMENTAL MONITORING AND SURVEILLANCES

A well spacing analysis for the Class A West embankment has been performed and is provided as Attachment 6 to this amendment request. The well spacing analysis provides reasonable assurance that releases from the Class A West embankment can and will be detected. As indicated on drawing 10014-U02, 16 existing groundwater monitoring wells will be abandoned; to be replaced with 10 new wells. Part IV.C.4 of the GWQDP requires advance DRC notification and approval before any well is abandoned; Part II.M requires an "As-Plugged" report within 30 days of completing the abandonment. Well

abandonment materials and procedures are controlled by UAC R655-4-14. These procedures have been successfully used multiple times at the facility.

Consistent with current environmental monitoring, the Class A West embankment will also be equipped with collection lysimeters to sample drainage, if any exists, from the embankment during operations. Section 1.2.3 above discusses revisions to the collection lysimeter network proposed for the Class A West embankment.

Environmental monitoring will be performed in accordance with the current approved Environmental Monitoring Plan per Radioactive Material License #UT 2300249, condition 26. The current approved version is revision 0, dated November 24, 2008. The Environmental Monitoring Plan does not require separate and distinct air, radon, or direct gamma monitoring for any particular embankment or waste type; rather, the dose and contamination limits apply at facility boundaries accessible to members of the public regardless of source.

Further, Energy*Solutions* analyzed the extents of the proposed Class A West embankment against wind patterns obtained from 18 years of onsite meteorological monitoring. It was determined that the current configuration of air stations (see drawing 10014-U02 in Attachment 2 to this LAR) were capable of alerting environmental staff of any potential airborne contamination. License Condition 53.D of Energy*Solutions*' Radioactive Material License also requires bulk waste handling operations to cease when wind speeds of 35 mph (15.6 mps) are reached, further ensuring that potential airborne contamination is registered in the air monitoring network.

As such, no further revision to the environmental monitoring program is needed at this time.

## 4.5 EMERGENCY AND CONTINGENCY PLAN

Energy*Solutions*' currently approved Emergency Response and Contingency Plan, operating procedure CL-SH-PR-500, is applicable to the Class A West embankment. The plan addresses general types of emergency, and does not specify different responses for the Class A, Class A North, and 11e.(2) disposal cells. Haul routes to the cell location already exist, and waste management practices at receipt and unloading facilities will be unchanged in relation to this request. Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A West embankment.

# 5.0 SITE CLOSURE PLAN AND INSTITUTIONAL CONTROLS

The embankment is designed to eliminate to the extent practicable the need for active maintenance after closure. Once the proposed Class A West embankment is closed, no further maintenance to the embankment is anticipated. Embankment closure is executed on a continuing basis, with cover construction generally completed within a relatively short time after a section of the embankment reaches its design limit of waste placement. See also sections 1.3.3 and 3.3.1.6 for further discussion of closure of the proposed Class A West embankment.

Closure of the proposed Class A West embankment is expected to begin well before overall facility decommissioning, since cover activities for this embankment are expected to begin for some lift areas within the next 5 to 7 years; while the facility is expected to continue operating for up to 20 years. Overall facility decommissioning is controlled by

RML condition 74. This condition requires that Energy*Solutions* submit a detailed site decontamination and decommissioning plan at least one year prior to the anticipated closure of the site. This plan will address site closure in the context of site conditions at that time.

## 5.1 SITE STABILIZATION

This topic is addressed in the 2005 LRA (Section 5.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 5.1.1 SURFACE DRAINAGE AND EROSION PROTECTION

This topic is addressed in the 2005 LRA (Section 5.1.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 5.1.2 GEOTECHNICAL STABILITY

This topic is addressed in the 2005 LRA (Section 5.1.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 5.2 SITE CLOSURE AND STABILIZATION CONSIDERATIONS FOR BELOW-GROUND VAULTS AND EARTH MOUNDED CONCRETE BUNKERS

Below ground vaults are defined as warehouse-sized vaults buried beneath grade. Concrete bunkers are defined as concrete-lined trenches with compartmental separation for different waste classes. Energy*Solutions* does not perform either of these types of disposal and therefore this topic is not applicable to the Class A West embankment.

## 5.3 DECONTAMINATION AND DECOMISSIONING

This topic is addressed in the 2005 LRA (Section 5.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 5.4 POST-OPERATIONAL ENVIRONMENTAL MONITORING

This topic is addressed in the 2005 LRA (Section 5.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

# 6.0 SAFETY ASSESSMENT

This topic is addressed in the 2005 LRA, Section 6. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Furthermore, the dose assessments are confirmed by monitoring data reported to DRC. Personnel monitoring information is provided to DRC by April 30 of each year in the annual report required by 10 CFR 20.2206. Monitoring of dose to the general public is reported to DRC with the quarterly environmental monitoring reports required by RML condition 29.A. Both of these regular reports confirm Energy*Solutions*' ongoing compliance with the applicable dose limits.

## 6.1 RELEASE OF RADIOACTIVITY

Anticipated sources and radioactivity of wastes will be no different than radioactive wastes currently being placed in the Class A and Class A North embankments, i.e., Class A LLRW. Radioactive Material License Condition 9.B prohibits receipt of Class B and C LLRW.

### 6.1.1 DETERMINATION OF TYPES, KINDS, AND QUANTITIES OF WASTE

This topic is addressed in the 2005 LRA (Section 6.1-6.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Although the Class A West embankment will increase the overall licensed disposal capacity at the Clive facility, annual volumes received for disposal will continue to be bounded by the evaluations performed for License renewal.

### 6.1.2 INFILTRATION

This topic is addressed in the 2005 LRA (Section 6.3.1.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Section 3.2.1 of this amendment request discusses infiltration modeling results for the Class A West embankment.

### 6.1.3 RADIONUCLIDE RELEASE – NORMAL CONDITIONS

Because of changes forecasted for infiltration, limiting waste concentrations for waste disposal beneath the Class A West Cell's Top Slope were added for Bk-247, Cl-36, and Ca-41 (as presented in Section 2.6.2). Similarly, the analysis demonstrates that reductions in side slope infiltration eliminates the necessity to limit waste disposal concentrations beneath the Class A West's side slope for Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 (see Section 7 of Attachment 3).

### 6.1.4 RADIONUCLIDE RELEASE – ACCIDENTAL OR UNUSUAL OPERATIONAL CONDITIONS

This topic is addressed in the 2005 LRA (Section 6.3.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 6.1.5 RADIONUCLIDE TRANSFER TO HUMAN ACCESS LOCATION

Because of changes modeled for the groundwater transport of infiltration limiting waste concentrations for waste disposal beneath the Class A West Cell's Top Slope were added for Bk-247, Cl-36, and Ca-41 (as presented in Section 2.6.2). Similarly, the analysis demonstrates that reductions in side slope infiltration eliminates the necessity to limit waste disposal concentrations beneath the Class A West's side slope for Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 (see Section 7 of Attachment 3).

### 6.1.6 ASSESSMENT OF IMPACTS AND REGULATORY COMPLIANCE

The analyses provided and referenced above demonstrate that Energy*Solutions*' exiting operations have impacts that are maintained within the applicable regulatory limits. Furthermore, personnel and environmental monitoring data confirm that the applicable limits are met on a continuing basis. Since there is no change in the types of waste that will be managed, this issue will be unaffected by the Class A West embankment.

## 6.2 INTRUDER PROTECTION

Prior licensing actions for the Clive facility have evaluated inadvertent intruder scenarios and concluded that the construction intruder, agriculture intruder, and off-site receptor scenarios are not reasonable (Streamline, 2005; Bingham, 1996). The Bingham Environmental report developed the basis (described below) for this conclusion and was approved with the 1998 renewal of the RML. The Streamline Consulting report then incorporated the Bingham Environmental evaluation by reference, and was approved with the 2008 renewal of the RML.

**Construction Intruder:** The construction intruder is assumed to construct a house and live on the disposal site, with a basement beneath the house excavated into waste materials. However, the Clive facility is located in an arid region with saline soil conditions and no local potable groundwater. In fact, the groundwater is two times saltier than ocean water. The facility and surrounding areas have never had permanent residents.

An archeological survey was performed in 1981 in order to qualify the site for the Vitro disposal cell (Archeological-Environmental Research Corporation, 1981). This survey found no cultural resource sites and one isolated artifact, which consisted of four pieces of broken purple glass from an unknown object. No further resource sites have been uncovered as a result of operations at the facility.

A second cultural and archaeological resources survey was conducted in 2001 on the north half of section 5, directly south of the Clive disposal facility (Sagebrush Consultants, LLC, 2001). No paleontological, prehistoric, or historic resources were found in the survey area. This report also summarizes six prior cultural resource inventories performed within a mile of the subject area, including Archeological-Environmental Research Corporation, 1981.

This review identified one further isolated artifact consisting of an evaporated milk can and flattened tobacco tin. The report concludes that there is little probability that paleontological resources will be found in the area. Therefore, one may conclude that the Clive vicinity has not been inhabited by permanent residents in the past due to unfavorable conditions for human habitation; and is not likely to have permanent residences established in the future.

Bingham Environmental, 1996, assessed the situation as follows: “The arid conditions of the site; the lack of a source of potable water at the site; and the absence of any conditions that would promote the site as a desirable place to live; minimize the possibility of a residence being constructed at the site. Also the existing fencing, monuments, and signs, would warn of the site's former use. The thick layer of riprap on the cell itself would discourage the development of a residence on the completed cell…”

**Agriculture Intruder:** The agriculture intruder is similarly not a reasonable scenario. Given the salinity and low yield of both the upper unconfined and the deeper confined aquifer, local groundwater is not suitable for irrigation. The arid climate precludes agricultural approaches that rely only on ambient precipitation; and the saline soils are not conducive to crops. Furthermore, the thick layer of rip rap on the cell itself would not permit crop growth directly on the disposal unit.

Livestock grazing is seasonally permitted and practiced on lands adjacent to the Clive facility. This potential pathway was evaluated by the NRC (NRC, 1993). This evaluation concludes, "The issue of potential food chain pathway for human exposure from sheep grazing in the area is not considered significant because of the low level of potential contamination and the scarcity of vegetation."

**Off-site Receptor:** The offsite receptor was initially assumed to build near the edge of the site and use local groundwater for a potable water source. As discussed in the construction intruder evaluation above, these are not reasonable assumptions for the immediate vicinity around the disposal cells.

### 6.2.1 NORMAL RELEASES

The waste to be disposed in the Class A West embankment is identical to that approved for the existing Class A and Class A North embankments. Therefore, there is no difference in potential radiological release with the proposed embankment. Ongoing confirmation that releases meet all applicable regulatory requirements is provided in the quarterly environmental monitoring reports referenced in Section 6.0 above.

#### 6.2.1.1 CONTROL OF WINDBORNE DISPERSION

Engineering and operational controls to prevent the resuspension and dispersion of particulate radioactivity are provided at RML condition 53 and in the LLRW and 11e(2) CQA/QC Manual. Those controls will be implemented without revision in construction of the Class A West embankment. As discussed in section 1.1 above, editorial changes to reference the Class A West embankment are provided as Attachment 8 to this amendment request.

#### 6.2.1.2 CONTROL OF SURFACE CONTAMINATION

All equipment, vehicles, and personnel are screened for both alpha and beta contamination before being released from the site. There will be no revision to these requirements associated with the Class A West embankment.

### 6.2.2 POTENTIAL ACCIDENTAL RELEASES

Construction of the proposed Class A West embankment will not change the nature of possible potential accidental releases that have been addressed in Energy*Solutions'* previous licensing actions. No new emergency response or contingency plans will be generated, as the nature of the waste that will be disposed of in the proposed Class A West embankment is identical to the waste currently being disposed of in the Class A and Class A North embankment.

### 6.2.3 POTENTIAL RELEASES FOLLOWING OPERATIONS

#### 6.2.3.1 RADIONUCLIDE TRANSFER TO HUMAN ACCESS LOCATIONS

The construction of the proposed Class A West embankment will not change the nature of possible transfer to human access locations discussed in previous licensing actions.

#### 6.2.3.2 PROJECTED DOSES TO MEMBERS OF THE GENERAL PUBLIC

Since there will be no change to the waste handled or to the operating and disposal procedures, previous dose assessment work remains applicable to the Class A West embankment. Furthermore, the dose assessments are confirmed to be conservative by monitoring data reported to DRC. Monitoring of dose to the general public is reported to

DRC with the quarterly environmental monitoring reports required by RML condition 29.A.

## 6.3 LONG-TERM STABILITY

### 6.3.1 SURFACE DRAINAGE AND EROSION PROTECTION

This topic is addressed in sections 3.1.5, 3.2.5, and 3.4.4 above.

### 6.3.2 SLOPE STABILITY

This topic is addressed in the 2005 LRA (Section 6.4.3.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above, and the basis for the projections is included in Attachment 5.

#### 6.3.2.1 SITE AND SLOPE AREA CHARACTERIZATION

This topic is addressed in the 2005 LRA (Section 6.4.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 6.3.3 SETTLEMENT AND SUBSIDENCE

Design criteria for settlement and subsidence are provided in Sections 3.1.1.2, 3.1.2.1 and 3.1.3.3 of the 2005 LRA. Projected performance of the cover system against these design criteria are discussed in Sections 3.3.1.2, 3.3.2.1 and 3.3.3.3 of that document. These analyses are applicable to the Class A West embankment because the liner, waste placement, and cover materials and material specifications are identical to that of the Class A and Class A North embankments. Updated performance projections are included in Tables 3.2, 3.3 and 3.4 above, and the basis for the projections is included in Attachment 5.

# 7.0 OCCUPATIONAL RADIATION PROTECTION

## 7.1 OCCUPATIONAL RADIATION EXPOSURES

### 7.1.1 POLICY CONSIDERATIONS

The objective of the Clive Radiation Protection Program is to ensure that all reasonable actions are taken to reduce radiation exposures and effluent concentrations to levels that are considered As Low As Reasonably Achievable (ALARA).

Energy*Solutions*' ALARA management policy is detailed in Section 5 of the ALARA Program document. Section 4 of the ALARA Program describes the organizational structure of the ALARA program and the responsibilities of those involved in managing and implementing the ALARA program. The ALARA Program is located in the 2005 LRA (Appendix H).

The waste type and classification that will be disposed of in the Class A West embankment will be no different than waste currently being disposed of in the Class A and Class A North embankments. Therefore, the ALARA Program will not require revision for the Class A West embankment.

The Class A West embankment was presented to and discussed by the Clive Radiation Safety Committee in accordance with the ALARA program. The committee's review and ALARA evaluation is provided as Attachment 7 to this amendment request.

### 7.1.2 DESIGN CONSIDERATIONS

This topic is addressed in the 2005 LRA (Section 7.1.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 7.1.3 OPERATIONAL CONSIDERATIONS

This topic is addressed in the 2005 LRA (Section 7.1.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 7.2 RADIATION SOURCES

The types and quantities of materials received for disposal in the Class A West embankment will be no different than materials disposed of in the Class A and Class A North embankments. Therefore, radiation protection, access control to restricted areas, and personnel protective equipment policies will not change from current standards. Although the Class A West embankment will increase the overall licensed disposal capacity at the Clive facility, annual volumes received for disposal will continue to be bounded by the evaluations performed for License renewal.

## 7.3 RADIATION PROTECTION DESIGN FEATURES

### 7.3.1 FACILITY DESIGN FEATURES

This topic is addressed in the 2005 LRA (Section 7.3.1). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 7.3.2 SHIELDING

This topic is addressed in the 2005 LRA (Section 7.3.2). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 7.3.3 VENTILATION

This topic is addressed in the 2005 LRA (Section 7.3.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 7.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

This topic is addressed in the 2005 LRA (Section 7.3.4) and Section 4.4.3 of this License Amendment Request. Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 7.3.5 EQUIPMENT, INSTRUMENTATION, AND FACILITIES

This topic is addressed in the 2005 LRA (Section 7.3.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 7.4 RADIATION PROTECTION PROGRAM

This topic is addressed in the 2005 LRA (Section 7.4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

### 7.4.1 ORGANIZATION

The specific organization of the radiation protection program is defined by the Class A RML, condition 32.A. These requirements will be unaffected by the Class A West embankment.

# 8.0 CONDUCT OF OPERATIONS

Operations at the Clive facility will not change with respect to the Class A West embankment. The type of waste, method of disposal and engineering design of the proposed embankment are no different than what is currently performed in the Class A and Class A North embankments.

## 8.1 ORGANIZATIONAL STRUCTURE

Detailed requirements and qualifications for significant organizational positions are described in the RML, Condition 32, Appendix I (currently approved revision is Rev. 22, August 2, 2010).

## 8.2 QUALIFICATIONS OF APPLICANT

A discussion of applicant qualifications is provided in Section 1.1.2 of this amendment request.

## 8.3 TRAINING PROGRAM

This topic is addressed in the 2005 LRA (Section 7.4.3). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 8.4 EMERGENCY PLANNING

This topic is addressed in the 2005 LRA (Section 4.5). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 8.5 REVIEW AND AUDIT

This topic is addressed in the 2005 LRA (Section 4.6). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 8.6 FACILITY ADMINISTRATIVE AND OPERATING PROCEDURES

This topic is addressed in the 2005 LRA (Section 4). Since there is no change in the types of waste that will be managed, this discussion will be unaffected by the Class A West embankment.

## 8.7 PHYSICAL SECURITY

The Site Radiological Security Plan is incorporated in the Class A RML at condition 54 (currently approved as revision 3, May 5, 2008). Since there is no change to the types of waste that will be managed, this plan will be unaffected by the Class A West embankment.

## 9.0 QUALITY ASSURANCE

Energy*Solutions'* Quality Assurance Program is described in the 2005 LRA (Section 9). Since there is no change to the types of waste that will be managed, this program will be unaffected by the Class A West embankment.

## 10.0 FINANCIAL ASSURANCE

In order to protect the State of Utah from financial damage arising from having to close and decommission the facility in the event that Energy*Solutions* is unwilling or unable to do so, the LLRW financial surety will be revised to include cost estimates for the closure of the Class A West embankment.

The annual surety review is submitted annually on or before December 1st. Because the 2010 surety update is still under review by DRC, a revised surety estimate is not included with this amendment request. Energy*Solutions* anticipates that the surety will need to be revised to include new groundwater monitoring points; and may require an adjustment for fencing and construction of haul roads. Adjustments will be made to the surety revision approved at the time this license amendment is approved, then funded prior to initiating any waste placement in portions of the Class A West embankment that exceed horizontally or vertically beyond the current approved Class A and Class A North designs.

## 10.1 FINANCIAL QUALIFICATIONS OF APPLICANT

Energy*Solutions'* financial qualifications are discussed in Section 1.1.1.2 above.

## 10.2 FUNDING ASSURANCES

### 10.2.1 SPECIFIC ACCEPTABLE FINANCIAL ASSURANCES

#### 10.2.1.1 SURETIES OR PERFORMANCE BONDS

Sureties are a type of financial mechanism provided to help protect the State of Utah from financial damage as a result of closing and decommissioning the facility. Performance bonds are another type of financial mechanism. Energy*Solutions* has chosen an alternative financial mechanism approved by the State.

#### 10.2.1.2 LETTERS OF CREDIT

Energy*Solutions* has chosen as its financial mechanism an irrevocable letter of credit. This irrevocable letter of credit has been entered into by Energy*Solutions* and Zions First

National Bank for the benefit of the Executive Secretary of the Utah Radiation Control Board.

Upon DRC approval of the Class A West embankment and associated financial surety calculations, and prior to placing waste in portions of the Class A West embankment that exceed horizontally or vertically beyond the current approved Class A and Class A North designs, Energy*Solutions* will amend the letters of credit as necessary to ensure funding for closure and post-closure monitoring of the Class A West embankment.

## 10.3 FINANCIAL ASSURANCE FOR INSTITUTIONAL CONTROLS

In addition to the estimated costs for decommissioning the facility, the financial surety also covers estimated costs of long-term surveillance of the site. This includes sampling of groundwater monitoring wells, site inspections and repairs and other miscellaneous costs. See also the discussion in Section 10.0 above.

## 11.0 REFERENCES

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Energy*Solutions* LLC, "Waste Characterization Plan", currently approved revision date March 10, 2008.

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USNRC, NUREG-1476, "Final Environmental Impact Statement to Construct and Operate a Facility to Receive, Store, and Dispose of 11e.(2) Byproduct Material Near Clive, Utah", August 1993.

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Attachment 1

Proposed Amendments

# RML Revisions

## LICENSE AMENDMENT

## UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
## DIVISION OF RADIATION CONTROL
## RADIOACTIVE MATERIAL LICENSE

Pursuant to Utah Code Annotated, Title 19, Chapter 3 and the Radiation Control Rules, Utah Administrative Code (UAC) R313, and in reliance on statements and representations heretofore made by the Licensee designated below, a license is hereby issued authorizing the Licensee to transfer, receive, possess, and use the radioactive material designated below; and to use radioactive material for the purpose(s) and at the place(s) designated below. The license is subject to all applicable rules, and orders now or hereafter in effect and to all conditions specified below.

**********
**

LICENSEE ) 3. License Number UT 2300249
) Amendment # 910
1. Name EnergySolutions, LLC (EnergySolutions) )

)**********
2. Address 423 West 300 South ) 4. Expiration Date
Suite 200
) January 25, 2013
Salt Lake City, UT 84101
)**********
) 5. License Category 4-a

**********
*

| 6. Radioactive Material (element and mass number) | | 7. Chemical and/or physical form | | 8. Maximum Radioactivity and/or quantity of material the Licensee may possess at any one time. |
|---|---|---|---|---|
| A. | Any Radioactive Material including Special Nuclear Material specified in License Condition 13 A through J. | A. and B.<br>Notwithstanding Conditions 9 (Authorized Use), 16 (Prohibitions and Waste Requirements), and 56 (containerized waste), typically large volume, bulky or containerized, soil or debris. Debris can include both decommissioning (cleanup) and routinely generated operational waste including but not limited to radiologically contaminated paper, piping, rocks, glass, metal, concrete, wood, bricks, resins, sludge, tailings, slag, residues, personal protective equipment (PPE) that conforms to the size limitations in currently | A. | 20,000 Curies*** |

UTAH DIVISION OF RADIATION CONTROL
RADIOACTIVE MATERIAL LICENSE
SUPPLEMENTARY SHEET

License #UT 2300249
Amendment #~~9~~10

Secretary of the Utah Radiation Control Board and also receiving approval from the Governor and the Legislature.

C. The Licensee shall fulfill and maintain compliance with all conditions and shall meet all compliance schedules stipulated in the Ground Water Quality Discharge Permit, number UGW 450005 (hereafter GWQ Permit), issued by the Executive Secretary of the Utah Water Quality Board.

D. The Licensee may receive and store up to twenty (20) empty radioactive waste transportation casks under the following conditions:

~~1.~~ The casks are dedicated to the transportation of low level radioactive wastes.

~~2.~~ Storage of the casks is confined to the Restricted Area within the area specified in License Condition 10, except when staged for return to commerce within 7 days.

~~3.~~ Internal contamination is kept minimal as practical but will not exceed the contamination limits specified for Department of Transportation, Class 7 Hazardous Material, Radioactive Material, Excepted Package-Empty Packaging, UN2908.

~~4.~~ During storage, casks are to be secured in accordance with their Department of Transportation or Nuclear Regulatory Commission approved design specifications.

E. The Licensee may dispose of Class A Low-Level Radioactive Waste (LLRW) and NARM in ~~both~~ the Class A ~~and Class A North~~West (CAW) disposal cell described in License Condition 40, and in the Mixed Waste Landfill Cell. Class A waste is defined in Utah Radiation Control Rule R313-15-1008 and NARM at R313-12-3.

F. Effective January 1, 2002, the Licensee shall not accept, possess, store or dispose of any radioactive waste delivered to the disposal site by any conveyance, unless the associated Shipping Documents have a valid Generator Site Access Permit number, issued by the Utah Division of Radiation Control, affixed.

G. The Licensee may receive and treat radioactively contaminated aqueous liquids and liquid mercury as characterized in the waste profile at the mixed waste facilities only, the waste must be Class A LLRW at receipt. Treated aqueous liquids may be disposed at the Mixed Waste Facility or the LLRW Facility, in accordance with Exhibit 3 of the Waste Characterization Plan. Treated (amalgamated) liquid mercury shall be disposed at the Mixed Waste Facility only.

H. Reserved

I. Licensed material in Items 6.C and 6.D, Sealed source(s) contained in compatible portable gauging devices (registered pursuant to R313-22-210 or an equivalent U.S. Nuclear Regulatory Commission or Agreement State regulation) for measuring properties of materials.

J. Licensed material in Items 6.E through 6.L, for operational checks and efficiency determinations of radiation detection instrumentation.

K. Licensed material in Items 6.M through 6.O, calibration or reference combined source(s) for use in conjunction with the Licensee's whole body counter.

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L. Licensed material in Item 6.P, sealed source(s) contained in MGP Instruments, Inc. Model IRD-2000 dosimeter calibrators/irradiators for tests and source checks of electronic dosimeters.

**SITE LOCATION**

10. A. The Licensee may receive, store and dispose of licensed material at the Licensee's facility located in Section 32 of Township 1 South and Range 11 West, Tooele County, Utah.

B. Section 32, Township 1 South and Range 11 West, Tooele County, Utah, is defined by the following points of reference:

| | |
|---|---|
| Southwest Section Corner: | Latitude 40° 40' 51.890" N<br>Longitude 113° 7' 28.580" W |
| Elevation | 4269.76 feet above mean sea level (amsl) |
| Southeast Section Corner | Latitude 40° 40' 51.879" N<br>Longitude 113° 6' 20.011" W |
| Elevation | 4277.27 feet-amsl |
| Northwest Section Corner | Latitude 40° 41' 44.098" N<br>Longitude 113° 7' 28.654" W |
| Elevation | 4273.06 feet-amsl |
| Northeast Section Corner | Latitude 40° 41' 44.086" N<br>Longitude 113° 6' 20.109" W |
| Elevation | 4280.83 feet-amsl |

C. The Southwest Section Corner marker of Section 32 shall be the Point of Beginning (POB).

D. The Licensee shall cause a survey to be conducted by a Utah licensed land surveyor to identify the section corners of Section 32, Township 1 South, and Range 11 West, Tooele County, Utah (as defined in Condition 10.B). Licensee shall place monuments with brass caps at the identified section corner locations. Monuments shall be permanent and constructed in a manner that will protect them from being disturbed.

E. Licensed material in Items 6.C through 6.P shall be used only at the Licensee's facilities referenced in Condition 10.B.

11. The open cell area within the Class A ~~and Class A North~~West disposal embankment~~s~~ where waste disposal/placement has or may occur, but the cover system has not been completed shall be limited to 3,650,000 square feet. Uncovered radioactive waste shall be limited to a surface area of 1,020,000 square feet.

12. Pursuant to UAC R313-12-55(1), the Licensee is granted an exemption to UAC R313-25-9, as it relates to land ownership and assumption of ownership.

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any combination of them in accordance with the following formula:

$$\frac{(\text{Grams U-235})}{350} + \frac{(\text{Grams U-233})}{200} + \frac{(\text{Grams Pu})}{200} \leq 1$$

"Possession" and "Disposal" are defined in License Conditions 63 and 64 respectively.

**MIXED WASTE**

14. A. The Licensee may receive for treatment, storage, and disposal any radioactive waste as authorized by this license that is also determined to be hazardous (commonly referred to as mixed waste) as permitted by the "Hazardous Waste Plan Approvals" issued and modified by the Executive Secretary, Utah Solid and Hazardous Waste Control Board and "HSWA Permit" issued by the U.S. Environmental Protection Agency.

B. The Licensee may dispose of treated mixed waste in the Class A ~~North or the Class A~~West disposal cell~~s~~ if it meets the criteria described in Exhibit 3 of the Waste Characterization Plan.

C. All other mixed wastes shall be disposed in the Mixed Waste Landfill Cell only.

**WASTE TREATMENT AND PROCESSING**

15. A. Prior to receipt of any low level radioactive or mixed wastes requiring treatment before disposal, the Licensee shall, based on knowledge of the technology to be used for treatment/processing of each particular radioactive or mixed waste, calculate and document that the resultant processed waste is neither Class B nor Class C waste.

B Reserved

C. Following treatment at the Mixed Waste facility the Licensee shall classify the resultant processed waste in accordance with UAC R313-15-1008.

D. The Licensee shall manifest treated waste from the Mixed Waste facility for disposal in accordance with UAC R313-15-1006.

**PROHIBITIONS AND WASTE ACCEPTANCE REQUIREMENTS**

16. A. Sealed sources as defined in Utah Administrative Code (UAC) R313-12 shall not be accepted for disposal.

B. In accordance with UAC R313-15-1008(2)(a)(v), waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.

C. In accordance with UAC R313-15-1008(2)(a)(vi), waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.

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L. The Licensee shall not accept containerized radioactive waste unless each waste package has been:
   i. Classified in accordance with R313-15-1008, "Classification and Characteristics of Low-Level Radioactive Waste." In addition, the Licensee shall require that all radioactive waste received for disposal meet the requirements specified in the Nuclear Regulatory Commission, "Branch Technical Position on Concentration Averaging and Encapsulation", as amended.
   ii. Marked as either Class A Stable or Class A Unstable as defined in the most recent version of the "Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification." originally issued May, 1983 by the U.S. Nuclear Regulatory Commission.
   iii. Marked with a unique package identification number, clearly visible on the package, that can be correlated with the manifest for the waste shipment in which the package arrives at the facility.

M. The Licensee may accept containerized Class A LLRW in the following waste packages for disposal in the Containerized Waste Facility of the Class A ~~or Class A North~~West disposal cell:

   i. DOT "strong, tight" containers in accordance with 49 CFR 173 and meeting the following void space criteria: void spaces within the waste and between the waste and its packaging shall be reduced to the extent practicable, but in no case shall less than 85 percent of the capacity of the container be filled
   ii. High-Integrity Containers (HICs) exceeding the void space criteria provided in License Condition 16.M.i, shall be approved by the Executive Secretary.
   iii. DOT "strong, tight" containers in accordance with 49 CFR 173 exceeding the void space criteria provided in License Condition 16.M.i and large components shall be placed as approved by the Executive Secretary.
   iv. Oversized DOT containers (larger than 215 cubic feet) meeting the void space criteria provided in License Condition 16.M.i shall be placed in accordance with the currently approved LLRW Construction QA/QC Manual.

**MANAGEMENT OF FREE LIQUIDS**

17. A. In accordance with UAC R313-15-1008(2)(a)(iv), solid waste received for disposal shall contain as little free standing and non-corrosive liquid as reasonably achievable, but shall contain no more free liquids than one percent of the volume of the waste.

B. Solid waste received and containing unexpected aqueous free liquid in excess of 1% by volume shall have the liquid removed and placed in the evaporation ponds or the liquid solidified prior to management.

C. Unexpected non-aqueous free liquids less than 1% of the volume of the waste within the container shall be solidified prior to disposal.

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that have been and are reasonably anticipated to be disposed of at the facility within 180 days of Executive Secretary approval of the performance assessment.

D. Remediation: If following the completion of DRC's review of the performance assessment described in paragraph 35 B, the disposal of DU as performed after the date of this license condition would not have met the requirements of the performance assessment, the facility will undertake remediation to ensure that the performance standards are met, or if that is not possible, shall remove the DU and transport it off-site to a licensed facility.

E. Surety: The Licensee shall fund the surety for the remediation, in License Condition 35 D. Within 30-days of the effective date of this license condition, the licensee shall submit for Executive Secretary review and approval, the surety cost estimates for remediation of existing Savannah River DU waste disposal and planned, similar large quantity DU waste disposal.

36. A. The West Rail Spur and Unloading facility shall be operated as a transfer station for Surface Contaminated Objects (SCO) and large components, (waste storage is prohibited). These objects may be set on the gravel pad for 24 hours to facilitate unloading and transferring to the Class A West disposal cell.

B. The West Rail Spur and Unloading facility shall be operated as a transfer station for conveyances to be unloaded at the Containerized Waste Facility (unloading of waste packages is prohibited).

37. All ion exchange resins shall be disposed of as follows:

A. Solidified using solidification agents approved by the Executive Secretary and disposed of in the Containerized Waste Facility; or

B. Packaged in High-Integrity Containers (HIC) approved by the Executive Secretary, carbon-steel liners, unapproved HICs, or poly HICs meeting the void space criteria described in License Condition 16.M.i and disposed of in the Containerized Waste Facility; or

C. Packaged in High-Integrity Containers (HIC) approved by the Executive Secretary, carbon-steel liners, unapproved HICs, or poly HICs not meeting the void space criteria described in License Condition 16.M.i and disposed of as approved by the Division under License Condition 16.M.ii or 16.M.iii in the Containerized Waste Facility; or

D. Disposed of in accordance with the requirements of the Construction Quality Assurance/Quality Control Manual.

38. The Licensee shall construct the Class A West disposal Cell identified in the Ground Water Quality Discharge Permit No. UGW450005 and in accordance with approved engineering design drawings "Series ~~9821~~10014".

39 Waste placement and backfilling within the Containerized Waste Facility shall be conducted in accordance with the following:

A. The Containerized Waste Facility shall conform to the characteristics defined, analyzed, and

described in the Engineering Justification Report "Class A Disposal Cell Containerized Waste Facility" (dated April 12, 2001); Engineering Justification Report, Addendum "Fifteen Percent Void Space Criteria" (Revision 1 dated October 10, 2001); and the AMEC letter to Envirocare of Utah, Inc. "Placement of Drums and B-25 Containers with 15 Percent Voids; Envirocare Class A - Containerized Waste Facility Near Clive, Utah" (dated October 2, 2001). Waste containers that have void space in excess of 15 percent shall be filled to the top of the container opening using Controlled Low Strength Material (CLSM) in accordance with the Construction QA/QC manual. The Licensee is exempt from the CLSM cold weather requirements and the 48 hour notification for void remediation only at the CWF Facility.

B. Waste container placement configurations and associated waste placement procedures, backfill materials and procedures, and backfill cover materials shall be those approved by the Executive Secretary following testing according to Work Element: Containerized Waste Facility-Waste Placement Test Pad of the currently approved LLRW Construction Quality Assurance/Quality Control Manual.

C. Waste delivered in a shielded transportation cask shall remain in the cask until the waste is approved for disposal and the disposal location is prepared for the shipment. Waste received for disposal in the Containerized Waste Facility shall not be handled, stored or transferred within the contaminated portion of the Restricted Area without the approval of the Director of Health Physics.

D. The Containerized Waste Facility shall be operated as a contamination-free portion of the Restricted Area until containerized waste disposal operations are completed. Bulk waste may then be used to complete the filling of the cell.

E Interim storage is applicable only to the Containerized Waste Facility. Packages containing radioactive material shall not be stored for a period of longer than 30 days from the date of receipt. Retention of waste materials above ground pending disposal up to 3 working days does not constitute storage. All packages in storage shall be shielded so that the package or shielding shall not exceed 40 mR/hour at one meter from the surface.

F. Disposal of non-containerized decomposable or compressible waste at the Containerized Waste Facility is prohibited. Such waste shall be disposed of as debris in bulk waste portions of the Class A ~~or Class A North~~West disposal embankments, in accordance with debris placement requirements of the currently approved LLRW and 11e.(2) CQA/QC Manual.

40. The LARW and Class A West Disposal Cells, shall be defined by the areas enclosed by the points of reference in the Ground Water Quality Discharge Permit No. UGW450005. The Containerized Waste Facility within the Class A West disposal cell shall be separated from the non-containerized area by a 6-foot chain link fence on the berm around the Containerized Waste Facility perimeter area.

41. Reserved.

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42. Reserved.

43. The Licensee shall construct the Class A ~~North~~ West disposal cell identified in the Ground Water Quality Discharge Permit No. UGW450005 and in accordance with approved engineering design drawings "Series ~~0408~~10014".

44. The Licensee shall fulfill all requirements and maintain compliance with all conditions in the LLRW CQA/QC Manual and engineering drawings currently approved by the Executive Secretary.

45. All engineering related soil tests conducted by the Licensee to demonstrate compliance with Condition 44 shall be performed by a laboratory certified and accredited by the AASHTO Materials Reference Laboratory (AMRL). Said certification / accreditation shall apply to clay liner, clay radon barrier, soil filter layers, sacrificial soils, and riprap materials, or other soil or man-made materials as directed by the Executive Secretary. Said certification shall include all engineering test methods required by License Condition 44, or as directed by the Executive Secretary. Certification is not required for the DRC approved sealed single ring infiltrometer permeability test contained in Appendix B to the LLRW and 11e(2) CQA/QC Manual.

46. Reserved

47. The Licensee shall not initiate disposal operations in newly excavated areas until the Division has inspected and the Executive Secretary has approved the cell/embankment liner.

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**CONSTRUCTION DRAWINGS.**

48. A. The Licensee shall provide a comprehensive set of drawings for the entire Clive site. The drawings shall correctly: (1) locate all structures, utilities, fences, ponds, drainage features railroad tracks, roads, storage facilities, loading and off-loading facilities, disposal embankments, all environmental monitoring locations including instruments/devices, and any other appurtenances related to the operation, maintenance and closure of the disposal facility; and (2) provide survey control including elevations in sufficient detail to fully describe the site. The drawings shall be developed in accordance with the standards of professional care. A drawing index shall be included that identifies drawings by discrete number. Each drawing shall include a revision block that documents the latest changes or modifications by date and includes the initials of the responsible reviewer for QA/QC tracking purposes.

B. Drawings showing approved future designs shall be marked as "Final Drawings." Final drawings or drawings developed for construction shall be sealed by a Utah registered professional engineer. The drawings shall be developed in accordance with the standards of professional care.

C. Within 30 days of completion of any project that requires approval by the Executive Secretary, a set of "As-Built" drawings shall be submitted for review. The drawings shall indicate as-built conditions as they existed no earlier than 30 days prior to the submittal. Drawings of finished construction shall be marked as "As-Built" in the final entry in the revision block.

**SITE OPERATING PROCEDURES**

49. Shipments containing free liquid in excess of 1% shall be absorbed, evaporated, or the liquids removed only at facilities with approved secondary containment or the rail rollover facility.

50. A. On-site generated waste shall be managed according to its radiological, physical and chemical characteristics. Solid phase material shall be disposed in either the Class A ~~Cell, Class A North~~West Cell, Mixed Waste Cell, or the 11e.(2) Cell. Waste water from decontamination facilities will be put in the evaporation ponds or sprayed on disposal cells for purposes of dust and engineering controls.

B. Site equipment that has reached the end of its useful life, is not operational and does not meet the removable contamination limits of License Condition 27, Table 27-A, shall be disposed in the LLRW Class A ~~Cell or Class A North~~West Cell within 90 days as debris in accordance with requirements of the LLRW Construction Quality Assurance/Quality Control Manual or stored on approved facilities for storage, transfer, and sampling of bulk waste.

C. Facility vehicles transferring or unloading waste shall not be left unattended.

51. The following shall be implemented for LLRW and 11e.(2) Waste segregation purposes:

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A. LLRW and 11e.(2) waste shall not be managed simultaneously at the Rail rollover facility, Shredder Facility, Rotary Dump Facility, or Rail Digging facility;

B. Any vehicle or facility used to manage waste for disposal within the 11e.(2) disposal embankment, must be clearly labeled to designate 11e.(2) management. The labels shall be visible from both sides of a vehicle/facility designated for 11e.(2) waste management.

C. Equipment, vehicles and facilities, which are used for management of LLRW will be cleaned of any material before being used for 11e.(2) waste management activities. Equipment, vehicles and facilities shall be cleaned of all waste material to a limit of 500 grams per square foot prior to being used for other waste types.

52. Waste shipments or transportation packages received shall meet the following contamination control requirements for removable contamination

*Less then 220 dpm/100cm$^2$ alpha
*Less then 2200 dpm/100cm$^2$ Beta-gamma

If a shipment or transportation package does not meet the above contamination requirements, the Licensee shall take actions to reduce the risk for spread of contamination.

53. A. Quarterly, the Licensee shall clean the facility roads, or more frequently when needed. The material collected from cleaning the roads shall be disposed within an approved disposal embankment for Class A waste.

B. On a biweekly basis (once every two weeks) between the first day of May and the last day of September, the Licensee shall spray a polymer solution on all exposed contaminated cell areas and areas of waste within the Class A ~~Cell and Class A North~~West Cell which have been disturbed in the previous two weeks. The Licensee will apply a polymer-based stabilizer in accordance with the manufacturer's instructions.

C. The Licensee shall minimize the dust created during the process of placing and moving waste, through the use of water. Water or other engineering controls shall be placed on roads and in areas which work is being performed.

D. The Licensee shall cease loading, hauling, and dumping of un-containerized waste whenever the 5-minute average wind velocities exceed 35 miles per hour. When both the 5-minute average and 5-minute maximum wind velocities are less than 35 mph as observed on the meteorological station, management of un-containerized waste may resume.

54. The Licensee shall fulfill and maintain compliance with all conditions and requirements in the Site Radiological Security Plan (Revision 3, May 5, 2008).

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55. A. For the Class A ~~and Class A North~~West disposal cell~~s~~, the Licensee shall ensure that the actual cumulative activity of chlorine-36 does not exceed 0.2828 picocuries per gram in accordance with the following formula:

*Total Activity of chlorine-36 Received (picocuries)* *<73,900 ~~0.2828~~ picocuries per gram*
*Total Mass of Active Cell (grams) + Completed Cell (grams)*

~~1.~~B. For the Class A ~~and Class A North~~West disposal cells, the Licensee shall ensure that the actual cumulative activity of berkelium-247 does not exceed 0.0001 picocuries per gram in accordance with the following formula:
Total Activity of berkelium-247 Received (picocuries) *≤ 1.92~~0.0001~~* picocuries per gram
*Total Mass of Active Cell (grams) + Completed Cell (grams)*

~~1.~~C. For the Mixed Waste disposal cell, the Licensee shall ensure that the actual cumulative activity of chlorine-36 does not exceed 8.75 picocuries per gram in accordance with the following formula:

*Total Activity of chlorine-36 Received (picocuries)* *≤ 8.75 picocuries per gram*
*Total Mass of Active Cell (grams) + Completed Cell (grams)*

~~2.~~D. For the Mixed Waste disposal cell, the Licensee shall ensure that the actual cumulative activity of berkelium-247 does not exceed 0.00314 picocuries per gram in accordance with the following formula:

*Total Activity of berkelium-247 Received (picocuries)* *≤ 0.00314 picocuries per gram*
*Total Mass of Active Cell (grams) + Completed Cell (grams)*

56. Containerized Class A waste shall be certified by the generator to meet the Waste Acceptance Criteria in accordance with the Waste Characterization Plan described in License Condition 58.

57. A. The Licensee shall move rail shipments into the Restricted Area within seven (7) days of arrival. The shipments may be returned to the carrier when management of the waste is not possible within the seven (7) day period, unless additional time is approved by the Executive Secretary of the Utah Radiation Control Board.
B. Empty outbound railcars shall be picked up by the local rail service within seven (7) days of release from the Restricted Area, unless additional time is approved by the Executive Secretary of the Utah Radiation Control Board.
C. Railcars that have been decontaminated and surveyed both internally and externally and found to meet criteria of non-fixed radioactive surface contamination less than 220 dpm/100 $cm^2$ Alpha, 2,200 dpm/100 $cm^2$ Beta and a dose rate less than 0.5 mrem/hr or that meet` the limits found in Table 27-A do not have to picked up by local rail service within seven (7) days.

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76. Reserved.

**SPECIAL HANDLING**

77. Except while waste packages are being handled in the active areas of the Containerized Waste Facility, external gamma radiation levels shall not exceed 40 mR/hr at one meter from the surface of any emplaced waste package or from shielding placed around disposed waste containers.

78. The Licensee shall observe the following controls on waste handling at the Containerized Waste Facility:

    A. Before unloading any waste container whose external gamma radiation at the surface exceeds 10 R/hr, an ALARA review shall be performed and documented and a pre-job briefing shall be conducted.

    B. As part of the ALARA review, the Licensee shall determine and record (1) estimates of the radiation dose rates for the waste container, disposal unit working face, and any other potentially significant radiation sources; (2) expected durations of exposures to and distances from each radiation source; and (3) expected doses to each person involved in the actual disposal operation.

    C. Before unloading any waste container whose external gamma radiation at the surface exceeds 200 R/hr, a practice run shall be conducted. The practice run shall involve shielding, container(s) filled with non-radioactive material, and handling equipment that are similar to those involved with the actual shipment. Similarity includes similar rigging and physical characteristics (e.g., weight, dimensions, and attachments). Those personnel who will participate in receiving, processing, handling, and disposing of the actual waste will participate in the practice run, using actual procedures. The Licensee shall notify the Division 24 hours in advance of conducting the practice runs.

    D. On a case-by-case basis, the Executive Secretary may exempt the Licensee from conducting the required practice run, considering the results of earlier practice runs and actual experience handling waste containers with high radiation levels.

~~73.~~79. Reserved.

~~74.~~80. The Licensee shall notify in writing the Executive Secretary at the earliest possible date, but no later than 10 days before scheduled receipt of each shipment with contact radiation levels in excess of 200 R/hr. The notification shall include the anticipated dates of receipt and plan for disposal in the Containerized Waste Facility.

~~75.~~81. The Director of Health Physics or other qualified person designated by the Director of Health Physics shall be present for and shall observe the receipt, processing, handling, and disposal of each waste package with contact radiation levels in excess of 200 R/hr.

~~76.~~82. The Licensee shall dispose of only closed containers in the Containerized Waste Facility. The Licensee shall not dispose of any breached waste container in the Containerized Waste Facility without first repairing the breached container or overpacking it in an undamaged container. The Licensee is authorized to open packages at its facility only to:

A. Repair or repackage breached containers.

B. Inspect for compliance with conditions of this license.

C. Confirm package contents and fill voids in packages/containers that have greater than 15% void space.

D. Accomplish other purposes as approved by the Executive Secretary.

~~(1)~~83. The Licensee shall handle and emplace LLRW packages in the Containerized Waste Facility such that packaging integrity is maintained during handling, emplacement, and subsequent backfilling. Waste packages deposited in the Containerized Waste Facility shall be protected from any adverse effects of operations which may damage them.

**SEALED SOURCES AND/OR DEVICES**

84. A. i. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by equivalent regulations of an Agreement State.

ii. In the absence of a certificate from a transferor indicating that a leak test has been made within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or by equivalent regulations of an Agreement State prior to the transfer, a sealed source received from another person shall not be put into use until tested.

iii. Sealed sources need not be tested if they are in storage and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source shall be stored for a period of more than 3 years without being tested for leakage and/or contamination.

iv. The leak test shall be capable of detecting the presence of 185 becquerels (0.005 μCi) of radioactive material on the test sample. If the test reveals the presence of 185 becquerels (0.005 μCi) or more of removable contamination, a report shall be filed with the Executive Secretary in accordance with R313-15-1208, and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Utah Radiation Control Rules. The report shall be filed within 5 days of the date the leak test result is known with the Division of Radiation Control, P.O. Box 144850, Salt Lake City, Utah 84114-4850. The report shall specify the source involved, the test results, and corrective action taken.

v. (a) The Licensee is authorized to collect leak test samples in accordance with Condition 85.D of this license, the Licensee's renewal application (dated March 1, 2001), and the Licensee's Memo (dated March 11, 2002).

(b) The analysis of leak test samples shall only be performed by individuals who meet the qualifications of a Health Physics Technician I or II, as defined by this

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A. On or before August 14, 2008, the licensee shall provide under oath or affirmation, a certification that the Trustworthiness and Reliability Official is deemed trustworthy and reliable by the licensee as required in paragraph 2.B of Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material."

B. All fingerprints obtained by the licensee pursuant to this requirement must be submitted to the U.S. Nuclear Regulatory Commission for transmission to the U.S. Federal Bureau of Investigation (FBI). Additionally, the licensee's submission of fingerprints shall also be accompanied by a certification, under oath and affirmation, of the trustworthiness and reliability of the Trustworthiness and Reliability Official as required by paragraph 2.B of Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material."

C. The licensee shall complete implementation of the fingerprinting requirements on or before November 12, 2008. The licensee shall notify the Executive Secretary when full compliance with the requirements described in the Executive Secretary's letter dated May 16, 2008, Attachment 1, "Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material" and Attachment 2, "Specific Requirements Pertaining to Fingerprinting and Criminal History Records Checks" have been achieved. Notification to the Executive Secretary shall be made within twenty-five (25) days after full compliance has been achieved.

D. The licensee shall notify both the Executive Secretary and the U.S. Nuclear Regulatory Commission within 24 hours if the results from a criminal history records check indicate that an individual is identified on the FBI's Terrorist Screening Data Base.

**CLOSEOUT CONDITIONS**

89. Except as specifically provided otherwise in this license, the Licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Utah Radiation Control Rules, Utah Administrative Code R313 shall govern unless the statements, representations, and procedures in the Licensee's application and correspondence are more restrictive than the rules.

~~1.~~A. License renewal application, Revision 2, dated June 20, 2005.

1. B. The following documents refer to revisions made in Amendment 22:

~~1.~~(1) Letter CD04-0481, dated October 27, 2004, Amendment and Modification Request – Class A North Embankment.

~~2.~~(2) Letter CD04-0548, dated December 23, 2004, Revised Class A North Disposal Embankment License Amendment Request.

~~3.~~(3) URS Review of Revised Class A North Embankment Amendment Request, dated December 29, 2004.

~~4.~~(4) Letter CD05-0024, dated January 17, 2005, Class A North Disposal Embankment

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~~5.~~(5) Letter CD05-0265, dated May 20, 2005, Revision of Appendix R, Environmental Monitoring and Surveillance Plan.

~~6.~~(6) Letter CD05-0266, dated May 25, 2005, Surety Calculations for the Class A North Disposal Cell.

~~7.~~(7) Memo: Treesa Parker to John Hultquist, dated May 25, 2005, Proposed revisions to RML for Amendment 22

~~8.~~(8) Email: Treesa Parker to Christine Hiaring, dated June 1, 2005, License Amendment 22 Minor Changes for Consistency.

C. The following documents refer to revisions made in Amendment 22A:

~~a.~~(1) Division letter dated November 14, 2005.

D. The following documents refer to revisions made in Amendment 22B:

~~B.~~(1) Letter CD05-0333, dated June 30, 2005, RML no. UT 2300249 Request for approval of revisions to Appendix I, Organization, and amendment of License Condition 32 A.

~~C.~~(2) Memorandum dated August 2, 2005, Subject; Review of Appendix I

~~D.~~(3) Letter CD05-0398, dated August 16, 2005, Request for approval of revisions to Appendix I, Organization and amendment of license condition 31.A,B,C, and 32A.

~~E.~~(4) Letter CD05-0507, October 26, 2005, Additional information regarding proposed revisions to Appendix I, Organization and amendment of license condition 31.A,B,C, and 32A.

~~F.~~(5) Letter CD05-0453, dated September 19, 2005 Request for amendment of License Condition 9.10 RML UT2300478; Organization.

~~G.~~(6) Letter dated November 22, 2005, Request for information regarding request to revise Appendix I of the 11e(2) License Application and Amendment of L.C. 9.10.

~~H.~~(7) Letter dated October 11, 2005, Re: Request for Information: Revision to Appendix I and amendment 31A. B. C. and 32A. dated August 16, 2005 (CD05-0398).

~~I.~~(8) Memorandum, dated October 3, 2005, Subject; Appendix I, revisions to RML UT2300249 conditions 31 A, B, C, and 32 A.

~~J.~~(9) Letter CD05-0411, dated August 23, 2005, Payment of administrative cost for Appendix I amendment request dated August 16, 2005.

~~K.~~(10) Letter CD05-0472, dated September 30, 2005, License condition 39.E amendment

~~L.~~(11) Email dated August 10, 2005, Subject: Draft amendment for LC 39.E and attached august 10, 2005, License Condition 39 E. amendment "draft".

~~M.~~(12) Email dated September 16, 2005, Subject: RE: FW: Draft amendment for LC 39.E.

~~N.~~(13) Letter CD05-0285, dated June 1, 2005, Envirocare containerized waste facility concrete overpacks corrective action plan.

~~O.~~(14) Letter dated June 2, 2005, filling waste package voids at the containerized waste facility using controlled low strength material (CLSM)

~~P.~~(15) Letter CD05-0326, dated June 27, 2005, Re: Letter to Mr. Dane Finerfrock, dated April 13, 2005, CD05-0181.

~~Q.~~(16) Letter CD05-0366, dated July 26, 2005, Re: Letter to Dane Finerfrock, dated June 27, 2005, CD05-0326.

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~~R.~~(17) Letter CD06-0011, dated January 12, 2006, Request to amend License Condition No. 2, Address.

~~S.~~(18) Letter CD06-0043, dated February 3, 2006, Request to amend License Condition No. 1, Company Name.

~~T.~~(19) Letter dated February 6, 2006, evidence of name change with the Utah Department of Commerce.

~~U.~~(20) Email dated October 6, 2005, Subject: License condition 39.E.

~~V.~~(21) Memorandum from Woodrow W. Campbell through Loren Morton and Dane Finerfrock to Envirocare File, dated January 13, 2006 regarding AMRL Soils Lab Certification for the Envirocare Soils Lab.

~~W.~~(22) Email dated February 15, 2006 from Loren Morton to Dan Shrum, Subject: License Amendment for Condition 73.

~~X.~~(23) Email dated December 23, 2005 from Loren Morton to Dane Finerfrock, Subject: Proposed Changes to License Condition 73 - Annual Surety Evaluation Report.

~~Y.~~(24) Letter dated February 22, 2006, Subject: Revise void remediation procedure OPC-6.0.

E. The following documents refer to revisions made in Amendment 22C:

~~A.~~(1) Letter CD05-0435, dated September 8, 2005, Request to amend RML UT 2300249: Condition 58, Waste Characterization Plan.

~~B.~~(2) Letter CD05-0557, dated December 5, 2005, RML UT 2300249; Condition 58 Waste Characterization Plan –Revised License Amendment Request.

~~C.~~(3) Letter CD06-0072, dated February 27, 2006, Radioactive Material License UT 2300249: Condition 58 Waste Characterization Plan – Revised License Amendment Request.

~~D.~~(4) Email dated February 24, 2006 from Boyd Imai to Sean McCandless Re: Waste Characterization Plan.

~~E.~~(5) Letter CD06-0059, dated February 15, 2006, Radioactive Material License UT 2300249 –Self Identified Noncompliance.

~~F.~~(6) Letter dated March 17, 2006, from the DRC regarding the February 15, 2006 letter of noncompliance.

~~G.~~(7) Letter CD06-0055) dated February 9, 2006, Request to Amend RML UT 2300249 to show addition of Liquid Radioactive Sources to License Condition 6.E.

~~H.~~(8) Letter (CD06-0092) dated March 8, 2006, RML UT 2300249; Request for administrative amendment. Conditions 21A and B and Condition 81.

F. The following documents refer to revisions made in Amendment 22E:

~~1.~~(1) CD06-0389, "Request to amend Radioactive Materials License No. UT 23000249 and 11e.(2) Radioactive Materials License No. UT 23000478 – Request for approval revised Appendix I, *Organization*," October 6, 2006.

~~2.~~(2) Shredder Facility

~~i.~~a. CD05-0448, "Radioactive Materials License No. UT 2300249 (RML) and Groundwater Quality Discharge Permit UGW450005 (GWQDP). Request to Construct Shredding Facility," September 15, 2005.

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~~ii.~~b. CD05-0532, "Request to Construct Shredding Facility – Revised Design and Interrogatory Response," November 14, 2005.

~~iii.~~c. CD05-0556, "Request to Construct Shredding Facility – Additional Information," December 2, 2005.

~~iv.~~d. CD06-0036, "Request to Construct Shredding Facility – Response to Round 2 Interrogatories", February 1, 2006.

~~v.~~e. CD06-0098, "Request to Construct Shredding Facility – Response to Round 3 Interrogatory," March 10, 2006.

~~vi.~~f. ASTM F-1417, "ASTM Method F 1417-92," March 29, 2006.

~~vii.~~g. CD06-0188, "Request to Construct Shredder Facility – Response to Round 4 Interrogatory," May 9, 2006.

~~viii.~~h. CD06-0211, "Request to Construct Shredder Facility – Response to Round 4B Interrogatory," May 25, 2006.

~~ix.~~i. CD06-0234, "Requests to Construct Shredder and Rotary Dump Facilities – Revised Wastewater Management Process," June 19, 2006.

~~x.~~j. "EnergySolutions LLC Low-Level Radioactive Waste Closure & Post-Closure Trust License UT 2300249 Trust #16673400," June 29, 2006.

~~xi.~~k. CD-0346, "Interim Wastewater Management Plan for the Shredder Facility – Response to August 18, 2006 Request for Additional Information," August 31, 2006.

~~xii.~~l. CD06-0388, "Radioactive Material License UT 2300429 and Groundwater Quality Discharge Permit (GWDP) No UGW450005 Shredder Facility – Request to Operate," October 5, 2006.

~~xiii.~~m. CD06-0407, "Comment on Proposed Amendment of Radioactive Material License UT 2300249 and Groundwater Quality Discharge Permit (GWDP) No UGW450005, October 18, 2006.

~~xiv.~~n. CD06-0414, "Radioactive Material License UT 2300249 and Groundwater Quality Discharge Permit No UGW450005 Shredder Facility – Submittal of Revised Drawings" October 25, 2006.

~~xv.~~o. CD06-0425, "Groundwater Quality Discharge Permit No UGW450005 (GWQDP) Submittal of Revised Appendix J and K," November 7, 2006.

~~1.~~(3) Rotary Dump Facility

~~1.~~a. CD05-0564, "Request to Construct – Rotary Dump," December 12, 2005.

~~2.~~b. CD05-0570, "Request to Construct Rotary Dump 00 Submittal of Dose Assessment," December 16, 2005.

~~3.~~c. CD06-0086, "Request to Construct Rotary Dump Facility – Response to Round 1 Interrogatory", March 2, 2006.

~~4.~~d. ASTM F-1417, "ASTM Method F 1417-92," March 29, 2006.

~~5.~~e. CD06-0147, "Request to Construct Rotary Dump Facility – Revised Drawings," April 10, 2006.

~~6.~~f. CD06-0210, "Request to Construct Rotary Dump Facility – Response to Round 2 Interrogatory," May 25, 2006.

~~7.~~g. CD06-0211, "Request to Construct Rotary Dump Facility – Response to Round 4B Interrogatory", May 25, 2006.

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~~8.~~h. CD06-0226, "Request to Construct Rotary Dump Facility – Response to Round 2B Interrogatories," June 8, 2006.

~~1.~~i. CD06-0234, "Requests to Construct Shredder and Rotary Dump Facilities – Revised Wastewater Management Process," June 19, 2006.

~~1.~~(4) Intermodal Container Wash Building

~~1.~~a. CD05-0291a, "Radioactive Materials License No. UT 2300249 (RML) and Groundwater Quality Discharge Permit UGW450005 (GWQDP). Request to Construct Intermodal Container Wash Building and Access Control Building," June 9, 2005.

~~2.~~b. CD05-0388, "Request to Construct Intermodal Container Wash Building – Revised Design and Supplemental Information," August 8, 2005.

~~3.~~c. CD05-0432, "Request to Construct Intermodal Container Wash Building – Revised Design and Interrogatory Response," September 1, 2005.

~~4.~~d. CD06-0110, "MARSSIM Release for New Intermodal Container Wash Facility," March 22, 2006.

~~5.~~e. CD06-0206, "Radioactive Material License UT 2300249 and Groundwater Quality Discharge Permit No UGW450005 Intermodal Container Wash Building – Request to Operate," May 22, 2006.

~~6.~~f. "EnergySolutions LLC Low-Level Radioactive Waste Closure & Post-Closure Trust License UT 2300249 Trust #16673400," June 29, 2006.

~~7.~~g. CD06-0259, "Groundwater Quality Discharge Permit (GWDP) No UGW450005 Intermodal Container Wash Building – Revised Appendix J and K," July 10, 2006.

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~~8.~~(5) Decontamination Access Control Building

~~1.~~a. CD05-0291b, "Radioactive Materials License No. UT 2300249 (RML) and Groundwater Quality Discharge Permit UGW450005 (GWQDP). Request to Construct Intermodal Container Wash Building and Access Control Building," June 9, 2005.

~~2.~~b. CD05-0367, "MARSSIM Release of New Boxwash Access Control", July 26, 2005.

~~3.~~c. CD06-0139, "Radioactive Material License UT 2300249 and Groundwater Discharge Quality Permit (GWDP) No UGW450005 Decontamination Access Control Building – Request to Operate", April 6, 2006.

~~4.~~d. "EnergySolutions LLC Low-Level Radioactive Waste Closure & Post-Closure Trust License UT 2300249 Trust #16673400," June 29, 2006.

~~5.~~e. CD06-0245, "Groundwater Discharge Quality Permit (GWDP) No UGW450005 Decontamination Access Control Building – Revised Appendix J and K and Drawing No 05015-S100," June 30, 2006.

~~1.~~(6) East Side Drainage Project

~~1.~~a. CD06-0175, "Request to Construct East Side Drainage and Gray Water System Modifications," May 1, 2005.

~~2.~~b. CD06-0244, "East Side Drainage and Gray Water System Modifications – Response to DRC Review," June 30, 2006.

~~3.~~c. CD06-0293, "Groundwater Discharge Quality Permit No UGW450005 East Side Drainage and Gray Water System – Revised Design and BAT Plans," August 4, 2006.

~~4.~~d. CD06-0327, "Groundwater Discharge Quality Permit No UGW450005 East Side Drainage and Gray Water System – Revised Appendix J BAT Performance Monitoring Plan and Appendix K BAT Contingency Plan," August 23, 2006.

~~5.~~e. CD06-0328, "Groundwater Discharge Quality Permit No UGW450005 East Side Drainage and Gray Water System – Revised Drawings," August 24, 2006.

G. The following documents refer to revisions made in Revision 0 of the License Renewal Application:

(1) AGRA Earth & Environmental, Inc. 1999. Summary Seismic Stability and Deformation Analysis: Envirocare LARW Disposal Facility, Clive, Tooele County, Utah. September 1, 1999. (1998 LRA Appendix J)

(2) AGRA Earth & Environmental, Inc. 2000a. Evaluation of Settlement of Compressible Debris Lifts: LARW Embankments, Clive, Tooele County, Utah. June 1, 2000.

(3) AGRA Earth & Environmental, Inc. 2000b. Evaluation of Settlement of Incompressible Debris Lifts: LARW Embankments, Clive, Tooele County, Utah. June 1, 2000.

(4) AMEC Earth & Environmental, Inc. 2000a. Letter Report: Allowable Differential Settlement and Distortion of Liner and Cover Materials. October 4, 2000.

(5) AMEC Earth & Environmental, Inc. 2000b. Letter Report Stability Considerations: Proposed LLRW Embankment. October 25, 2000.

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Hultquist, Review; Formerly Characteristic Waste – License Amendment Request.

(8) Letter dated August 31, 2009, Sean McCandless to Dane Finerfrock, Radioactive Material License No. UT2300249 – Revised request for Amendment – Formerly Characteristic (LLRW Destined) Waste.

(9) Email dated October 15, 2009 Sean McCandless to John Hultquist, Formerly Characteristic, Attachments Revised RML 10/8/09 and WCP Revised 10/8/09.

(10) Memorandum dated October 19, 2009, from Boyd Imai to John Hultquist, Formerly Characteristic Wastes – Transfer to LLRW.

N. The following documents refer to revisions made in Amendment 7:

(1) Letter dated September 21, 2009 (CD09-0241) from Val J. Christensen to Amanda Smith; RML No. UT2300249 – Commitments Relating to Depleted Uranium Disposal.

(2) Letter dated October 1, 2009 (CD09-0258) from Val J. Christensen to Dane Finerfrock; RML No. UT2300249 – Commitments Relating to Depleted Uranium Disposal

(3) Notice of Agency Action to Consider Proposed License Condition No. 35 dated October 21, 2009.

(4) Email dated February 22, 2010, from Laura Lockhart to Dane Finerfrock and John Hultquist, License Condition documents –comment response document.

~~1.~~O. The following document refer to revision made in Amendment 8:

~~1.~~(1) Letter dated June 1, 2010 (CD10-0162) from Sean McCandless to Dane Finerfrock; RML No. UT2300249—Request for Amendment.

~~2.~~(2) Letter dated July 15, 2010 (CD10-0200) from Sean McCandless to Rusty Lundberg; RML No. UT2300249—Revision of Appendix I, *Organization.*

~~3.~~(3) Letter dated August 2, 2010 (CD10-0219) from Sean McCandless to Rusty Lundberg; RML No. UT2300249—Revision of Appendix I, *Organization.*

~~4.~~(4) Letter dated November 1, 2010 (CD10-0298) from Rick Chalk to Rusty Lundberg; 1. Radioactive Material License UT 2300249, License Condition 16.1 (sic) Letter dated November 23, 2009 to Dane Finer frock from Mark Ledoux, CD09-0323, 2. Administrative request from DRC to EnergySolutions to amend License UT 2300249, License Conditions 6, 7, and 8.

~~5.~~(5) Email date November 18, 2010 from Thomas Brown to Boyd Imai, LC 8 E, K, M and O.

P. The following documents refer to revision made in Amendment 9:

~~1.~~(1) Letter dated December 6, 2010 (CD10-0347) from Dan B. Shrum to Rusty Lunberg; RML No. UT2300249—Amendment Request – Condition 35.B, Depleted Uranium.

~~2.~~(2) Memorandum dated December 13, 2010 from John Hultquist to File regarding Amendment request.

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Q. The following documents refer to revision made in Amendment 10:

(1) AMEC Earth & Environmental, Inc. 2011. Report: Geotechnical Update Report – Energy*Solutions* Clive Facility Class A West Embankment. February 15, 2011.

(2) Whetstone Associates, Inc. 2011. Class A West Disposal Cell Infiltration and Transport Modeling. April19, 2011.

**UTAH RADIATION CONTROL BOARD**

_____ _____

Rusty Lundberg, Executive Secretary Date

# GWQDP Revisions

**Permit No. UGW450005**

**STATE OF UTAH**
**DIVISION OF WATER QUALITY**
**UTAH WATER QUALITY BOARD**
P.O. BOX 16690
SALT LAKE CITY, UTAH 84116-0690

**Ground Water Quality Discharge Permit**

In compliance with the provisions of the
Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended,
**EnergySolutions, LLC**
**423 West 300 South, Suite 200**
**Salt Lake City, Utah 84101**

hereafter referred to as the "Permittee", is granted a Ground Water Quality Discharge Permit for a Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility in accordance with conditions set forth herein. This facility currently consists of five separate operable units: a Low-Activity Radioactive Waste (LARW) cell, an 11e.(2) Cell, a Mixed Waste cell, and a Class A West cell, ~~and a Class A North cell,~~ which are located at approximately latitude 40° 41' 18" North, longitude 113° 06' 54" West.

This modified Ground Water Quality Discharge Permit amends and supersedes all other Ground Water Discharge permits for this facility issued previously.

This modified permit shall become effective on ~~October 4 2010~~
This permit and the authorization to operate shall expire at midnight, **June 8, 2013.**

_____
Co-Executive Secretary
Water Quality Board

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3. Ground Water Protection Levels for Radiologic Parameters, Mixed Waste Cell

Based on the type of waste to be disposed of in the Mixed Waste Cell, which includes low-level radioactive waste, an evaluation of indicater isotopes, and the Ground Water Quality Standards (GWQS); ground water protection levels (GWPL) defined as either the GWQS or the Background Concentration, whichever is greater as listed in Table 1E and 1F of this Permit. In all cases, ground water quality in any compliance monitoring well at the Mixed Waste Cell shall comply with the GWPLs found in Table 1E, unless other GWPLs have been cited on a well and radiologic parameter-specific basis in Table 1F, below.

4 Revision of Ground Water Protection Levels

After submittal of additional ground water quality data, the ground water protection levels may be revised by the Executive Secretary.

**Table 1A: Ground Water Protection Levels (GWPL) – Universal to All LARW, ~~Class A,~~ Class A West~~North, and~~ Evaporation Pond Wells**

| Parameter | GWPL [1] | Parameter | GWPL [1] |
|---|---|---|---|
| *Field and Inorganic Parameters (mg/l)* | | *Radiologic Parameters – Alpha Emitters [9] (pCi/l)* | |
| Cyanide | 0.2 | Adjusted Gross Alpha [10] | 15 |
| Fluoride | 4.0 | Neptunium-237 [11] | 7 |
| Total Nitrate/Nitrite (as N) | 10.0 | Strontium-90 | 42 |
| pH (units) | 6.5 – 8.5 | Thorium-230 | 83 |
| *Dissolved Metals (mg/l)* | | Thorium-232 | 92 |
| Antimony[16] | 0.006 | Uranium-233 | 26 |
| Arsenic | NA [2] | Uranium-234 | 26 |
| Barium | 2.0 | Uranium-235 | 27 |
| Beryllium [3] | 0.004 | Uranium-236 | 27 |
| Cadmium | 0.005 | Uranium-238 | 26 |
| Chromium | 0.1 | | |
| Copper | 1.3 | *Radiologic Parameters – Beta/Gamma Emitters [12] (pCi/l)* | |
| Lead | 0.015 | Carbon-14 | 3,200 |
| Mercury | 0.002 | Iodine-129 [13] | 21 |
| Molybdenum | NA [2] | Technetium-99 | 3,790 |
| Nickel [3] | 0.10 | Tritium | 60,900 |
| Selenium | 0.05 | | |
| Silver | 0.1 | *Combined Radiologic Parameters (pCi/l)* | |
| Thallium[16] | 0.002 | | |
| Uranium – total [4] | 0.03 | Radium-226 + Radium-228 [14] | 5 |
| Zinc | 5.0 | | |
| *Organic Parameters (mg/l)* | | | |
| Acetone [5] | 0.7 | 1,2-Dichloroethane | 0.005 |

| Parameter | GWPL [1] | Parameter | GWPL [1] |
|---|---|---|---|
| 2-Butanone [15] | 4.0 | Methylene Chloride [7] | 0.005 |
| Carbon Disulfide [5] | 0.7 | 1,1,2-Trichloroethane [8] | 0.005 |
| Chloroform [6] | 0.08 | Vinyl Chloride | 0.002 |
| | | | |

1. All ground water protection levels (GWPLs) derived from Ground Water Quality Standards (GWQS, see UAC R317-6-2), except as noted.
2. Due to naturally elevated concentrations of arsenic and molybdenum in the Class IV saline aquifer at Clive, Utah, these constituents are poor indicators of cell leakage and therefore will not be used as compliance parameters with ground water protection levels. However, the Permittee will continue to sample, analyze, and report arsenic and molybdenum data in all compliance monitoring wells at Permit and License renewal as a best management practice.
3. Beryllium and Nickel GWQS derived from EPA drinking water Maximum Contaminant Levels (MCL), as published in the July 17, 1992 Federal Register, Vol. 57, No. 138, pp. 31776 – 31849, Table 1.
4. Total uranium GWQS of 0.03 mg/l from EPA final MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).
5. GWQS for acetone, and carbon disulfide determined by DWQ staff from reference doses available in the technical literature, see August 8, 1994 DWQ Staff Report: Ground Water Quality Conditions and Proposed Revision to Ground Water Protection Levels, Envirocare of Utah Inc., Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility, near Clive, Tooele County, Utah, p. 3.
6. GWQS for chloroform derived from a 1998 EPA final drinking water MCL for total trihalomethane compounds in "Drinking Water Standards and Health Advisories", EPA 822-B-00-001, Summer 2000.
7. GWQS for methylene chloride derived from EPA drinking water MCL (ibid.).
8. GWQS for 1,1, 2-Trichloroethane from final EPA MCL in "Drinking Water Regulations and Health Advisories", EPA 822-B-96-002, October 1996.
9. All GWPL values for alpha-emitting radionuclides based on 1E-4 lifetime cancer mortality risk concentration levels provided in 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078-9, 33100-3, and Appendix C).
10. Adjusted Gross alpha activity excludes radon, radium-226, and uranium alpha particle activity. Gross alpha activity to be determined by co-precipitation, EPA Method 00-02.
11. Neptunium-237, as determined by Total Radioactive Neptunium, EPA Method 907.0.
12. All GWPL values for beta/gamma emitting radionuclide parameters based on a 4 millirem/year equivalent dosage, as per 1991 EPA draft MCL values for drinking water (July 18, 1991 Federal Register, Vol. 56, No. 138, pp. 33078, 33103, and Appendix B).
13. Iodine-129, as determined by Total Radioactive Iodine, EPA Method 902.0.
14. GWQS of 5 pCi/l for combined radium-226 + radium-228 from final EPA MCL in National Primary Drinking Water Regulations Final Rule for Radionuclides (December 7, 2000 Federal Register, Vol. 65, No. 236, p. 76708).
15. GWQS for 2-Butanone (methyl ethyl ketone) derived from Life-time health advisory value in "2006 Edition of the Drinking Water Standards and Health Advisories", EPA 822-R-06-013, August 2006.
16. Antimony and Thallium GWPL were recently established by the Utah Water Quality board. EnergySolutions is in the process of establishing baseline GWPL for these parameters, see Part I.I.4 for details.

**Table 1C: Ground Water Protection Levels – Universal for all 11e.(2) Wells**

| Parameter | GWPL [1] | Parameter | GWPL [1] |
|---|---|---|---|
| *Field and Inorganic Parameters [2] (mg/l)* | | *Organic Parameters – Specific to 11e.(2) (mg/l)* | |
| Cyanide | 0.2 | Acetone [5] | 0.7 |
| Fluoride | 4.0 | 2-Butanone [11] | 4.0 |
| Total Nitrate/Nitrite (as N) | 10.0 | Carbon Disulfide [5] | 0.7 |
| pH (units) | 6.5 – 8.5 | Chloroform [6] | 0.08 |
| *Dissolved Metals [2] (mg/l)* | | 1,2-Dichloroethane | 0.005 |
| Arsenic | NA [3] | Methylene Chloride [7] | 0.005 |
| Barium | 2.0 | Naphthalene [8] | 0.02 |
| Beryllium [4] | 0.004 | Diethyl Phthalate [9] | 5.0 |
| Cadmium | 0.005 | 2-Methylnaphthalene [10] | 0.004 |
| Chromium | 0.1 | | |
| Copper | 1.3 | | |
| Lead | 0.015 | | |
| Mercury | 0.002 | | |
| Molybdenum | NA [3] | | |
| Nickel [4] | 0.10 | | |
| Selenium | 0.05 | | |
| Silver | 0.1 | | |
| Uranium – total | 0.03 | | |
| Zinc | 5.0 | | |
| | | | |
| *Combined Radiologic Parameters (pC/l)* | | | |
| Radium-226+radium-228 | 5 | | |
| | | | |
| *Radiologic Parameters (pC/l)* | | | |
| Thorium-230 | 83 | | |
| Thorium-232 | 92 | | |
| | | | |
| | | | |

1. All field, inorganic, dissolved metals, and organic indicator organic parameters and corresponding GWPLs for the 11e.(2) wells are equivalent to those for the LARW wells in Table 1A, above.
2. All ground water protection levels (GWPL) derived from Ground Water Quality Standards (GWQS, see UAC R317-6-2), except as noted.
3. Due to naturally elevated concentrations of arsenic and molybdenum in the Class IV saline aquifer at Clive, Utah, these constituents are poor indicators of cell leakage and therefore will not be used as compliance parameters with ground water protection levels. However, the Permittee will continue to sample, analyze, and report arsenic and molybdenum data in all compliance monitoring wells at Permit and License renewal as a best management practice.
4. Beryllium and Nickel GWQS derived from EPA drinking water Maximum Contaminant Levels (MCL), as published in the July 17, 1992 Federal Register, Vol. 57, No. 138, pp. 31776 – 31849, Table 1.
5. GWQS for acetone, and carbon disulfide determined by DWQ staff from reference doses available in the technical literature, see August 8, 1994 DWQ Staff Report: Ground Water Quality Conditions and Proposed Revision to Ground Water Protection Levels, Envirocare of Utah Inc., Low-Level Radioactive Waste and 11e.(2) Waste Disposal Facility, near Clive, Tooele County, Utah, p. 3.
6. GWQS for chloroform derived from a 1998 EPA final drinking water MCL for total trihalomethane compounds in "Drinking Water Standards and Health Advisories", EPA 822-B-00-001, Summer 2000.
7. GWQS for methylene chloride derived from EPA drinking water MCL (ibid.).
8. Naphthalene GWQS derived from final EPA drinking water LHA (ibid.).

4) A 6-inch lower filter zone consisting of sandy gravel material with a minimum permeability of 3.5 cm/sec,

5) A 2-foot thick clay radon barrier measured perpendicular to the slope. Said radon barrier will be divided into two layers:

   i. An upper layer, 1 foot thick, with a field hydraulic conductivity of 5.0E-8 cm/sec or less, and

   ii. A lower layer, 1 foot thick with a field hydraulic conductivity of 1.0E-6 cm/sec or less.

Top slope of the embankment shall be between 2% and 4%, as specified on the approved engineering drawings, and side slopes shall be no steeper than approximately 5:1. The outside toe of the clay radon barrier/liner shall extend outward and beyond the outermost edge of the waste layer and shall merge with the bottom clay liner.

b) Waste Layer – the waste layer shall not exceed a final thickness of 43 feet above the top of the bottom clay liner.

c) Clay Bottom Liner – the bottom clay liner shall be constructed below natural grade on slopes no greater than 0.12% north to south and 0.2% east to west. Final grade and elevation for the base of the clay liner will comply with the approved engineering design (Table 2A). This liner will be constructed after excavation of the site to the total design depth, followed by placement of imported clay materials, which meet the approved specifications for material and construction. The new clay liner shall be graded to prevent the accumulation of leachate over the existing 1-foot thick clay liner. The clay liner shall be a minimum of 2 feet thick, measured perpendicular to the slope, constructed in accordance with the approved LLRW and 11e.(2) CQA/QC Plan (Radioactive Materials License, Condition 44), and have a field hydraulic conductivity of 1.0E-6 cm/sec or less.

**Table 2A: Approved LARW Cell Engineering Design Drawings**

| Drawing | Last Revision Date | Subject |
|---|---|---|
| 9407-2, Rev. E | July 28, 1998 | LARW Disposal Cell – Cell Location and Excavation Limits |
| 9407-4, Rev. V | February 1, 2005 | LARW Disposal Cell – LARW Cell Closure |
| 9407-4A, Rev. L | May 16, 2003 | LARW Disposal Cell – LARW Cell Closure |
| 9407-4B, Rev. J | May 16, 2003 | LARW Disposal Cell – LARW Cell Closure |
| 9407-5, Rev. I | February 4, 1999 | LARW Disposal Cell – Site Layout |
| 9407-6, Rev. E | July 28, 1998 | LARW Disposal Cell – Site Layout |
| 9407-7, Rev. A | June 27, 1994 | Drainage Plan – Plan View |
| 9407-7A, Rev. A | June 27, 1994 | Drainage Plan – Details |
| 9407-8, Rev. C | October 16, 1998 | LARW Disposal Cell Wedge Expansion Cross Section |
| 03046-VO1, Rev. 0 | May 16, 2003 | LARW Disposal Cell – Radon Barrier Design Sections and Details |
| 03046A-VO1 Rev. - | August 1, 2003 | LARW Disposal Cell Closure – Plan and Details |
| 03046A-VO2 Rev. 1 | August 1, 2005 | LARW Disposal Cell Closure – Sections and Details |
| | | |

Moisture Content shall be the asymptotic value measured by ASTM Methods D-3152 and D-2325 at soil tensions above 15 bars, If the fines content (#200 sieve) of the sacrificial soil is greater than or equal to 15%, residual moisture content testing is not required,

4) A 6-inch lower (Type B) filter zone consisting of sandy gravel material with a minimum permeability of 3.5 cm/sec,

5) A 2-foot thick clay radon barrier measured perpendicular to the slope. Said radon barrier will be divided into two layers:

   i. an upper layer, 1 foot thick, with a field hydraulic conductivity of 5.0E-8 cm/sec or less, and

   ii. a lower layer, 1 foot thick with a field hydraulic conductivity of 1.0E-6 cm/sec or less.

Top slope of the embankment shall be between 2% and 4%, as specified on the approved engineering drawings, and side slopes shall be no steeper than approximately 5:1. The outside toe of the clay radon barrier/liner shall extend outward and beyond the outermost edge of the waste layer and shall merge with the bottom clay liner.

b) Waste Layer – the waste layer shall not exceed a final thickness of 75.3~~54~~ feet above the top of the bottom clay liner.

c) Clay Bottom Liner – the bottom clay liner shall be constructed below natural grade. Final grade and elevation for the base of the clay liner will comply with the approved engineering design (Table 2C). This liner will be constructed after excavation of the site to the total design depth, followed by placement of imported clay materials, which meet the approved specifications for material and construction. The clay liner shall be a minimum of 2 feet thick, measured perpendicular to the slope, constructed in accordance with the approved LLRW and 11e.(2) CQA/QC Plan (Radioactive Materials License, Condition 44), and have a field hydraulic conductivity of 1.0E-6 cm/sec or less.

**Table 2C: Approved ~~Class A and~~ Class A West~~North~~ Cell Engineering Design Drawings**

| Drawing | Last Revision | Subject |
|---|---|---|
| **Class A Disposal Embankment** | | |
| 10014-C019~~821-01~~, Rev. 0~~-1~~ | 4~~2~~/11~~9~~/11~~09~~ | Class A West Embankment~~Disposal Cell~~ – Embankment Features and Controls~~Layout Plan and Cover Details~~ |
| 100149~~821~~-C02, Rev. 0~~D~~ | 4~~2~~/11~~9~~/11~~09~~ | Class A West Embankment~~Disposal Cell~~ – Cross Sections |
| 100149~~821~~-C03, Rev. 0~~D~~ | 4~~7~~/11~~8~~/11~~09~~ | Class A West Embankment~~Disposal Cell~~ – Sections and Details 1 of 2~~Ditch Details~~ |
| 100149~~821~~-C04, Rev. 0~~A~~ | 4~~7~~/11~~25~~/11~~00~~ | Class A West Embankment~~Disposal Cell~~ – Sections and Details 2 of 2~~Updated Drainage System~~ |
| ~~**Class A North Disposal Embankment**~~ | | |
| 1001~~404080~~-C05~~,1~~ Rev. 0~~3~~ | 4~~2~~/11~~9~~/11~~09~~ | Class A West Embankment~~North Disposal Cell~~ – Active CWF and LC Areas~~Layout Plan and Cover Details~~ |
| 1001~~404080~~-C06~~2~~, Rev. 0~~4~~ | 4~~7~~/11~~8~~/11~~09~~ | Class A West Embankment~~North Disposal Cell~~ – Large Component Area Plan & Details~~Cross Sections~~ |

**Table 2C: Approved ~~Class A and~~ Class A West~~North~~ Cell Engineering Design Drawings**

| | | |
|---|---|---|
| 1001~~404080~~-C07~~3~~, Rev. 0~~3~~ | ~~4~~7/11~~8~~/11~~09~~ | Class A West Embankment~~North Disposal Cell~~ – CWF Area Plan & Details~~Ditch Details~~ |
| 1001~~404080~~-C09~~4~~, Rev. 0~~3~~ | ~~410~~/11~~26~~/11~~09~~ | Class A West~~North~~ Embankment~~Proposed~~ – CWF Cross Sections~~CWF & LC Area, Area & Haul Road Layout~~ |
| 1001~~408080~~-U~~C~~01~~6~~, Rev. 04 | ~~410~~/11~~26~~/11~~09~~ | Class A West~~North~~ Embankment - Embankment Location, Map and Buffer Zone~~Proposed CWF Area, CWF Area Plan and Details~~ |
| 1001~~408080~~-U~~C~~02~~6A~~ | ~~410~~/11~~29~~/11~~09~~ | Class A West~~North~~ Embankment – Environmental Monitoring~~Proposed CWF area, CWF Area Plan and Details~~ |

5. Disposal Cell Location Restrictions

The LARW, 11e.(2), ~~Class A,~~ and Class A West~~North~~ disposal cells shall be restricted to the following locations in Section 32, Township 1 South, Range 11 West, SLBM, as specified on the currently approved engineering plans, drawings, and the approximate Latitude and Longitude Coordinates provided in Table 3 below:

**Table 3: Authorized LARW, 11e.(2), ~~Class A,~~ and Class A West~~North~~ Disposal Cell Locations**

| Disposal Cell | Edge of Waste Position | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| LARW | NW Corner | 40° 41' 11.382" N | 113° 06' 51.318" W |
| | SW Corner | 40° 40' 52. 908" N | 113° 06' 51. 203" W |
| | SE Corner | 40° 40' 52. 960" N | 113° 06' 36. 734" W |
| | NE Corner | 40° 41' 11.434" N | 113° 06' 36. 848" W |
| 11e.(2) | NW Corner | 40° 41' 12. 590" N | 113° 07' 24. 545" W |
| | SW Corner | 40° 40' 55. 055" N | 113° 07' 24. 761" W |
| | SE Corner | 40° 40' 54. 845" N | 113° 06' 55. 564" W |
| | NE Corner | 40° 41'12.380" N | 113° 06' 55.346" W |
| Class A West | NW Corner | 40° 41' 39~~28~~.609~~061~~" N | 113° 07' 24.76~~535~~" W |
| | SW Corner | 40° 41' 14. 230" N | 113° 07' 24. 702" W |
| | SE Corner | 40° 41' 14.191" N | 113° 06' 55.369" W |
| | NE Corner | 40° 41' 28.022" N | 113° 06' 55.403" W |
| ~~Class A North~~ | ~~NW Corner~~ | ~~40° 41' 38. 509" N~~ | ~~113° 07' 24. 752" W~~ |
| | ~~SW Corner~~ | ~~40° 41' 30. 527" N~~ | ~~113° 07' 24. 740" W~~ |
| | ~~SE Corner~~ | ~~40° 41' 30.550" N~~ | ~~113° 06' 57.211" W~~ |
| | ~~NE Corner~~ | ~~40° 41' 38. 532" N~~ | ~~113° 06' 57.222" W~~ |

This description does not include the Mixed Waste facility, located east of the LARW Cell, which is authorized under a separate State-issued Part B Permit from the Utah Division of Solid and Hazardous Waste.

6. Definition of LARW Waste

For purposes of this Permit, Low-Activity Radioactive Waste (LARW) is defined as radioactive wastes, which meet the definition of Class A Low-Level Radioactive Waste (LLRW) under the Utah Radiation Control Rules, UAC R313-

15-1008, or are defined as Naturally Occurring and Accelerator Produced Radioactive Materials under the Utah Radiation Control Rules, UAC R313-12-3.

7. Definition of Mobile Waste

Any waste containing any of the following isotopes shall be considered a mobile waste and subject to special provisions or requirements under this Permit: aluminum-26, berkelium-247, calcium-41, californium-249, californium-250, carbon-14, chlorine-36, iodine-129, neptunium-237, rhenium-187, sodium-22, technetium-99, terbium-157, terbium-158, or tritium.

8. Definition of PCB/Radioactive Waste

For purposes of this Permit, PCB/Radioactive Waste to be accepted for disposal shall meet the criteria specified in R315-315-7(2)(a) or (3)(b)(i-vi) of the rules designated for disposal in a municipal or non-municipal non-hazardous landfill.

9. Definition of 11e.(2) Waste

For purposes of this Permit, 11e.(2) Waste is defined as "... tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content", as defined in Section 11e.(2) of the U.S. Atomic Energy Act of 1954, as amended.

10. Collection Lysimeters for Future Construction at the ~~Class A and~~ Class A West~~North~~ Cell~~s~~

Future construction of the clay bottom liner of the ~~Class A and~~ Class A West~~North~~ Cell~~s~~ shall include the installation of collection lysimeters below the bottom clay liner, in accordance with the CQA Plan for Collection Lysimeter Construction currently approved by the Executive Secretary and included herein as Appendix C. The Permittee shall also comply with the currently approved Operation, Maintenance and Closure Plan for Collection Lysimeters, also included herein as Appendix C. In addition, the Permittee shall comply with the following requirements:

a) Collection Lysimeter "As-Built" Report – within 30 days of completion of the construction of each lysimeter, the Permittee shall submit an "As-Built" Report for Executive Secretary approval.

b) Future Collection Lysimeter Construction Notification – the Permittee shall submit a notice of construction of additional lysimeters in the ~~Class A and~~ Class A ~~w~~West~~North~~ Cell~~s~~. Said notice shall be submitted at least one week prior to construction in order to allow the Executive Secretary to inspect lysimeter construction.

c) Future Collection Lysimeter Construction – in addition to any design or construction requirements found in the currently approved Appendix C, the Permittee shall construct all future collection lysimeters in a manner that will allow the lysimeter to be operated in compliance with all performance standards mandated by Part I.E.11 or monitoring requirements dictated by Part I.F.6 of this Permit. Any changes to the approved design or construction

specifications in Appendix C shall require prior Executive Secretary approval.

11. Future Modification of Disposal Cell Engineering Design or Specifications

Any change in the approved engineering design or specifications which causes a significant adverse effect to the infiltration performance of a disposal cell shall require prior submittal and Executive Secretary approval of infiltration and contaminant transport analysis of the proposed change. Said changes must be submitted to the Executive Secretary as a written request with the revised engineering drawings, specifications, ground water flow and contaminant transport models, or any other documentation deemed necessary by the Executive Secretary, at least 180 days prior to the effective date desired by the Permittee.

12. Final Authorized Engineering Design and Specifications for Waste and Wastewater Related Facilities

Best available technology design standards for related facilities at the disposal site shall be defined by, and construction conform to the engineering plans and specifications summarized in Table 5, below:

**Table 5: Approved Engineering Design Drawings for Waste/Wastewater Related Facilities**

| Related Facility | Drawing No. | Last Revision | Subject / Title |
|---|---|---|---|
| Track 2 Railcar Decontamination Pad | 9513-1, Rev. B | May 26, 1996 | Plan, Section, and Details |
| Track 4 Railcar Decontamination Pad | T-100, Rev. 3 | Aug. 14, 1999 | Foundation |
| | T-101, Rev. 3 | Aug. 16, 1999 | Foundation Details |
| | 9906-02, Rev. H | Feb 26, 2007 | Wash Water System As-Built |
| | 9906-02A, Rev. H | Feb. 26, 2007 | Wash Water System As-Built |
| Class A West~~North~~ Containerized Waste Facility and Large Component Area Evaporation Basin | 1001~~404080~~-C05, Rev. 0~~3~~ | April 11~~July 14~~, 2011~~08~~ | Class A West Embankment - Active CWF & LC Areas: Area and Haul Road Layout~~Plan and Section~~ |
| | 1001~~404080~~-C06, Rev. 0 ~~4~~ | April 11~~October 26~~, 2011~~09~~ | Class A West~~North~~ Embankment Large Component Area Plan & Details~~Proposed CWF Area, CWF Area Plan & Details~~ |
| | 1001~~408080~~-C0~~76A~~, Rev. 0~~1~~ | April 11~~October 26~~, 2011~~09~~ | Class A West~~North~~ Embankment ~~Proposed CWF Area,~~ CWF Area Plan & Details |
| 1995 Evaporation Pond | 9718-1, Rev. C | March 13, 2007 | Facility Layout |
| | 9504-3, Rev. E | Oct. 28, 1999 | Storage Pond |
| | 9504-3A, Rev. A | Oct. 28, 1999 | Leak Detection System Details, As-Built |
| | 9504-4, Rev. E | Oct. 28, 1999 | Facility Details |
| | 9718-4, Rev. A | Aug. 17, 1998 | Piping Diagrams and Pump Station |
| | 08007-C01, Rev. 1 | June 26, 2008 | 1995 Evaporation Pond HDPE Repairs, New 60 mil HDPE Liner |
| 1997 Evaporation Pond | 9718-1, Rev. C | March 13, 2007 | Facility Layout |
| | 9718-2, Rev. D | Feb. 25, 1999 | Evaporation and Storage Pond |
| | 9718-2a, Rev. B | Feb. 25, 1999 | Leak Detection System Details, As-Built |
| | 9718-3, Rev. - | Sept. 17, 1997 | Details |
| | 9718-4, Rev. A | Aug. 17, 1998 | Piping Diagrams and Pump Station |

**Table 5: Approved Engineering Design Drawings for Waste/Wastewater Related Facilities**

| Related Facility | Drawing No. | Last Revision | Subject / Title |
|---|---|---|---|
| 2000 Evaporation Pond | 0009-00, Rev. A | July 10, 2000 | Site Plan and Facility Layout |
| | 0009-01, Rev.E | Feb. 22, 2008 | Plan View |
| | 0009-02, Rev. A | Jan. 29, 2001 | Cross Sections |
| | 0009-03, Rev. B | Jan. 29, 2001 | Details |
| | 0009-04, Rev. A | Jan. 29, 2001 | Sump/Side Slope Cross-Section |
| | 0009-05, Rev. A | Jan. 29, 2001 | Leak Detection Details |
| | 0009-06, Rev. A | Feb. 22, 2008 | Water Transfer Piping Details |
| Mixed Waste Evaporation Pond | 9802-1, Rev. D | Dec. 22, 1999 | Facility Layout |
| | 9802-2, Rev. F | Dec. 22, 1999 | Water Storage Facility |
| | 9802-3, Rev. D | Dec. 22, 1999 | Facility Details As-Built |
| | 9802-4, Rev. B | Dec. 4, 1998 | Water Storage Facility |
| | 9802-5, Rev. A | Dec. 22, 1999 | Leak Detection System Details, As-Built |
| | 9803-2, Rev. - | Feb. 11, 1998 | Storage Pad Drain Line As-Built |
| Box Washing Facility | 9621-1, Rev. C | July 20, 1998 | Site Plan As-Built Drawing |
| | 9621-2, Rev. B | July 20, 1998 | Foundation Plan As-Built Drawing |
| | 9621-3, Rev. B | July 20, 1998 | Elevation Views As-Built Drawing |
| | 9621-4, Rev. B | July 20, 1998 | Elevation Views As-Built Drawing |
| | 9621-5, Rev. B | July 20, 1998 | Wall Detail As-Built Drawing |
| Intermodal Unloading Facility | 9705-1, Rev. A | July 31, 1998 | Plan View |
| | 9705-2, Rev. A | July 31, 1998 | Cross Section Drawings |
| | 9813-01, Rev. B | March 13, 2007 | Layout |
| | 9813-02, Rev. A | July 31, 1998 | Layout (and Details) |
| | 0701-G03, Rev. 1 | June 8, 2007 | Site Layout and Facility Legend |
| Railcar Rollover Facility | 0221-01 | March 26, 2002 | Site Layout and Drain Line |
| | 0221-02 | March 26, 2002 | Fabric Cover Frame Layout |
| | 0221-03 | March 26, 2002 | Rollover Cover South Elevation |
| | 0221-04, Rev. A | April 24, 2002 | Cover Run-off Collection and Drainage |
| | 07013-C0, Rev 0 | March 31, 2008 | Drainage repair plan |
| Rail Digging Facility | 0107-01, Rev. B | April 25, 2002 | Site Layout |
| | 0107-02, Rev. B | April 19, 2002 | Digging Track Plan |
| | 0107-03, Rev. B | April 12, 2002 | Track and Pad Details |
| | 0107-04A, Rev. A | April 25, 2002 | Excavator Ramp |
| Container Storage Pad | 9514-1, Rev. C | March 13, 2007 | Plan, Sections and Details |
| East Truck Unloading Facility | 05023-C104, Rev. 9 | April 26, 2007 | New Site Layout |
| | 05023-C301, Rev. 4 | Sept. 22, 2005 | Cross Sections |
| | 05023-C401, Rev. 5 | Dec. 12, 2005 | Truck Unloading Area Plan View |
| | 05023-C402, Rev. 5 | De. 12, 2005 | Truck Unloading Dock Plan View |
| | 05023-C403, Rev. 7 | April 26, 2007 | Enlarged Dock Plan View |
| | 05023-C501, Rev. 5 | Dec. 12, 2005 | Truck Unloading Area Details |
| | 05023-C502, Rev. 4 | Dec. 12, 2005 | Truck Dock Details |
| | 05023-C503, Rev. 4 | Dec. 12, 2005 | Truck Dock Details |
| | 05023-S1, Rev. 1 | Sept. 22, 2005 | Concrete Container Holding Pad Safety Protection |
| Shredder Facility | 05056-F13, Rev._ | 09/30/06 | Shredder Facility; Outfeed Pad Plan and Pad Details (As-Constructed) |
| | 05056-F13A, Rev._ | 09/30/06 | Shredder Facility; Shredder Pad Plan (As-Constructed) |
| | 05056-F13B, Rev._ | 09/30/06 | Shredder Facility; Shredder Pad Details (As-Constructed) |

PCB/Radioactive Waste, the currently approved State-issued Part B Permit.

**Table 6: Maximum Allowable Concentrations in 11e.(2) Waste**

| Parameter | TCLP Leachate Regulatory Limit (mg/l) | Total Waste Concentration (mg/kg) |
|---|---|---|
| Volatile Organic Compounds | | |
| Acetone | n/a | 10.0 |
| 2-Butanone | 200.0 | 10.0 |
| Carbon Disulfide | n/a | 10.0 |
| Chloroform | 6.0 | 10.0 |
| 1,1-Dichloroethane | 0.5 | 10.0 |
| Diethyl Phthalate | n/a | 80.0 |
| Methylene Chloride | n/a | 70.0 |
| 2-Methylnaphthalene | n/a | 80.0 |
| Naphthalene | n/a | 80.0 |
| 1,1,2-Trichloroethane | n/a | 7.27 |
| Vinyl Chloride | 0.2 | 0.66 |

b) Liquid Waste – acceptance of liquids and liquid content of all wastes shall be in accordance with the Radioactive Materials License.

c) Chelating Agents – the disposal of any waste containing chelating agents shall be limited to the Mixed Waste Cell and is prohibited in the ~~Class A,~~ Class A West~~North,~~ and 11e.(2) Disposal Cells. The disposal of any waste in the Mixed Waste Cell containing chelating agents in excess of 22% by weight is prohibited.

3. Failure to Construct as per Approval

Failure to construct any portion of the facility in compliance with the approved engineering design and specifications or in a manner inconsistent with the LLRW and 11e.(2) CQA/QC Plan (Radioactive Materials License UT 2300249, Condition 44) shall be cause for the Executive Secretary to require excavation of the materials and remedial construction, retrofit of the embankment or any other mitigative action to prevent the release of pollutants to soil or ground water.

4. Unsaturated Soil Moisture Content Monitoring

The Permittee shall conduct soil moisture content monitoring to verify performance of the engineered containment systems for the LARW, 11e.(2), ~~Class A,~~ and Class A West~~North~~ Disposal Cells in accordance with the requirements of Part 1.H.17 of this Permit and Radioactive Material License Condition 28. This monitoring shall consist of instrumentation, as approved by the Executive Secretary, installed in the Cover Test Cell.

The Permittee shall maintain and replace all soil moisture instrumentation as directed by the Executive Secretary.

The Executive Secretary reserves the right to require similar soil moisture content monitoring in the radon barrier at the 11e.(2) Cell. The Permittee shall install and make operational any soil moisture instrumentation in compliance with the schedule to be determined by the Executive Secretary.

5. Allowable Heavy Metal Waste Concentration Limits

Waste containing any of the following non-radionuclide metals: Arsenic, Barium, Cadmium, Chromium, Copper, Lead, Mercury, Selenium, Silver, and Zinc can be disposed of in the ~~Class A,~~ Class A West~~North,~~ or 11e.(2) Cells at any concentrations.

6. Open Cell Time Limitation

For each open portion of any disposal cell, final cover construction shall be completed in accordance with the approved engineering plans and specifications (Part I.D.2 and 4) and the approved Construction Quality Assurance / Quality Control Plan requirements under the Radioactive Materials License on or before the end of 18 years after the date of initial placement of the first lift of any LLRW waste in that portion of the open cell. Final cover construction shall include but is not limited to completion of the following:

a. Riprap Layer
b. Type A Filter Layer
c. Sacrificial Soil Layer
d. Type B Filter Layer
e. Upper Radon Barrier Layer
f. Lower Radon Barrier Layer
g. Temporary cover layer
h. Settlement stand installation and all monitoring necessary to demonstrate waste platform is stable and ready for final cover construction.

Any modification of this 18 -year limitation shall require submittal of detailed justification including but not limited to ground water flow and contaminant transport modeling of open cell conditions or other technical information as necessary, and prior Executive Secretary approval. Said modeling report or other studies must be submitted in their entirety to the Executive Secretary 180 days prior to the expiration date of the respective 18-year open cell time limit. Failure to secure Executive Secretary approval prior to expiration of the 18 -year deadline shall not be cause for the Permittee to postpone construction of the cover of any cell in accordance with the currently approved engineering design and specifications in Part I.D.2 or 4 of this Permit.

7. General Stormwater Management Requirements

The Permittee shall contain all stormwater runoff at the ~~Class A,~~ Class A West~~North,~~ and 11e.(2) Disposal Cells which has contacted the waste (i.e.,

contact stormwater). The Permittee shall not begin pumpage or removal of stormwater that falls inside the restricted area that has not contacted the waste (i.e., non-contact stormwater) before beginning removal of contact stormwater. This includes runoff from waste disposed in excavated, below grade areas of the ~~Class A,~~ Class A West~~North,~~ and 11e.(2) Disposal Cells, additionally, and:

a) Within 24 hours of discovery of an accumulation of contact stormwater, the Permittee shall immediately begin pumpage and removal of said wastewater in compliance with the following priority schedule, ranked from highest to lowest priority:

1) Contact stormwater inside the footprint of the ~~Class A,~~ Class A West~~North,~~ and 11e.(2) Disposal Cells,

2) Contact stormwater at the Rollover and Rotary Dump Facility, and

3) Contact stormwater at the Intermodal Unloading Facility.

The Permittee shall pump and remove contact stormwater in an uninterrupted manner until it is completely removed from said location. Under no circumstance will the Permittee begin pumpage and removal of contact stormwater at a lower priority location without first completing removal at all higher priority location(s).

b) All contact stormwater accumulated and pumped shall be disposed of in the evaporation ponds only as explicitly approved by the Executive Secretary. However, contact stormwater from the ~~Class A,~~ Class A West~~North,~~ and 11e.(2) disposal cells may be used for minimal engineering and dust control purposes on the waste in the ~~Class A and~~ Class A West~~North~~ disposal cell~~s~~.

c) Class A West~~North~~ Containerized Waste Facility and Large Component Evaporation Basin – precipitation that falls on the Class A West~~North~~ Containerized Waste Facility and Large Component Area shall be allowed to accumulate in an engineered evaporation basin constructed in accordance with the following conditions:

1) The evaporation basin shall be constructed in accordance with the design specifications in engineering drawings listed in Table 5 for the Class A West~~North~~ Embankment and the requirements of the currently approved LLRW and 11e.(2) CQA/QC Plan.

2) Fluid head in the evaporation basin shall not exceed a 1-foot level above the lowest point of the bottom clay liner of the basin. The occurrence of fluid levels above this 1-foot maximum allowable head limit shall constitute a violation of this Permit.

3) The Permittee shall ensure that the physical integrity of the clay liner is not compromised by desiccation or freeze/thaw cycles by implementing quality assurance/quality control requirements in the currently approved LLRW and 11e.(2) CQA/QC Plan.

8. 11e.(2) Waste Management Requirements

The Permittee shall manage the 11e.(2) Waste and related activities at the facility in accordance with all applicable requirements of the currently approved Radioactive Materials License, No. UT2300478, for the following activities and procedures:

a) Spill response and prevention

b) Runon and runoff containment

c) Decontamination of vehicles, equipment, and containers

d) Unloading procedures

e) Waste storage time limits

f) Stormwater/wastewater collection and disposal

g) Leaking waste shipments

In addition, the Permittee shall manage 11e.(2) waste storage and handling in compliance with the containment and spill prevention requirements of Part I.E.10.a of this Permit.

9. 11e.(2) Waste Storage

Storage of 11e.(2) waste at the facility shall be explicitly limited to areas within the confines of the 11e.(2) Disposal Cells having completed and approved clay liner.

10. LLRW Waste Management Performance Requirements

The Permittee shall operate and maintain all facilities in compliance with the following performance requirements:

a) Contaminant Containment and Spill Prevention – the Permittee shall manage all site operations to:

1) Prevent contact of wastes with the ground surface.

2) Prevent spills of wastes or liquids contained therein from any contact with the ground surface or ground water.

3) Prevent contact of surface water or stormwater run-on with the waste.

4) Control any runoff, which may have contacted the waste from subsequent contact with the ground surface or ground water by means of approved engineering containment. Any accumulations of such contact runoff or leachates shall be removed and managed in accordance with Part I.E.7.

5) Prevent wind dispersal of wastes.

6) Minimize the time any waste is held in temporary storage without disposal in a disposal cell or embankment. In no case shall any waste be in temporary storage beyond 365 days after the date of waste entry into the controlled area. Once the waste is removed from temporary

12. Stormwater Drainage Works Performance Criteria

All stormwater drainage works constructed and operated at the LARW, ~~Class A,~~ Class A West~~North~~, and 11e.(2) facilities shall perform in accordance with the following criteria:

a) Seepage Control to Prevent Ground Water Mounding – all drainage works at the facility shall be constructed of either low-permeability clay liner materials or of an impermeable man-made conveyance in order to control and prevent any alteration of local natural ground water hydraulic gradients or velocities. This infiltration control shall address seepage during periods of storm water storage in the drainage system.

b) Free Drainage – all stormwater drainage works shall be free draining and under gravity conditions shall convey stormwater from the contributing facilities to an off-site location, except as follows:

1. The stormwater culvert at the southeast margin of the 11e.(2) cell, as found on the Permittee's engineering drawing 9420-7D as listed in Table 5 of this Permit. Said construction includes an engineered catch basin and lift station.

c) Temporary Stormwater Drainage Works – plans and specifications for any temporary stormwater drainage works shall be submitted for Executive Secretary review and approval prior to installation. As-Built reports shall be submitted for Executive Secretary approval within 30 days following installation. Prior to site closure, the Permittee shall remove all temporary stormwater drainage works (e.g., drainage grates, piping, ditches, etc. not approved under Part I.D.4) as part of the site Decontamination and Decommissioning Plan required under Radioactive Material License, Condition 74.

13. Reserved

14. Wastewater Management Requirements

The Permittee shall operate and maintain all wastewater storage, treatment, and disposal facilities in accordance with Best Available Technology requirements approved by the Executive Secretary, as follows:

a) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Ponds – the Permittee shall operate and maintain the 1995, 1997, 2000 , and Northwest Corner evaporation ponds and the Mixed Waste evaporation pond to prevent release of fluids to subsurface soils or groundwater, in accordance with the following requirements:

1) Leak Detection System Pumping and Monitoring Equipment Continuous Operation – the Permittee shall provide continuous operation of the leak detection system pumping and monitoring equipment, including, but not limited to, the submersible pump, pump controller, head/pressure transducer, and flow meter equipment approved by the Executive Secretary. Failure of any pumping or

monitoring equipment not repaired and made fully operational within 24 hours of discovery shall constitute failure of Best Available Technology and a violation of this Permit.

2) Maximum Allowable Daily Leakage Volumes – the Permittee shall measure the daily volume of all fluids pumped from the respective leak detection systems of the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds. Under no circumstance shall the daily leak detection system flow volume, as determined pursuant to Part I.F. a.3, exceed the following limits:

| | |
|---|---|
| i. 1995 Evaporation Pond: | 162 gallons/day |
| ii. 1997 Evaporation Pond: | 171 gallons/day |
| iii. Mixed Waste Evaporation Pond: | 171 gallons/day |
| iv. 2000 Evaporation Pond: | 382 gallons/day |
| v. Northwest Corner Evaporation Pond: | 326 gallons/day |

Daily leak detection system flow volumes in excess of these limits shall constitute failure of Best Available Technology and a violation of this Permit.

3) Maximum Allowable Head – the Permittee shall measure fluid head in the respective leak detection sumps of the 1995, 1997, 2000, the Mixed Waste, and Northwest Corner evaporation ponds by use of pressure transducer equipment approved by the Executive Secretary. Under no circumstance shall fluid head in the leak detection system sump exceed a 1-foot level above the lowest point in the lower flexible membrane liner. The occurrence of leak detection system fluid levels above this 1-foot limit shall constitute failure of Best Available Technology and a violation of this Permit.

4) 2-foot Minimum Vertical Freeboard Criteria – the Permittee shall operate and maintain at least 24 inches of vertical freeboard in the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds to ensure total containment of fluids. This vertical distance shall be determined by use of a gauging station approved by the Executive Secretary. If at any time the Permittee operates the pond with less than 24 inches of vertical freeboard, such operation shall constitute failure of Best Available Technology and a violation of this Permit.

b) Box-Washing Facility – the Permittee shall operate and maintain the Box-Washing Facility to ensure:

1) Free draining conditions exist across the floor to the wastewater collection sumps.

2) The integrity of the concrete working surface to prevent discharge.

The Permittee shall repair or otherwise seal and render impermeable any and all cracks, ruptures, damage, or porous areas prior to resuming use of the facility. At least one week prior to the annual inspection, the Permittee shall submit written notice to allow the Executive Secretary the opportunity to have a DRC representative present.

d) To ensure that free draining conditions exist in all wastewater transfer pipes without release or discharge to subsurface soils or ground water.

e) To ensure the leak detection annulus of the sediment basin is free of fluids.

f) To ensure the water level in the sediment basin is below the level of the grate covering the pump sump.

g) The dual-walled pipe used to transfer fluids from the sediment basin is free draining, and the leak detection annulus within the secondary pipe is free of fluids.

22. Intermodal Container Wash Building

The Permittee shall operate and maintain the Intermodal Container Wash Building:

a) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

b) To ensure free draining conditions exist:

i. Within each wash bay and trench drain to the sediment basin, and

ii. From each boot wash station to the sediment basin.

c) To ensure the integrity of all concrete surfaces to prevent discharge of waste water to subsurface soils or ground water.

d) To ensure the sediment basin provides a total containment system and does not cause a direct or in-direct discharge to subsurface soils or ground water.

e) To ensure the water level in the sediment basin is always maintained below the grate located over the pump sump.

f) To ensure the leak detection annulus of the sediment basin is free of liquids.

g) To ensure the dual-walled pipe used to transfer fluids from the sediment basin is free draining, and the leak detection annulus within the secondary pipe is free of fluids.

23. Decontamination Access Control Building

The Permittee shall operate and maintain the Decontamination Access Control Building:

a) In accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K, respectively of this Permit.

d) Deep Aquifer Monitoring Wells– the Permittee shall monitor heads in all deep aquifer monitoring wells, including, but not limited to monitoring wells I-1-100, I-3-100, GW-19B, GW-27D, and GW-148~~139~~D.

e) Well Construction Criteria – any ground water monitoring well used as a compliance monitoring point shall be:

1) Located hydrologically downgradient of waste disposal,

2) Completed exclusively in the uppermost aquifer,

3) Located as close as practicable to the waste and no more than 90 feet from edge of waste,

4) Constructed in conformance to guidelines found in the EPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document, 1986, OSWER-9950.1.

f) Well Network Early Warning Requirement – any network of ground water monitoring wells used as points of compliance shall be adequately constructed, both in location and spacing, to provide early warning of a contaminant release from a waste embankment before the contaminant leaves the embankment's 100-foot wide buffer zone, as defined in Table 7, below. For purposes of this Permit, early warning shall be provided by a compliance monitoring well network with an inter-well spacing distance to be approved by the Executive Secretary.

g) Buffer-Zone Requirements– waste disposal is prohibited inside the buffer zone, as described in Tables 3 and 7 of this Permit.

**Table 7: Buffer Zone Boundary Locations**

| Disposal Cell | Edge of Buffer Zone Position | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| LARW | NW Corner | 40° 41' 12.366" N | 113° 06' 52.622" W |
| | SW Corner | 40° 40' 51.915" N | 113° 06' 52.494" W |
| | SE Corner | 40° 40' 51.976" N | 113° 06' 35.429" W |
| | NE Corner | 40° 41' 12.427" N | 113° 06' 35.556" W |
| Class A West | NW Corner | 40° 41' 4029.599~~052~~" N | 113° 07' 26.06~~537~~" W |
| | SW Corner | 40° 41' 13. 245" N | 113° 07' 25. 996" W |
| | SE Corner | 40° 41' 13.201~~2~~" N | 113° 06' 54.167~~069~~" W |
| | NE Corner | 40° 41' 4029.556~~008~~" N | 113° 06' 54.464~~109~~" W |
| ~~Class A North~~ | ~~NW Corner~~ | ~~40° 41' 39. 496" N~~ | ~~113°0 7' 26.051" W~~ |
| | ~~SW Corner~~ | ~~40° 41' 29. 536" N~~ | ~~113° 07' 26.035" W~~ |
| | ~~SE Corner~~ | ~~40° 41' 29. 563" N~~ | ~~113° 06' 55.911" W~~ |
| | ~~NE Corner~~ | ~~40° 41' 39. 521" N~~ | ~~113° 06' 55.926" W~~ |
| 11e.(2) | NW Corner | 40° 41' 13.587" N | 113°0 7' 25.832" W |
| | SW Corner | 40° 40' 54.077" N | 113° 07' 26.070" W |
| | SE Corner | 40° 40' 53.849" N | 113° 06' 54.279" W |
| | NE Corner | 40° 41' 13.359" N | 113° 06' 54.037" W |

h) Protection of Monitoring Network – all compliance monitoring wells must be protected from damage due to surface vehicular traffic or contamination due to surface spills. All monitoring wells shall be maintained in full operational condition for the life of this Permit.

The criteria for determining full operational condition are:

1) Accessibility – each well must be accessible for sampling and shall not be located in an area of standing water.

2) Casing Measuring Point – each well shall have a permanent surveyed reference point such as the top of the protective casing.

3) Physical Integrity – any physical disturbance to any well, which may alter the surveyed water level measuring point, is prohibited. In addition, all wells shall have an adequate surface seal around the well casing to prevent surface or storm water from entering the well.

4) Chemical Integrity – all well and sampling materials shall be constructed of inert materials to prevent the introduction of contaminants from leaching or corrosion.

5) Silt Content – if the measured water column of any well is less than 90% of the theoretical water column, the monitoring well shall be redeveloped prior to sampling.

Any well that becomes damaged beyond repair or is rendered unusable for any reason will be replaced by the Permittee within 90 days or as directed by the Executive Secretary.

i) Notification of Ground-water Monitoring Event

At least 30 calendar days prior to the annual Ground Water Monitoring event required under Part I.H.1, the Permittee will submit a written notice and schedule, with approximate dates the wells will be sampled, to the Executive Secretary to allow the DRC the opportunity to collect duplicate or split ground-water samples from the same wells at the same time as the Permittee's staff during a regularly scheduled sampling event for independent laboratory analysis.

2. <u>BAT Compliance Monitoring Points</u>

The Permittee shall inspect, sample, analyze, or otherwise monitor other points of compliance in order to confirm compliance with this Permit. These points or instruments shall include:

a) East Truck Unloading Area – including monitoring of free draining conditions to the stormwater collection troughs, water level in the collection troughs, and physical condition/integrity of all exposed asphalt and concrete surfaces.

2) Presence or absence of fluids in the Sediment Basin leak detection annulus,

3) Water level in the sediment basin,

4) Free draining conditions in all wastewater transfer piping, and

5) Presence or absence of fluids in the leak detection annulus within the secondary pipe of all dual-walled wastewater transfer piping systems.

k) Intermodal Container Wash Building – including monitoring to determine:

1) Free draining conditions, physical condition, and integrity of concrete floor and floor trenches,

2) Presence or absence of fluids in the sediment basin leak detection annulus,

3) Fluid level in the sediment basin, and

4) Presence or absence of fluids in the leak detection annulus within the secondary pipe of all dual-walled wastewater transfer piping systems.

l) Decontamination Access Control Building – including monitoring to determine:

1) Free draining conditions in all wastewater transfer piping,

2) Presence or absence of fluids in the gray water collection tank leak detection annulus,

3) Water level in the gray water collection tank, and

4) Presence or absence of fluids in the leak detection annulus within the secondary pipe of all dual-walled wastewater transfer piping systems.

m) East Side Drainage Project - including monitoring to determine the presence or absence of fluids in the leak detection annulus within the secondary piping of all dual-wall wastewater transfer systems. All dual-walled pressurized pipe connected to the East Side Drainage Project, that does not gravity drain to a leak detection port, including both primary and secondary piping, shall be pressure tested annually by an independent Professional Engineer registered in the State of Utah.

3. Future Modification of Compliance Monitoring Systems or Equipment

If at any time the Executive Secretary determines that additional systems, mechanisms or instruments are necessary to monitor ground water quality or Best Available Technology compliance at the facility, the Permittee shall submit within 30 days of receipt of notification, a plan and compliance schedule to modify the compliance monitoring equipment, for Executive Secretary approval. Any failure to construct the required compliance monitoring system or equipment in accordance with the approved plan and schedule shall constitute a violation of this Permit.

maintain a written record of these inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

13. Evaporation Ponds Monitoring

a) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Pond Daily Monitoring – the Permittee shall conduct daily inspections of the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds to determine compliance with the Best Available Technology requirements of Part I.E.14.a of this Permit, including:

1) Visual observation of pond water level, relative to pond spillway centerline, to evaluate pond freeboard compliance against BAT performance criteria.

2) Determination of operational status of leak detection system pump, pump controller, head/pressure transducer, and flow meter equipment.

3) Measurement of daily leak detection system flow volume. For BAT compliance monitoring purposes for the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds, the Permittee shall calculate an average daily leakage volume across a consecutive 7-day period. The Permittee shall perform this calculation for each evaporation pond weekly.

4) Measurement of daily leak detection system head. For BAT compliance monitoring purposes for the 1995, 1997, 2000, Mixed Waste, and Northwest Corner evaporation ponds, the Permittee shall determine the maximum head limit to be measured by the approved head/pressure transducer construction that complies with the 1-foot BAT head performance standard of Part I.E.14.a.3. On a daily basis, the Permittee shall compare the daily measured head against the maximum head limit for each evaporation pond.

The Permittee shall maintain written records of the findings of these daily inspections on site. All daily inspection records shall comply with the requirements of Part II.G of this Permit.

b) 1995, 1997, 2000, Mixed Waste, and Northwest Corner Evaporation Pond Leak Detection System Pump Tests – the Permittee shall conduct a pump test of the evaporation pond's leak detection sump within 5 days of discovery that the average daily leak detection system flow volume (Part 1.F.2.d)exceeds the following limits:

| | | |
|---|---|---|
| 1) | 1995 Evaporation Pond: | 155 gallons/day |
| 2) | 1997 Evaporation Pond: | 160 gallons/day |
| 3) | Mixed Waste Evaporation Pond: | 160 gallons/day |
| 4) | 2000 Evaporation Pond: | 355 gallons/day |
| 5) | Northwest Corner Evaporation Pond: | 300 gallons/day |

21. Reserved

22. BAT Performance Monitoring Plan

The Permittee shall demonstrate compliance with the BAT requirements and performance standards and Best Management Practices in Parts I.D and I.E of this Permit by implementing the most current BAT Performance Monitoring Plan approved by the Executive Secretary and provided in Appendix J of this Permit.

23. BAT Contingency Plan

In the event that BAT failure occurs at any facility, the Permittee shall implement the most current BAT Contingency Plan approved by the Executive Secretary and provided in Appendix K of this Permit to regain the BAT requirements and performance standards and Best Management Practices specified in Parts I.D and I.E of this Permit.

24. Stormwater Monitoring

The Permittee shall demonstrate compliance with stormwater removal requirements of Part I.E.7 of this Permit by maintaining daily written records for the following stormwater management activities:

a) Date, time, and location of discovery of stormwater accumulation

b) Date and time when stormwater removal activities were initiated at each location

c) Date and time when stormwater removal was completed at each location

d) First and last name(s) of all personnel involved with stormwater removal activities

e) Unique identity of locations of where stormwater was removed

f) Type of stormwater removed: contact or non-contact stormwater

g) Identify equipment used to remove contact and non-contact stormwater

h) Volumes of stormwater removed at each location

i) Location(s) where stormwater was disposed

25. Shredder Facility

The Permittee shall conduct daily monitoring of the Shredder Facility to demonstrate compliance with the Best Available Technology requirements of Part I.E.20 of this Permit in accordance with the currently approved BAT Performance Monitoring Plan and BAT Contingency Plan in Appendices J and K of this Permit, respectively, including:

a) Free draining conditions

b) Physical integrity of concrete surfaces

c) Absence of discharge to the ground or ground water

d) Horizontal Hydraulic Gradient Reporting – on a monthly basis the Permittee shall calculate the following and provide within the annual monitoring report as required by Part I.H.1:

1) A site-wide summary of maximum, minimum, and average horizontal hydraulic gradient for all wells located in Section 32 based on saline and fresh water equivalent ground water elevations and

2) Individual disposal cell summary of maximum, minimum, and average horizontal hydraulic gradient based on saline and fresh water equivalent ground water elevations for the Class A West~~, Class A North~~ LARW, 11e.(2), and Mixed Waste disposal facilities. Determination of these individual hydraulic gradients shall be made after division of each disposal cell into smaller sub-areas for purposes of hydraulic gradient comparisons through time, as approved by the Executive Secretary. On an individual cell basis, the Permittee shall identify the cell sub-areas where the monthly maximum, minimum, and average hydraulic gradients occurred, as summarized in the August 31, 2004 letter response from Envirocare of Utah Inc. to DRC comments regarding the 2003 2nd Semi-Annual Ground Water Report.

In the event that the average fresh water equivalent horizontal hydraulic gradient of any sub-area exceeds the cell-specific Permit limit listed below, the Permittee shall report and identify the sub-area in which the exceeded limit occurred within the annual ground water monitoring report required by Part I.H.1 of this Permit.

| Disposal Cell | Fresh Water Equivalent Horizontal Hydraulic Gradient Limit |
|---|---|
| ~~Class A~~ | ~~1.00E-3~~ |
| Class A West~~North~~ | 1.00E-3 |
| LARW | 9.67E-4 |
| Mixed Waste | 9.67E-4 |
| 11e.(2) | 3.29E-3 |

3. Ground Water and Pore Water Quality Sampling

Reporting will include:

a) Field Data Sheets – or copies thereof, including the field measurements, required in Part I.F.5(c)(2) of this Permit, and other pertinent field data, such as:

1) Ground Water Monitoring – well name/number, date and time, names of sampling crew, type of sampling pump or bail, measured casing

volume, volume of water purged before sampling, volume of water collected for analysis.

b) Results of Ground Water, Pore Water, and Surface Water Analysis – including date sampled, date received; and the results of analysis for each parameter, including: value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, the date of the analysis, counting error for each radiochemical analysis, and total anions and cations for each inorganic analysis.

c) Quality Assurance Evaluation – with every sampling report the Permittee shall include a quality assurance evaluation of the reported ground water and pore water data. Said report shall evaluate the sample collection techniques, sample handling and preservation, and analytical methods used in sampling with the objective of verifying the accuracy of the compliance monitoring results.

d) Electronic Data Files and Format – in addition to written results required for every sampling report, the Permittee shall provide an electronic copy of all laboratory results for ground water, pore water, and surface water quality sampling. Said electronic files shall consist of a Comma Separated Values (CSV) file format, or as otherwise approved by the Executive Secretary.

4. Spill Reporting

The Permittee shall report as per UAC 19-5-114, any spill or leakage of waste or waste liquids which come in contact with native soil or ground water in compliance with Part II.I of this Permit. For spills of solid waste greater than 100 kg, the spill must be reported to the Division of Radiation Control within 7 calendar days of discovery.

5. Post-Closure Monitoring

Reporting of post-closure monitoring shall comply with the requirements of the currently approved Post-Closure Monitoring Plan in Appendix F of this Permit.

6. Annual "As-Built" Report

The Permittee shall submit an annual "As-Built" Report to document interim construction of the ~~Class A,~~ Class A West~~North~~, and 11e.(2) Disposal cells in compliance with the currently approved design and specifications and LLRW and 11e.(2) Construction Quality Assurance/Quality Control Plan (Radioactive Materials License, Condition 44). These reports will be submitted for the Executive Secretary's approval on or before December 1of each calendar year and will be prepared in accordance with the LLRW and 11e.(2) Construction Quality Assurance/Quality Control Plan..

7. Waste Characterization Reporting

In the event that a new contaminant is detected in any waste at the facility, which has not been authorized by Part I.E.1, or if concentrations of approved

contaminants are detected above the limits established in Part I.E.2 of this Permit, the Permittee shall notify the Executive Secretary in writing within 7 calendar days from the date of discovery.

8. Collection Lysimeter Reporting

The Permittee shall provide a verbal report to the Executive Secretary within 24 hours of discovery of the presence of any fluid in the standpipe of the collection lysimeters. The Permittee shall provide a written report of the incident to the Executive Secretary within 7 calendar days of discovery. The Permittee shall provide a report of the annual video log survey of the lysimeter's drainpipe, as required by the currently approved Appendix C of this Permit, on or before December 31 of each calendar year.

9. Reporting of Mechanical Problems or Discharge System Failures

The Permittee shall verbally notify the Executive Secretary within 24 hours of initial discovery of any mechanical or discharge system failure that could affect the chemical characteristics or volume of the discharge. The Permittee shall submit a written report of the failure within 7 calendar days of said failure.

10. Meteorological Reporting

On or before March 1 of each calendar year, the Permittee shall submit an annual meteorological report for the previous meteorological year (January 1 to December 31) for Executive Secretary approval.

The objective of this report shall be to show that the meteorological assumptions made in the infiltration and unsaturated zone modeling used to support issuance of the Permit were conservative or representative of the actual conditions at the site. In addition, and in conjunction with an application for permit renewal, 180 days before expiration of the Permit, the Permittee shall submit a summary report of all meteorological data collected since issuance of the last Permit (minimum of 4 years of data). Said report shall compare the data observed against regional normal values, as available, and provide summary statistics of all meteorological data collected.

11. Containerized Waste Storage Area Reporting

The Permittee shall report the following events in accordance with the requirements of Part I.E.10:

a) Failure of sump pump or other equipment to provide removal of stormwater and free and uninterrupted drainage of the pad, and

b) Any container spill or leakage that may have caused a release to the subsurface soils or ground water via cracks or other damage to the asphalt surface.

12. Evaporation Ponds Reporting

a) Annual Water Quality Sampling –annual water quality samples collected and analyzed shall be reported in conjunction with the ground water quality monitoring report required by Part I.H.1 of this Permit.

23. Reserved.

24. Revised Hydrogeologic Report

180 days prior to Permit expiration, the Permittee shall submit for Executive Secretary approval a revised hydrogeologic report for the disposal facility and surrounding area. In submittal of this report the Permittee shall provide a comprehensive and thorough description of hydrogeologic conditions at the facility current through the time of report submittal. This report will include, but is not limited to an evaluation of:

a) Ground-water hydraulics, including ground-water flow directions, velocities, and hydraulic gradients, in both the horizontal and vertical directions, and will include equipotential maps, cross-sections, and related calculations, and

b) An updated evaluation and reinterpretation of the site hydrogeology using all available data including new or additional data acquired since Executive

c) Secretary approval of the last revised hydrogeologic report dated September 1, 2004.

## I. Compliance Schedule

1. Ground Water Institutional Control Plan

The Permittee shall submit a ground water institutional control plan for Executive Secretary approval at the time the site Decontamination and Decommissioning Plan required under Radioactive Materials License Condition 74 is submitted. In submittal of this plan the Permittee shall eliminate future inadvertent intrusion into potentially contaminated ground water at the disposal facilities and subsequent routes of exposure to the public and the environment. Said plan shall include at least one of the options listed in the July 27, 1998 Utah Division of Radiation Control Request for Information.

2. Revision of the Water Monitoring Quality Assurance Plan (QAP).

By the time of and in conjunction with the annual Ground-Water Monitoring Report for 2009 (due on March 1, 2010) the Permittee shall submit for Executive Secretary review a redline-strikeout version, and for approval, a final version of the Water Monitoring Quality Assurance Plan (QAP), Appendix B of the Permit. This version of the QAP will reflect the annual sampling frequency to ensure sufficient, reliable, acceptable and quality data are generated in water monitoring at the site.

provide all information requested and resolve all issues raised by a deadline approved by the Executive Secretary.

5. DU Storage Building

Prior to using the DU Storage Building to store any waste, the Permittee shall submit for Executive Secretary review and receive approval of the following:

a) As built Report detailing final construction of the DU Storage Building. The As Built Report shall also document:

   1. Any deviation in design and specifications authorized by any portion of any drawing listed in Table 5 of this Permit.

   2. Inspection, testing, test results, measurements, and other quality control/quality assurance activities.

b) Revised Best Available Technology (BAT) Performance Monitoring Plan (Appendix J of this Permit), and Best Available Technology (BAT) Contingency Pan (Appendix K of this Permit).

# Environmental Monitoring Plan Revisions

# ENVIRONMENTAL MONITORING PLAN

## 1.0 PURPOSE AND SCOPE

**Purpose:** The purpose of the Environmental Monitoring Plan is to provide a comprehensive plan for monitoring radiation and radioactive emissions to the environment. This information will be used to verify regulatory compliance and evaluate the effectiveness of measures to control the environmental impact of disposal operations.

**Scope:** The scope of this plan includes the activities Energy*Solutions* performs to monitor the site and surrounding area during operations at the Clive radioactive waste disposal facilities, and to report the net radiological effects that result from managing the licensed material. The details of this Plan include the applicable assumptions, tested parameters, and testing methods that collectively express regulatory compliance with regard to radioactive emissions and non-occupational radiation doses.

With the exception of the PCB soil sampling this plan does not include occupational, chemical, or groundwater monitoring requirements.

## 2.0 REFERENCES

Clive, *Radiation Protection Program*, Salt Lake City, Energy*Solutions,* Inc, Utah, As Revised.

ICRP Publication 30, *Limits for the Intake of Radionuclides by Workers*, Annals of the International Commission on Radiation Protection Vol. 19, November 1978.

ICRP Publication 60, *Recommendations of the International Commission on Radiation Protection*, Annals of the International Commission on Radiation Protection Vol. 21 No. 1-3, 1990.

ICRP Publication 65, *Protection against Radon-222 at Home and at Work*, Annals of the International Commission on Radiation Protection Vol. 23 No. 2, 1993.

ICRP Publication 66, *Human Respiratory Tract Model for Radiation Protection*, Annals of the International Commission on Radiation Protection Vol. 24, 1994.

ICRP Publication 68, *Dose Coefficients for Intakes of Radionuclides by Workers*, Annals of the International Commission on Radiation Protection Vol. 24 No. 4, 1995.

ICRP Publication 72, *Age-dependent Doses to Members of the Public from Intake of Radionuclides*, Annals of the International Commission on Radiation Protection Vol. 26 No. 1, 1996.

Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*, United States Nuclear Regulatory Commission, 1974

NRC Regulatory Guide 3.64, *Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers*, United States Nuclear Regulatory Commission, 1989

NRC Regulatory Guide 4.14, *Radiological Effluent and Environmental Monitoring at Uranium Mills*, United States Nuclear Regulatory Commission, 1980

NRC Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment, United States Nuclear Regulatory Commission*, 2007.

NRC Regulatory Guide 4.20, *Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors*, United States Nuclear Regulatory Commission, 1996.

NRC Regulatory Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, United States Nuclear Regulatory Commission, 1992.

NRC Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities*, United States Nuclear Regulatory Commission,1993.

10 CFR Part 20, *Standards for Protection Against Radiation*, United States Nuclear Regulatory Commission, As Revised.

10 CFR Part 40, *Domestic Licensing of Source Material*, United States Nuclear Regulatory Commission, As Revised.

49 CFR.173.428, *Empty Class 7 (radioactive) materials packaging*, United States Department of Transportation, As Revised

49CFR 173.443, *Contamination control*, United States Department of Transportation, As Revised

Utah Administrative Code, R313-15, *Standards for Protection against Radiation*, As Revised.

Utah Administrative Code, R313-25, *Requirements for the Land Disposal of Radioactive Waste*, As Revised.

## 3.0 DEFINITIONS

**Activity Mean Aerodynamic Diameter (AMAD):** Fifty percent of the activity in the aerosol is associated with particles of aerodynamic diameter greater than the Activity Mean Aerodynamic Diameter.

**As Low As Reasonably Achievable (ALARA):** Reasonable effort to maintain exposures to radiation as far below the dose limits as is practical consistent with the purpose for which the licensed activity is undertaken. The determination of what is "reasonable" considers; the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations.

**Non-contaminated Restricted Area Exits:** A gate in the Restricted Area Security fence used to exit directly from a Non-contaminated Restricted Area.

**Committed Dose Equivalent (CDE):** The dose equivalent to organs or tissues from an intake of radioactive material by an individual during the 50-year period after intake.

**Committed Effective Dose Equivalent (CEDE):** is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

**Controlled Area:** an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

**Deep Dose Equivalent (DDE):** applies to external whole-body exposure, is the dose equivalent at a tissue depth of 1 cm (1000 mg/cm$^2$).

**Dose Coefficient:** Factors determining the radiation exposure of individual organs and the whole body by incorporated radioactive substances. Dose factors depend on the radionuclide, the incorporation type (inhalation/ingestion), the chemical compound of the radionuclide and on the age of the person.

**Effluent Concentration Limit (ECL):** Radionuclide which, if inhaled or ingested continuously over the course of a year, would produce a stochastic total effective dose equivalent of 50 mrem. With the exception of radon-220 (radon) and radon-222 (thoron), the dose coefficients from International Commission on Radiation Protection Publication 68 and International Commission on Radiation Protection Publication 72 were used to calculate effluent concentration limit values. The Dose Coefficients used assume a 50 year CEDE and a 1 um AMAD particle size. International Commission on Radiation Protection Publication 65 "Protection against Radon-222 at Home and at Work" was used to calculate the Radon ECL and the thoron ECL was taken from 10CFR20. Table 3 lists the "ECL" values for several licensed radionuclides, and provides additional details regarding the ECL derivation process.

**Member of the Public:** A member of the public as defined by UAC, R313-15-301 is "any individual except when that individual is receiving an occupational dose". A member of the public as applied to Utah Administrative Code R313-15-101(4), and Utah Administrative Code R313-25-19 is unassociated with Site operations and located outside controlled area boundaries.

**Minimum Detectable Concentration (MDC):** the smallest radioactivity of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

**Occupancy Factor:** The fraction of time a person may have occupied a space or area having a known quantity of exposure. The exposure rate is assumed to be fairly constant for the entire exposure period.

**Particulate Air Sample (PAS) Action Levels:** Airborne particulate alpha or net beta concentration used to insure that the PAS results remain below the ECL. The alpha action level is 1.4E-13 uCi/ml, based on the thorium-230 Class S effluent concentration limit, and the beta action level is 2.1E-12 uCi/ml, based on the lead-210 Type F effluent concentration limit.

In the past the alpha PAS action level was based on the Th-232 ECL. While Table 3 of the Environmental Monitoring Plan indicates that Th-232 is more restrictive, Th-232 is always accompanied by several alpha emitting decay progeny at or near secular

equilibrium with the Th-232 parent. The Th-232 ECL must be adjusted to account for the alpha emitting daughters when it used as the PAS Action Level. For this reason the Th-230 ECL is more restrictive.

Regulatory Guide 3.51 states that thorium in ore, yellowcake, and tailings dusts is 100% class Y, which is consistent with most of the waste containing Th-230. Class "Y" under the ICRP 30 system is analogous to type "S" under the newer ICRP recommendations.

**Radiological Release:** Survey, documentation and actions as required to meet the following:

- DOT Empty Release, in accordance with 49CFR173.428.
- Return to Service Release, in accordance with 49CFR173.443
- Unrestricted Use Release, in accordance with NRC Regulatory Guide 1.86

**Replicate Error Ratio (RER):** The difference between two different analytical results divided by the statistical sum of their analytical uncertainty. The value is used to assess amount of agreement between two different analytical results with respect to their analytical uncertainty.

$$RER = \frac{|A-B|}{\sqrt{\sigma_A{}^2 + \sigma_B{}^2}}$$

Where:

A = First analytical result.

B= Second analytical result

$\sigma_A$= Reported analytical uncertainty for the first sample.

$\sigma_B$= Reported analytical uncertainty for the second sample.

**Restricted Area:** An area where access is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. The fenced area that includes the disposal embankments and associated radioactive waste handling areas is generally referred to as the Restricted Area.

**Soil Action Levels:** 5 pCi/g by gamma spectroscopy for a naturally occurring radionuclide (other than potassium-40), 3 pCi/g cesium-137, or 2 pCi/g for any other radionuclide.

**Total Effective Dose Equivalent (TEDE):** The sum of the deep-dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

**Vacuum Assisted Thermal Desorption (VTD)**: Treatment used to extract volatile contaminants from Mixed Waste. The VTD unit is located in the Mixed Waste Storage Building.

## 4.0 DESCRIPTION

The Site is located in the semi-arid west desert of Utah. The surrounding region is restricted by zoning statute for exclusive use by the hazardous waste industry. The

closest residents are the live-in care takers at the I-80 rest stop, seven miles northeast of the Site.

The disposal site is a parcel of land, consisting of one square mile in Tooele County, Utah. Energy*Solutions* also owns the adjacent one square mile section of land to the North and an adjacent 0.5 square mile section of land to the south. The area used for waste disposal, unloading, hauling, and handling waste (Restricted Area) is completely surround by fence. There is a buffer area of 100 feet between the Restricted Area fence and the foot print of any embankment. There is also a secondary buffer area of 300 feet between the closest edge of any embankment and the property line. Most of the other land within a 10 mile radius of the site is public domain administered by the Bureau of Land Management. The dry arid desert limits use of the land to sheep grazing, jack rabbit hunting, and recreational driving.

The site boundaries are under continuous electronic surveillance by a full-time security staff. This security staff physically patrols the site boundary several times during each 24 hour period. Any unauthorized individuals found near the controlled area are advised by the security staff not to loiter near the Site.

## 4.1 EXPOSURE PATHWAY: INGESTION

Regulatory Guide 4.14 states that vegetation and surface water samples should be collected "Where a significant pathway to man is identified in individual licensing cases." Because there is no significant ingestion pathway, vegetation and surface water samples are not taken.

The site has no nearby residents or crops. The groundwater is not suitable for irrigation, or consumption by either humans or animals. Surrounding vegetation is accessible to grazing animals but the sparse foliage and water sources are not adequate to keep livestock near the site.

There are no natural bodies of surface water near the site, and storm water quickly evaporates from the puddles which appear temporarily in shallow depressions following precipitation events. There is no natural drainage of this storm water away from the site area, and the facility design precludes runoff outside the approved waste management areas.

Administrative procedures require an immediate response to promptly characterize and remediate any suspected radioactive liquid found anywhere outside of the approved liquid waste management areas. Any incidental deposition of effluent radionuclides outside of the restricted areas is easily detected by soil sampling.

## 4.2 EXPOSURE PATHWAY: EXTERNAL RADIATION

External radiation to members of the public is limited to gamma radiation. The potential sources of radiation include the waste disposal cells, waste unloading areas, treatment areas, storage pads, the railcar rollover, the rotary dump, the shredder, the laboratory, and haul roads. Historically, external radiation contributes a small fraction of the off-site dose.

External radiation is monitored at designated air stations located along the Restricted Area boundaries. In addition, monitors are set up, as needed, inside buildings and on the Restricted Area fence to ensure compliance with the regulations.

## 4.3 EXPOSURE PATHWAY: INHALATION

Direct inhalation of radioactive airborne particulates, radon, and thoron has the highest potential for off-site dose. Sources of inhalation exposure particulates include the rollover, the rotary dump, the shredder, rail car unloading area, bulk waste storage areas, haul roads, the VTD, and waste disposal cells.

Airborne radioactive particulates and gasses are continuously monitored at designated monitoring stations. With the exception of locations used to establish background and the VTD effluent monitoring station, the monitored locations are situated near the fenced boundaries that surround waste management areas. The overall sampling pattern is designed to intercept airborne radioactive effluents leaving the site in any direction. The airborne exposure measured at these monitoring stations is used to calculate the dose received from Site airborne effluents.

## 4.4 DOSE LIMITS

The dose calculated from the environmental monitoring results is compared with the limits in Utah Administrative Codes (UAC), R313-15-301, R313-15-101(4), and R313-25-19 to demonstrate compliance. Energy*Solutions* monitors the boundaries of the restricted areas and calculates an estimated radiation dose at each monitored location. The estimated radiation dose is calculated by multiplying the measured dose, CEDE, TEDE or CDE, by an occupancy factor. The occupancy factor should be a conservative estimate of the time a person may have been present at the location where the exposure occurs. The estimated radiation dose is used to demonstrate compliance with regulatory standards and is not intended represent the dose to an actual individual. The assumption and methods used to apply the environmental monitoring results are described in Energy*Solutions*' ALARA Program document.

### 4.4.1 UAC R313-15-101(4) ALARA Constraint

This regulation requires meeting a constraint of 10 mrem per year CEDE (excluding radon-222 and its decay products) to the individual member of the public, located outside the Site boundary, who is likely to receive the highest dose from effluent air emissions. Regulatory Guide 4.20, "Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees other than Power Reactors", outlines the acceptable methods for demonstrating compliance with this regulatory requirement. Energy*Solutions* will employ one or more of the general techniques in Reg. Guide 4.20 to demonstrate compliance.

#### 4.4.2 UAC R313-15-301 Public Dose limits

This regulation requires that the TEDE to individual members of the public from licensed or registered operations does not exceed 100 mrem in a year. Compliance is determined using one of the approved options presented in UAC R313-15-302.

#### 4.4.3 UAC R313-25-19 Public Dose limits

The radioactive material which may be released to the general environment shall not result in an annual dose exceeding 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ of a member of the public. Compliance is demonstrated by calculating the CDE multiplying the airborne monitoring results measured at each of the air monitoring stations by an occupancy factor, which is representative of a member of the public located outside the Site Boundary.

## 5.0 OPERATIONAL REQUIREMENTS

### 5.1 AIR SAMPLING

#### 5.1.1 AIRBORNE PARTICULATES - Alpha/Beta Screening

Air is continuously sampled at the sample locations, listed in Table 1 and Drawing 07007-J01, Revision 54, with the exception of the VTD effluent which is only sampled during VTD operation. The stations located around the Restricted Area perimeter are used to determine the airborne concentration of radioactive particulates from disposal operations. Station A-16, located west of the Site, at the Clean Harbors Clive facility, is used to determine background. Station A-6, located on the northwest corner of Vitro is used for the sole purpose of identifying abnormal airborne radioactivity having the potential of increasing the soil radioactivity in the VITRO buffer area above the soil action levels. Radioactive airborne particulate samples are collected using a constant-flow air sampler to draw air through a glass fiber filter, or a functionally similar particulate sampling media. The particulate air sampling apparatus maintains a flow rate of approximately 60 liters per minute through the filter media. The Restricted Area perimeter and Station A-6 airborne particulate sampling filters are changed twice weekly under most circumstances. When holidays or other production stoppages limit radioactive waste handling or disposal operations to three days or less during any calendar week, the particulate filters collection may be reduced to once a week.

All particulate filters are analyzed for alpha and beta activity at least 7 days but not more than 14 days after collection. The delay of 7 days is needed to allow for the decay of short-lived radon progeny that could potentially interfere with detecting the long-lived contaminants of

concern. The time limit of 14 days is to ensure that samples are analyzed in a timely manner. With the exception of the VTD sample, the alpha and beta concentration measured at Station A-16 is subtracted from the concentrations measured at the other stations. If for some reason the data from A-16 is not available or is indeterminate, no background will be subtracted for the samples collected during the sampling period, so the gross concentrations will be used instead of the net concentrations.

Any individual sample filters with a net alpha or net beta concentration above the applicable PAS Action Level will be analyzed by gamma spectroscopy within 3 working days of the alpha/beta analysis. Gamma spectroscopy analysis results will be reviewed to determine if any additional actions need to be taken. PAS filters collected from Station A-6 that exceed the action level shall require a review of potential sources and soil sampling in the VITRO buffer zone. The number and location of the soil samples shall be based on the potential sources for the greater than of the PAS Action Level air sample result and the its impact on the VITRO buffer area soil.

When an individual filter has a net alpha concentration above 3E-12 uCi/ml or net beta concentration above 5E-11 uCi/ml (approximately 25 times the PAS Action Level, based on 25 or 26 filters per quarter per location), additional radiochemical analyses will be performed on that filter according to the requirements for quarterly composite filters, unless gamma spectroscopy associates at least 50 percent of the net alpha or net beta activity present on the filter with gamma-emitting radionuclides.

### 5.1.2 AIRBORNE PARTICULATE – Quarterly Composite

~~All~~ Restricted Area perimeter and VTD particulate air sample filters collected during the quarter are gathered into a composite sample for each air monitoring station. Each composite sample is analyzed by gamma spectroscopy using either the on-site instruments or one of the qualified contractor laboratories. The composite samples (with the exception of VTD) will also be analyzed specifically for uranium-238 (U-238), uranium-234 (U-234), and uranium-235 (U-235), thorium-228 (Th-228), thorium-230 (Th-230), and thorium-232 (Th-232), radium-226 (Ra-226), lead-210 (Pb-210), and polonium-210 (Po-210). The specific analytical methods are determined by the accredited laboratories doing the analysis.

In order to maximize the detection sensitivity for the important radionuclides, any additional radiochemical analyses shall be limited to those radionuclides that could reasonably be expected to contribute more than five percent of the aggregate CEDE over the quarter. The potential relative dose fraction for each radionuclide will be determined each quarter by weighting its effective inhalation dose coefficient according to its relative abundance in the waste disposed during the quarter. Containerized Waste, large components, and encapsulated Mixed Waste are inherently not wind dispersible, so the nuclide activities of these waste

types are therefore excluded from consideration for the quarterly nuclide dose fraction determination.

### 5.1.3 RADON AND THORON

Air is continuously sampled at the locations listed in Table 1 and Drawing 07007-J01, Revision 4 for radon and thoron. Stations B-2, A-27, and A-16 sample results are used to determine background.

The ICRP 65 radon dose conversion factor is 388 mrem CDE per working-level month (WLM) for members of the public, and 227 Bq/m$^3$ per Working Level (WL). The radon concentration that will result in 50 mrem TEDE per year of continuous exposure is approximately 1 WL, or 6 pCi/L, when the ICRP 66 lung weighting factor of 0.12 is applied. ICRP 65 does not provide a dose conversion factor for thoron so the thoron ECL in 10 CFR 20 is assumed. Radon and Thoron working levels have been too low to empirically determine an equilibrium factor for radon released from waste so the radon dose estimate assumes that particulate decay products are not present.

Radon and thoron concentrations are monitored using Landauer RadTrak® Dosimeters. A single dosimeter is used to measure both radon and thoron concentrations. The algorithm used to calculate exposure assumes that total exposure is due to radon. Because the radon ECL is lower than the thoron ECL, the calculated dose from the single radon plus thoron measurement is more conservative. The radon plus thoron concentration will be reported as "radon equivalent" to indicate that the radon efficiency was used to determine the reported concentration.

### 5.1.4 AIRBORNE TRITIUM (H-3)

Tritium is monitored at the air stations identified in Table 1 and Drawing 07007-J01, Revision 4. The airborne tritium concentration is determined by collecting water vapor in a desiccant material, at a flow rate of approximately 200-300 ml/min. The samples shall be analyzed at the end of each quarter. The H-3 ECL used to calculate dose is 1.0E-07 uCi/ml.

## 5.2 VTD EFFLUENT

**General**

The VTD discharge is sampled for airborne particulates, and shall be sampled for H-3, iodine-129 (I-129), krypton-85 (Kr-85), and krypton (Kr-81) if these contaminants are present within the waste fed into the VTD unit. The VTD discharge stack is located down stream of the stack filters but up stream of the discharge blower. VTD effluent concentration for each of these sample types is determined by dividing the measured VTD air sample concentrations by 200.

This is done to account for the effluent dilution resulting from the blower. Because the VTD particulate air sampler draws suction from a closed system the results do not include a background, consequently the A-16 concentration is not subtracted from the measured concentrations.

**Alpha/Beta Screening**

Air is continuously sampled at the VTD discharge while the VTD is used to treat radioactive wastes. Radioactive airborne particulate samples are collected using a constant-flow air sampler to draw air through a glass fiber filter, or a functionally similar particulate sampling media. The particulate air sampling apparatus maintains a flow rate of approximately 60 liters per minute through the filter media. All particulate filters are analyzed for alpha and beta radioactivity at least 7 days but not more than 14 days after collection.

Any individual sample filters with a net alpha or net beta concentration above the applicable PAS Action Level will be analyzed by gamma spectroscopy within 3 working days of the alpha/beta analysis. Gamma spectroscopy analysis results will be reviewed to determine if any additional actions need to be taken.

When an individual filter has a net alpha concentration above 3E-12 uCi/ml or net beta concentration above 5E-11 uCi/ml (approximately 25 times the PAS Action Level, based on 25 or 26 filters per quarter per location), additional radiochemical analyses will be performed on that filter according to the requirements for quarterly composite filters, unless gamma spectroscopy associates at least 50 percent of the net alpha or net beta activity present on the filter with gamma-emitting radionuclides.

**Airborne Particulate – Composite samples**

Quarterly composite VTD samples will be analyzed by gamma spectroscopy using either the on-site instruments or one of the qualified contractor laboratories and those isotopes expected to contribute more than five percent to the aggregate CEDE. The potential relative dose fraction for each radionuclide will be determined each quarter by weighting its effective inhalation dose coefficient according to its relative abundance in the waste treated using VTD during the quarter.

**Tritium, Iodine -129, Krypton – 85, and Krypton – 81**

Tritium is monitored at the VTD discharge when tritium is manifested in the waste. The airborne tritium concentration is determined by collecting water vapor in a desiccant material, at a flow rate of approximately 200-300 ml/min. VTD effluent tritium samples shall be analyzed at the end of each quarter. The H-3 ECL used to calculate dose is 4.6E-08 uCi/ml.

Iodine-129 (I-129) is also continuously monitored at the VTD discharge, when I-129 is manifested in the waste being treated. The sample is collected using a charcoal cartridge installed in the sampling line after the particulate sampling filter. Iodine-129 cartridges shall be analyzed by gamma spectroscopy within seven days of sample collection. The I-129 ECL used to calculate dose is 5E-11 uCi/ml.

Radioactive gasses, Kr-81 and Kr-85, are monitored by taking a "grab sample" at the VTD discharge, when these gasses are manifested in the waste being treated. The sample is collected using a Marinelli beaker installed in the stack sampling manifold. Kr-81 and Kr-85 samples from the VTD discharge shall be analyzed by gamma spectroscopy within seven days of sample collection. The Kr-81 ECL and the Kr-85 ECL used to calculate dose is 3E-06 uCi/ml and 7E-07 uCi/ml, respectively.

## 5.3 GAMMA RADIATION

Gamma radiation is continuously monitored at each designated airborne radioactivity monitoring location listed in Table 1 and Drawing 07007-J01, Revision 4 using an optically stimulated luminescent dosimeter (OSL) or a functionally equivalent device. Locations B-2, A-27, and A-16 are used determine the background gamma radiation exposure. Additional monitoring is performed near the fenced boundary that surrounds the waste management areas, and at additional locations as directed by the Director of Health Physics (DHP).

## 5.4 SOIL

### 5.4.1 General

Environmental Soil samples required by the Environmental Monitoring Plan are analyzed by Gamma spectroscopy. In order to facilitate the accurate measurement of radionuclides, the samples shall be collected from the top one inch of soil. To prepare the soil samples for gamma spectroscopy analysis the soil sample shall be dried, sifted, homogenized for matrix uniformity, and placed in sealed containers. Alternative soil collection and analytical preparation methods may be used provided it is authorized and documented by the Environmental Manager.

Soil samples shall be sealed, or canned, for at least 14 days prior to analysis in order to ensure that the accurate measurement of Ra-226. Soil samples used to facilitate remediation activities are not required to be held for 14 days after canning for gamma spectroscopy analysis however, a 14 day hold time is required for the soil samples used to verify that an area is below the soil action levels.

Routine soil samples that exceed the Soil Action Levels shall also be analyzed for isotopic thorium. The locations of any quarterly or annual soil sample above these action levels will be further characterized by additional sampling to verify the initial finding, and to subsequently

determine the nature, extent, and cause of any problem once the initial finding is verified. Areas with confirmed radioactivity above the Soil Action Level shall be remediated.

Except for sampling activities, Executive Secretary of the Division of Radiation Control shall be notified prior to disturbing the soil inside quarterly soil monitoring stations.

### 5.4.2 Quarterly Soil Samples

The quarterly soil sample locations and analytical requirements are listed in Table 1 and Drawing 07007-J01, Revision 4. Quarterly soil samples are also required at active Non-contaminated Restricted Area exits, in accordance with Section 5.4.5.

### 5.4.3 Annual Soil Samples

Soil samples will also be collected annually to assess potential wind blown contamination from the site. Surface soil samples will be taken at 300 meter intervals along the 8 compass directions centered near the center of Section 32. The first sample will be taken just outside the site boundary and additional samples will be taken at 300 meter intervals extending out to 1500 meters. All 48 samples will be analyzed by gamma spectroscopy.

### 5.4.4 PCB Soil Samples

Samples are also collected to determine PCB concentrations in soil. Soil samples are collected twice each year from the Soil Monitoring stations identified in Table 1 and Drawing 07007-J01, Revision 4. The samples are collected from the soil surface and each sample will weigh approximately 30 g. Samples are refrigerated and stored in the dark when collected. Sample analytical preparation shall be started within 14 days after collection and the analysis shall be completed within 40 days after collection.

### 5.4.5 Quarterly Restricted Area Exit Gate Soil Samples

Radioactivity concentrations in the soil near rail gates and gates that directly access Non-contaminated Restricted Areas shall be monitored. A soil sample shall be taken near rail gates used to exit the Restricted Area during the quarter. A soil sample shall also be taken at gates that directly access Non-contaminated Restricted Areas; where vehicles, person, or material were permitted to exit during the quarter without a radiological release. The sample should be taken where the soil is most likely to be affected by contamination that may be present on vehicles exiting the Restricted Area. All soil samples will be analyzed by gamma spectroscopy.

Additional soil samples shall be collected when soil sample radioactivity exceeds the soil action level to determine the cause and scope of the elevated radioactivity. Areas found to exceed the soil action levels shall

be remediated as necessary until the radioactive contamination in the area is below the Soil Action Level.

# 6.0 QUALITY ASSURANCE/QUALITY CONTROL

## 6.1 ANALYTICAL LABORATORY QUALIFICATIONS

Analyses to be used for dose determination or for comparison to standards are performed by a laboratory accredited or certified by the National Environmental Laboratory Accreditation Conference (NELAC) or the State of Utah to perform radiochemical and gamma spectroscopy analysis on environmental samples.

The Energy*Solutions* gamma spectroscopy system has been qualified by a company that performs such evaluations as a commercial service. The State of Utah has accepted that as evidence of Energy*Solutions*' qualifications for performing gamma spectroscopy analysis.

## 6.2 MDC REQUIRMENTS

### 6.2.1 General

The detection sensitivity can be influenced by several factors. These include branching ratios, the presence of interfering contaminants, and the probability of a given type of emission per disintegration. Most gamma emitting radionuclides of concern are easily detected by gamma spectroscopy at the specified sensitivity levels. In practice the typical detection levels achieved in radiological analysis of environmental samples are very close to natural background radiation levels.

All analyses will achieve the specified MDC at the commonly accepted error of two standard deviations, or an approximate confidence interval of 95%.

Samples that indicate a positive result for the target analyte(s) need not be counted to achieve the specified MDC(s) if the counting uncertainty is less than 50% of the reported concentration.

### 6.2.2 Particulate Air Sample Alpha/Beta screening

The required MDC for the initial alpha and beta screening is based on 50% of the Th-230 concentration action level, or 7E-14 uCi/ml for gross alpha before the background contribution from A-16 is subtracted. The gamma spectroscopy performed on samples above the alpha or beta action levels will be sensitive enough to detect 50% of the concentration listed in Table 3 of the Environmental Monitoring Plan for the gamma emitting nuclides of concern, or as needed to positively characterize the major contributors to the activity present.

### 6.2.3 Particulate Air Sample Quarterly Composite

The MDC for the quarterly composite air samples will be sufficiently sensitive to detect or reject the presence of the target analyte(s) at a concentration equal to 10% of the applicable ECL. The use of certified or accredited laboratories is considered sufficient evidence of analysis quality, since an approved Quality Assurance plan is one prerequisite for attaining certification. Each contractor laboratory performs a method blank, split, duplicate, and/or spike tests as controls for each analysis according to the requirements of the approved Quality Assurance plan.

## 6.3 RADON DETECTOR QUALITY CONTROL REQUIREMENTS

As a test of repeatability, each quarter one additional radon monitor will be placed at three air monitoring station as a field replicate. The stations to be used as field replicates will be selected at random each quarter.

Each quarter, Energy*Solutions* will submit four detectors used to measure radon for exposure to a calibrated radon chamber standard. The results will be compared to the exposure to demonstrate the accuracy and precision of the routine measurement technique and the associated calculations.

## 6.4 GAMMA DETECTOR QUALITY CONTROL REQUIREMENTS

As a test of repeatability, each quarter one additional gamma monitor will be placed at three air monitoring station as a field replicate. The stations to be used as field replicates will be selected at random each quarter.

Each quarter four detectors used to monitor gamma radiation will be concurrently exposed to a known dose from a calibrated gamma source. The results will be compared to the known exposure value.

## 6.5 SOIL SAMPLING QUALITY CONTROL REQUIREMENTS

Soil sample gamma spectroscopy:

- Shall be counted for at least 1000 seconds
- The uranium-238 MDC value shall be less than or equal to 1.5 pCi/g except when the uncertainty is less than 50% of the measured activity.

Four of the routine soil samples from each quarterly sampling event will be split. The routine samples and the split samples will be analyzed at different laboratories. The results from the routine samples will be compared with the corresponding split samples to verify the precision of the results obtained between different laboratories.

Four of the routine soil samples are collected twice as simultaneous blind field replicates. All four routine samples and their blind duplicate will be analyzed by gamma spectroscopy at the same laboratory. One of the four routine samples and its blind duplicate will also be analyzed for Th-230 and Th-232. The analytical

results will be used to indicate the laboratory's analytical repeatability and the error associated with the sampling technique.

### 6.6 AIR SAMPLER FLOW INDICATOR CALIBRATION FREQUENCY

Air sampler flow indicators will be calibrated at intervals not to exceed 6 months.

## 7.0 ENVIRONMENTAL MONITORING REPORT

A quarterly report will be submitted to the UDRC within 90 days after the expiration of each calendar quarter, unless otherwise approved by the Executive Secretary of the Division of Radiation Control.

Each quarterly report shall include a brief introduction and narrative that summarizes and explains the data, the results obtained, and conclusions. The narrative shall also explain any unusual or anomalous results and list any exceedances of a limit listed in this plan that occurred during the reporting period.

Each quarterly report shall also include the following data from the current report quarter:

- Contract laboratory data that pertains to any sample analysis that was performed under this program. The data package shall include the results of QC checks the contractor laboratory performs in the course of analyzing the samples (splits and duplicates, for example). The outside laboratory data may be submitted either electronically or by hard copy.
- The analytical results from gamma spectroscopy performed on quarterly soil samples and associated analytical results from soil samples used to verify soil radioactivity in areas where the environmental soil samples exceed the action level.
- Historical Ra-226 and U-238 in soil data used for trending to determine if a positive change in soil concentrations is occurring;
- The results of any quality control tests performed to meet a requirement of the Environmental Monitoring Plan, including but not limited to duplicates, split samples, and known exposures;
- A summary and tabulation of any data acquired as a result of sampling performed during the report quarter, to the extent that such data applies to a requirement of the Environmental Monitoring Plan;
- A table listing the activities and estimated relative dose weighting of each disposed radionuclide considered for additional radiochemical analysis according to the selection criteria of section 5.1.2 of the Environmental Monitoring Plan;
- VTD operating history and the results for any VTD monitoring performed during the reporting period.
- Results of weekly alpha-beta counting of air filters at each monitored location.

- Quarterly average alpha and beta air particulate concentrations at each monitored location.
- The cumulative TEDE, DDE, and CEDE at each POC for the current report quarter and the prior three quarters
- The calculated annual dose from the monitoring results to demonstrate compliance with UAC R313-15-301, R313-15-101(4), and R313-25-19. The information shall include DDE, CDE, CEDE, and TEDE calculations.
- Soil Sample Results
- A brief narrative summarizing the dosimetry data and explaining the CEDE estimates.

## TABLE 1: RADIOLOGICAL PROGRAM SUMMARY TABLE

| | Air | | | | Soil | | | Rad |
|---|---|---|---|---|---|---|---|---|
| Location Number | PAS - (5.1.1, 5.1.2, or 5.2) | Radon/Thoron - (5.1.4) | Tritium - (5.1.3 or 5.2) | VTD - I-129, Kr-85, Kr-81 - (5.2) | Gamma Spec - (5.4.2) | Th-232 & 230 (5.4.2) | PCB - (5.4.4) | Gamma - (5.3) |
| S-1 | | | | | x | | | |
| S-2 | | | | | x | | | |
| S-3 | | | | | x | | | |
| S-4 | | | | | x | | | |
| S-5 | | | | | x | | | |
| S-8 | | | | | x | | | |
| S-12 | | | | | x | | x | |
| S-13 | | | | | x | | | |
| S-15 | | | | | x | | | |
| S-17 | | | | | x | | | |
| S-18 | | | | | x | | | |
| S-19 | | | | | x | x | | |
| S-21 | | | | | x | | | |
| S-22 | | | | | x | | | |
| S-23 | | | | | x | | | |
| S-24 | | | | | x | | x | |
| S-25 | | | | | x | x | x | |
| S-26 | | | | | x | | x | |
| S-27 | | | | | x | | x | |
| S-28 | | | | | x | | x | |
| S-29 | | | | | x | x | x | |
| S-32 | | | | | x | | x | |
| S-33 | | | | | x | | x | |
| S-34 | | | | | x | | x | |
| S-36 | | | | | x | x | | |
| S-37 | | | | | x | x | | |
| S-38 | | | | | x | | | |
| S-39 | | | | | x | | | |
| S-40 | | | | | x | | | |
| S-50 | | | | | x | | | |
| S-51 | | | | | x | | | |
| S-52 | | | | | x | | | |
| S-53 | | | | | x | | | |
| S-54 | | | | | x | | | |
| S-56 | | | | | x | x | x | |
| S-57 | | | | | x | x | x | |
| S-58 | | | | | x | | | |
| S-59 | | | | | x | | x | |

| | Air | | | | Soil | | | Rad |
|---|---|---|---|---|---|---|---|---|
| Location Number | PAS - (5.1.1, 5.1.2, or 5.2) | Radon/Thoron - (5.1.4) | Tritium - (5.1.3 or 5.2) | VTD - I-129, Kr-85, Kr-81 - (5.2) | Gamma Spec - (5.4.2) | Th-232 & 230 (5.4.2) | PCB - (5.4.4) | Gamma - (5.3) |
| S-64 | | | | | x | | | |
| S-65 | | | | | x | x | | |
| S-66 | | | | | x | | | |
| S-71 | | | | | x | | | |
| S-72 | | | | | x | | x | |
| S-73 | | | | | x | x | | |
| S-74 | | | | | x | | x | |
| S-75 | | | | | x | | | |
| S-76 | | | | | x | | | |
| S-77 | | | | | x | | | |
| S-78 | | | | | x | | | |
| S-79 | | | | | x | | | |
| A-1 | x | x | x | | | | | x |
| A-4 | x | x | x | | x | | | x |
| A-5 | x | x | x | | x | | | x |
| A-6 | X | | | | | | | |
| A-10 | x | x | | | x | | x | x |
| A-11 | x | x | | | x | x | | x |
| A-13 | x | x | x | | x | x | | x |
| A-16 | x | x | | | | | | x |
| A-17 | x | x | x | | | | | x |
| A-18 | x | x | x | | x | | | x |
| A-19 | x | x | | | | | | x |
| A-20 | x | x | | | | | | x |
| A-21 | x | x | | | | | | x |
| A-22 | x | x | x | | | | | x |
| A-26 | x | x | | | | | | x |
| A-27 | | x | | | | | | x |
| A-28 | x | x | x | | | | | x |
| A-29 | x | x | | | | | | x |
| A-30 | x | x | x | | | | | x |
| A-33 | x | x | | | | | | x |
| A-35 | x | x | x | | | | | x |
| A-36 | x | x | x | | | | | x |
| A-37 | x | x | | | | | | x |
| VTD | x | | x | x | | | | |
| B-2 | | x | | | x | | | x |
| SC | | | | | | | | x |

* SC is used to identify the Sample Control. Area inside the Operations Building

- **TABLE 2: MONITORING LOCATIONS**

NOTE: Point of Beginning is the Clive monument at the Southwest corner of Section 32

| Station | North | East | | Station | North | East | | Station | North | East |
|---|---|---|---|---|---|---|---|---|---|---|
| A-1 | 5163 | 2749 | | S-2 | 4896 | 3126 | | S-38 | 40 | 600 |
| A-4 | -88 | 5252 | | S-3 | 4891 | 3463 | | S-39 | 1050 | 200 |
| A-5 | -14 | 2647 | | S-4 | 4883 | 3812 | | S-40 | 1600 | 200 |
| A-6 | 4472 | 2726 | | S-5 | 4877 | 4204 | | S-50 | 4440 | 4175 |
| A-10 | -10 | 4124 | | S-8 | 3599 | 4209 | | S-51 | 4023 | 4168 |
| A-11 | 28 | 1196 | | S-12 | 1992 | 4155 | | S-52 | 3118 | 4149 |
| A-13 | 499 | 198 | | S-13 | 2002 | 3679 | | S-53 | 2659 | 4140 |
| A-16 | 2412 | -6633 | | S-15 | 2011 | 3111 | | S-54 | 2367 | 4137 |
| A-17 | 2167 | 5323 | | S-17 | 5195 | 3399 | | S-56 | 2551 | 85 |
| A-18 | 5417 | 4853 | | S-18 | 5035 | 4015 | | S-57 | 2963 | 91 |
| A-19 | 3965 | 5383 | | S-19 | 5213 | 5162 | | S-58 | 3339 | 99 |
| A-20 | 5084 | 5409 | | S-21 | 4537 | 5359 | | S-59 | 3735 | 106 |
| A-21 | 2162 | 71 | | S-22 | 3967 | 5356 | | S-64 | 4038 | 272 |
| A-22 | 2962 | 88 | | S-23 | 3347 | 5344 | | S-65 | 4430 | 286 |
| A-26 | -129 | 3282 | | S-24 | 2764 | 5335 | | S-66 | 4801 | 335 |
| A-27 | -2701 | 3406 | | S-25 | 2169 | 5322 | | S-71 | 5291 | 796 |
| A-28 | 4043 | 104 | | S-26 | 1596 | 5375 | | S-72 | 5282 | 1222 |
| A-29 | 4636 | 115 | | S-27 | 379 | 5355 | | S-73 | 5273 | 1658 |
| A-30 | 5287 | 319 | | S-28 | -70 | 4754 | | S-74 | 5256 | 2429 |
| A-33 | 5501 | 2762 | | S-29 | -229 | 3389 | | S-75 | 4471 | 2724 |
| A-35 | 5280 | 1495 | | S-32 | 2047 | 2690 | | S-76 | 2784 | 2703 |
| A-36 | 5256 | 2402 | | S-33 | 3238 | 2694 | | S-77 | 5174 | 2678 |
| A-37 | 658 | 5377 | | S-34 | 3764 | 2717 | | S-78 | 2162 | 76 |
| B-2 | 2650 | 13200 | | S-36 | -5 | 2200 | | S-79 | -2709 | 3438 |
| S-1 | 4892 | 2745 | | S-37 | 10 | 1600 | | | | |

## TABLE 3: ECL FOR SELECTED RADIONUCLIDES

The listed concentration values are listed in units of uCi/ml and are based on continuous exposure for one year equals 50 mrem.

| | | | |
|---|---|---|---|
| Thorium | Th-228 | M | 6.3E-14 |
| | | S | 5.1E-14 |
| | Th-230 | M | 4.7E-14 |
| | | S | 1.4E-13 |
| | Th-232 | M | 4.5E-14 |
| | | S | 8.2E-14 |
| | Th-234 | M | 3.0E-10 |
| | | S | 2.6E-10 |

| | | | |
|---|---|---|---|
| Uranium | U-234 | F | 3.4E-12 |
| | | M | 6.1E-13 |
| | | S | 2.2E-13 |
| | U-238 | F | 3.8E-12 |
| | | M | 7.2E-13 |
| | | S | 2.6E-13 |

| | | | |
|---|---|---|---|
| Radium | Ra-224 | M | 6.5E-13 |
| | Ra-226 | M | 5.9E-13 |
| | Ra-228 | M | 7.2E-13 |

| | | | |
|---|---|---|---|
| Actinium | Ac-228 | F | 7.5E-11 |
| | | M | 1.2E-10 |
| | | S | 1.3E-10 |

| | | | |
|---|---|---|---|
| Bismuth | Bi-210 | F | 1.7E-09 |
| | | M | 2.2E-11 |
| | Bi-212 | F | 2.0E-10 |
| | | M | 6.3E-11 |
| | Bi-214 | F | 2.6E-10 |
| | | M | 1.3E-10 |

| | | | |
|---|---|---|---|
| Lead | Pb-210 | F | 2.1E-12 |
| | Pb-212 | F | 9.9E-11 |
| | Pb-214 | F | 6.5E-10 |

| | | | |
|---|---|---|---|
| Polonium | Po-210 | F | 3.1E-12 |
| | | M | 6.3E-13 |

| | | | |
|---|---|---|---|
| Protactinium | Pa-234 | M | 4.9E-09 |
| | | S | 4.7E-09 |

| | | | |
|---|---|---|---|
| Radon* | Rn-222 | 1 WLM | 6.0E+00 |

*Radon ECL units is pCi/L.

Notes:

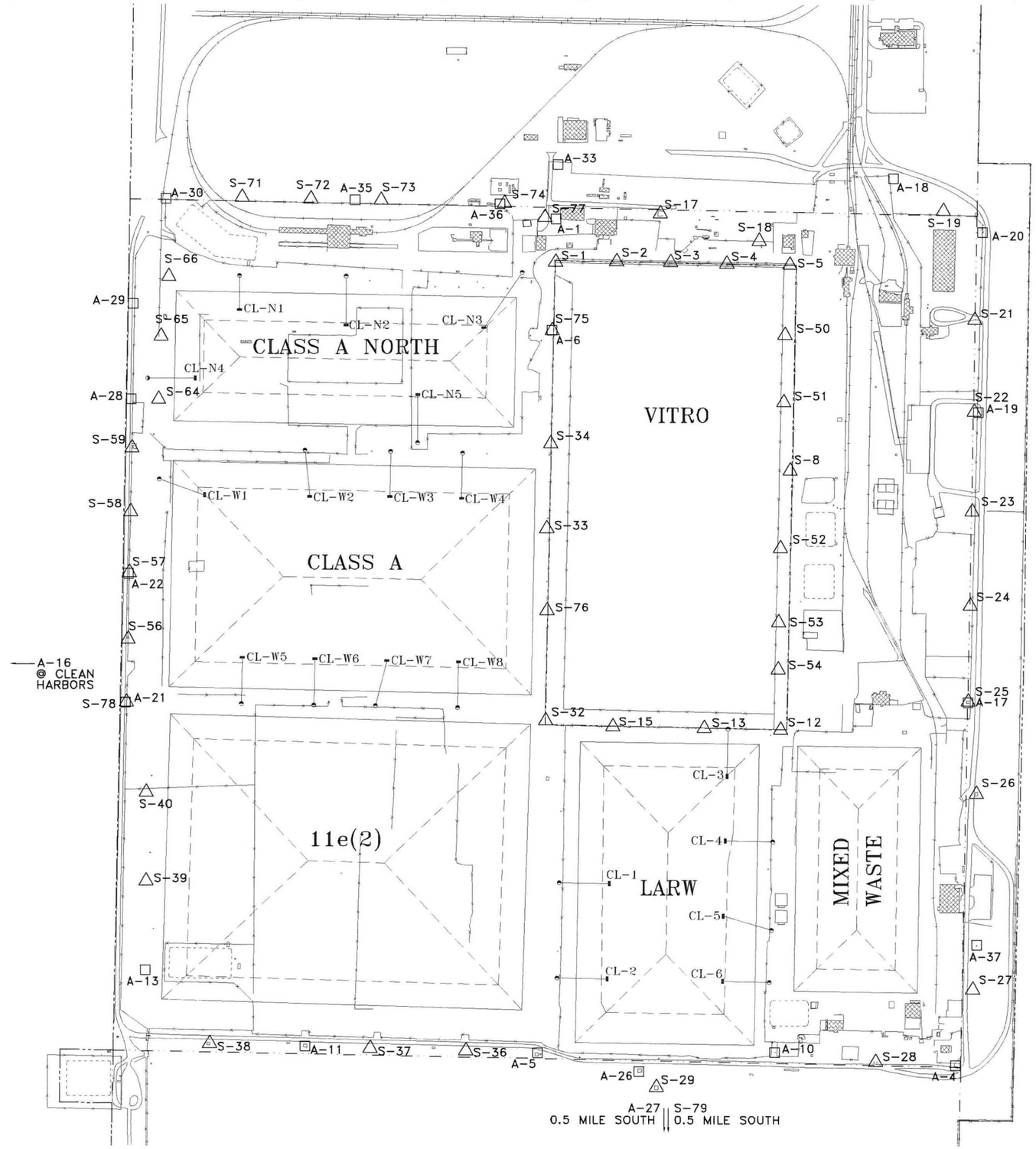
These updated "ECL" values were calculated following the general technique described in Appendix B to Part 20 which relates the Annual Limit on Intake to the Effluent Concentration Limit.

The 50-year committed effective equivalent inhalation dose conversion factors for an adult worker, for an AMAD of 1 um, from ICRP 68 were multiplied by the 3.7 E 9 conversion factor which relates the given units of Sv/Bq to mrem/uCi.

The resulting DCF in uCi/ml was then divide into the effective dose limit off 5000 mrem/year to obtain the value for the ALI in uCi/year.

The ALI is divided by breathing rate for an adult worker of 2.4e9 ml/yr, and also divided by the additional factor of 300 used in Appendix B to Part 20 to relate the stochastic DAC to the ECL.

The ICRP 68 biological elimination type designations "F" (Fast), "M" (Medium), and "S" (Slow) are roughly analogous to the Part 20 "D" (Day), "W" (Week), and "Y" (Year) solubility classes.




N

LEGEND

- FENCE
- ROAD
- PROPERTY LINE
- RAILROAD
- SECTION LINE
- PERMITTED EMBANKMENT LIMITS
- EMBANKMENT EARTHWORK BREAK LINES
- □ AIR MONITORING STATIONS
- △ SOIL MONITORING STATIONS

360 0 360 720

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

| REV | DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|---|
| 7 | 1/5/12 | DFB | REPLACED THE PREVIOUSLY REMOVED AIR STATION A-6 |
| 6 | 9/29/10 | DFB | MOVED S-19 FURTHER NORTH AND REMOVED S-20 |
| 5 | 2/18/10 | DFB | UPDATED TOPOGRAPHY |
| 4 | 11/3/08 | DFB | DELETED B-1, S-41; ADDED S-78, S-79, A-27 |
| 3 | 9/18/08 | DFB | ADDED SOIL STATIONS S-75, S-76 & S-77 AND AIR STATION A-37 |
| 2 | 6/18/07 | DFB | MOVED V-17 TO THE WEST AND SOUTH |
| 1 | 5/22/07 | DFB | ANNUAL UPDATE: REMOVED A-25, MOVED S-18, ADDED V-17 |
| 0 | 03/16/07 | DGS | FOR PERMIT ONLY - RELOCATED A-25 |

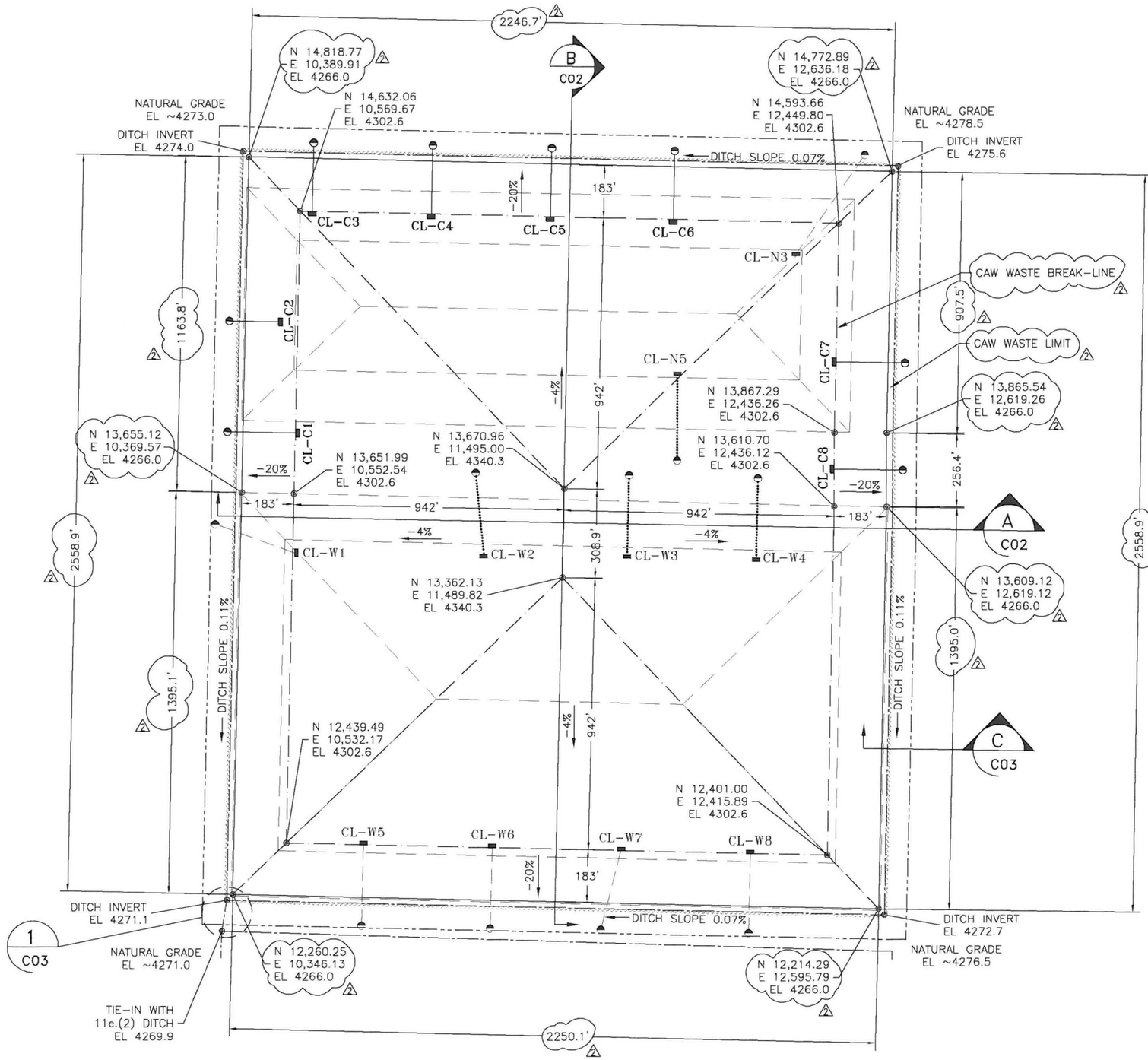
ENERGYSOLUTIONS

"CLIVE" FACILITY
ENERGYSOLUTIONS SITE FACILITIES
ENVIRONMENTAL MONITORS
CLIVE, UTAH

DRAFTED BY D.BOOTH
REVIEWED BY W.JOHNS
APPROVED BY D.BOOTH
SCALE AS SHOWN DATE 05/22/07 REV. 7
DRAWING NO. 07007 J01

Attachment 2

Engineering Drawings




## LEGEND:

- CAW WASTE LIMIT (TOE OF WASTE)
- CAW WASTE BREAK-LINES
- EDGE OF CLAY LINER (MIN)
- DITCH CENTERLINE
- BUFFER ZONE LIMITS
- CLASS A AND CLASS A NORTH EMBANKMENTS
- CL-XY EXISTING LYSIMITER
- CL-XY PROPOSED LYSIMTER
- CL-XY EXISTING OR CURRENT PLANNED LYSIMETER TO BE ABANDONED

200 0 200 400

## NOTES:

1. ALL ELEVATIONS ARE FOR TOP OF WASTE, UNLESS OTHERWISE NOTED.
2. LYSIMETER CL-W2 HAS NOT BEEN CONSTRUCTED.
3. EMBANKMENT CAPACITY FROM THE TOP OF THE LINER PROTECTIVE COVER (EL 4266') TO THE TOP OF WASTE IS CALCULATED TO BE 8,724,097 CY.
4. DESIGN AND AS-BUILT TOP OF CLAY LINER ELEVATIONS FOR THE CLASS A, CLASS A NORTH AND CLASS A WEST EMBANKMENTS ARE ALL 4265 (LEVEL SURFACES).

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

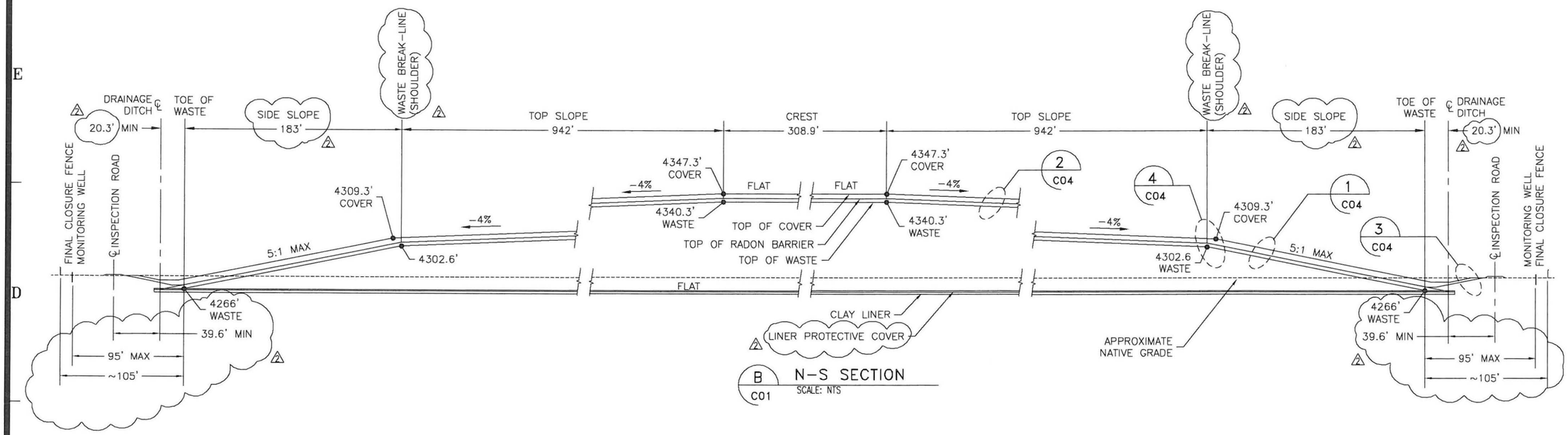
| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT (TOE); REMOVED WASTE RESTRICTION AREA |
| 10/4/11 | DFB | FOR LICENSING/CONSTRUCTION: ADDED DETAIL 1 & WASTE RESTRICTION AREA |
| 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

ENERGYSOLUTIONS

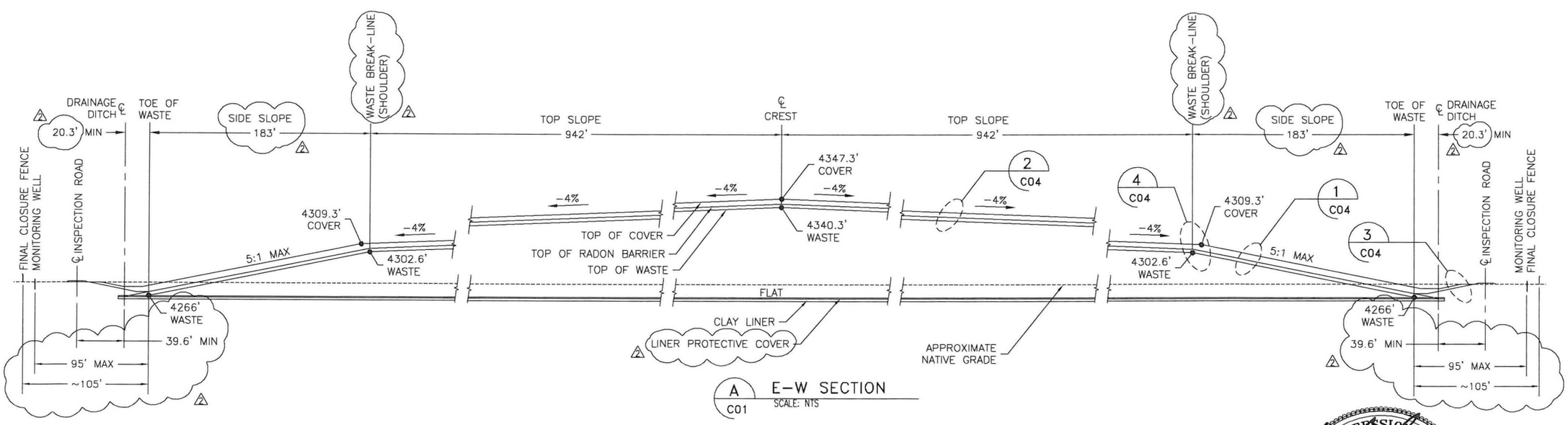
ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT FEATURES AND CONTROLS
CLIVE, UTAH

# FINAL DRAWING

DRAFTED BY: D. BOOTH
REVIEWED BY: G. DUTSON
APPROVED BY: D. BOOTH
SCALE: AS NOTED | DATE: 04/28/11 | REV.
DRAWING NO.: 10014 C01




B C01 N-S SECTION
SCALE: NTS




A C01 E-W SECTION
SCALE: NTS

NOTE:
ELEVATIONS SHOWN ARE FOR THE TOP OF LINER, WASTE AND COVER AS INDICATED.

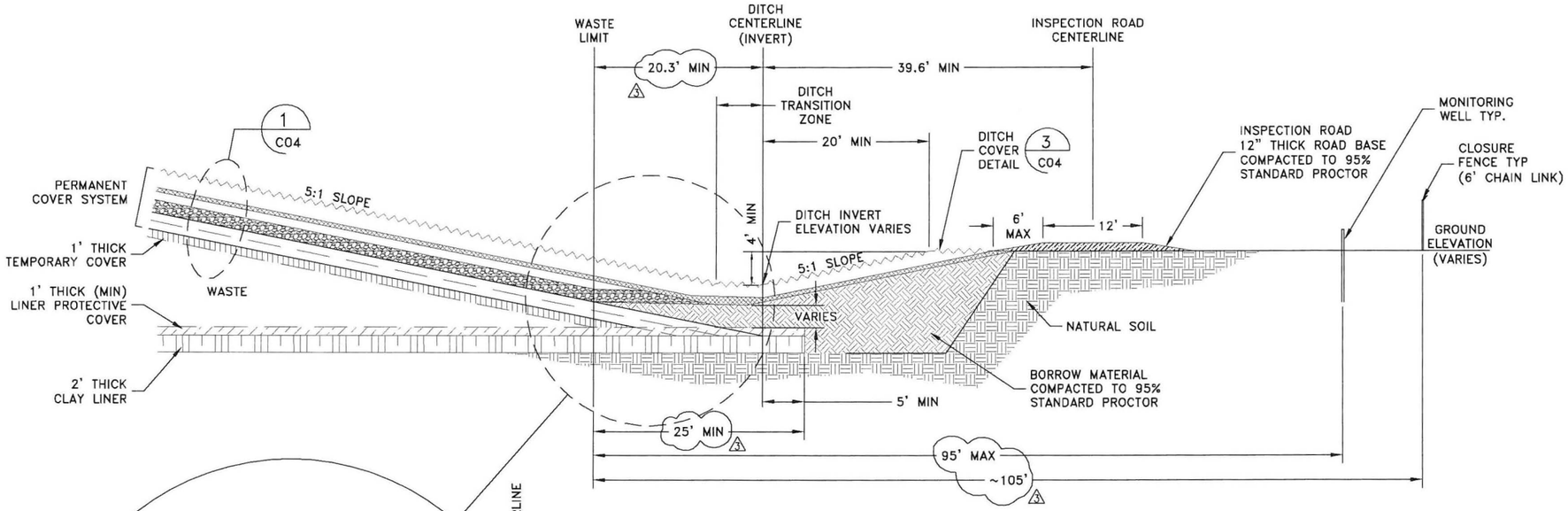
LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT; ADDED & CHANGED LABELS |
| 11/4/11 | DFB | FOR LICENSING/CONSTRUCTION: REVISED COVER THICKNESS AND ELEVATIONS |
| 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

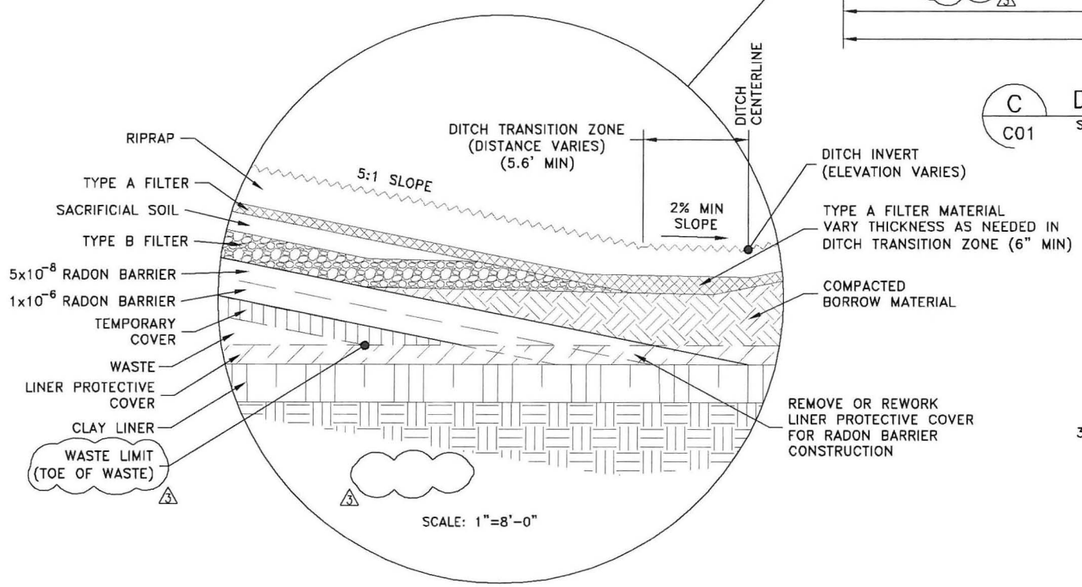
ENERGYSOLUTIONS
ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT CROSS SECTIONS
CLIVE, UTAH

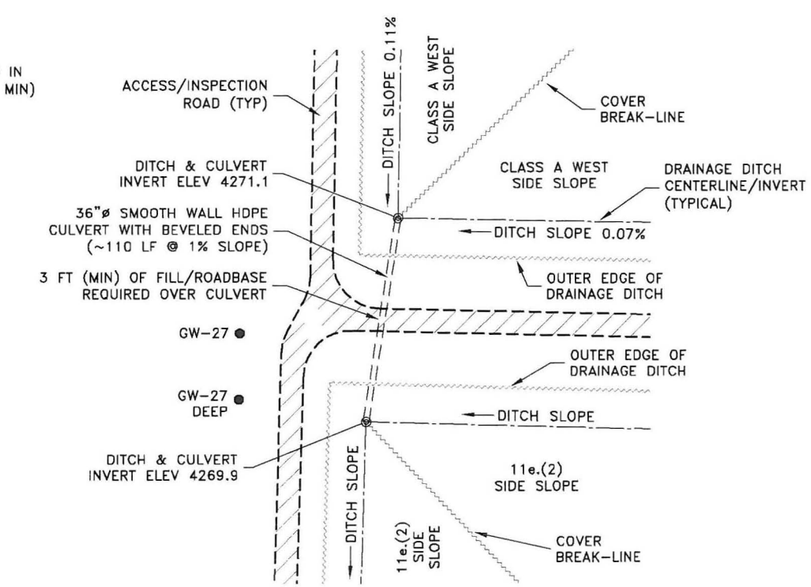
# FINAL DRAWING

DRAFTED BY D. BOOTH
REVIEWED BY G. DUTSON
APPROVED BY D. BOOTH
SCALE AS NOTED
DATE 04/28/11
REV. 2
DRAWING NO. 10014 C02




C / C01 DITCH & ROAD DETAIL TYP.
SCALE: 1"=16'-0"




1 / C01 DITCH CONFLUENCE DETAIL
SCALE: 1"= 80'

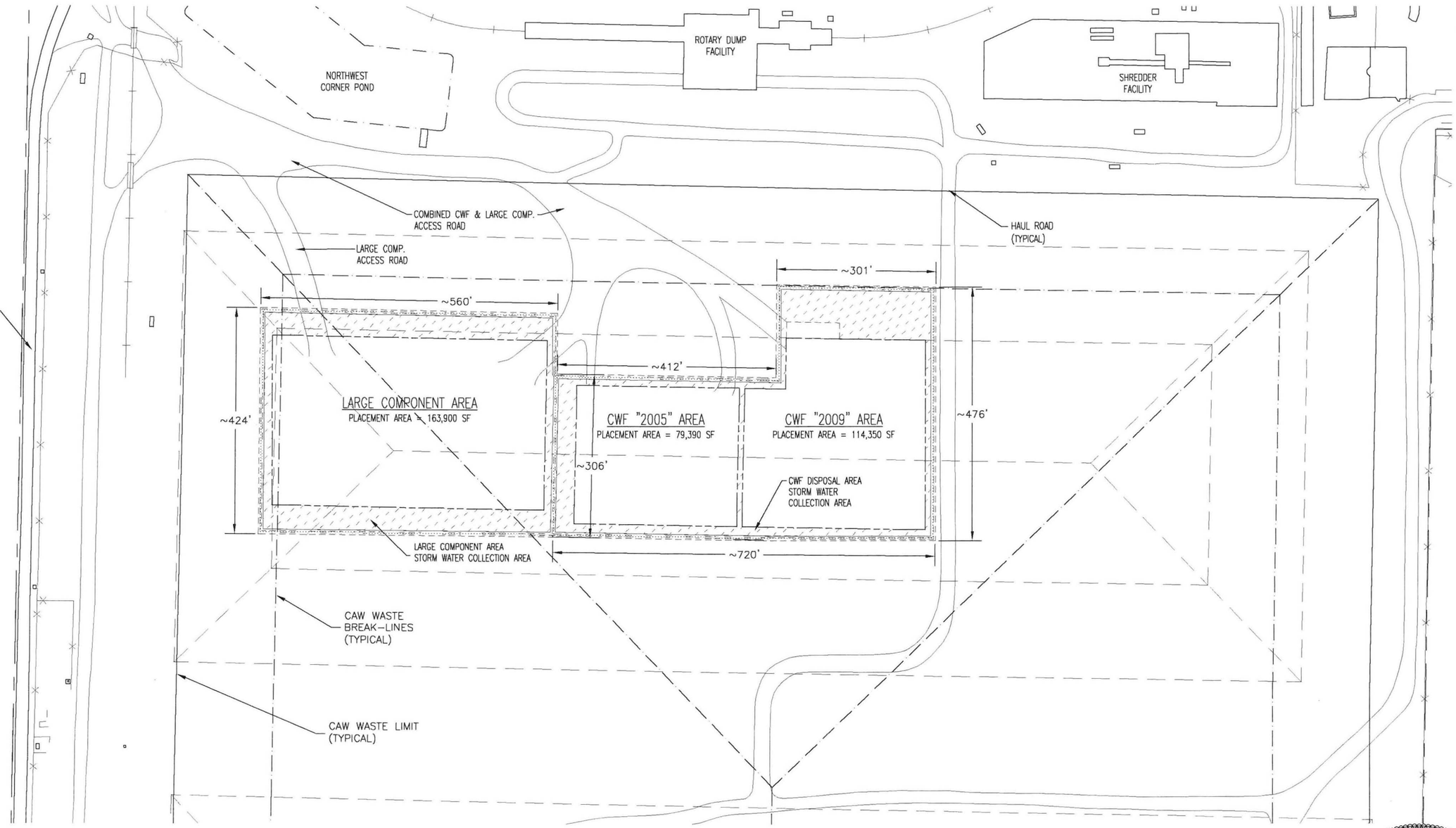
LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT (TOE OF WASTE) |
| 11/4/11 | DFB | FOR LICENSING/CONSTRUCTION: REVISED TYPE B AND RIPRAP THICKNESSES |
| 10/4/11 | DFB | FOR LICENSING/CONSTRUCTION: ADDED DITCH CONFLUENCE DETAIL & DIMENSION |
| 4/28/11 | DFB | FOR LICENSING |

ENERGYSOLUTIONS
ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
SECTIONS AND DETAILS, 1 OF 2
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY D. BOOTH
REVIEWED BY G. DUTSON
APPROVED BY D. BOOTH
SCALE AS NOTED | DATE 04/28/11 | REV.
DRAWING NO. 10014 C03




**LEGEND:**

- CLASS A WEST WASTE LIMITS
- CLASS A WEST WASTE BREAK-LINES
- ACTIVE LC & CWF PLACEMENT LIMITS
- CLASS A & CLASS A NORTH WASTE LIMITS & BREAKS
- STORM WATER COLLECTION AREA
- TOP OF RUN-OFF BERM
- TOE OF RUN-OFF BERM

PLAN VIEW-CLASS A WEST EMBANKMENT

100 0 100 200

**NOTE:**
DRAWING INCORPORATES INFORMATION CONTAINED ON FORMER DRAWING 04080-C04, REV 3.

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

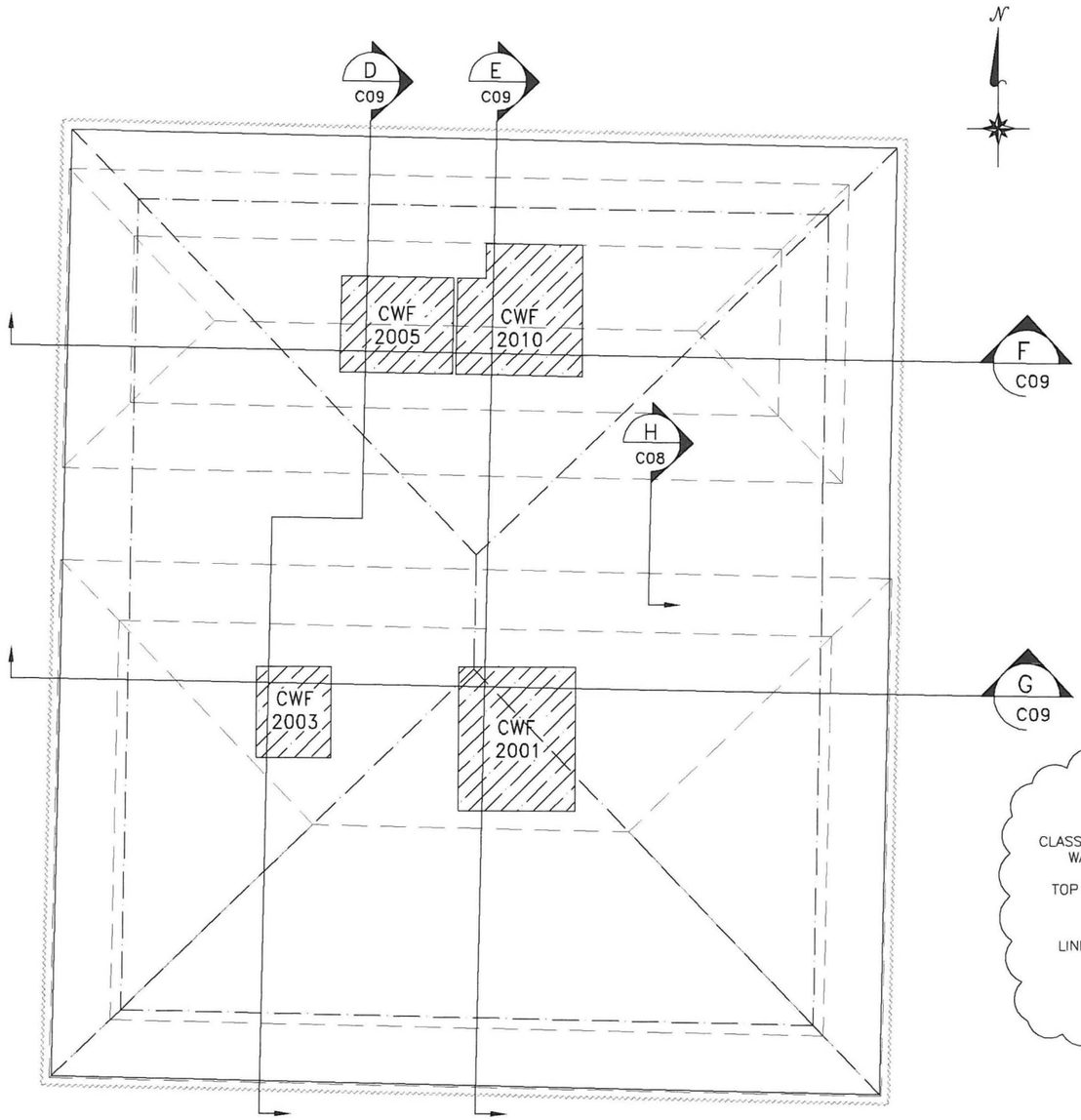
| REV | DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|---|
| 3 | 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT & LINE TYPES |
| 2 | 8/29/11 | DFB | FOR LICENSING/CONSTRUCTION-ADDED LABELS TO CAW BOUNDARY AND BREAKOVERS |
| 1 | 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

ENERGYSOLUTIONS

CLASS A WEST EMBANKMENT
ACTIVE CWF & LC AREAS
AREA & HAUL ROAD LAYOUT
CLIVE, UTAH

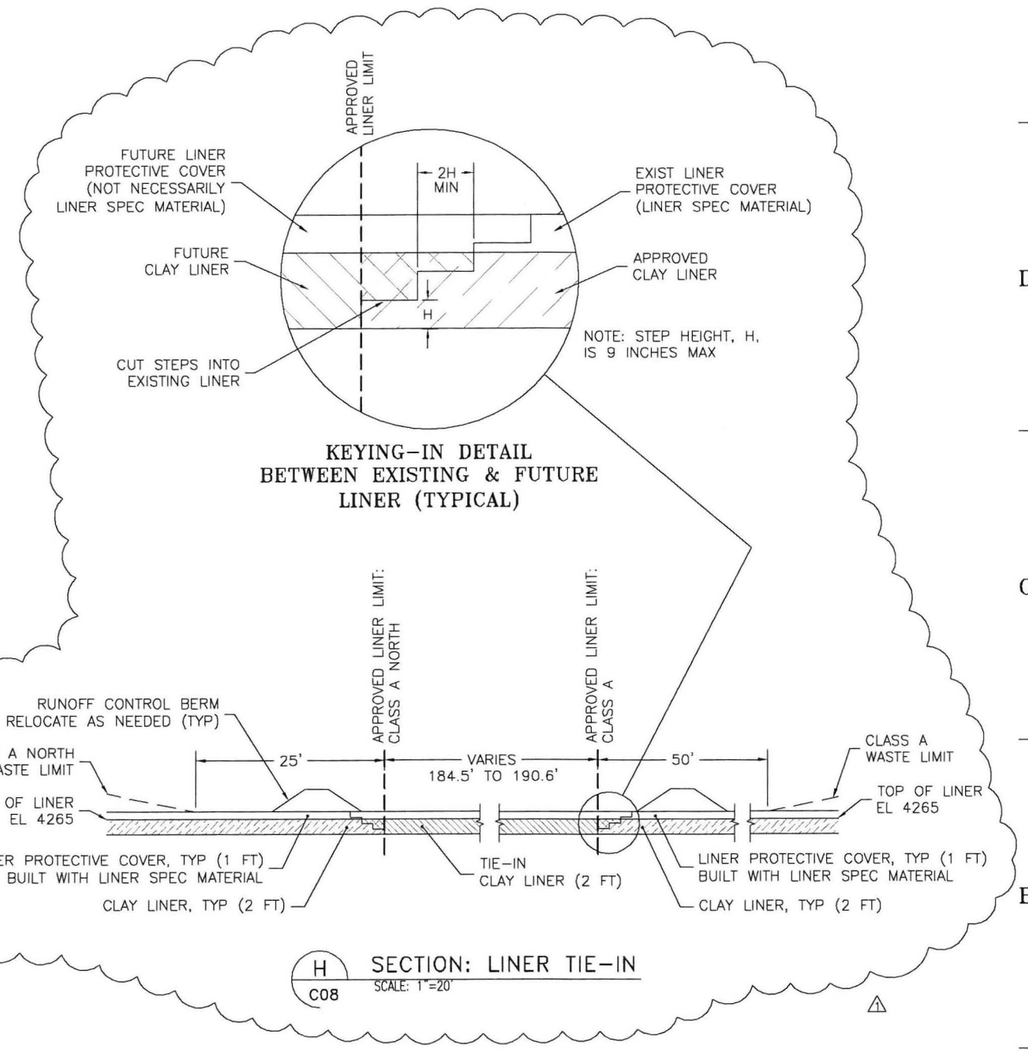
FINAL DRAWING

DRAFTED BY: D. BOOTH
REVIEWED BY: G. DUTSON
APPROVED BY: D. BOOTH
SCALE: AS NOTED | DATE: 04/28/11 | REV. 3
DRAWING NO. 10014 C05




PLAN VIEW – CLASS A WEST EMBANKMENT

200 0 200 400




**LEGEND:**

- CLASS A & CLASS A NORTH EMBANKMENTS
- WASTE LIMITS: CLASS A WEST
- BREAKLINES: CLASS A WEST
- LINER LIMITS: CLASS A WEST
- CWF DISPOSAL AREAS

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

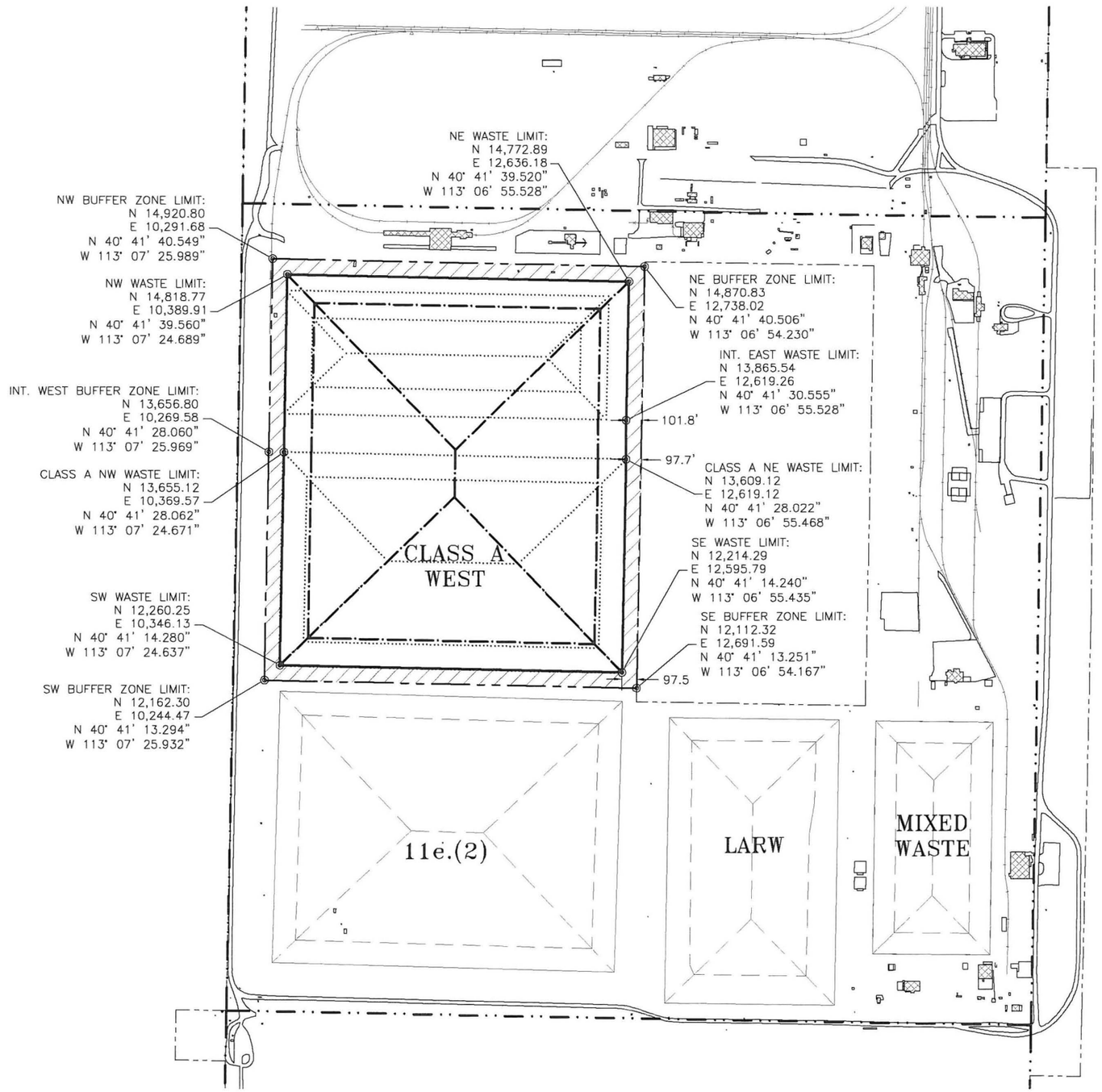
| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT (TOE OF WASTE), ADDED LINER TIE-IN DETAIL |
| 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
CLASS A, CLASS A NORTH & CLASS A WEST MAP
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY: D. BOOTH
REVIEWED BY: G. DUTSON
APPROVED BY: D. BOOTH
SCALE: AS NOTED
DATE: 04/28/11
REV.
DRAWING NO.: 10014 C08




**LEGEND:**

- CAW WASTE LIMITS
- CAW WASTE BREAK-LINES
- CAW BUFFER ZONE LIMITS
- SECTION BOUNDARIES
- PROPERTY BOUNDARIES
- CLASS A & CLASS A NORTH
- CAW BUFFER ZONE

**NOTES:**

1. COORDINATES ARE LISTED BOTH IN THE LOCAL "CLIVE" SYSTEM AND AS LATITUDE AND LONGITUDE.
2. BUFFER ZONE LIMITS ARE 100 FT FROM DESIGN WASTE LIMIT, EXCEPT AS SHOWN.

2

400 0 400 800

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

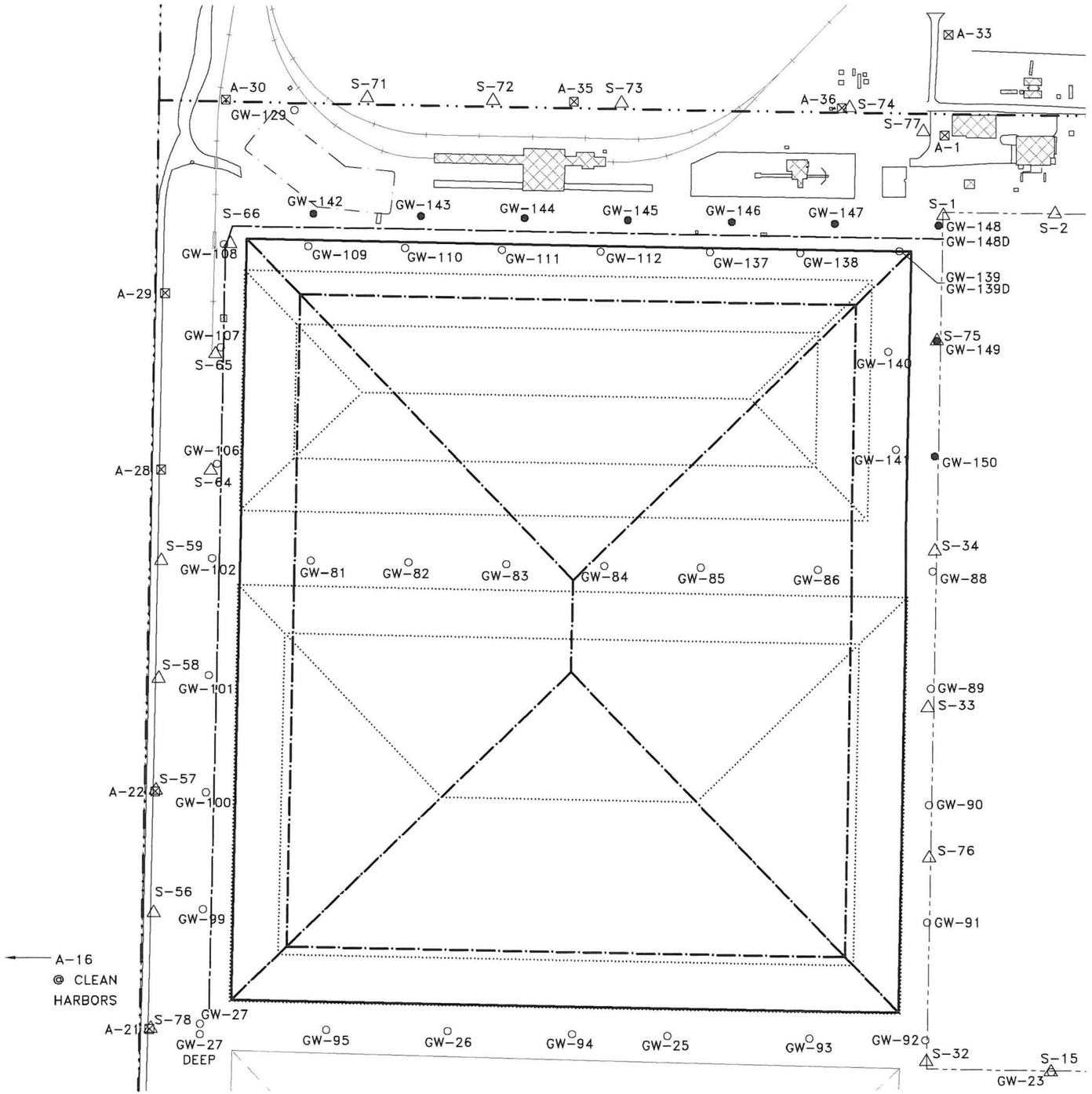
| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 2 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE & BUFFER ZONE LIMITS & COORDINATES |
| 1 10/4/11 | DFB | FOR LICENSING/CONSTRUCTION: ADDED BUFFER ZONE DIMENSIONS AND NOTES 2 & 3 |
| 0 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT LOCATION MAP & BUFFER ZONE
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY D. BOOTH
REVIEWED BY G. DUTSON
APPROVED BY D. BOOTH
SCALE AS NOTED DATE 04/28/11 REV. 2
DRAWING NO. 10014 U01




LEGEND:

- CAW WASTE LIMITS
- CAW WASTE BREAK-LINES
- RUN-ON BERM CENTERLINE
- SECTION BOUNDARIES
- PROPERTY BOUNDARIES
- CLASS A & CLASS A NORTH
- A-XX ⊠ EXIST. AIRSAMPLING STATION
- S-YY △ EXIST. SOIL SAMPLING STATION
- GW-ZZ ○ EXIST. GROUNDWATER MONITORING WELL
- GW-ZZ ● NEW GROUNDWATER MONITORING WELL

200 0 200 400

| GROUNDWATER MONITORING WELLS TO BE ABANDONED OR RELOCATED | |
|---|---|
| GW-81 | GW-111 |
| GW-82 | GW-112 |
| GW-83 | GW-137 |
| GW-84 | GW-138 |
| GW-85 | GW-139 |
| GW-86 | GW-139D |
| GW-109 | GW-140 |
| GW-110 | GW-141 |
| | |

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
1/5/12
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 1/5/12 | DFB | FOR LICENSING/CONSTRUCTION: REVISED WASTE LIMIT |
| 10/4/11 | DFB | FOR LICENSING/CONSTRUCTION: REMOVED SOIL S-66 STATION FROM TABLE |
| 4/28/11 | DFB | FOR LICENSING/CONSTRUCTION |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT ENVIRONMENTAL MONITORING
CLIVE, UTAH

# FINAL DRAWING

DRAFTED BY: D. BOOTH
REVIEWED BY: G. DUTSON
APPROVED BY: D. BOOTH
SCALE: AS NOTED
DATE: 04/28/11
REV: 2
DRAWING NO.: 10014 U02

# Attachment 3

# Groundwater Modeling

# ENERGY*SOLUTIONS*
# CLASS A WEST
# DISPOSAL CELL
# INFILTRATION AND TRANSPORT
# MODELING REPORT

Prepared for

*EnergySolutions, LLC*
*423 West 300 South, Suite 200*
*Salt Lake City, UT  84101*

Prepared by

*Whetstone Associates, Inc.*
*104 W Ruby Avenue*
*Gunnison, Colorado  81230*
*970-641-7471*

*Document 4104K.120223*

February 23, 2012

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## LIST OF ATTACHMENTS

Attachment 1. HELP Infiltration Model Output Files
Attachment 2. UNSAT-H Model Input and Output Files
Attachment 3. PATHRAE Vertical Model Output Files
Attachment 4. Infiltration & Transport Modeling Electronic Data Files

# 1. INTRODUCTION

Energy*Solutions* operates a radioactive waste and mixed waste disposal facility in Tooele County, Utah. Waste disposal cells at the site (Figure 1) are permanent, clay-lined cells with composite clay and rock cap designed to perform for a minimum of 500 years. The existing Class A and Class A North disposal cells occupy the western portion of Section 32 of T1S, R11W and are partially filled. Energy*Solutions* proposes to combine the existing Class A disposal cell with the Class A North disposal cell, and to increase the maximum waste height to approximately 76 ft. The combined facility would be called the Class A West (CAW) cell, and would occupy 133 acres at completion.

Although the modeling builds upon previous modeling reports and technical memoranda submitted for the Energy*Solutions* site, this report is intended as a standalone document that describes the model methods, assumptions, input parameters, and results.

## 1.1 Purpose and Objective

The Groundwater Quality Discharge Permit for the Energy*Solutions* site (UGW450005) requires that environmental impacts to groundwater are kept within tolerable risk levels. To assess these risks, groundwater models are used to evaluate the potential flow of water and transport of constituents from the disposal cell to a compliance well located 90 feet from the edge of the waste. The models predict groundwater concentrations at the compliance well for a period of 200 and 500 years after closure, for hazardous and radioactive constituents, respectively. The purpose of this document is to describe the assumptions, input parameters, and results of the infiltration and fate and transport modeling.

## 1.2 Previous Modeling

Fate and transport modeling of a similar nature has been performed previously for the Class A cell, LARW cell, 11e.(2) cell, and Mixed Waste cell at the Energy*Solutions* Clive facility. This modeling has been based on site-specific parameters, where available, or conservative assumptions where no site-specific data existed. Over time, as more data have been collected for the site, these models have been refined and updated to provide more accurate yet extremely environmentally conservative estimates of the leaching, transport, and arrival of constituents at compliance monitoring wells for decades and centuries into the future.

Previous groundwater flow and contaminant transport models of the Envirocare facility have been generated by Rogers and Associates Engineering (1990), Bingham Environmental (1991, 1993a. 1993b, 1994a, 1995a, 1995c), Adrian Brown Consultants (ABC) (1996a, 1996b, 1997a, 1997b, 1997d, 1998), the Utah Department of Environmental Quality (DEQ) Division of Water Quality (1993, 1994), and Whetstone Associates (2000a, 2000c, 2000d, 2000e, 2000f, 2001a, 2001b, 2003, 2005, 2006a, 2006b). The methodology used in the modeling was initially described in detail in a two-volume comprehensive modeling report for the LARW cell, prepared by Adrian Brown Consultants (ABC) in 1997.

An infiltration and transport modeling report for the CAW cell was prepared in April 2011, using the methodologies established previously and refinements developed over time (Whetstone, 2011a). The refinements in radionuclide inventory, half lives, and $K_d$ values for the Class A radionuclides that developed over time in the course of modeling (and in response to Utah Division of Radiation Control [DRC] comments) were incorporated into the modeling. The CAW cell model uses the most up-to-date Class A nuclide inventory approved by DRC. Aquifer hydraulic conductivity and meteorological data were also updated.

DRC reviewed the submission and prepared interrogatory comments (DRC 2011). The reviewers identified that the vadose zone water velocities were incorrectly calculated in the tables of the report and that the incorrect values were used in the PATHRAE transport calculations. The incorrect velocities that

were used in the PATHARAE calculations resulted in incorrect radionuclide concentrations and peak times at the water table.

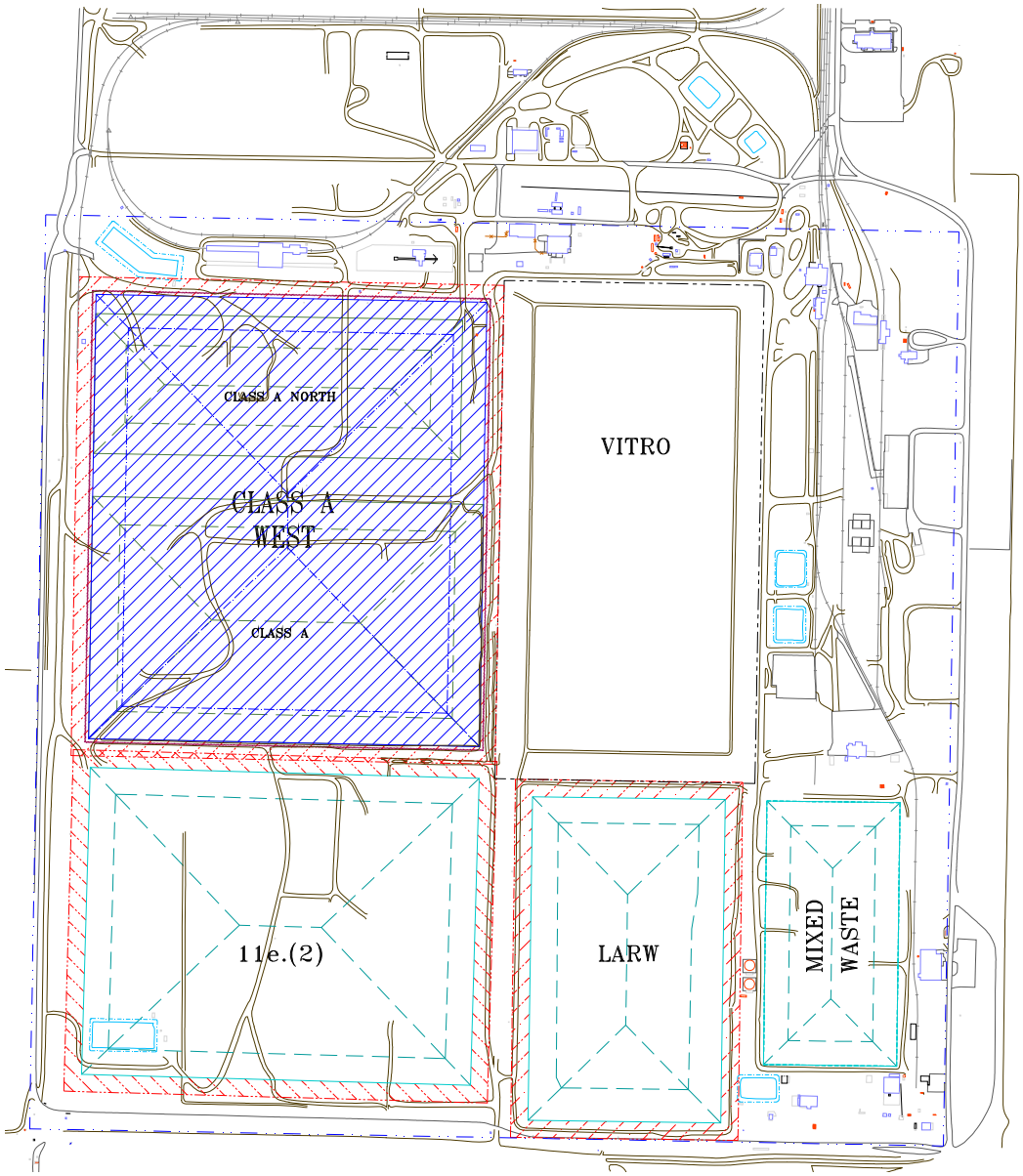



***Figure 1. Plan View Map of Section 32 Showing Embankments, Buffer Zones, and Proposed Class A West Cell***

In response to the interrogatory comments, the CAW cell modeling has been revised using corrected vadose zone velocities. The rip rap thickness and evaporative zone depth have also been increased, and infiltration through the cell has been remodeled. The fate and transport of radionuclides in the vadose zone and aquifer have been remodeled using the updated infiltration rates and vadose zone velocities.

Although minor modifications to the cover thicknesses are proposed in the revised modeling, the engineering design for the proposed CAW cell is similar to the April 2011 design and the design of the existing Class A cell. Although the CAW cell is larger than the existing Class A Cell, the approach and

methodology for the modeling are similar. Because the designs are similar, it is appropriate that the same methodology be applied.

## 1.3 Modeling Method

The potential migration of hazardous and radioactive constituents from the CAW cell were investigated using the EPA HELP model (Schroeder and Peyton, 1995), the Pacific Northwest Laboratories UNSAT-H model (Fayer and Jones, 1990; Fayer, 1999), and the PATHRAE-RAD model (Merrell, et al, 1995).

The modeling project was divided into the following four phases:

1. The infiltration through the closed CAW cell was predicted using the EPA HELP model;
2. Percolation rates predicted by the HELP model were input into the UNSAT-H model to predict the moisture content and time of travel from the bottom of the waste to the top of the aquifer;
3. A dispersive solution for contaminant transport from the base of the cell to the top of the water table (vertical solution) was determined using the PATHRAE model; and
4. The horizontal migration of constituents through the saturated zone to a compliance well was modeled, again using PATHRAE.

The infiltration (HELP) and moisture content (UNSAT-H) models are described in Sections 2 and 3 of this report. The contaminant transport (PATHRAE) modeling is described in Sections 4 through 6.

# 2. INFILTRATION (HELP) MODELING

The infiltration modeling code and input are briefly described below. More detailed information on the infiltration modeling approach, code, and design in relation to the Energy*Solutions* site is contained in the 1997 document prepared for the LARW cell entitled "Volume I. Final Report on Infiltration Modeling" (ABC, 1997).

## 2.1 Code

Infiltration through the CAW cell was modeled using the EPA Hydrologic Evaluation of Landfill Performance (HELP) model (version 3.06). The HELP model (Schroeder and Peyton, 1995) is a quasi-two-dimensional code developed by Paul Schroeder (U.S. Army Corps of Engineers) and R. Lee Peyton (University of Missouri, Columbia). The model was adapted from the EPA HSSWDS model (Perrier and Gibson, 1980) and various codes from the US Agricultural Research Service, and National Weather Service, and it uses weather, soil, and landfill design data to perform water balance analysis of the designed cell. Influences of surface storage, snowmelt, runoff, infiltration, evapotranspiration, soil moisture storage, lateral subsurface drainage, and unsaturated surface drainage can all be modeled.

The HELP code is distributed by EPA and has widespread acceptance as a tool for the evaluation of the hydrologic performance of landfills. The HELP code was used previously in the prediction of infiltration at the Energy*Solutions* site, and was accepted by DRC as part of license renewal.

## 2.2 Weather Data Input

The HELP weather data input to the CAW cell model is based on 17 years of meteorological data available for the Clive site, as reported by Meteorological Solutions, Inc (MSI, 2010). The average annual precipitation measured at the Energy*Solutions* Clive facility from 1993-2009 is 8.53 inches per year (in/yr). Based on site-specific data, input files for evapotranspiration, precipitation, temperature, and solar radiation data were generated using a synthetic weather generator. The weather generator routine, developed by the USDA Agricultural Research Service (Richardson and Wright, 1984), generated 100 years of daily climate data based on site-specific monthly average precipitation and temperature coupled with the climate distribution parameters for a selected analog city.

The climatological input values are summarized in Table 1 and described briefly in the following sections.

***Table 1. Summary of HELP Model Weather and Climate Input***

```
                              EVAPOTRANSPIRATION AND WEATHER DATA
-----------------------------------------------------------------------------------------------
            NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM SALT LAKE CITY UTAH
              STATION LATITUDE                        =  40.69 DEGREES
              MAXIMUM LEAF AREA INDEX                 =   0.00
              START OF GROWING SEASON (JULIAN DATE)   =    117
              END OF GROWING SEASON (JULIAN DATE)     =    289
              EVAPORATIVE ZONE DEPTH                  =  20.0  INCHES
              AVERAGE ANNUAL WIND SPEED               =   7.20 MPH
              AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  50.50 %
              AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  28.60 %
              AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  22.70 %
              AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  47.90 %

          NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                   COEFFICIENTS FOR    SALT LAKE CITY      UTAH

                   NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
      JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
      -------     -------     -------     -------     -------     -------
        0.79        0.86        0.85        1.18        0.95        0.89
        0.30        0.33        0.40        0.74        0.50        0.51

          NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                   COEFFICIENTS FOR    SALT LAKE CITY      UTAH

              NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
      JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
      -------     -------     -------     -------     -------     -------
       29.10       32.40       41.40       49.10       60.30       69.60
       79.50       76.80       64.90       50.20       37.00       27.70

          NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                   COEFFICIENTS FOR    SALT LAKE CITY      UTAH
                      AND STATION LATITUDE  =  40.69 DEGREES
```

### *2.2.1 Evapotranspiration*

Evapotranspiration was calculated by HELP using the location, maximum leaf area, and evaporative zone depth (EZD) specified for the site.

*Location.* Salt Lake City appears to be the most appropriate analog city for the Clive site (DRC, 1997). Therefore, Salt Lake City was used in the model as the analog city, from which HELP generated synthetic evapotranspiration data. The default latitude (40.76°) was adjusted to 40.6858°(40°41’15”) for the Clive site.

*Evaporative Zone Depth (EZD).* The EZD is defined as the depth to which evaporation and transpiration from the soil or rock can occur. Because the CAW cell will not be vegetated, the EZD represents the maximum depth of evaporation. In the HELP model, any water that percolates below the EZD can only be routed laterally, via a filter (or lateral drainage) layer, or vertically downward as percolation. The model determines the amount of evaporation that occurrs in the evaporative zone based on the available energy in the system, according to the temperature, solar radiation, and wind speed for each given day.

The EZD limits the amount of evaporation which can occur from the landfill cell. The effect of EZD is more pronounced for vegetated landfill covers than for bare soils, because evaporation from bare soils is determined internally within the HELP model based on cover soil material properties. The HELP model calculates the potential soil evaporation using the Penman equation, then applies a “Stage 1” evaporation (controlled only by the available energy) and “Stage 2” evaporation (limited by the rate at which water can be transported to the surface). The Stage 1 evaporation is limited by an evaporation coefficient, which is restricted so as to not yield a capillary flux outside of the range for soils (3.30-5.50) reported by Knisel

(1980). This restriction limits the evaporation coefficient of the rip rap to 3.30 mm/day, which results in an upper limit of Stage 1 evaporation (U) of 0.21 inches/day[1]. The evaporation demand is applied to seven segments of the evaporative zone, from the surface down.

The revised design of the CAW cell (Section 2.3) incorporates a thicker rip rap cover layer (24 inches compared to the previous 18 inches) and a correspondingly higher EZD (20 inches vs. the previous 18 inches). The 20-inch EZD only allows water to evaporate from the upper 83% of the 24-inch thick rip rap layer. Water that percolates beyond the upper 20 inches in the rip rap layer is not removed by the HELP model via evaporation. The EZD input value is considered to be extremely environmentally conservative, for the following reasons:

- Water is evaporated from the rip rap where dry air is in contact with wet or moist surfaces of the cobbles. Water that adheres to the surfaces of the rip rap is evaporated whenever the vapor pressure of the interstitial air is less than the saturated vapor pressure. These conditions allow evaporation from nearly all rip rap interstices.
- The rate of evaporation is controlled by the available energy at the evaporating surface and the ease with which water vapor diffuses into the atmosphere (Shuttleworth, 1993). If water molecules that vaporize from the surface of the rip rap can diffuse away, then the interstitial vapor pressure remains low and evaporation from the rip rap continues. Turbulent diffusion is a much more efficient transport mechanism than molecular diffusion (Shuttleworth, 1993) and occurs where wind blowing horizontally over natural surfaces is retarded by interaction with the ground. This mechanism plays a substantial role in diffusing water vapor from the upper portion of the rip rap cover.
- The site is located in an area of groundwater discharge to evapotranspiration (Harrill et al, 1988). Given that the depth to water is approximately 25 feet at the site, evaporation and transpiration are drawing water from a depth of 25 feet up to the surface. Although the material properties for the engineered cover differ from those of native soils and plants at the site, the meteorologic properties that contribute the site being a groundwater discharge zone are identical. The potential evaporation is high in this area of the Great Salt Lake Desert (NOAA, 1983).
- A nation-wide map (Figure 2) showing EZD for bare ground conditions suggests a maximum EZD of 48 inches (Schroeder, et al., 1994b) for the region containing Salt Lake City, Park City, Jackson Wyoming, Aspen, Colorado, and Coeur d'Alene, Idaho, as well as the Great Salt Lake Desert, in which the Clive site is located. The map suggests a **minimum** EZD of 16 inches for the same region. The minimum EZD for the broad region shown in the HELP model engineering documentation would more likely apply to higher altitude sites than to lower altitude desert environments. This fact is reflected in the NCDC Climatic Atlas of the United States (NOAA, 1983) which shows that the mean annual lake evaporation in the region designated by the HELP model documentation ranges from less than 26 inches to over 50 inches, with the Clive site showing about 43 inches mean annual lake evaporation.
- A conversation with HELP co-author Lee Peyton during the original LARW modeling led to the conclusion that the evaporative zone depth probably extends at least to the bottom of the rip rap layer, and probably into the upper portion of the filter zone below (ABC, 1997).
- Vapor diffusion is the primary process that will cause evaporation to occur in the rip rap cobble layer. This process is well-documented in the literature. Corey and Kemper (1968) state that "if gravel is at the surface…water transferred upward through the gravel layer is by vapor diffusion ." This process removes moisture from the surfaces of cobbles, particularly during low intensity storm events.

[1] Upper limit of Stage 1 evaporation (U) in inches/day is determined by $U=(9/25.4)*(3.3-3.0)^{0.42}$ (Schroeder, et al., 1994b).

- The 20-inch EZD is considered conservative when combined with the hydraulic properties of the rip rap used in the current modeling. The HELP model water balance indicates that over 1.5 inches of water percolate through the base of the rip rap on average annually. However, background conditions at the Clive site indicate that net infiltration is zero (or negative) for undisturbed native soils (Harrill, et al, 1988). Therefore, the 1.5+ inches that percolate downward through the rip rap in the model are significantly higher than in natural background conditions.
- Evaluations of the HELP3 model indicate that "an evaporative zone depth of 100 cm [39.4 inches] may be used for bare soil because no transpiration occurs and HELP computes an internal value for the soil evaporative depth" (Berger, 2002) based on soil material properties. Similarly, numerical modeling of six test cells in New Mexico used a maximum evaporative zone depth of 100 cm (Dwyer, 2003).

Based on this information, the 20-inch maximum EZD used in the modeling is considered an environmentally-conservative underestimate of the actual zone in which evaporation may occur from the CAW cell.

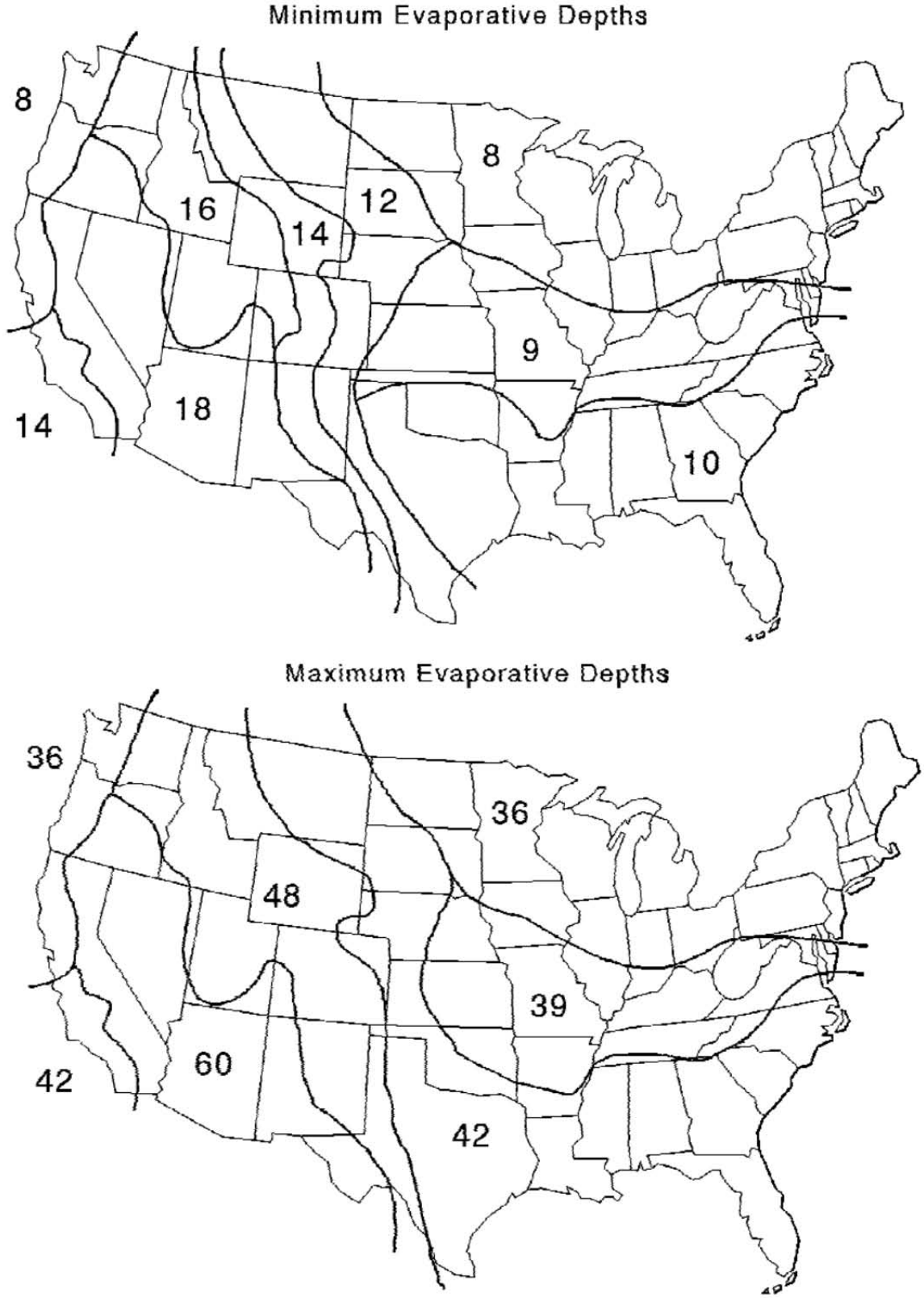



***Figure 2. Geographic Distribution of Maximum and Minimum Evaporative Zone Depths***
(Shroeder, et al., 1994b)

*Maximum Leaf Area Index*. The maximum leaf area was set to zero, which is appropriate for bare ground. The CAW cell will not be vegetated.

*Growing Season*. The model is insensitive to the input values for the start and end of growing season, because the CAW cell will not be vegetated. The growing season for Salt Lake City (start day 117, end day 289) was left as the default input.

*Wind Speed.* The site-specific 17-year average wind speed (July 1, 1992 through December 31, 2009) of 3.2 meters per second (7.2 miles per hour) was used in the base case model. This value is 25% higher than the long-term average wind speed from Dugway, Utah (5.75 mph) used in previous modeling.

Previous sensitivity analyses using wind speeds of 5.75, 7.27, and 8.8 mph (ABC, 1997) indicated that the HELP model is insensitive to slight variations in wind speed. As stated in the 1997 report:

> "Long-term climatic data from Dugway … indicates that the average annual wind speed is 5 knots (5.75 mph). The long term average wind speed measured at the site from April through September 1994 was 3.5 meters per second … or 7.27 mph. The default wind speed for Salt Lake City is 8.8 mph. The long-term Dugway value of 5 knots (5.75 mph) was used in the modeling. A sensitivity analysis … indicates that the model was insensitive to these slight variations in wind speed."

The site-specific average wind speed (3.2 meters per second, 7.2 mph) used in the CAW cell modeling is within the range of previous sensitivity analyses.

*Relative Humidity*. The long-term relative humidity data from Dugway was used in the HELP model simulations. The data are based on a 20-year period of record of monthly mean relative humidity values, from 13:00 hours local standard time from NWS, NOAA. The quarterly values were derived as a simple average of the monthly values.

***Table 2. Quarterly Relative Humidity at Dugway Proving Ground***

| Quarter | Month 1 | Month 2 | Month 3 | Quarterly Average |
|---|---|---|---|---|
| 1st (Jan., Feb., Mar.) | 57.9 | 52.8 | 40.9 | 50.5 |
| 2nd (Apr., May, June) | 33.4 | 27.5 | 25 | 28.6 |
| 3rd (July, Aug., Sept.) | 19.8 | 21.8 | 26.7 | 22.7 |
| 4th (Oct., Nov., Dec.) | 34.3 | 47.2 | 62.4 | 47.9 |

Note: Dugway average monthly relative humidity data from 13:00 hours local standard time from NWS, NOAA (summarized from NOAA internet site data)

### *2.2.2 Precipitation*

Precipitation data were generated using the HELP synthetic precipitation generator to stochastically generate 100 years of daily precipitation data. The mean monthly precipitation values, from which the 100 years of daily precipitation data were generated, include 17 years of recorded precipitation available for the Clive site (MSI, 2010). The precipitation measured from 1992 – 2009 at the Clive meteorological station is summarized in Table 3. The annual average precipitation, based on valid data from the 17-year record, is 8.53 in/yr. The monthly values were input to the HELP synthetic weather generator, which generated a 100-year data set with an average annual precipitation of 8.44 in/yr.[2.]

[2] The synthetic weather generator created a 100-year synthetic precipitation data set having a mean annual precipitation of 8.44 inches per year, which was 99% of the sum of the monthly values (8.53 inches) input to the weather generator. The difference of 1% (0.09 inches) in the mean is within the expected range of variability in data sets produced by the synthetic weather generator.

A statistical analysis of the 100-year synthetic precipitation data set indicates that the synthetic weather generator produced daily data having a mean annual precipitation of 8.44 in/yr, with a minimum of 4.87 in/yr and a maximum of 12.65 in/yr. The 100-year data set contains 232 days having precipitation greater than 0.4 inches, 53 days having precipitation greater than 0.6 inches, and 19 days having precipitation greater than 0.8 inches. The complete data set is presented in Attachment 4, file U100.d4.

***Table 3. Summary of Precipitation at Clive, Utah July 1992 through December 2009***

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | | | | | | | 0.51 | 0.24 | 0.07 | 0.89 | 0.33 | 1.03 | n/a |
| 1993 | 1.17 | 0.39 | 0.67 | 0.17 | 0.99 | 0.7 | 0.03 | 0.1 | 0.27 | 0.78 | 0.33 | 0.18 | 5.78 |
| 1994 | 0.13 | 0.63 | 1.14 | 1.66 | 0.79 | 0.02 | 0.06 | 0.39 | 0.51 | 0.89 | 1.91 | 0.22 | 8.35 |
| 1995 | 0.95 | 0.78 | 1.74 | 0.44 | 2.58 | 1.88 | 0.17 | 0.04 | 0.15 | 0.06 | 0.24 | 0.78 | 9.81 |
| 1996 | 1.31 | 0.78 | 0.88 | 0.91 | 1.9 | 0.29 | 1.1 | 0.01 | 0.41 | 0.69 | 0.6 | 0.77 | 9.65 |
| 1997 | 1.56 | 0.87 | 0.17 | 1.42 | 0.98 | 2.36 | 1.19 | 0.32 | 0.9 | 0.47 | 0.72 | 0.6 | 11.56 |
| 1998 | 0.71 | 2.21 | 1.67 | 1.63 | 1.04 | 2.69 | 0.43 | 0.28 | 0.52 | 1.94 | 0.1 | 0.32 | 13.54 |
| 1999 | 0.81 | 0.64 | 0.46 | 2.65 | 0.41 | 1.84 | 0.06 | 0.68 | 0.12 | 0.04 | 0.13 | 0.18 | 8.02 |
| 2000 | 1.31 | 1.87 | 0.23 | 0.38 | 0.53 | 0.10 | 0.07 | 1.05 | 0.15 | 1.92 | 0.15 | 0.44 | 8.2 |
| 2001 | 0.21 | 0.55 | 1.48 | 1.17 | 0.0 | 0.52 | 0.13 | 0.25 | 0.22 | 0.2 | 1.25 | 0.81 | 6.79 |
| 2002 | 0.50 | 0.07 | 0.44 | 1.36 | 0.57 | 0.08 | 0.24 | 0.01 | 0.52 | 0.95 | 0.50[a] | 0.51[a] | 5.75[b] |
| 2003 | 0.79[a] | 0.86[a] | 0.85[a] | 1.18[a] | 0.91 | 0.12 | 0.03 | 0.45 | 0.21 | 0.17 | 0.62 | 1.27 | 7.46[b] |
| 2004 | 0.06 | 1.3 | 0.43 | 1.98 | 0.6 | 0.19 | 0.35 | 0.57 | 0.99 | 1.5 | 0.91 | 0.18 | 9.06 |
| 2005 | 1.15 | 1.09 | 0.93 | 1.29 | 2.94 | 0.92 | 0.01 | 0.60 | 0.09 | 0.4 | 0.36 | 0.38 | 10.16 |
| 2006 | 0.82 | 0.25 | 1.58 | 1.24 | 0.51 | 0.33 | 0.32 | 0.58 | 0.35 | 0.94 | 0.25 | 0.22 | 7.39 |
| 2007 | 0.35 | 1.15 | 1.27 | 0.55 | 0.45 | 1.32 | 0.78 | 0.07 | 0.89 | 0.49 | 0.04 | 0.93 | 8.29 |
| 2008 | 0.5 | 0.26 | 0.24 | 0.13 | 0.33 | 0.42 | 0.01 | 0.19 | 0.08 | 0.46 | 0.36 | 0.22 | 3.2 |
| 2009 | 1.04 | 0.86 | 0.31 | 1.97 | 0.64 | 1.32 | 0.05 | 0.06 | 0.48 | 0.76 | 0.05 | 0.58 | 8.12 |
| **17-yr avg** | **0.79[c]** | **0.86[c]** | **0.85[c]** | **1.18[c]** | **0.95** | **0.89** | **0.3** | **0.33** | **0.4** | **0.74** | **0.50[c]** | **0.51[c]** | **8.53** |

Source: MSI (2010)
a) Monthly totals based on 16-year climatological average
b) Annual total based on valid data and 15-year climatological averages
c) Mean is based on 16 years of data (excludes 2002 and 2003 climatological averages)

The 100-year synthetic data set had a mean precipitation of 8.44 inches. For comparison, the 8.44 inches of precipitation used in the HELP model is 11% higher than the long-term average annual precipitation measured at Dugway from September 1950 – December 2009. The monthly precipitation received at Clive has been similar to that received at Dugway over a 17-year period (Figure 3). The monthly average during this period has been similar (Figure 4), although the precipitation received at the Energy*Solutions* Clive site has exceeded Dugway's by 3.5% (Table 4).

Precipitation in recent years has exceeded the long-term average. During the 17-year period from July 1992 to December 2009, the average precipitation at Dugway exceeded the long-term average by 8% (Table 4). Assuming that the Clive precipitation has also exceeded the long-term average by 8%, the calculated long-term precipitation at Clive is 7.88 inches per year (Table 4) and the 8.44 inches used in the model is conservatively high.

The synthetic precipitation data set (with a long-term mean of 8.44 in/yr) used in the HELP model is considered environmentally conservative because 1) the precipitation data set is based on a 17-year period of above-average precipitation in the region and 2) the data set captures extreme precipitation events.

***Figure 3. Monthly Precipitation at Clive and Dugway, July 1992 – December 2009***

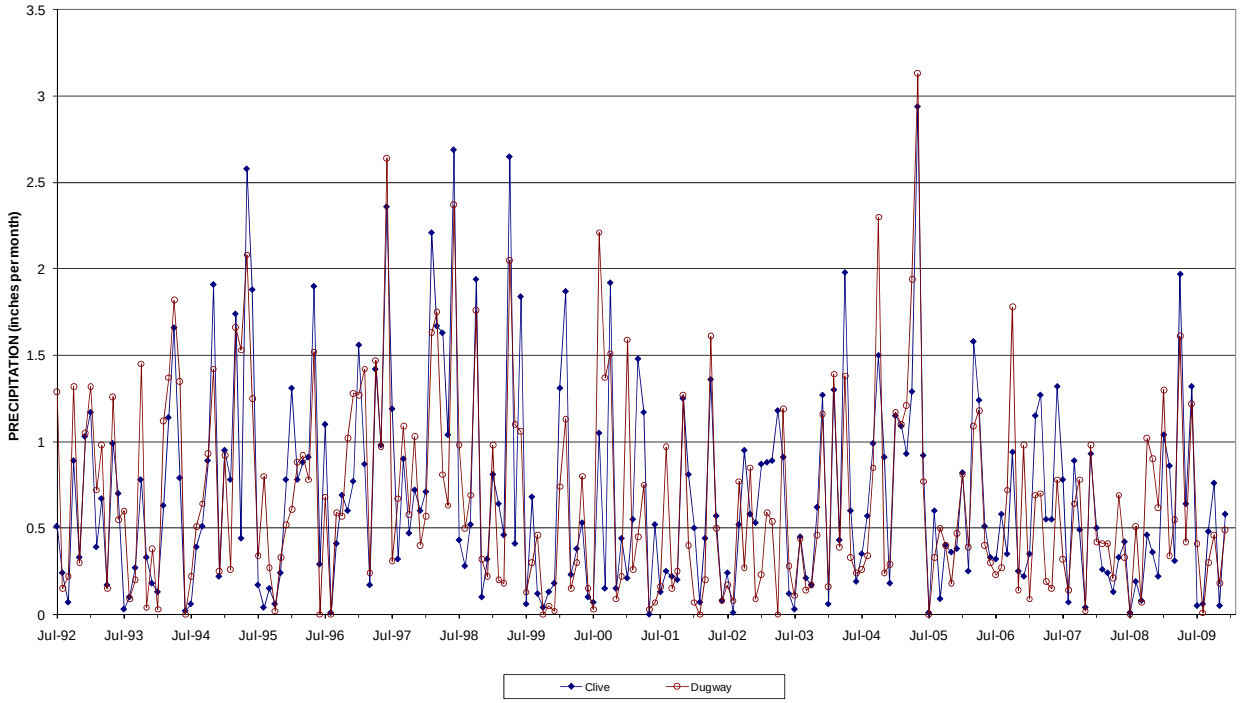



***Figure 4. 17-Year Mean Monthly Precipitation at Clive and Dugway, July 1992 – December 2009***

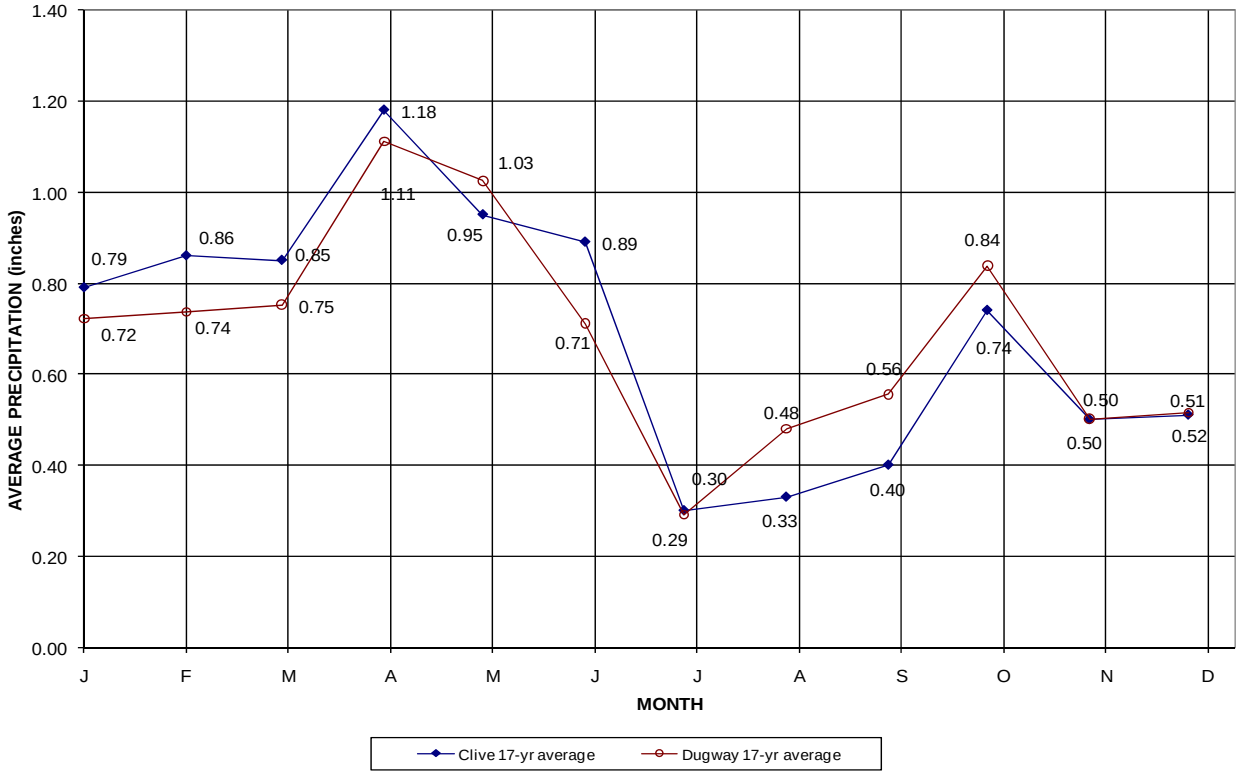


***Table 4. Monthly Precipitation (in inches) at Clive and Dugway Stations July 1992-Dec 2009 with Comparison to Long-Term Mean***

| DATA | J | F | M | A | M | J | J | A | S | O | N | D | ANNUAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17-yr Average Clive | 0.79 | 0.86 | 0.85 | 1.18 | 0.95 | 0.89 | 0.30 | 0.33 | 0.40 | 0.74 | 0.50 | 0.51 | 8.53 |
| 17-yr Average Dugway | 0.72 | 0.74 | 0.75 | 1.11 | 1.03 | 0.71 | 0.29 | 0.48 | 0.56 | 0.84 | 0.50 | 0.52 | 8.24 |
| 1950-2009 Avg. Dugway | 0.56 | 0.61 | 0.73 | 0.84 | 0.98 | 0.55 | 0.46 | 0.55 | 0.58 | 0.73 | 0.53 | 0.56 | 7.61 |
| Dugway 17-yr avg./Long-term | 1.29 | 1.21 | 1.03 | 1.32 | 1.05 | 1.29 | 0.63 | 0.87 | 0.96 | 1.15 | 0.95 | 0.92 | 1.083 |
| Clive fraction of Dugway | 1.09 | 1.17 | 1.13 | 1.06 | 0.93 | 1.25 | 1.03 | 0.69 | 0.72 | 0.88 | 1.00 | 0.99 | 1.035 |
| Clive long-term | 0.58 | 0.63 | 0.76 | 0.87 | 1.01 | 0.57 | 0.48 | 0.57 | 0.60 | 0.76 | 0.55 | 0.58 | 7.88 |
| Clive long-term (sum of monthly means) | | | | | | | | | | | | | 7.95 |

**NOTES:**
Precipitation data reported in inches.
17-year average: Monthly averages for Dugway are based on mean monthly values for July 1992 – December 2009. Annual average is calculated as the sum of the mean monthly values.
% of long-term: Calculated by dividing seventeen-year average at Dugway by the long term average at Dugway; determined that Dugway precipitation from July 1992 - December 2009 has been 8.3% higher than the long-term average.
Clive fraction: Calculated by dividing seventeen-year average at Clive by the seventeen-year average at Dugway; Determined that on an annualized basis, the precipitation at Clive is 103.5% of that at Dugway
Clive long-term: Calculated by multiplying the long-term average at Dugway by the annualized conversion factor (103.5%).
**DATA SOURCES:**
Dugway data for 1950-December 2009 from Western Regional Climate Center (WRCC, 2010)
Clive data from Meteorological Solutions, Inc. (MSI, 2010)
Long-term statistics for Dugway calculated by WRCC
17-year statistics for Clive calculated by MSI
17-year statistics for Dugway calculated by MSI and include 7 monthly values from Sep 2006 – Mar 2007 substituted from Mesowest Station DPG01

### *2.2.3 Temperature*

One hundred years of temperature data were created using the HELP synthetic temperature generator based on coefficients for Salt Lake City and the monthly average temperature at the Clive site. A statistical analysis of the 100 years of synthetic daily precipitation data indicates that the mean daily temperature is 51.74 °F, with a minimum of 2.5 °F and a maximum of 95.1 °F (Table 5). The 100-year data set contains 22,677 days having temperatures lower than 60 °F, 12,062 days having temperatures lower than 40 °F, and 1,218 days having temperatures lower than 20 °F (Table 6).

***Table 5. Summary and Evaluation of Daily Temperature Data in HELP Model 100-Year Synthetic Weather Data Set***

*(See large tables at end of report document)*

***Table 6. Event Distribution of Mean Daily Temperature in 100-year Synthetic Data Set***

| Temperature (°F) | Number of Events |
|---|---|
| <95 | 36,524 |
| <90 | 36,485 |
| <80 | 33,970 |
| <70 | 28,114 |
| <60 | 22,677 |
| <50 | 17,512 |
| <40 | 12,062 |
| <30 | 5,746 |
| <20 | 1,218 |
| <10 | 61 |
| <5 | 6 |

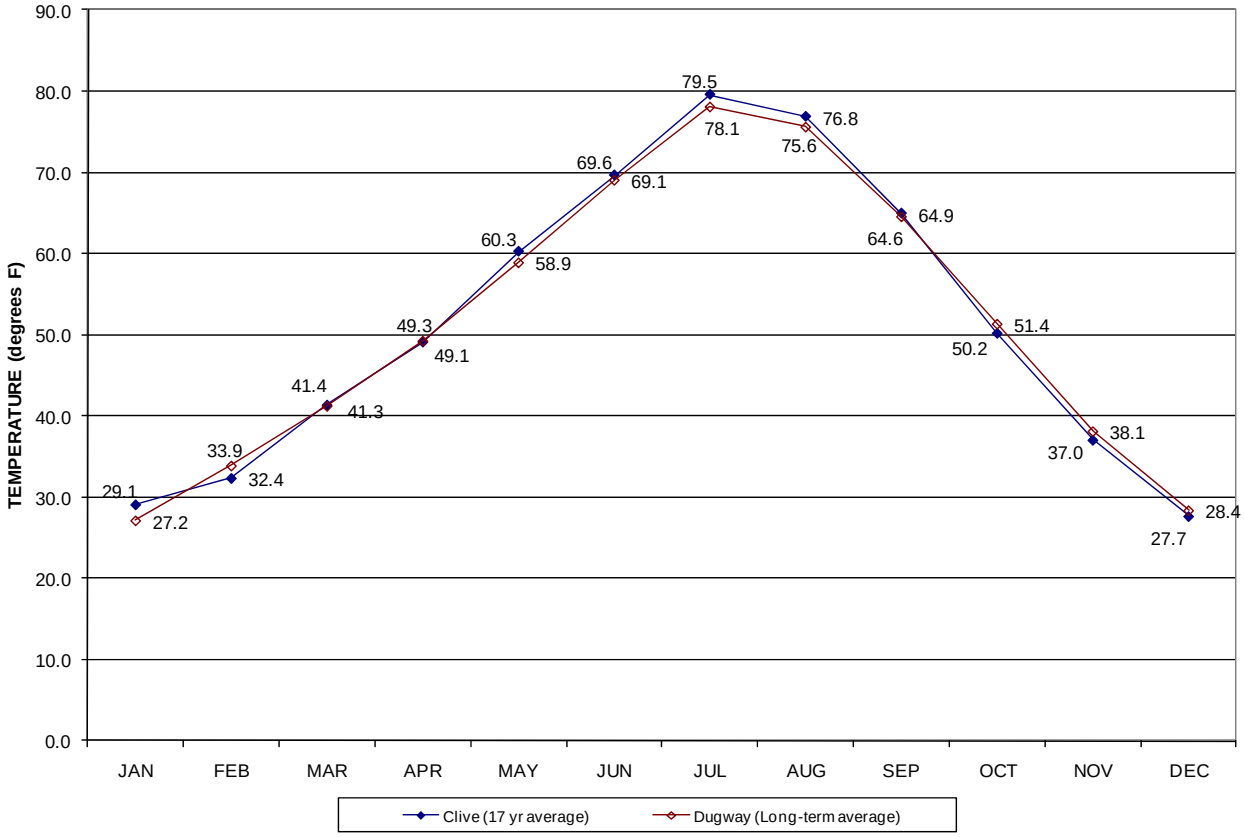
The 17-year average monthly temperatures from the Energy*Solutions* meteorological station (MSI, 2010) compare favorably with the long-term (Sept. 1950 – May 2010) average monthly temperatures at Dugway, Utah (Table 7, Figure 5) indicating that the temperature values from Dugway used in previous modeling were representative of the site. Long-term temperatures for Dugway tend to be slightly higher in the winter and lower in the summer than the 17-year average temperatures for the Clive site.

***Table 7. Mean Monthly Temperature for the EnergySolutions Site***

| Month | 17 -Year Average Temperature (°C) at Energy*Solutions* Site | 17 -Year Average Temperature (°F) at Energy*Solutions* Site | Long-Term Average Temperature (°F) at Dugway Sept 1950 – May 2010 |
|---|---|---|---|
| January | -1.6 | 29.1 | 27.2 |
| February | 0.2 | 32.4 | 33.9 |
| March | 5.2 | 41.4 | 41.3 |
| April | 9.5 | 49.1 | 49.3 |
| May | 15.7 | 60.3 | 58.9 |
| June | 20.9 | 69.6 | 69.1 |
| July | 26.4 | 79.5 | 78.1 |
| August | 24.9 | 76.8 | 75.6 |
| September | 18.3 | 64.9 | 64.6 |
| October | 10.1 | 50.2 | 51.4 |
| November | 2.8 | 37.0 | 38.1 |
| December | -2.4 | 27.7 | 28.4 |

Data Sources: Energy*Solutions* 17-year data: MSI (2010)
Dugway 1950-2010 data: Western Regional Climate Center (WRCC, 2010)

***Figure 5. Comparison of 12-Year Mean Monthly Temperature at Clive (July 1992 – Dec 2009) with Long-term at Dugway (Sept 1950 – May 2010)***




### *2.2.4 Solar Radiation Data*

The synthetic generation of solar radiation data is a strong function of precipitation, therefore the precipitation data sets were generated first, followed by temperature, followed by solar radiation. The solar radiation data set was generated by first generating precipitation data (based the long-term average of 8.53 in/yr), then generating synthetic temperature data (based on long-term mean monthly temperatures at the Energy*Solutions* Clive meteorological station), then generating the solar radiation data using the location coefficients for Salt Lake City and the latitude (40°41'15", 40.6858°) for the Clive site.

Solar radiation data collected at the site over a 17-year period indicates that the maximum solar radiation occurs in June and averages 674 Langleys per day (MSI, 2010).

## 2.3 Landfill Soil and Design Data

The design of the CAW cell is similar to the design of the existing Class A cell, with a larger footprint. At completion, the CAW disposal cell will occupy 2,569 x 2,259 feet (approximately 133 acres). The cell will be excavated into the native Unit 4 silty clay soil. Waste will be placed above a layer of compacted Unit 4 clayey soils, and covered with a layered engineered cover constructed of natural (no man-made) materials. The top slopes of the cell will be finished at a 4.0% grade, with side slopes no steeper than 5:1 (20%).

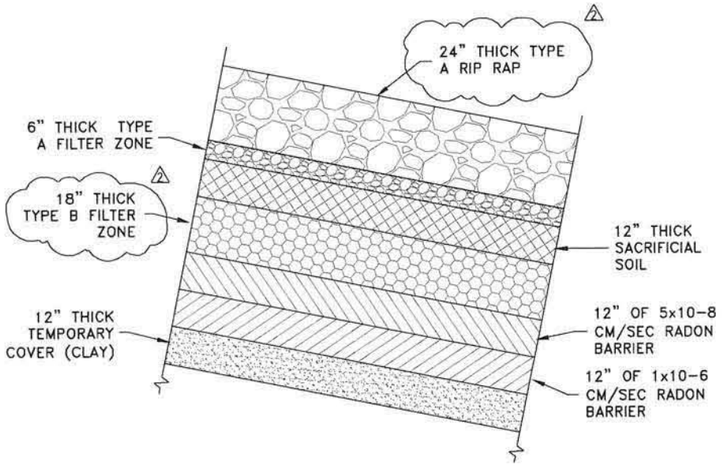
The cover design is engineered to reduce infiltration, prevent erosion, and protect from radionuclide exposure. As shown in Figure 6, the landfill design includes both a low-angled top slope and steeper side slope section of the cover. The layers to be used in the CAW top slope cover are listed in Table 8, and consist of the following, from bottom to top:

- Lower liner. The cell will be lined with a 2-foot thick layer of compacted clayey native soil (Unit 4). This bottom clay liner will be constructed with a field hydraulic conductivity of $1.0 \times 10^{-6}$ centimeters per second (cm/sec) or less.
- Waste. The waste layer will not exceed a final thickness of 75.3 feet above the top of the clay bottom liner. The height of waste at the shoulder of the top slope (the contact between the top slope and side slope) will be approximately 37.6 feet. Therefore the average waste height in the top slope area is 56.5 feet ((75.3+37.6)/2). Since the moisture contents of the waste in the model are initialized to steady state (no moisture goes into or out of storage in the waste), the model is completely insensitive to waste thickness. A unit thickness of 100 inches was used for the waste in all model runs.
- Radon Barrier. The top slope cover design contains an upper radon barrier consisting of 12 inches of compacted clay with a maximum hydraulic conductivity of $5 \times 10^{-8}$ cm/sec and a lower radon barrier consisting of 12 inches of compacted clay with a hydraulic conductivity of $1 \times 10^{-6}$ cm/sec or less.
- Filter Zone (Lower). Six inches of Type-B filter material will be placed above the radon barrier in the top slope cover. This filter material ranges in size from 0.2 to 1.5 inches, with 100% passing a 1 1/2-inch sieve, 24.5% passing a 3/4-inch sieve, and 0.4% passing a no. 4 sieve (0.187 inch). The Type-B size gradation corresponds to a coarse sand and fine gravel mix, according to the Universal Soil Classification System.
- Sacrificial Soil (Frost Protection Layer). A 12-inch layer consisting of a mixture of silty sand and gravel will be placed above the lower filter zone to protect the lower layers of the cover from freeze/thaw effects. The sacrificial soil material ranges in size from <0.003 to 0.75 inches, with 100% passing a 3/4-inch sieve, 50.2% passing a no. 8 sieve (0.093 inch), and 7.6% passing a no. 200 sieve (0.003 inch).
- Filter Zone (Upper). Six inches of Type-A filter material, will be placed above the sacrificial soil in the top slope cover. The Type-A filter material ranges in size from 0.08 to 6.0 inches, with 100% passing a 6-inch sieve, 70% passing a 3-inch sieve, and not more than 10% passing a no. 10 sieve (0.079 inch). The Type-A size gradation corresponds to a poorly sorted mixture of coarse sand to coarse gravel and cobble, according to the Universal Soil Classification System.
- Rip Rap cobbles. Approximately 24 inches of Type-B rip rap will be placed on the top slopes, above the upper (Type-A) filter zone. The Type-B rip rap used on the top slopes ranges in size from 0.75 to 4.5 inches with a nominal diameter of approximately 1.25 to 2 inches. Engineering specifications indicate that not more than 50% of the Type B rip rap would pass a 1 1/4-inch sieve.

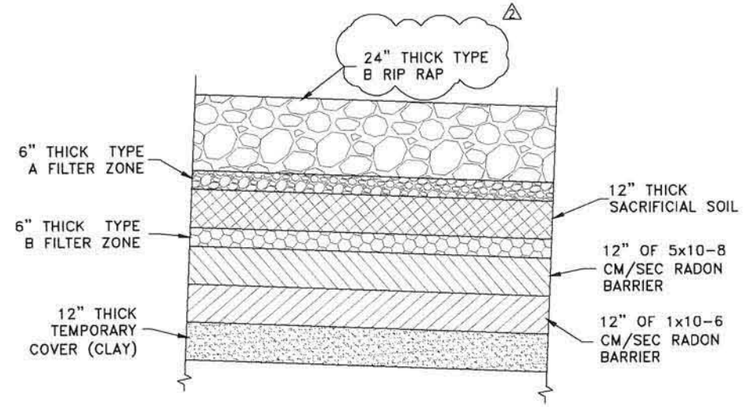
The design for the side slope is similar to the top slope (Figure 6), except for the thickness of the waste layer and the material used in the rip rap layer. The layers used in the CAW side slope cover are listed in Table 8 and consist of the following, from bottom to top:

- Lower liner. (Same design as top slope.)
- Waste. The thickness of waste will range from zero at the edge of the cell to 37.6 feet at the shoulder, for an average waste height of 18.8 feet ((0+37.6)/2). The side-slope infiltration modeling used a unit waste thickness of 100 inches, as discussed above for the top-slope simulations.
- Radon Barrier. (Same design as top slope.)
- Filter Zone (Lower). The thickness of the Type B filter in the side slope will be 18 inches. The Type B filter material in the side slope will have the same size specifications as the top slope.
- Frost Protection Layer (Sacrificial Soil). (Same design as top slope.)
- Filter Zone (Upper). (Same design as top slope.)

- Rip Rap cobbles. Approximately 24-inches of Type-A rip rap will be placed on the side slopes above the Type-A filter zone. The Type-A rip rap ranges in size from 2 to 16 inches (equivalent to coarse gravel to boulders) with a nominal diameter of 12 inches. Engineering specifications indicate that 100% of the Type-A rip rap would pass a 16-inch screen and not more than 50% would pass a 4 1/2-inch screen.




1 C02 DETAIL–SIDE SLOPE
NTS
TYPICAL SIDE SLOPE COVER DETAIL




2 C02 DETAIL–TOP SLOPE
NTS
TYPICAL TOP SLOPE COVER DETAIL

## COVER MATERIAL GRADATIONS (ASTM C-136)

TYPE A RIP RAP
- $D_{100}$<= 16 INCH
- $D_{90}$ <= 12 INCH
- $D_{50}$ >= 4-1/2 INCH
- $D_{10}$ >= 2 INCH
- $D_5$ >= NO. 200 SIEVE

TYPE B RIP RAP
- $D_{100}$<= 4-1/2 INCH
- $D_{50}$ >= 1-1/4 INCH
- $D_{10}$ >= 3/4 INCH
- $D_5$ >= NO. 200 SIEVE

TYPE A FILTER ZONE
- $D_{100}$<= 6 INCH
- $D_{70}$ <= 3 INCH
- $D_{50}$ <= 1.57 INCH (40 mm)
- $D_{15}$ <= .85 INCH (22 mm)
- $D_{10}$ >= NO. 10 SIEVE (2mm)
- $D_5$ >= NO. 200 SIEVE

TYPE B FILTER & SACRIFICIAL SOIL

TYPE B FILTER & SACRIFICAIL SOIL MATERIAL GRADATIONS ARE DETERMINED BY THE FOLLOWING SPECIFICATION:

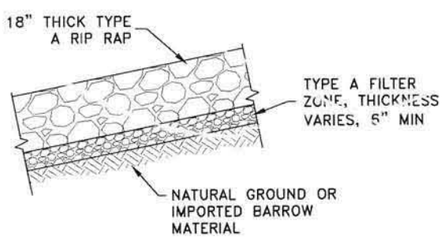
$\frac{D15\ FILTER}{D85\ SOIL}$ MUST BE < 5

$\frac{D50\ FILTER}{D50\ SOIL}$ MUST BE <= 25

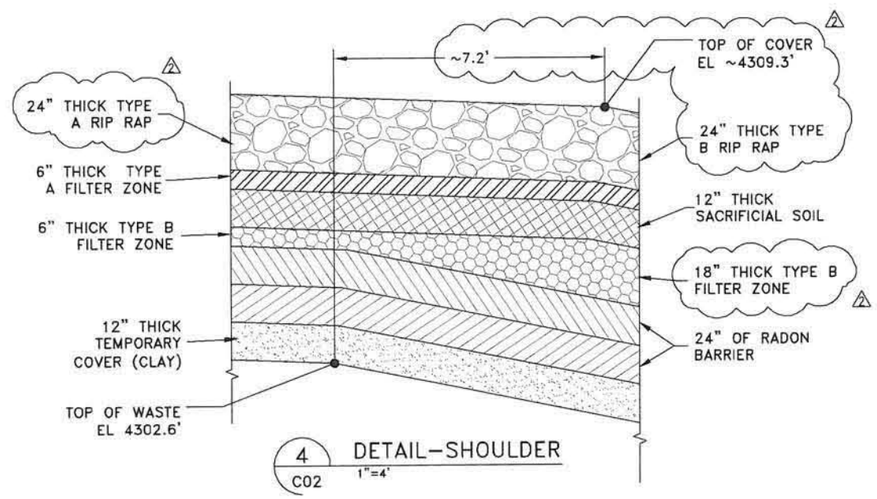
$\frac{D15\ FILTER}{D15\ SOIL}$ MUST BE >= 4

TYPE B FILTER MIN PERMEABILITY = 3.5 cm/sec

SACRIFICIAL SOIL MIN MOISTURE @ 15 atm = 3.5%




3 C02 DETAIL–DITCH OUTER SLOPE
NTS
TYPICAL PERIMETER DITCH COVER DETAIL




4 C02 DETAIL–SHOULDER
1"=4'

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
11/3/11
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 11/3/11 | DFB | FOR LICENSING: INCREASED RIP RAP TO 24" AND SIDE SLOPE TYPE B FILTER TO 18" |
| 10/4/11 | DFB | FOR LICENSING: INCREASED DITCH RIPRAP THICKNESS & ADDED MATIL SPEC |
| 4/28/11 | DFB | FOR LICENSING |

ENERGYSOLUTIONS
ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
SECTIONS AND DETAILS, 2 OF 2
CLIVE, UTAH

FIGURE 6
FINAL DRAWING

DRAWN BY D. BOOTH
REVIEWED BY G. DUTSON
APPROVED BY D. BOOTH
SCALE AS NOTED DATE 04/28/11 REV. 2
DRAWING NO. 10014 C04

## *Table 8. Class A West Cell HELP Model Layers and Material Properties*

| TOP SLOPE DESIGN - CLASS A WEST CELL | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Layer | Material | Thickness (inches) | n (v/v) | $\theta_{fc}$ (v/v) | $\theta_{wp}$ (v/v) | $\theta_i$ (v/v) | $K_s$ (cm/sec) | Layer Type n/a | Size (inches) | Material Description |
| Layer 1 | Type-B Rip Rap | 24 | 0.190 | 0.024 | 0.007 | initialized to ss | 42 | vertical percolation | 0.75-4.5 | 1.25 inches |
| Layer 2 | Type-A Filter (upper) | 6 | 0.190 | 0.024 | 0.007 | initialized to ss | 42 | vertical percolation | 0.08-6.0 | Coarse Sand - Fine Cobble |
| Layer 3 | Sacrificial Soil | 12 | 0.31 | 0.2 | 0.025 | initialized to ss | 4.00E-03 | vertical percolation | <0.75 | Silty Sand and Gravel |
| Layer 4 | Type-B Filter (lower) | 6 | 0.28 | 0.032 | 0.013 | initialized to ss | 3.5 | lateral drainage | 0.2-1.5 | Coarse Sand -Fine Gravel |
| Layer 5 | Upper Radon Barrier | 12 | 0.430 | 0.390 | 0.28 | 0.43 | 5.00E-08 | barrier soil | n/a | Clay |
| Layer 6 | Lower Radon Barrier | 12 | 0.430 | 0.390 | 0.28 | initialized to ss | 1.00E-06 | vertical percolation | n/a | Clay |
| Layer 7 | Waste | 100 | 0.437 | 0.062 | 0.024 | initialized to ss | 5.00E-04 | vertical percolation | n/a | Sand |
| Layer 8 | Clay Liner | 24 | 0.430 | 0.390 | 0.28 | 0.43 | 1.00E-06 | barrier soil | n/a | Clay |

| SIDE SLOPE DESIGN - CLASS A WEST CELL | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Layer | Material | Thickness (inches) | n (v/v) | $\theta_{fc}$ (v/v) | $\theta_{wp}$ (v/v) | $\theta_i$ (v/v) | $K_s$ (cm/sec) | Layer Type n/a | Size (inches) | Material Description |
| Layer 1 | Type-A Rip Rap | 24 | 0.170 | 0.007 | 0.003 | initialized to ss | 80 | vertical percolation | 2.0-16.0 | 12 inches |
| Layer 2 | Type-A Filter (upper) | 6 | 0.190 | 0.024 | 0.007 | initialized to ss | 42 | vertical percolation | 0.08-6.0 | Coarse Sand - Fine Cobble |
| Layer 3 | Sacrificial Soil | 12 | 0.31 | 0.2 | 0.025 | initialized to ss | 4.0E-03 | vertical percolation | <0.75 | Silty Sand and Gravel |
| Layer 4 | Type-B Filter (lower) | 18 | 0.28 | 0.032 | 0.013 | initialized to ss | 3.5 | lateral drainage | 0.2-1.5 | Coarse Sand -Fine Gravel |
| Layer 5 | Upper Radon Barrier | 12 | 0.430 | 0.390 | 0.28 | 0.43 | 5.0E-08 | barrier soil | n/a | Clay |
| Layer 6 | Lower Radon Barrier | 12 | 0.430 | 0.390 | 0.28 | initialized to ss | 1.0E-06 | vertical percolation | n/a | Clay |
| Layer 7 | Waste (Side Slopes) | 100 | 0.437 | 0.062 | 0.024 | initialized to ss | 5.0E-04 | vertical percolation | n/a | Sand |
| Layer 8 | Clay Liner (Side Slope) | 24 | 0.430 | 0.390 | 0.28 | 0.43 | 1.0E-06 | barrier soil | n/a | Clay |

Notes:
n = porosity
$\theta_{fc}$ = field capacity
$\theta_{wp}$ = wilting point
$\theta_i$ = initial moisture content
$K_s$ = saturated hydraulic conductivity
n/a = not applicable
ss = steady state

### *2.3.1 Side Slope Run-On*

The side-slope modeling includes the effects of run-on from the filter layers in the Top Slope. As described in previous reports, run-on or drainage from up-slope can be simulated by adjusting the slope length to an effective length (L'). The procedure is summarized as follows:

1. Run the HELP3 simulation on the up-slope panel (which is the Top Slope, in this case.) Note the initial volume estimate of drainage ($D_u$).
2. Run the simulation on the receiving (down-slope) panel using the actual slope length (L) for that section. Note the initial volume estimate of drainage ($D_{d1}$).
3. Determine an incremental increase in slope length ($\Delta L$):

$$\Delta L = L \cdot \left( \frac{D_u}{D_d} \right)$$

4. Add the incremental increase in slope length to the initial slope length to determine the effective slope length:

$$L' = \Delta L + L$$

5. If the new estimate of drainage ($D_{d2}$) is significantly different from the previous estimate ($D_{d1}$), repeat the process to calculate a new effective length (L') and run the simulation again to compute a final estimate of drainage ($D_d$), runoff, evapotranspiration, and percolation.

The effective slope length calculations are shown in Table 9.

***Table 9. CAW Cell HELP Infiltration Modeling – Effective Slope Length For Lateral Drainage Run-On To Side Slopes***

| RUN | DESCRIPTION | SLOPE LENGTH ft. | WIDTH ft. | AREA acres | PERC. in. | LATERAL DRAINAGE | in. | $ft^3/yr$ | $\Delta L$ | L' |
|---|---|---|---|---|---|---|---|---|---|---|
| MT6-2024 | Upslope Drainage | 940 | 100 | 2.1579 | 0.036 | $D_u$ | 1.613 | 12662 | | |
| S18-24 | Downslope Drainage, Without Run-on | 188 | 100 | 0.4316 | 0.043 | $D_{d1}$ | 1.513 | 2370 | 1004 | 1192 |
| S18-24R1 | Downslope Drainage, 1st Iteration | 1192 | 100 | 0.4316 | 0.066 | $D_{d2}$ | 1.492 | 2333 | 1020 | 1208 |
| S18-24R2 | Downslope Drainage, 2nd Iteration | 1208 | 100 | 0.4316 | 0.066 | $D_{d3}$ | 1.489 | 2333 | 1021 | 1209 |

Note: PERC. = percolation
$\Delta L$ = change in slope length
L' = effective slope length

## 2.4 HELP Infiltration Modeling Results

The results of the HELP modeling runs are summarized in Table 10 and Table 11 and discussed in the following sections. The output files are provided in Attachment 1.

***Table 10. CAW Cell HELP Infiltration Model Results***

| RUN: | CASE: | INFILTRATION (inches) | (cm) |
|---|---|---|---|
| MT6-2024 | Top-slope, 942 ft length, 6" Type-B filter | 0.036 | 0.090 |
| S18-24 | Side-slope, 188 ft length, 18" thick Type-B filter, 24" Rip Rap, no run-on | 0.043 | 0.109 |
| S18-24R1 | Side-slope, 1192 ft length, 18" thick Type-B, 24" Rip Rap, w/run-on, 1st iteration | 0.066 | 0.167 |
| S18-24R2 | Side-slope, 1208 ft length, 18" thick Type-B, 24" Rip Rap, w/run-on 2nd iteration | 0.066 | 0.168 |

***Table 11. CAW Cell HELP Infiltration Model Water Balance Summary (in/yr)***

| **HELP Results (inches of water)** | **Top Slope** MT6-2024 | **Side Slope** S18-24R2 |
|---|---|---|
| Precipitation | 8.44 | 8.44 |
| Runoff | 0.031 | 0.036 |
| Evapotranspiration | 6.761 | 6.850 |
| Drainage Collected from Type B Filter | 1.613 | 1.489 |
| Percolation/leakage through Upper Radon Barrier | 0.035 | 0.066 |
| Average Head on Top of Upper Radon Barrier | 0.005 | 0.002 |
| Percolation/Leakage through Clay Liner | 0.036 | 0.066 |
| Average Head on Top of Clay Liner | 0.000 | 0.000 |
| Change in Water Storage | 0.000 | 0.000 |

### *2.4.1 Top Slope Infiltration Results*

The top slope infiltration modeling indicates that an average of 0.036 in/yr (0.090 cm/yr) will infiltrate through the CAW cell top slope under long-term quasi-steady state. The infiltration rate is affected by the relatively long slope length, low precipitation, and lateral drainage layers. Because the moisture contents of the lower radon barrier in the model are initialized to steady state (no moisture goes into or out of storage in the lower radon barrier), the model is completely insensitive to lower radon barrier thickness.

### *2.4.2 Side Slope Infiltration Results*

The side slope infiltration modeling indicates that an average of 0.066 in/yr (0.168 cm/yr) would infiltrate through the side slope cover. The infiltration rate is affected by the relatively long slope length, low precipitation, and lateral drainage layers. Because the moisture contents of the lower radon barrier in the model are initialized to steady state (no moisture goes into or out of storage in the lower radon barrier), the model is completely insensitive to lower radon barrier thickness.

# 3. MOISTURE CONTENT (UNSAT-H) MODELING

The UNSAT-H model was used to predict the moisture content in the radon barrier, waste, clay liner, and Unit 3 sand and Unit 2 clay to the top of the aquifer. The final moisture content from UNSAT-H is used as input to the contaminant transport modeling (PATHRAE). Although the HELP model does report the final moisture content in each model layer for each simulation, the UNSAT-H model is considered to be more accurate with regard to predicting moisture content.

## 3.1 UNSAT-H Code

The UNSAT-H code was developed at Pacific Northwest Laboratory for assessing the water dynamics of arid sites which are used or proposed for near-surface waste disposal. The code can be used to estimate recharge/percolation rates and to assist in optimizing barrier design. Groundwater flow in the vadose zone is modeled using a one-dimensional finite-difference analysis.

The UNSAT-H code models groundwater flow in the unsaturated zone using a modified form of the Richards Equation (Richards, 1931), which describes the change in water storage and redistribution at every point within the soil profile. The flows across the boundaries of the profile are represented by specified fluxes (precipitation, evaporation, and drainage). The Richards Equation is given by:

$$C(h)\frac{\partial h}{\partial t} = \frac{\partial}{\partial z}\left(K_l(h)\frac{\partial H}{\partial z}\right)$$

where C(h) represents the negative of the specific moisture capacity ($L^3/L^3T$)
h is the negative of $\psi$, the matric (or suction) head potential (L/T)
$K_l(h)$ is the unsaturated hydraulic conductivity function
H is the total hydraulic head (L)

To solve the flow equation, UNSAT-H was supplied with van Genuchten parameters, which define the soil water retention curve, and saturated hydraulic conductivity values. Given the relationships for both hydraulic conductivity and water content as functions of suction head (h), UNSAT-H calculates the capacity term (C). Simply stated, where the volumetric water content in a soil exceeds the soil capacity, water flows downward in response to gravity.

UNSAT-H also has the ability to model heat flow and vapor diffusion. These features were not invoked in the CAW cell model, because the vadose zone modeled below the CAW cell is considered to be below the influence of surface heat flux and above any significant geothermal gradient.

UNSAT-H calculates the unsaturated hydraulic conductivity at each node, at each time step, based on user specifications for the hydraulic conductivity model. The Mualem hydraulic conductivity model (the Mualem [$m$ = 1-(1/$n$)] restriction) was imposed during this modeling exercise, in part because it is recommended for all data sets except for those having a very well-defined soil water retention data set. Also, it is necessary to invoke one of the restrictions ([$m$ = 1-(1/$n$)], [$m$ = 1-(2/$n$)] or $n\rightarrow\infty$) for structured (clay) or coarse-textured (filter zone) soils, and the Mualem [$m$ = 1-(1/$n$)] restriction is consistent with previous modeling.

### *3.1.1 UNSAT-H Model Limitations*

The UNSAT-H code is strictly one-dimensional. As such, it is not suited to the analysis of facility designs that route water laterally (Meyer, et al., 1996). Because the UNSAT-H model was used only to determine the moisture contents and unsaturated hydraulic conductivities (HELP performed the water balance, including lateral water routing), this limitation is not of concern in the current application of the model. Also, the version of UNSAT-H code used (ver. 2.05) allows a maximum of 5 layers per model.

Another consideration is that careful user oversight is required to avoid potentially large mass balance errors, especially when modeling arid environments (Meyer, et al, 1996). The model calculation variables were adjusted in this modeling exercise to prevent overly large mass balance errors.

## 3.2 UNSAT-H Node Geometry

The UNSAT-H model node geometry started at the top of the radon barrier and included the waste, clay liner, and vadose zone below the liner. The waste was modeled using the approximate average[3] thickness of 1,737 cm (57 feet) in the top slope area and 579 cm (19 feet) in the side slope area.

The vertical distance was discretized into nodes, with a finer nodal spacing near layer boundaries and a coarser nodal spacing toward the center of each material layer. In the top slope model, a total of 129 nodes were used to represent the 30.5 cm (12 inches) of upper radon barrier, 30.5 cm (12 inches) of lower radon barrier, 1,737 cm of waste (57 feet), 61 cm (24 inches) of clay liner, and 409 cm (13.4 feet) of Units 2 and 3, with a maximum nodal spacing of 337 cm and a minimum of 0.1 cm. In the side slope model, a total of 125 nodes were used to represent the 30.5 cm (12 inches) of upper radon barrier, 30.5 cm (12 inches) of lower radon barrier, 579 cm of waste (19 feet), 61 cm (24 inches) of clay liner, and 409 cm (13.4 feet) of Units 2 and 3, with a maximum nodal spacing of 128 cm and a minimum of 0.1 cm. The node geometry used for each UNSAT-H model is shown in Table 12.

***Table 12. Layer Thicknesses Used in UNSAT-H Model Runs***

| Model | # of Nodes | Upper Radon Barrier (cm) | Lower Radon Barrier (cm) | Waste (cm) | Clay Liner (cm) | Units 2 and 3 (cm) |
|---|---|---|---|---|---|---|
| Top Slope | 129 | 30.5 | 30.5 | 1,737 | 61 | 409 |
| Side Slope | 125 | 30.5 | 30.5 | 579 | 61 | 409 |

The vadose zone underlying the CAW cell was modeled with a thickness of 13.4 feet (Table 14), which is the distance from the base of the clay liner to the top of the aquifer. The top and base of the clay liner occur at design elevations of 4,265.0 and 4,263.0 ft, respectively. The top of the aquifer occurs at an average elevation of 4,249.6 ft, based on fresh water heads calculated from saline heads measured in 39 wells near the CAW cell in August 2010 (Table 13). The use of the average water level from these 39 wells is conservative, because the length of the capillary zone calculated by UNSAT-H was subtracted from the vertical transport distance in the PATHRAE model, thus decreasing the vertical transport distance even further. The standard deviation of freshwater heads in the 39 wells is 0.49 ft (Table 13), indicating relatively little spatial variation in freshwater equivalent heads beneath the disposal cell in August 2010.

[3] The UNSAT-H model runs use an approximate average waste thickness of 57 feet for the top slope and 19 feet for the side slope, compared to the design average waste thicknesses of 56.5 feet and 18.8 feet. The model is insensitive to slight differences in waste thickness, with respect to the final stabilized moisture content in the waste profile.

### *Table 13. Groundwater Elevation Below the CAW Cell*

| Well ID | STATE PLANE COORDINATES | | Top of Casing | Depth to Water | Fresh Water Correction | Fresh Water Groundwater Elevation |
|---|---|---|---|---|---|---|
| | (feet) | (feet) | (feet) | (feet) | (feet) | (feet) |
| GW-25 | 1191653.78 | 7423063.07 | 4276.24 | 26.03 | 5.04 | 4250.40 |
| GW-26 | 1190914.85 | 7423076.13 | 4274.67 | 24.37 | 3.86 | 4250.46 |
| GW-27 | 1190080.14 | 7423096.01 | 4272.43 | 22.50 | 4.77 | 4250.10 |
| GW-81 | 1190443.90 | 7424663.46 | 4276.78 | 27.14 | 4.90 | 4249.81 |
| GW-82 | 1190775.09 | 7424656.41 | 4276.81 | 27.12 | 4.82 | 4249.84 |
| GW-83 | 1191104.52 | 7424649.76 | 4276.90 | 27.25 | 4.70 | 4249.78 |
| GW-84 | 1191437.33 | 7424643.60 | 4277.29 | 27.70 | 4.55 | 4249.73 |
| GW-85 | 1191760.63 | 7424637.19 | 4277.88 | 28.49 | 4.40 | 4249.53 |
| GW-86 | 1192156.78 | 7424629.75 | 4278.15 | 29.07 | 6.31 | 4249.26 |
| GW-88 | 1192544.56 | 7424621.61 | 4279.58 | 30.38 | 3.28 | 4249.31 |
| GW-89 | 1192538.62 | 7424228.21 | 4279.35 | 30.02 | 3.36 | 4249.45 |
| GW-90 | 1192532.94 | 7423836.73 | 4278.76 | 29.28 | 3.82 | 4249.58 |
| GW-91 | 1192526.75 | 7423442.09 | 4278.48 | 29.00 | 3.82 | 4249.61 |
| GW-92 | 1192519.86 | 7423043.16 | 4279.05 | 28.80 | 4.02 | 4250.32 |
| GW-93 | 1192132.23 | 7423053.12 | 4277.86 | 27.81 | 4.70 | 4250.23 |
| GW-94 | 1191333.27 | 7423069.20 | 4276.55 | 26.30 | 5.32 | 4250.43 |
| GW-95 | 1190503.49 | 7423084.58 | 4274.63 | 24.71 | 3.82 | 4250.07 |
| GW-99 | 1190086.62 | 7423490.09 | 4273.71 | 23.70 | 4.19 | 4250.14 |
| GW-100 | 1190095.32 | 7423883.07 | 4274.37 | 24.51 | 3.91 | 4249.97 |
| GW-101 | 1190103.65 | 7424276.48 | 4275.03 | 25.50 | 5.77 | 4249.70 |
| GW-102 | 1190112.50 | 7424670.52 | 4275.47 | 25.88 | 5.39 | 4249.77 |
| GW-106 | 1190128.01 | 7424985.74 | 4276.18 | 26.80 | 7.71 | 4249.62 |
| GW-107 | 1190138.43 | 7425378.55 | 4276.26 | 26.50 | 7.87 | 4249.99 |
| GW-108 | 1190148.09 | 7425724.70 | 4275.96 | 26.26 | 7.95 | 4249.95 |
| GW-109 | 1190431.34 | 7425719.12 | 4276.46 | 26.99 | 7.49 | 4249.67 |
| GW-110 | 1190759.58 | 7425712.95 | 4276.72 | 27.38 | 7.31 | 4249.53 |
| GW-111 | 1191086.37 | 7425706.84 | 4277.07 | 27.72 | 7.18 | 4249.56 |
| GW-112 | 1191421.81 | 7425701.46 | 4277.40 | 28.40 | 6.87 | 4249.25 |
| GW-113 | 1191832.38 | 7425665.32 | 4278.80 | 29.77 | 6.22 | 4249.26 |
| GW-114 | 1191980.82 | 7425661.87 | 4279.19 | 30.36 | 5.74 | 4249.00 |
| GW-115 | 1192131.65 | 7425659.50 | 4279.87 | 30.82 | 5.72 | 4249.26 |
| GW-116 | 1192281.72 | 7425655.99 | 4280.68 | 31.83 | 5.07 | 4249.03 |
| GW-117 | 1192491.00 | 7425331.85 | 4279.84 | 31.16 | 5.48 | 4248.88 |
| GW-125 | 1192483.38 | 7424975.36 | 4280.27 | 31.19 | 5.59 | 4249.24 |
| GW-137 | 1191789.80 | 7425698.91 | 4278.43 | 29.52 | 4.87 | 4249.05 |
| GW-138 | 1192096.34 | 7425695.21 | 4279.42 | 30.65 | 5.69 | 4248.94 |
| GW-139 | 1192429.66 | 7425689.53 | 4282.92 | 34.27 | 3.71 | 4248.72 |
| GW-140 | 1192424.28 | 7425362.15 | 4280.88 | 32.20 | 5.17 | 4248.81 |
| GW-141 | 1192420.84 | 7425032.89 | 4280.19 | 31.32 | -4.22 | 4248.78 |
| **Mean Elevation** | | | | | | **4249.59** |
| **Standard Deviation** | | | | | | **0.49** |

Note: Depth to water measured August 2010

***Table 14. Thickness of Vadose Zone Below the CAW Cell***

| | | |
|---|---|---|
| Top of Clay Elevation | 4265.0 | ft amsl |
| Clay thickness | 2.0 | ft |
| Base of clay elevation | 4263.0 | ft amsl |
| Water table elevation (Aug 2010) | 4249.6 | ft amsl |
| **Thickness of vadose zone below CAW cell** | **13.4** | **ft** |

## 3.3 Boundary Conditions

The lower boundary of the model was set at a constant head of zero cm, to represent the top of the water table. The layers modeled in UNSAT-H are located below the zone of evaporation and drainage. Therefore, evaporation at the upper boundary was set to zero and "precipitation" was set to the percolation rate predicted by the HELP model.

The upper boundary of the model received moisture as a constant, steady-state application to the top of the radon barrier. The average annual infiltration predicted by HELP was distributed over 24 hours per day, 365 days per year. For the top slope simulation, the infiltration was applied at a rate of 0.00025 cm/day, which equals the 0.090 cm/yr of total infiltration calculated by HELP model run MT6-2024 (Table 15). For the side slope simulation, the infiltration was applied at a rate of 0.00046 cm/day, which equals the 0.168 cm/yr of total infiltration calculated by HELP model run S18-24R2 (Table 15).

***Table 15. Steady-State Seepage Applied to UNSAT-H Model***

| Cell Area | Top Slope | Side Slope |
|---|---|---|
| HELP Model Run | MT6-2024 | S18-24R2 |
| Infiltration (inches/yr) | 0.036 | 0.066 |
| Infiltration (cm/yr) | 0.090 | 0.168 |
| Infiltration (cm/day) | 0.00025 | 0.00046 |
| UNSAT-H Model Run | T24_08 | S18_06 |

According to Meyer, et al. (1996), the UNSAT-H program predicts a higher infiltration rate when the precipitation is distributed as a 24-hour total. Therefore, this approach is conservative, and all of the applied water had the greatest opportunity to infiltrate into the radon barrier.

## 3.4 Initial Head Conditions

The suction head ($\Psi$) was iterated to quasi-steady state, in order to predict the long-term moisture content and velocity in the cover, waste, liner, and underlying soil. The suction head from each run was used as input to the next simulation. Each series was run for an adequate time (140 - 240 years), until quasi-steady state head conditions were achieved.

## 3.5 Material Properties

The UNSAT-H model with the van Genuchten option, required the input of $\theta_r$, $\theta_s$, $K_s$, $\alpha$, $n$, and $m$ for each material modeled. These included the radon barrier, waste, clay liner, and underlying Units 2 and 3. The material properties used in the UNSAT-H modeling of the CAW waste disposal cell (Table 17) are similar to those used in previous modeling. The hydraulic conductivity of Units 2 and 3 is $7.53 \times 10^{-4}$ cm/sec, which is the 90% UCL for the Units 2 and 3, based on 118 slug test results (Table 16). The geometric mean hydraulic conductivity of the 188 slug tests is $6.16 \times 10^{-4}$ cm/sec (Table 16).

***Table 16. Site-Wide Hydraulic Conductivity Values***

*(See large tables at end of report document)*

***Table 17. UNSAT-H Model Material Properties Input Parameters***

| Model | Van Genuchten Parameter | Upper Radon Barrier | Lower Radon Barrier | Waste | Clay Liner | Unit 3 and Upper Unit 2 |
|---|---|---|---|---|---|---|
| Moisture Retention | $\theta_s$ | 0.432 | 0.432 | 0.35 | 0.432 | 0.34 |
| | $\theta_r$ | 0.1 | 0.1 | 0.02 | 0.100 | 0.02 |
| | $\alpha$ | 0.003 | 0.003 | 0.115 | 0.003 | 0.055 |
| | n | 1.172 | 1.172 | 2.013 | 1.172 | 2.518 |
| | m | Mualem | Mualem | Mualem | Mualem | Mualem |
| Conductivity | $K_s$ (cm/sec) | 5.00E-08 | 1.00E-06 | 5.00E-04 | 1.00E-06 | 7.53E-04 |
| | $\alpha$ | 0.003 | 0.003 | 0.115 | 0.003 | 0.055 |
| | n | 1.172 | 1.172 | 2.013 | 1.172 | 2.518 |
| | m | Mualem | Mualem | Mualem | Mualem | Mualem |
| | *l* | 4.5 | 4.5 | 0.5 | 4.5 | 0.5 |

NOTES:
$\theta_s$ = saturated moisture content (v/v)
$\theta_r$ = residual moisture content (v/v)
$\alpha$ = air entry pressure (bubbling pressure)
n = van Genuchten's n, fitting parameter
$K_s$ = saturated hydraulic conductivity (cm/sec)
m = Mualem's m
*l* = pore connectivity parameter

## 3.6 UNSAT-H Modeling Results

The UNSAT-H model was run in 10-year to 50-year increments, using output heads from each model run as input into the successive run. Quasi-steady-state is achieved by running the model for sufficient time that moisture contents stabilize, and water is not taken into or released from storage. The model was run eight times (240 years) for the top slope and six times (140 years) for the side slope, to approach quasi-steady-state conditions. The resulting moisture contents represent the long-term modeled moisture contents in the CAW cell materials and the underlying subsurface.

### *3.6.1 Moisture Content*

The final average moisture content for each model material is summarized in Table 18. Moisture content versus depth for the CAW cell top slope and side slope design are listed in Table 19 and Table 20 and the results are shown graphically in Figure 7 and Figure 8.

The clay layers in the cover and liner of the CAW cell retain high volumetric moisture contents (approximately 0.42 v/v) while the waste and native soil layers have relatively low moisture contents (Table 18). For the top slope model with 0.090 cm/yr infiltration, the average moisture content stabilized at 0.0501 v/v in the waste and 0.0362 v/v in the native soil below the cell (Table 19). The predicted volumetric moisture contents for the CAW cell side slope model is slightly higher than for the top slope model, due to a higher infiltration rate. For the side slope model with 0.168 cm/yr infiltration, the average moisture content stabilized at 0.0541 v/v in the waste and 0.0420 v/v in the native soil below the cell (Table 20). The soil suction head versus depth for the CAW top slope and side slope design are shown in Figure 7 and Figure 8.

***Table 18. UNSAT-H Model Results – Average Moisture Content in Waste, Clay Liner, and Units 2 and 3***

| UNSAT-H Model Run | | | Average Moisture Content (v/v) | | | | |
|---|---|---|---|---|---|---|---|
| Run Name | Description | Infiltration (cm/yr) | Radon Barrier (Upper) | Radon Barrier (Lower) | Waste | Clay Liner | Units 2 and 3 |
| T24_08 | Top Slope, 0.090 cm/yr | 0.090 | 0.4204 | 0.4211 | 0.0501 | 0.4157 | 0.0362 |
| S18_06 | Side Slope, 0.168 cm/yr | 0.168 | 0.4229 | 0.4225 | 0.0541 | 0.4173 | 0.0420 |

### *3.6.2 Capillary Fringe*

The moisture content of the vadose zone below the CAW cell was determined for the zone from the bottom of the clay liner to the top of the capillary fringe. This approach is conservative because 1) a higher vadose zone velocity is calculated using the lower moisture content ($v_v=q/n_e$) and 2) the length of the vertical path was decreased in the PATHRAE model to exclude the capillary fringe.

The UNSAT-H results for the top slope and side slope models (Figure 7 and Figure 8) indicate that the capillary fringe may extend as far as 62.3 cm above the water table. To account for this phenomenon, the distance from the bottom of the waste to the water table was decreased by 2.04 feet in PATHRAE runs, and the moisture contents from the vadose zone (omitting the capillary fringe) were used in determining vertical transport velocities.

## *Table 19. Moisture Content vs. Depth - UNSAT-H Results for CAW Cell Top Slope*

| TOP SLOPE, 0.090 cm/yr | | | | |
|---|---|---|---|---|
| NODE NUMBER | DEPTH | θ | Average θ | Unit / Material |
| 1 | 0.0 | 0.4215 | | Upper Radon Barrier |
| 2 | 0.1 | 0.4215 | | Upper Radon Barrier |
| 3 | 0.3 | 0.4215 | | Upper Radon Barrier |
| 4 | 0.6 | 0.4215 | | Upper Radon Barrier |
| 5 | 1.1 | 0.4215 | | Upper Radon Barrier |
| 6 | 2.0 | 0.4214 | | Upper Radon Barrier |
| 7 | 3.5 | 0.4213 | | Upper Radon Barrier |
| 8 | 6.5 | 0.4212 | | Upper Radon Barrier |
| 9 | 11.5 | 0.4209 | | Upper Radon Barrier |
| 10 | 19.0 | 0.4203 | | Upper Radon Barrier |
| 11 | 24.0 | 0.4200 | | Upper Radon Barrier |
| 12 | 27.0 | 0.4197 | | Upper Radon Barrier |
| 13 | 28.5 | 0.4196 | | Upper Radon Barrier |
| 14 | 29.4 | 0.4195 | | Upper Radon Barrier |
| 15 | 29.9 | 0.4195 | | Upper Radon Barrier |
| 16 | 30.2 | 0.4194 | | Upper Radon Barrier |
| 17 | 30.4 | 0.4194 | | Upper Radon Barrier |
| 18 | 30.5 | 0.4194 | 0.4204 | Upper Radon Barrier |
| 19 | 30.6 | 0.4194 | | Lower Radon Barrier |
| 20 | 30.8 | 0.4194 | | Lower Radon Barrier |
| 21 | 31.1 | 0.4195 | | Lower Radon Barrier |
| 22 | 31.6 | 0.4195 | | Lower Radon Barrier |
| 23 | 32.5 | 0.4196 | | Lower Radon Barrier |
| 24 | 34.0 | 0.4198 | | Lower Radon Barrier |
| 25 | 37.0 | 0.4200 | | Lower Radon Barrier |
| 26 | 42.0 | 0.4205 | | Lower Radon Barrier |
| 27 | 49.5 | 0.4213 | | Lower Radon Barrier |
| 28 | 54.5 | 0.4218 | | Lower Radon Barrier |
| 29 | 57.5 | 0.4221 | | Lower Radon Barrier |
| 30 | 59.0 | 0.4222 | | Lower Radon Barrier |
| 31 | 59.9 | 0.4223 | | Lower Radon Barrier |
| 32 | 60.4 | 0.4224 | | Lower Radon Barrier |
| 33 | 60.7 | 0.4224 | | Lower Radon Barrier |
| 34 | 60.9 | 0.4224 | | Lower Radon Barrier |
| 35 | 61.0 | 0.4224 | 0.4211 | Lower Radon Barrier |
| 36 | 61.1 | 0.0503 | | Waste |
| 37 | 61.3 | 0.0503 | | Waste |
| 38 | 61.6 | 0.0503 | | Waste |
| 39 | 62.1 | 0.0503 | | Waste |
| 40 | 63.0 | 0.0503 | | Waste |
| 41 | 64.5 | 0.0503 | | Waste |
| 42 | 67.5 | 0.0503 | | Waste |
| 43 | 72.5 | 0.0503 | | Waste |
| 44 | 82.5 | 0.0503 | | Waste |
| 45 | 102.5 | 0.0503 | | Waste |
| 46 | 142.5 | 0.0503 | | Waste |
| 47 | 222.5 | 0.0503 | | Waste |
| 48 | 372.5 | 0.0503 | | Waste |
| 49 | 592.5 | 0.0502 | | Waste |
| 50 | 929.5 | 0.0503 | | Waste |
| 51 | 1266.5 | 0.0503 | | Waste |
| 52 | 1486.5 | 0.0503 | | Waste |
| 53 | 1636.5 | 0.0503 | | Waste |
| 54 | 1716.5 | 0.0502 | | Waste |
| 55 | 1756.5 | 0.0491 | | Waste |
| 56 | 1776.5 | 0.0468 | | Waste |
| 57 | 1786.5 | 0.0440 | | Waste |
| 58 | 1791.5 | 0.0416 | | Waste |
| 59 | 1794.5 | 0.0394 | | Waste |
| 60 | 1796.0 | 0.0379 | | Waste |
| 61 | 1796.9 | 0.0368 | | Waste |
| 62 | 1797.4 | 0.0361 | | Waste |
| 63 | 1797.7 | 0.0357 | | Waste |
| 64 | 1797.9 | 0.0353 | | Waste |
| 65 | 1798.0 | 0.0352 | | Waste |
| 66 | 1798.1 | 0.0350 | 0.0501 | Waste |

| TOP SLOPE, 0.090 cm/yr | | | | |
|---|---|---|---|---|
| NODE NUMBER | DEPTH | θ | Average θ | Unit / Material |
| 67 | 1798.2 | 0.4129 | | Clay Liner |
| 67 | 1798.2 | 0.4129 | | Clay Liner |
| 68 | 1798.4 | 0.4129 | | Clay Liner |
| 69 | 1798.7 | 0.4129 | | Clay Liner |
| 70 | 1799.2 | 0.4130 | | Clay Liner |
| 71 | 1799.9 | 0.4131 | | Clay Liner |
| 72 | 1800.9 | 0.4132 | | Clay Liner |
| 73 | 1802.4 | 0.4133 | | Clay Liner |
| 74 | 1804.1 | 0.4137 | | Clay Liner |
| 75 | 1808.1 | 0.4142 | | Clay Liner |
| 76 | 1814.1 | 0.4150 | | Clay Liner |
| 77 | 1824.1 | 0.4158 | | Clay Liner |
| 78 | 1833.1 | 0.4167 | | Clay Liner |
| 79 | 1843.1 | 0.4173 | | Clay Liner |
| 80 | 1849.1 | 0.4176 | | Clay Liner |
| 81 | 1853.1 | 0.4178 | | Clay Liner |
| 82 | 1854.8 | 0.4179 | | Clay Liner |
| 83 | 1856.3 | 0.4180 | | Clay Liner |
| 84 | 1857.3 | 0.4181 | | Clay Liner |
| 85 | 1858.0 | 0.4181 | | Clay Liner |
| 86 | 1858.5 | 0.4182 | | Clay Liner |
| 87 | 1858.8 | 0.4182 | | Clay Liner |
| 88 | 1859.0 | 0.4182 | 0.4157 | Clay Liner |
| 89 | 1859.1 | 0.0359 | | Units 2 and 3 |
| 90 | 1859.2 | 0.0359 | | Units 2 and 3 |
| 91 | 1859.4 | 0.0359 | | Units 2 and 3 |
| 92 | 1859.7 | 0.0359 | | Units 2 and 3 |
| 93 | 1860.2 | 0.0359 | | Units 2 and 3 |
| 94 | 1860.9 | 0.0359 | | Units 2 and 3 |
| 95 | 1861.9 | 0.0359 | | Units 2 and 3 |
| 96 | 1863.4 | 0.0359 | | Units 2 and 3 |
| 97 | 1865.4 | 0.0359 | | Units 2 and 3 |
| 98 | 1868.4 | 0.0359 | | Units 2 and 3 |
| 99 | 1872.4 | 0.0358 | | Units 2 and 3 |
| 100 | 1878.4 | 0.0358 | | Units 2 and 3 |
| 101 | 1888.4 | 0.0358 | | Units 2 and 3 |
| 102 | 1903.4 | 0.0358 | | Units 2 and 3 |
| 103 | 1921.4 | 0.0358 | | Units 2 and 3 |
| 104 | 1942.4 | 0.0358 | | Units 2 and 3 |
| 105 | 1966.4 | 0.0358 | | Units 2 and 3 |
| 106 | 1990.4 | 0.0358 | | Units 2 and 3 |
| 107 | 2014.4 | 0.0358 | | Units 2 and 3 |
| 108 | 2038.4 | 0.0359 | | Units 2 and 3 |
| 109 | 2064.5 | 0.0361 | | Units 2 and 3 |
| 110 | 2088.5 | 0.0368 | | Units 2 and 3 |
| 111 | 2112.5 | 0.0385 | | Units 2 and 3 |
| 112 | 2136.5 | 0.0427 | | Units 2 and 3 |
| 113 | 2160.5 | 0.0518 | | Units 2 and 3 |
| 114 | 2184.5 | 0.0682 | 0.0362 | Units 2 and 3 |
| 115 | 2205.5 | 0.0979 | | Units 2 and 3 |
| 116 | 2223.5 | 0.1524 | | Units 2 and 3 – Capillary Fringe |
| 117 | 2238.5 | 0.2210 | | Units 2 and 3 – Capillary Fringe |
| 118 | 2248.5 | 0.2752 | | Units 2 and 3 – Capillary Fringe |
| 119 | 2254.5 | 0.3089 | | Units 2 and 3 – Capillary Fringe |
| 120 | 2258.5 | 0.3273 | | Units 2 and 3 – Capillary Fringe |
| 121 | 2261.5 | 0.3350 | | Units 2 and 3 – Capillary Fringe |
| 122 | 2263.5 | 0.3383 | | Units 2 and 3 – Capillary Fringe |
| 123 | 2265.0 | 0.3394 | | Units 2 and 3 – Capillary Fringe |
| 124 | 2266.0 | 0.3398 | | Units 2 and 3 – Capillary Fringe |
| 125 | 2266.7 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 126 | 2267.2 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 127 | 2267.5 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 128 | 2267.7 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 129 | 2267.8 | 0.3400 | | Units 2 and 3 – Capillary Fringe |

## *Table 20. Moisture Content vs. Depth - UNSAT-H Results for CAW Cell Side Slope*

| SIDE SLOPE, 0.168 cm/yr | | | | |
|---|---|---|---|---|
| NODE NUMBER | DEPTH | θ | Average θ | Unit / Material |
| 1 | 0.0 | 0.4250 | | Upper Radon Barrier |
| 2 | 0.1 | 0.4250 | | Upper Radon Barrier |
| 3 | 0.3 | 0.4250 | | Upper Radon Barrier |
| 4 | 0.6 | 0.4250 | | Upper Radon Barrier |
| 5 | 1.1 | 0.4249 | | Upper Radon Barrier |
| 6 | 2.0 | 0.4249 | | Upper Radon Barrier |
| 7 | 3.5 | 0.4247 | | Upper Radon Barrier |
| 8 | 6.5 | 0.4244 | | Upper Radon Barrier |
| 9 | 11.5 | 0.4238 | | Upper Radon Barrier |
| 10 | 19.0 | 0.4228 | | Upper Radon Barrier |
| 11 | 24.0 | 0.4220 | | Upper Radon Barrier |
| 12 | 27.0 | 0.4215 | | Upper Radon Barrier |
| 13 | 28.5 | 0.4212 | | Upper Radon Barrier |
| 14 | 29.4 | 0.4210 | | Upper Radon Barrier |
| 15 | 29.9 | 0.4209 | | Upper Radon Barrier |
| 16 | 30.2 | 0.4209 | | Upper Radon Barrier |
| 17 | 30.4 | 0.4208 | | Upper Radon Barrier |
| 18 | 30.5 | 0.4208 | 0.4229 | Upper Radon Barrier |
| 19 | 30.6 | 0.4208 | | Lower Radon Barrier |
| 20 | 30.8 | 0.4208 | | Lower Radon Barrier |
| 21 | 31.1 | 0.4209 | | Lower Radon Barrier |
| 22 | 31.6 | 0.4209 | | Lower Radon Barrier |
| 23 | 32.5 | 0.4210 | | Lower Radon Barrier |
| 24 | 34.0 | 0.4211 | | Lower Radon Barrier |
| 25 | 37.0 | 0.4214 | | Lower Radon Barrier |
| 26 | 42.0 | 0.4219 | | Lower Radon Barrier |
| 27 | 49.5 | 0.4226 | | Lower Radon Barrier |
| 28 | 54.5 | 0.4231 | | Lower Radon Barrier |
| 29 | 57.5 | 0.4234 | | Lower Radon Barrier |
| 30 | 59.0 | 0.4235 | | Lower Radon Barrier |
| 31 | 59.9 | 0.4236 | | Lower Radon Barrier |
| 32 | 60.4 | 0.4237 | | Lower Radon Barrier |
| 33 | 60.7 | 0.4237 | | Lower Radon Barrier |
| 34 | 60.9 | 0.4237 | | Lower Radon Barrier |
| 35 | 61.0 | 0.4237 | 0.4225 | Lower Radon Barrier |
| 36 | 61.1 | 0.0547 | | Waste |
| 37 | 61.3 | 0.0547 | | Waste |
| 38 | 61.6 | 0.0547 | | Waste |
| 39 | 62.1 | 0.0547 | | Waste |
| 40 | 63.0 | 0.0547 | | Waste |
| 41 | 64.5 | 0.0547 | | Waste |
| 42 | 67.5 | 0.0547 | | Waste |
| 43 | 72.5 | 0.0547 | | Waste |
| 44 | 82.5 | 0.0547 | | Waste |
| 45 | 102.5 | 0.0547 | | Waste |
| 46 | 142.5 | 0.0547 | | Waste |
| 47 | 222.5 | 0.0547 | | Waste |
| 48 | 350.5 | 0.0547 | | Waste |
| 49 | 478.5 | 0.0546 | | Waste |
| 50 | 558.5 | 0.0547 | | Waste |
| 51 | 598.5 | 0.0538 | | Waste |
| 52 | 618.5 | 0.0513 | | Waste |
| 53 | 628.5 | 0.0481 | | Waste |
| 54 | 633.5 | 0.0452 | | Waste |
| 55 | 636.5 | 0.0425 | | Waste |
| 56 | 638.0 | 0.0406 | | Waste |
| 57 | 638.9 | 0.0392 | | Waste |
| 58 | 639.4 | 0.0383 | | Waste |
| 59 | 639.7 | 0.0376 | | Waste |
| 60 | 639.9 | 0.0372 | | Waste |
| 61 | 640.0 | 0.0369 | | Waste |
| 62 | 640.1 | 0.0367 | 0.0541 | Waste |
| 63 | 640.2 | 0.4147 | | Clay Liner |

| SIDE SLOPE, 0.168 cm/yr | | | | |
|---|---|---|---|---|
| NODE NUMBER | DEPTH | θ | Average θ | Unit / Material |
| 64 | 640.4 | 0.4147 | | Clay Liner |
| 65 | 640.7 | 0.4147 | | Clay Liner |
| 66 | 641.2 | 0.4147 | | Clay Liner |
| 67 | 641.9 | 0.4148 | | Clay Liner |
| 68 | 642.9 | 0.4149 | | Clay Liner |
| 69 | 644.4 | 0.4150 | | Clay Liner |
| 70 | 646.1 | 0.4151 | | Clay Liner |
| 71 | 650.1 | 0.4154 | | Clay Liner |
| 72 | 656.1 | 0.4159 | | Clay Liner |
| 73 | 666.1 | 0.4167 | | Clay Liner |
| 74 | 675.1 | 0.4174 | | Clay Liner |
| 75 | 685.1 | 0.4182 | | Clay Liner |
| 76 | 691.1 | 0.4187 | | Clay Liner |
| 77 | 695.1 | 0.4191 | | Clay Liner |
| 78 | 696.8 | 0.4192 | | Clay Liner |
| 79 | 698.3 | 0.4194 | | Clay Liner |
| 80 | 699.3 | 0.4195 | | Clay Liner |
| 81 | 700.0 | 0.4195 | | Clay Liner |
| 82 | 700.5 | 0.4196 | | Clay Liner |
| 83 | 700.8 | 0.4196 | | Clay Liner |
| 84 | 701.0 | 0.4196 | | Clay Liner |
| 85 | 701.1 | 0.4196 | 0.4173 | Clay Liner |
| 86 | 701.2 | 0.0387 | | Units 2 and 3 |
| 87 | 701.4 | 0.0387 | | Units 2 and 3 |
| 88 | 701.7 | 0.0387 | | Units 2 and 3 |
| 89 | 702.2 | 0.0387 | | Units 2 and 3 |
| 90 | 702.9 | 0.0387 | | Units 2 and 3 |
| 91 | 703.9 | 0.0387 | | Units 2 and 3 |
| 92 | 705.4 | 0.0387 | | Units 2 and 3 |
| 93 | 707.4 | 0.0387 | | Units 2 and 3 |
| 94 | 710.4 | 0.0387 | | Units 2 and 3 |
| 95 | 714.4 | 0.0387 | | Units 2 and 3 |
| 96 | 720.4 | 0.0387 | | Units 2 and 3 |
| 97 | 730.4 | 0.0387 | | Units 2 and 3 |
| 98 | 745.4 | 0.0387 | | Units 2 and 3 |
| 99 | 763.4 | 0.0387 | | Units 2 and 3 |
| 100 | 784.4 | 0.0387 | | Units 2 and 3 |
| 101 | 808.4 | 0.0387 | | Units 2 and 3 |
| 102 | 832.4 | 0.0387 | | Units 2 and 3 |
| 103 | 856.4 | 0.0387 | | Units 2 and 3 |
| 104 | 880.4 | 0.0387 | | Units 2 and 3 |
| 105 | 906.5 | 0.0387 | | Units 2 and 3 |
| 106 | 930.5 | 0.0388 | | Units 2 and 3 |
| 107 | 954.5 | 0.0391 | | Units 2 and 3 |
| 108 | 978.5 | 0.0403 | | Units 2 and 3 |
| 109 | 1002.5 | 0.0437 | | Units 2 and 3 |
| 110 | 1026.5 | 0.0521 | | Units 2 and 3 |
| 111 | 1047.5 | 0.0683 | 0.0420 | Units 2 and 3 |
| 112 | 1065.5 | 0.0980 | | Units 2 and 3 – Capillary Fringe |
| 113 | 1080.5 | 0.1524 | | Units 2 and 3 – Capillary Fringe |
| 114 | 1090.5 | 0.2210 | | Units 2 and 3 – Capillary Fringe |
| 115 | 1096.5 | 0.2752 | | Units 2 and 3 – Capillary Fringe |
| 116 | 1100.5 | 0.3089 | | Units 2 and 3 – Capillary Fringe |
| 117 | 1103.5 | 0.3273 | | Units 2 and 3 – Capillary Fringe |
| 118 | 1105.5 | 0.3350 | | Units 2 and 3 – Capillary Fringe |
| 119 | 1107.0 | 0.3383 | | Units 2 and 3 – Capillary Fringe |
| 120 | 1108.0 | 0.3394 | | Units 2 and 3 – Capillary Fringe |
| 121 | 1108.7 | 0.3398 | | Units 2 and 3 – Capillary Fringe |
| 122 | 1109.2 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 123 | 1109.5 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 124 | 1109.7 | 0.3400 | | Units 2 and 3 – Capillary Fringe |
| 125 | 1109.8 | 0.3400 | | Units 2 and 3 – Capillary Fringe |

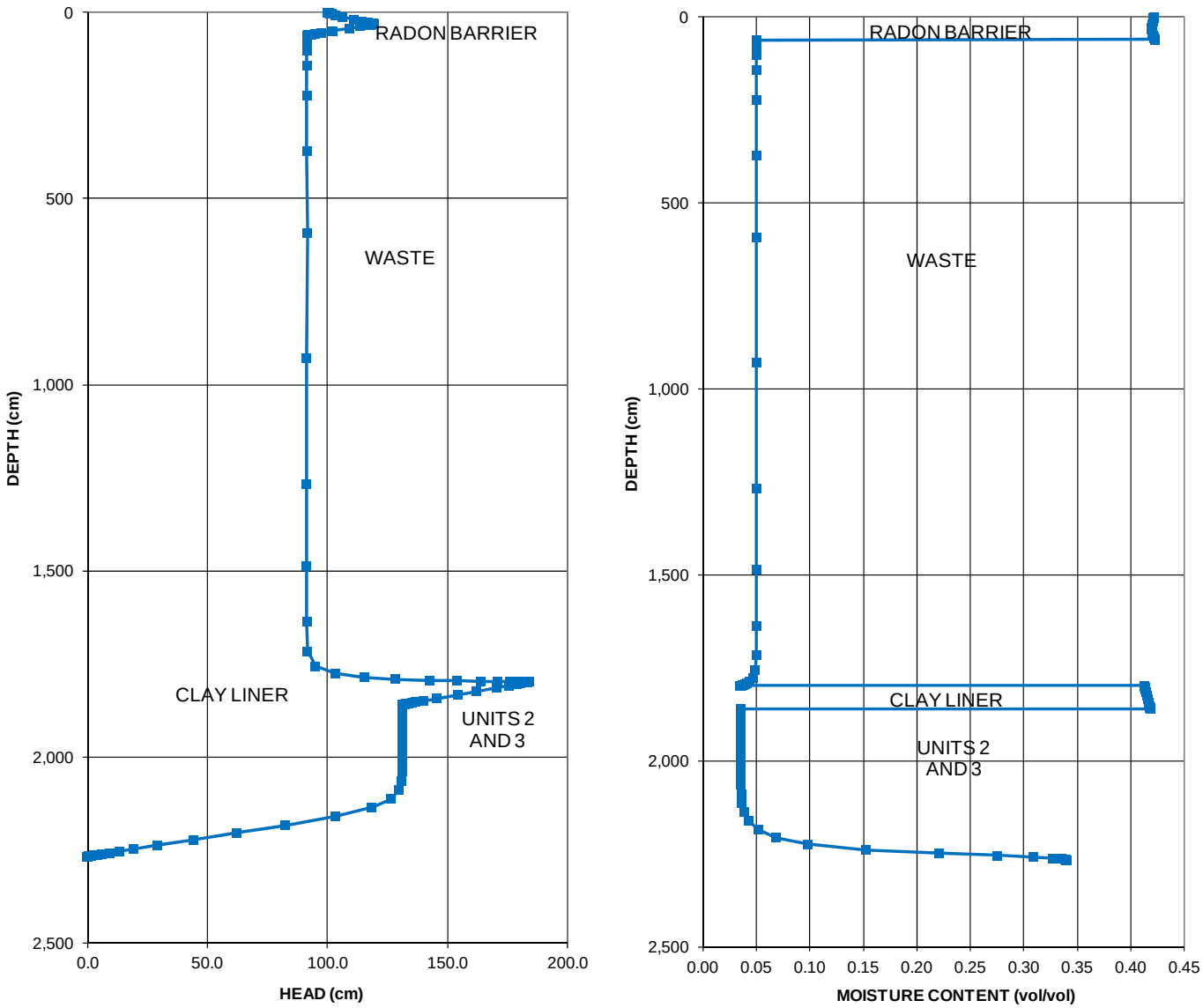



***Figure 7. Suction Head and Moisture Content vs. Depth Below Top of Radon Barrier – UNSAT-H Top Slope Model Results***

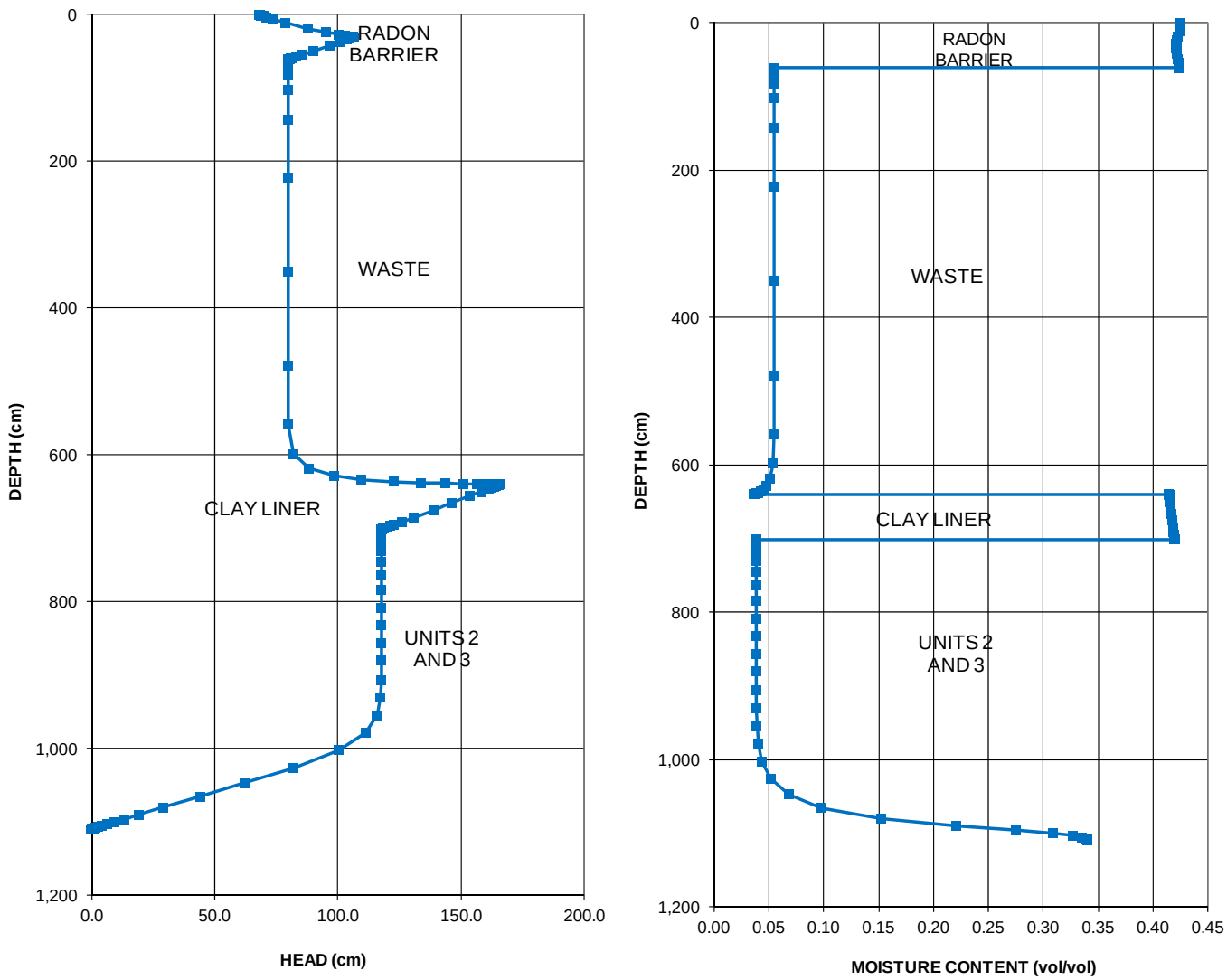



***Figure 8. Suction Head and Moisture Content vs. Depth Below Top of Radon Barrier – UNSAT-H Side Slope Model Results***

# 4. FATE AND TRANSPORT MODELING APPROACH

## 4.1 PATHRAE Code

Transport modeling was performed using the PATHRAE-RAD Performance Assessment Code for the Land Disposal of Radioactive Wastes (Merrell, et. al, 1995). The PATHRAE code was first developed for the US EPA in the 1980s, for use in assessing the maximum annual dose to a critical population group resulting from the disposal of "below regulatory concern" (BRC) wastes. The CAW cell modeling used the PATHRAE-RAD version of the code, which was released on February 9, 1995 (code) and March 1995 (documentation). A modification to the code to allow for more than 10 output times was made by Adrian Brown Consultants in 1997, was verified in the 1998 modeling report (ABC, 1998).

The PATHRAE code is generally made up of three components: release, transport, and uptake solutions. The model calculates a closed form solution for dose (or concentration) at a point in each pathway at a user-specified set of times. The code can be used to simulate multiple transport/receptor pathways. In the CAW cell model, the groundwater to a river and groundwater to a well pathways were applied, in order to determine the concentration at a compliance point located 90 feet from the edge of the disposal cell. The three PATHRAE components are described below:

- *Release.* PATHRAE uses a constant rate for predicting the release of contaminants from the waste, in the current modeling exercise. That is, the model assumes that the quantity of contaminant released each year is a constant fraction of the amount of waste initially present[4].
- *Transport.* The transport component of PATHRAE is similar to that in many other groundwater contaminant transport models. PATHRAE solves the advection/dispersion equation, includes aquifer diffusion, assumes that diffusion is Fickian, allows for retardation of contaminants using a blanket $K_d$ (retardation coefficient), and includes radioactive decay.
- *Uptake.* PATHRAE also calculates the maximum annual doses to a receptor consuming river or well water and crops grown using that water. However, the groundwater protection levels for the Energy*Solutions* site are given as concentrations derived from dose/uptake conversions. Therefore, PATHRAE was used to determine concentrations, rather than dose.

If modeled constituents fail to meet applicable groundwater standards at the water table, then both a vertical transport path and a horizontal transport path are modeled. The vertical model is run first, using the groundwater to river pathway, to determine the arrival time and concentrations of constituents at the water table. The output from the vertical model is then input into the horizontal model, using the discrete dispersed source method which is described in previous reports. The horizontal model uses the groundwater to a well pathway to predict concentrations at a compliance well located 90 feet from the edge of the waste.

## 4.2 Groundwater Protection Levels

Ground Water Protection Levels (GWPLs) are numerical standards that are set by UDEQ in the groundwater quality discharge permit. Groundwater in the vicinity of the site is defined as Class IV, saline ground water (UDEQ, 2009), and GWPLs for existing wells surrounding the Class A and Class A North cells (the site of the proposed CAW cell) were determined by UDEQ according to administrative rules for Class IV saline aquifers. GWPLs were set at the greater of either the Ground Water Quality Standard (GWQS) or the upper boundary of the Background Concentration[5]. Table 1A of the Permit lists

[4] The assumption that the release rate (leach rate) is constant over time is conservative. The release rate would actually decrease over time as the source term concentration decreases.

[5] The upper boundary of the Background Concentration was calculated as the mean concentration plus two standard deviations for each constituent in each individual well, based on Clive facility groundwater quality samples.

"universal" GWPLs that apply to all LARW, Class A, Class A North, and Evaporation Pond wells while Table 1B of the Permit lists GWPL exceptions that apply to specific LARW, Class A, Class A North, and Evaporation Pond wells.

The GWPLs listed in the Permit include only a portion of the 260 Class A radionuclides evaluated in the current modeling. Groundwater standards for the remaining nuclides (not specifically listed in the Permit) were developed from several sources, and all of the compiled standards are referred to as "GWPLs" for convenience. Table 21 lists the numeric GWPLs for all constituents modeled, along with the source of each GWPL. These sources include the following:

- Maximum contaminant levels (MCLs) and secondary MCLs (SMCLs) in drinking water established by UDEQ and the US EPA.
- Proposed drinking water standards for alpha emitters, as published in the EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix C - Alpha Emitters. The EPA's proposed standards for beta, gamma, and alpha emitters were also published in the Federal Register on April 21, 2000.
- Proposed drinking water standards for beta emitters, as published in the - EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix B - Beta Particle and Photon Emitters.
- Site specific GWPL exceptions established by UDEQ for the existing Class A and Class A North monitoring wells. These standards are listed in Table 1B of Energy*Solutions*' groundwater quality discharge permit.
- GWPLs used in previous modeling performed by UDEQ DRC.
- Calculated values using Federal Guidance Report (FGR) 11 or FGR 13. The most conservative (lowest) value calculated by Loren Morton (UDEQ DRC) were selected for nuclides which were not included in EPA's proposed rules or for which background GWPLs had not been established. GWPLs for two nuclides that were not provided in the spreadsheet from Loren Morton were calculated by Wayne Johns using FGR 11. Both Loren Morton and Wayne Johns calculated the GWPL using the following equation:

$$GWPL = \frac{4mrem(CEDE)}{Year} \times \frac{1ALI(\mu Ci)}{5000mrem} \times \frac{10^6\, pCi}{\mu Ci} \times \frac{1year}{365days} \times \frac{1day}{2Liters} = \frac{pCi}{Liter}$$

  Where: CEDE = committed effective dose equivalent
  ALI = annual limits of intake

- The GWPL for Nb-94 was also used for Nb-91 and Nb-92, because no values for these two nuclides are listed in MCLs, FGR 11, or FGR 13. The Nb-94 GWPL would be lower than those of Nb-91, Nb-92 based on radioactive half-life, decay products, and decay energies.
- GWPLs estimated using International Commission on Radiological Protection (ICRP) 30 (for Po-208, Po-209).

The final output from the PATHRAE model was compared to the GWPLs in Table 21 to determine the year in which the GWPL is first exceeded. The year to exceed is conservatively reported as the next *lowest* model output time.

## *Table 21. Ground Water Protection Levels (GWPLs) for CAW Cell Monitoring Wells*

Radiological Constituents:

| PARAMETER | | GWPL (pCi/L) | GWPL (Ci/m$^3$) | Ref. |
|---|---|---|---|---|
| Actinium | Ac-227 | 1.27E+00 | 1.27E-09 | 2 |
| Silver-108m | Ag-108m | 7.23E+02 | 7.23E-07 | 2 |
| Silver-110m | Ag-110m | 5.12E+02 | 5.12E-07 | 2 |
| Aluminum-26 | Al-26 | 4.38E+02 | 4.38E-07 | 5 |
| Americium-241 | Am-241 | 6.45E+00 | 6.45E-09 | 1 |
| Americium-242m | Am-242m | 1.27E+00 | 1.27E-09 | 2 |
| Americium-243 | Am-243 | 6.49E+00 | 6.49E-09 | 1 |
| Barium-133 | Ba-133 | 1.52E+03 | 1.52E-06 | 2 |
| Beryllium-7 | Be-7 | 4.35E+04 | 4.35E-05 | 2 |
| Beryllium-10 | Be-10 | 1.10E+03 | 1.10E-06 | 5 |
| Bismuth-207 | Bi-207 | 1.01E+03 | 1.01E-06 | 2 |
| Bismuth-210m | Bi-210m | 3.46E+01 | 3.46E-08 | 4 |
| Berkelium-247 | Bk-247 | 5.48E-01 | 5.48E-10 | 4 |
| Carbon-14 | C-14 | 3.20E+03 | 3.20E-06 | 2 |
| Calcium-41 | Ca-41 | 3.29E+03 | 3.29E-06 | 5 |
| Calcium-45 | Ca-45 | 1.73E+03 | 1.73E-06 | 2 |
| Cadmium-109 | Cd-109 | 2.27E+02 | 2.27E-07 | 2 |
| Cadmium-113 | Cd-113 | 2.19E+01 | 2.19E-08 | 5 |
| Cadmium-113m | Cd-113m | 2.19E+01 | 2.19E-08 | 4 |
| Californium-249 | Cf-249 | 5.48E-01 | 5.48E-10 | 4 |
| Californium-250 | Cf-250 | 1.10E+00 | 1.10E-09 | 4 |
| Californium-251 | Cf-251 | 5.48E-01 | 5.48E-10 | 4 |
| Californium-252 | Cf-252 | 1.70E+01 | 1.70E-08 | 1 |
| Chlorine-36 | Cl-36 | 1.85E+03 | 1.85E-06 | 2 |
| Curium-242 | Cm-242 | 1.45E+02 | 1.45E-07 | 1 |
| Curium-243 | Cm-243 | 8.47E+00 | 8.47E-09 | 1 |
| Curium-244 | Cm-244 | 1.00E+01 | 1.00E-08 | 1 |
| Curium-245 | Cm-245 | 6.35E+00 | 6.35E-09 | 1 |
| Curium-246 | Cm-246 | 6.38E+00 | 6.38E-09 | 1 |
| Curium-247 | Cm-247 | 6.93E+00 | 6.93E-09 | 1 |
| Curium-248 | Cm-248 | 1.71E+00 | 1.71E-09 | 1 |
| Cobalt-57 | Co-57 | 4.87E+03 | 4.87E-06 | 2 |
| Cobalt-60 | Co-60 | 2.18E+02 | 2.18E-07 | 2 |
| Cesium-134 | Cs-134 | 8.13E+01 | 8.13E-08 | 2 |
| Cesium-135 | Cs-135 | 7.94E+02 | 7.94E-07 | 2 |
| Cesium-137 | Cs-137 | 1.19E+02 | 1.19E-07 | 2 |
| Europium-152 | Eu-152 | 8.41E+02 | 8.41E-07 | 2 |
| Europium-154 | Eu-154 | 5.73E+02 | 5.73E-07 | 2 |
| Europium-155 | Eu-155 | 3.59E+03 | 3.59E-06 | 2 |
| Iron-55 | Fe-55 | 9.25E+03 | 9.25E-06 | 2 |
| Iron-60 | Fe-60 | 7.96E+00 | 7.96E-09 | 4 |
| Gadolinium-148 | Gd-148 | 1.10E+01 | 1.10E-08 | 4 |
| Tritium H-3 | H-3 | 6.09E+04 | 6.09E-05 | 2 |
| Mercury-194 | Hg-194 | 2.19E+01 | 2.19E-08 | 4 |
| Holmium-166m | Ho-166m | 6.58E+02 | 6.58E-07 | 5 |
| Iodine-129 | I-129 | 2.10E+01 | 2.10E-08 | 2 |
| Manganese-53 | Mn-53 | 5.48E+04 | 5.48E-05 | 5 |
| Sodium-22 | Na-22 | 4.66E+02 | 4.66E-07 | 2 |
| Niobium-91 | Nb-91 | 7.07E+02 | 7.07E-07 | 6 |
| Niobium-92 | Nb-92 | 7.07E+02 | 7.07E-07 | 6 |
| Niobium-93m | Nb-93m | 1.05E+04 | 1.05E-05 | 2 |
| Niobium-94 | Nb-94 | 7.07E+02 | 7.07E-07 | 2 |
| Nickel-59 | Ni-59 | 2.70E+04 | 2.70E-05 | 2 |
| Nickel-63 | Ni-63 | 9.91E+03 | 9.91E-06 | 2 |
| Neptunium-237 | Np-237 | 7.19E+00 | 7.19E-09 | 1 |
| Osmium-194 | Os-194 | 1.28E+02 | 1.28E-07 | 4 |
| Protactinium-231 | Pa-231 | 1.02E+01 | 1.02E-08 | 1 |
| Pb-202 | Pb-202 | 5.48E+00 | 5.48E-09 | 5 |
| Pb-203 | Pb-203 | 5.05E+03 | 5.05E-06 | 2 |
| Pb-210 | Pb-210 | 1.01E+00 | 1.01E-09 | 2 |
| Palladium-107 | Pd-107 | 3.66E+04 | 3.66E-05 | 2 |
| Promethium-145 | Pm-145 | 1.10E+04 | 1.10E-05 | 5 |
| Promethium-147 | Pm-147 | 5.24E+03 | 5.24E-06 | 2 |
| Polonium-208 | Po-208 | 1.64E+00 | 1.64E-09 | 8 |
| Polonium-209 | Po-209 | 1.48E+00 | 1.48E-09 | 4 |
| Platinum-193 | Pt-193 | 4.61E+04 | 4.61E-05 | 2 |
| Plutonium-236 | Pu-236 | 3.33E+01 | 3.33E-08 | 1 |
| Plutonium-238 | Pu-238 | 7.15E+00 | 7.15E-09 | 1 |
| Plutonium-239 | Pu-239 | 6.49E+01 | 6.49E-08 | 1 |

Non-radiological Constituents:

| PARAMETER | GWPL (mg/l) | GWPL (kg/m$^3$) |
|---|---|---|
| Arsenic | 0.05 | 5.00E-05 |
| Barium | 2 | 2.00E-03 |
| Beryllium | 0.004 | 4.00E-06 |
| Cadmium | 0.005 | 5.00E-06 |
| Chromium | 0.1 | 1.00E-04 |
| Copper | 1.3 | 1.30E-03 |
| Lead | 0.015 | 1.50E-05 |
| Mercury | 0.002 | 2.00E-06 |
| Molybdenum | 0.04 | 4.00E-05 |
| Nickel | 0.1 | 1.00E-04 |
| Selenium | 0.05 | 5.00E-05 |
| Silver | 0.1 | 1.00E-04 |
| Zinc | 5 | 5.00E-03 |

***Table 21. Ground Water Protection Levels (GWPLs) for CAW Cell Monitoring Wells (Continued)***

| PARAMETER | | GWPL (pCi/L) | GWPL (Ci/m$^3$) | Ref. |
|---|---|---|---|---|
| Plutonium-240 | Pu-240 | 6.49E+01 | 6.49E-08 | 1 |
| Plutonium-241 | Pu-241 | 1.60E+03 | 1.60E-06 | 7 |
| Plutonium-242 | Pu-242 | 6.83E+01 | 6.83E-08 | 1 |
| Plutonium-244 | Pu-244 | 7.02E+00 | 7.02E-09 | 1 |
| Radium-226 + Radium-228 | Ra-226 | 5.00E+00 | 5.00E-09 | 3 |
| Rhenium-187 | Re-187 | 5.82E+05 | 5.82E-04 | 2 |
| Rubidium-83 | Rb-83 | 6.58E+02 | 6.58E-07 | 5 |
| Ruthenium-106 | Ru-106 | 2.03E+02 | 2.03E-07 | 2 |
| Selenium-79 | Se-79 | 2.16E+02 | 2.16E-07 | 4 |
| Silicon-32 | Si-32 | 5.65E+02 | 5.65E-07 | 4 |
| Samarium-151 | Sm-151 | 1.41E+04 | 1.41E-05 | 2 |
| Tin-121m | Sn-121m | 2.26E+03 | 2.26E-06 | 2 |
| Tin-126 | Sn-126 | 2.29E+02 | 2.29E-07 | 2 |
| Strontium-90 | Sr-90 | 4.20E+01 | 4.20E-08 | 2 |
| Tantalum-182 | Ta-182 | 8.42E+02 | 8.42E-07 | 2 |
| Terbium-157 | Tb-157 | 2.19E+03 | 2.19E-06 | 5 |
| Terbium-158 | Tb-158 | 1.25E+03 | 1.25E-06 | 2 |
| Technicium-99 | Tc-99 | 3.79E+03 | 3.79E-06 | 2 |
| Tellurium-123 | Te-123 | 5.48E+02 | 5.48E-07 | 5 |
| Thorium-229 | Th-229 | 6.58E-01 | 6.58E-10 | 4 |
| Thorium-230 | Th-230 | 8.27E+01 | 8.27E-08 | 1 |
| Thorium-232 | Th-232 | 9.18E+01 | 9.18E-08 | 1 |
| Titanium-44 | Ti-44 | 7.26E+01 | 7.26E-08 | 4 |
| Thallium-204 | Tl-204 | 1.68E+03 | 1.68E-06 | 2 |
| Thulium-170 | Tm-170 | 1.03E+03 | 1.03E-06 | 2 |
| Uranium-232 | U-232 | 1.02E+01 | 1.02E-08 | 1 |
| Uranium-233 | U-233 | 2.56E+01 | 2.56E-08 | 1 |
| Uranium-234 | U-234 | 2.60E+01 | 2.60E-08 | 3 |
| Uranium-235 | U-235 | 2.65E+01 | 2.65E-08 | 1 |
| Uranium-236 | U-236 | 2.74E+01 | 2.74E-08 | 1 |
| Uranium-238 | U-238 | 2.60E+01 | 2.60E-08 | 3 |
| Vanadium-50 | V-50 | 2.19E+03 | 2.19E-06 | 5 |
| Yttrium-88 | Y-88 | 1.60E+02 | 1.60E-07 | 7 |
| Zirconium-93 | Zr-93 | 5.09E+03 | 5.09E-06 | 2 |
| Zirconium-95 | Zr-95 | 1.46E+03 | 1.32E-06 | 5 |

References:
1- EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix C - Alpha Emitters.
2- EPA 1991 Proposed Rules, Federal Register, Vol. 56, No. 138, 40 CFR Parts 141 and 142, Appendix B - Beta Particle and Photon Emitters.
3- Universal GWPL listed in Table 1A, Permit No. UGW450005.
4- Most conservative (lowest) value provided in spreadsheet from Loren Morton (UDEQ DRC).
5- Calculated based on FGR-11
6- Not listed in MCLs, FGR 11, or FGR 13. The Ni-94 GWPL was used, and would be lower than Ni-91, -92 based on radioactive half-life, decay products, and decay energies.
7- Used in previous modeling by UDEQ DRC.
8- Calculated using ICRP 30.

# 5. VERTICAL PATHRAE FATE AND TRANSPORT MODELING

The transport of constituents from the waste to the water table was modeled using PATHRAE. The input parameters for the vertical model are shown in the model output files (Attachment 3) and are described in detail below. The vertical model results (Section 5.3) serve as input to the horizontal PATHRAE model (Section 6.3.) Electronic files for both vertical and horizontal PATHRAE modeling are provided in Attachment 4.

## 5.1 Vertical Input Parameters for Contaminant Release

PATHRAE requires five input files, which define the waste release, transport conditions, and uptake.

### *5.1.1 Waste Source Term Concentrations*

The Class A West cell will contain low-level radioactive waste and metals for permanent disposal. The current modeling evaluates a total of 260 isotopes and 13 metals. Radionuclide and metals waste concentrations are input to the PATHRAE model as Ci/m$^3$ and mg/m$^3$, respectively. Table 22 provides

source concentrations, half lives, and $K_d$ values for each nuclide modeled. The derivation of source term concentrations is described in detail in the following sections.

#### *5.1.1.1 Radionuclide Concentrations*

The current modeling evaluates the 260 isotopes[6] listed in Table 22. The waste concentrations for each isotope were initially developed in 2000 from data supplied by the Manifest Information Management System (MIMS), a database managed by the Department of Energy (DOE) that summarizes national low-level radioactive waste disposal information. The list of radioisotopes established from the MIMS database was then classified by R313-15-1009 and their respective maximum Class A concentrations determined. If a radioisotope was not listed on Table I or Table II, it is Class A in accordance with R313-15-1009(2)(f). In these cases, the waste source term in the model was set at the specific activity. The specific activity, in picocuries per gram (pCi/g), was calculated using the following formula:

$$SA = \frac{\ln(2)}{t_{1/2}}\left(6.02x10^{23}\,\frac{molecules}{Mole}\right)\left(\frac{1}{GMW_{g/m}}\right) \div \left(3.7x10^{-2}\right)$$

where SA = Specific activity in pCi/g
$t_{1/2}$ = Half life in seconds
GMW= Gram molecular weight in grams per mole

The waste source term concentrations for the current version of the CAW cell modeling are identical to those used in previous modeling of the Class A cell (Whetstone, 2000e) with the following exceptions:

- K-40 is not a Class A nuclide and has been omitted from the current modeling;
- Bk-247 concentrations were increased to 10,000 pCi/g based on Class A limits;
- Ca-41 concentrations were increased from 440,000,000 pCi/g to 86,654,863,732 pCi/g based on specific activity;
- Cf-250 concentrations were increased from 500 pCi/g to 10,000 pCi/g based on Class A limits;
- Cl-36 concentrations were increased from 24.334 pCi/g to 33,522,654,030 pCi/g based on specific activity; and
- U-235 concentrations were increased from 1,900 pCi/g to 15,500 pCi/g based on the site license.
- Th-230 concentrations were increased from 150,000 pCi/g to 20,628,000,000 pCi/g.
- U-234 concentrations were increased from 370,000 pCi/g to 6,210,000,000 pCi/g.
- U-238 concentrations were increased from 330,000 pCi/g to 336,260 pCi/g.

The initial Class A concentrations for all nuclides evaluated are shown in Table 22. The 92 nuclides selected for modeling are indicated with a check-mark listed in Table 22. Nuclides that were not modeled directly were represented by a synthetic (dummy) surrogate nuclide. The surrogates are not real nuclides, but have the $K_d$, half life, and concentration properties appropriate for a conservative surrogate for the real nuclide.

Starting concentrations were input to the PATHRAE model in units of $Ci/m^3$ waste. The radionuclide concentrations shown in Table 23 were converted from pCi/g to $Ci/m^3$ using the waste bulk density of 1.8 $gm/cm^3$.

[6] Although 260 isotopes are evaluated, only 92 isotopes and 7 surrogates are explicitly modeled. Isotopes having very short half-lives and/or very high sorption coefficients ($K_d$s) are modeled using one of the 7 surrogate isotopes.

## *Table 22. List of Class A Radionuclides and Model Surrogates*

| ELEMENT | NUCLIDE | Maximum Concent. (pCi/gm) | Maximum Concentration (Ci/m3) | Concentration Data Source | Distribution Coefficient ($K_d$) (L/Kg) | 1/2 life | | 1/2 life (Years) | Isotope to be Modeled | Model Surrogate |
|---|---|---|---|---|---|---|---|---|---|---|
| Actinium | Ac-225 | 440000000 | 792 | Class A | 4.5 | 10 | d | 2.74E-02 | | Ks-23 |
| Actinium | Ac-227 | 72300000000000 | 130140000 | SA | 4.5 | 21.77 | y | 2.18E+01 | ✓ | |
| Silver | Ag-105 | 440000000 | 792 | Class A | 2.7 | 41.3 | d | 1.13E-01 | | Ks-23 |
| Silver | Ag-108 | 440000000 | 792 | Class A | 2.7 | 2.37 | m | 4.51E-06 | | Ks-23 |
| Silver | Ag-108m | 26081000000000 | 46945800 | SA | 2.7 | 418 | y | 4.18E+02 | ✓ | |
| Silver | Ag-110m | 440000000 | 792 | Class A | 2.7 | 249.8 | d | 6.84E-01 | | Ks-23 |
| Silver | Ag-111 | 440000000 | 792 | Class A | 2.7 | 7.45 | d | 2.04E-02 | | Ks-23 |
| Aluminum | Al-26 | 18600000000 | 33480 | SA | 15 | 740000 | y | 7.40E+05 | ✓ | |
| Americium | Am-241 | 10000 | 0.018 | Class A | 1 | 432.2 | y | 4.32E+02 | ✓ | |
| Americium | Am-242 | 440000000 | 792 | Class A | 1 | 0.67 | d | 1.83E-03 | | Ks-23 |
| Americium | Am-242m | 10000 | 0.018 | Class A | 1 | 141 | y | 1.41E+02 | ✓ | |
| Americium | Am-243 | 10000 | 0.018 | Class A | 1 | 7370 | y | 7.37E+03 | ✓ | |
| Americium | Am-244 | 440000000 | 792 | Class A | 1 | 10.1 | h | 1.15E-03 | | Ks-23 |
| Americium | Am-245 | 440000000 | 792 | Class A | 1 | 2.05 | h | 2.34E-04 | | Ks-23 |
| Arsenic | As-73 | 440000000 | 792 | Class A | 1 | 80.3 | d | 2.20E-01 | | Ks-23 |
| Arsenic | As-74 | 440000000 | 792 | Class A | 1 | 17.77 | d | 4.87E-02 | | Ks-23 |
| Gold | Au-195 | 440000000 | 792 | Class A | 0.25 | 186.1 | d | 5.10E-01 | | Ks-22 |
| Gold | Au-198 | 440000000 | 792 | Class A | 0.25 | 2.695 | d | 7.38E-03 | | Ks-22 |
| Gold | Au-199 | 440000000 | 792 | Class A | 0.25 | 3.14 | d | 8.60E-03 | | Ks-22 |
| Barium | Ba-133 | 256160000000000 | 461088000 | SA | 10 | 10.51 | y | 1.05E+01 | ✓ | |
| Barium | Ba-140 | 440000000 | 792 | Class A | 10 | 12.75 | d | 3.49E-02 | | Ks-22 |
| Beryllium | Be-10 | 22000000000 | 39600 | SA | 2.5 | 1510000 | y | 1.51E+06 | ✓ | |
| Beryllium | Be-7 | 440000000 | 792 | Class A | 2.5 | 53.29 | d | 1.46E-01 | | Ks-23 |
| Bismuth | Bi-205 | 440000000 | 792 | Class A | 1 | 15.31 | d | 4.19E-02 | | Ks-23 |
| Bismuth | Bi-206 | 440000000 | 792 | Class A | 1 | 6.243 | d | 1.71E-02 | | Ks-23 |
| Bismuth | Bi-207 | 53670000000000 | 96606000 | SA | 1 | 31.55 | y | 3.16E+01 | ✓ | |
| Bismuth | Bi-210m | 567820000 | 1022.076 | SA | 1 | 3040000 | y | 3.04E+06 | ✓ | |
| Bismuth | Bi-214 | 440000000 | 792 | Class A | 1 | 19.9 | m | 3.79E-05 | | Ks-23 |
| Berkelium | Bk-247 | 10000 | 0.018 | Class A | 0.001 | 1400 | y | 1.40E+03 | ✓ | |
| Berkelium | Bk-249 | 440000000 | 792 | Class A | 0.001 | 320 | d | 8.77E-01 | | Ks-20 |
| Berkelium | Bk-250 | 440000000 | 792 | Class A | 0.001 | 0.134 | d | 3.68E-04 | | Ks-20 |
| Carbon | C-14 | 7207207.21 | 9 | Class A | 8.52 | 5730 | y | 5.73E+03 | ✓ | |
| Calcium | Ca-41 | 440000000 | 155979 | Class A | 0.05 | 103000 | y | 1.03E+05 | ✓ | |
| Calcium | Ca-45 | 440000000 | 792 | Class A | 0.05 | 162.61 | d | 4.46E-01 | | Ks-21 |
| Calcium | Ca-47 | 440000000 | 792 | Class A | 0.05 | 4.536 | d | 1.24E-02 | | Ks-21 |
| Cadmium | Cd-105 | 440000000 | 792 | Class A | 1 | 55.5 | m | 1.06E-04 | | Ks-23 |
| Cadmium | Cd-107 | 440000000 | 792 | Class A | 1 | 6.5 | h | 7.42E-04 | | Ks-23 |
| Cadmium | Cd-109 | 440000000 | 792 | Class A | 1 | 462.6 | d | 1.27E+00 | | Ks-26 |
| Cadmium | Cd-113 | 0.4303 | 7.74613E-07 | SA | 1 | 9.3E+15 | y | 9.30E+15 | ✓ | |
| Cadmium | Cd-113m | 224520000000000 | 404136000 | SA | 1 | 14.1 | y | 1.41E+01 | ✓ | |
| Cerium | Ce-129 | 440000000 | 792 | Class A | 1 | 3.5 | m | 6.66E-06 | ✓ | Ks-23 |
| Cerium | Ce-133 | 440000000 | 792 | Class A | 1 | 1.6167 | h | 1.85E-04 | | Ks-23 |
| Cerium | Ce-137 | 440000000 | 792 | Class A | 1 | 9 | h | 1.03E-03 | | Ks-23 |
| Cerium | Ce-139 | 440000000 | 792 | Class A | 1 | 137.6 | d | 3.77E-01 | | Ks-23 |
| Cerium | Ce-141 | 440000000 | 792 | Class A | 1 | 32.5 | d | 8.90E-02 | | Ks-23 |
| Cerium | Ce-143 | 440000000 | 792 | Class A | 1 | 1.377 | d | 3.77E-03 | | Ks-23 |
| Cerium | Ce-144 | 440000000 | 792 | Class A | 1 | 284.9 | d | 7.81E-01 | | Ks-23 |
| Cerium | Ce-147 | 440000000 | 792 | Class A | 1 | 56.44944 | s | 1.79E-06 | | Ks-23 |
| Californium | Cf-248 | 440000000 | 792 | Class A | 2 | 333.5 | d | 9.14E-01 | | Ks-20 |
| Californium | Cf-249 | 10000 | 0.018 | Class A | 2 | 351 | y | 3.51E+02 | ✓ | |
| Californium | Cf-250 | 10000 | 0.018 | Class A | 2 | 13.08 | y | 1.31E+01 | ✓ | |
| Californium | Cf-251 | 10000 | 0.018 | Class A | 2 | 898 | d | 2.46E+00 | ✓ | |
| Californium | Cf-252 | 440000000 | 792 | Class A | 2 | 2.65 | y | 2.65E+00 | ✓ | |
| Chlorine | Cl-36 | 33522654030 | 60,341 | Class A | 0.0025 | 301000 | y | 3.01E+05 | ✓ | |
| Curium | Cm-241 | 440000000 | 792 | Class A | 93.3 | 32.8 | d | 8.99E-02 | | Ks-24 |
| Curium | Cm-242 | 2000000 | 3.6 | Class A | 93.3 | 162.8 | d | 4.46E-01 | | Ks-24 |
| Curium | Cm-243 | 10000 | 0.018 | Class A | 93.3 | 29.1 | y | 2.91E+01 | ✓ | |
| Curium | Cm-244 | 10000 | 0.018 | Class A | 93.3 | 18.1 | y | 1.81E+01 | ✓ | |
| Curium | Cm-245 | 10000 | 0.018 | Class A | 93.3 | 8500 | y | 8.50E+03 | ✓ | |
| Curium | Cm-246 | 10000 | 0.018 | Class A | 93.3 | 4730 | y | 4.73E+03 | ✓ | |
| Curium | Cm-247 | 10000 | 0.018 | Class A | 93.3 | 1.56E+07 | y | 1.56E+07 | ✓ | |
| Curium | Cm-248 | 10000 | 0.018 | Class A | 93.3 | 340000 | y | 3.40E+05 | ✓ | |
| Curium | Cm-249 | 440000000 | 792 | Class A | 93.3 | 1.07 | h | 1.22E-04 | | Ks-23 |
| Cobalt | Co-56 | 440000000 | 792 | Class A | 370 | 77.3 | d | 2.12E-01 | | Ks-25 |
| Cobalt | Co-57 | 440000000 | 792 | Class A | 370 | 271.8 | d | 7.45E-01 | | Ks-25 |
| Cobalt | Co-58 | 440000000 | 792 | Class A | 370 | 70.86 | d | 1.94E-01 | | Ks-25 |
| Cobalt | Co-60 | 440000000 | 792 | Class A | 370 | 5.27 | y | 5.27E+00 | ✓ | |
| Cobalt | Co-63 | 440000000 | 792 | Class A | 370 | 27.4 | s | 8.69E-07 | | Ks-25 |
| Chromium | Cr-51 | 440000000 | 792 | Class A | 1 | 27.7 | d | 7.59E-02 | | Ks-23 |
| Cesium | Cs-134 | 440000000 | 792 | Class A | 133 | 2.065 | y | 2.07E+00 | | Ks-25 |
| Cesium | Cs-135 | 1152100000 | 2073.78 | SA | 133 | 2300000 | y | 2.30E+06 | ✓ | |
| Cesium | Cs-136 | 440000000 | 792 | Class A | 133 | 13.16 | d | 3.61E-02 | | Ks-25 |
| Cesium | Cs-137 | 630000 | 1.134 | Class A | 133 | 30.07 | y | 3.01E+01 | ✓ | |
| Copper | Cu-67 | 440000000 | 792 | Class A | 1 | 61.83 | d | 1.69E-01 | | Ks-23 |
| Dysprosium | Dy-166 | 440000000 | 792 | Class A | 6.5 | 3.4 | d | 9.32E-03 | | Ks-23 |
| Einsteinium | Es-253 | 440000000 | 792 | Class A | 0.001 | 20.47 | d | 5.61E-02 | | Ks-20 |
| Einsteinium | Es-254 | 440000000 | 792 | Class A | 0.001 | 275.7 | d | 7.55E-01 | | Ks-20 |
| Europium | Eu-152 | 173050000000000 | 311490000 | SA | 6.5 | 13.54 | y | 1.35E+01 | ✓ | |
| Europium | Eu-154 | 270420000000000 | 486756000 | SA | 6.5 | 8.59 | y | 8.59E+00 | ✓ | |
| Europium | Eu-155 | 440000000 | 792 | Class A | 6.5 | 4.76 | y | 4.76E+00 | ✓ | |

## *Table 22. List of Class A Radionuclides and Model Surrogates (Part 2)*

| ELEMENT | NUCLIDE | Maximum Concent. (pCi/gm) | Maximum Concentration (Ci/m3) | Concentration Data Source | Distribution Coefficient ($K_d$) (L/Kg) | 1/2 life | | 1/2 life (Years) | Isotope to be Modeled | Model Surrogate |
|---|---|---|---|---|---|---|---|---|---|---|
| Europium | Eu-156 | 440000000 | 792 | Class A | 6.5 | 15.2 | d | 4.16E-02 | | Ks-23 |
| Iron | Fe-52 | 440000000 | 792 | Class A | 1.4 | 0.345 | d | 9.45E-04 | | Ks-23 |
| Iron | Fe-53 | 440000000 | 792 | Class A | 1.4 | 8.51 | m | 1.62E-05 | | Ks-23 |
| Iron | Fe-55 | 440000000 | 792 | Class A | 1.4 | 2.73 | y | 2.73E+00 | ✓ | |
| Iron | Fe-59 | 440000000 | 792 | Class A | 1.4 | 44.5 | d | 1.22E-01 | | Ks-23 |
| Iron | Fe-60 | 3974800000 | 7154.64 | SA | 1.4 | 1500000 | y | 1.50E+06 | ✓ | |
| Fermium | Fm-252 | 440000000 | 792 | Class A | 0.001 | 1.058 | d | 2.90E-03 | | Ks-20 |
| Gallium | Ga-67 | 440000000 | 792 | Class A | 15 | 3.26 | d | 8.93E-03 | | Ks-23 |
| Gadolinium | Gd-148 | 32228000000000 | 58010400 | SA | 6.5 | 74.6 | y | 7.46E+01 | ✓ | |
| Gadolinium | Gd-151 | 440000000 | 792 | Class A | 6.5 | 124 | d | 3.40E-01 | | Ks-23 |
| Gadolinium | Gd-153 | 440000000 | 792 | Class A | 6.5 | 241.6 | d | 6.62E-01 | | Ks-23 |
| Germanium | Ge-68 | 440000000 | 792 | Class A | 0.25 | 270.8 | d | 7.42E-01 | | Ks-20 |
| Hydrogen | H-3 | 25000000 | 45 | Class A | 0.04 | 12.33 | y | 1.23E+01 | ✓ | |
| Hafnium | Hf-172 | 440000000 | 792 | Class A | 4.5 | 1.87 | y | 1.87E+00 | | Ks-26 |
| Hafnium | Hf-175 | 440000000 | 792 | Class A | 4.5 | 70 | d | 1.92E-01 | | Ks-23 |
| Hafnium | Hf-181 | 440000000 | 792 | Class A | 4.5 | 42.4 | d | 1.16E-01 | | Ks-23 |
| Mercury | Hg-194 | 3546100000000 | 6382980 | SA | 10 | 444 | y | 4.44E+02 | ✓ | |
| Mercury | Hg-203 | 440000000 | 792 | Class A | 10 | 46.6 | d | 1.28E-01 | | Ks-23 |
| Holmium | Ho-166 | 440000000 | 792 | Class A | 2.5 | 1.115 | d | 3.05E-03 | | Ks-23 |
| Holmium | Ho-166m | 1800000000000 | 3240000 | SA | 2.5 | 1200 | y | 1.20E+03 | ✓ | |
| Iodine | I-123 | 440000000 | 792 | Class A | 0.12 | 13.3 | h | 1.52E-03 | | Ks-22 |
| Iodine | I-125 | 440000000 | 792 | Class A | 0.12 | 59.4 | d | 1.63E-01 | | Ks-22 |
| Iodine | I-126 | 440000000 | 792 | Class A | 0.12 | 13.11 | d | 3.59E-02 | | Ks-22 |
| Iodine | I-129 | 5000 | 0.009 | Class A | 0.12 | 15700000 | y | 1.57E+07 | ✓ | |
| Iodine | I-131 | 440000000 | 792 | Class A | 0.12 | 8.02 | d | 2.20E-02 | | Ks-22 |
| Iodine | I-133 | 440000000 | 792 | Class A | 0.12 | 0.867 | d | 2.37E-03 | | Ks-22 |
| Iodine | I-135 | 440000000 | 792 | Class A | 0.12 | 6.57 | h | 7.50E-04 | | Ks-22 |
| Iodine | I-137 | 440000000 | 792 | Class A | 0.12 | 24.5 | s | 7.77E-07 | | Ks-22 |
| Indium | In-111 | 440000000 | 792 | Class A | 15 | 2.8047 | d | 7.68E-03 | | Ks-23 |
| Indium | In-113m | 440000000 | 792 | Class A | 15 | 0.069 | d | 1.89E-04 | | Ks-23 |
| Indium | In-114 | 440000000 | 792 | Class A | 15 | 0.00083 | d | 2.28E-06 | | Ks-23 |
| Indium | In-114m | 440000000 | 792 | Class A | 15 | 49.51 | d | 1.36E-01 | | Ks-23 |
| Iridium | Ir-192 | 440000000 | 792 | Class A | 1.5 | 73.8 | d | 2.02E-01 | | Ks-23 |
| Lanthanum | La-140 | 440000000 | 12.606066 | Class A | 6.5 | 1.678 | d | 4.60E-03 | | Ks-23 |
| Manganese | Mn-52 | 440000000 | 792 | Class A | 6.4 | 5.591 | d | 1.53E-02 | | Ks-23 |
| Manganese | Mn-52m | 440000000 | 792 | Class A | 6.4 | 0.0147 | d | 4.01E-05 | | Ks-23 |
| Manganese | Mn-53 | 1800000000 | 792 | SA | 6.4 | 3740000 | y | 3.74E+06 | ✓ | |
| Manganese | Mn-54 | 440000000 | 3240 | Class A | 6.4 | 312.3 | d | 8.56E-01 | | Ks-23 |
| Molybdenum | Mo-99 | 440000000 | 792 | Class A | 1 | 2.748 | d | 7.53E-03 | | Ks-23 |
| Sodium | Na-22 | 440000000 | 792 | Class A | 1 | 2.602 | y | 2.60E+00 | ✓ | |
| Niobium | Nb-91 | 5780000000000 | 792 | SA | 1.6 | 680 | y | 6.80E+02 | ✓ | |
| Niobium | Nb-92 | 112000000 | 10404000 | SA | 1.6 | 34700000 | y | 3.47E+07 | ✓ | |
| Niobium | Nb-93m | 263460000000000 | 201.6 | SA | 1.6 | 16.13 | y | 1.61E+01 | ✓ | |
| Niobium | Nb-94 | 13000 | 474228000 | Class A | 1.6 | 20300 | y | 2.03E+04 | ✓ | |
| Neodymium | Nd-144 | 4.27 | 0.0234 | SA | 6.5 | 2.29E+15 | y | 2.29E+15 | | stable |
| Neodymium | Nd-147 | 440000000 | 7.6917E-06 | Class A | 6.5 | 10.98 | d | 3.01E-02 | | Ks-23 |
| Nickel | Ni-59 | 14000000 | 792 | Class A | 10 | 76000 | y | 7.60E+04 | ✓ | |
| Nickel | Ni-63 | 2200000 | 25.2 | Class A | 10 | 100.1 | y | 1.00E+02 | ✓ | |
| Neptunium | Np-235 | 440000000 | 3.96 | Class A | 3 | 1.085 | y | 1.09E+00 | | Ks-26 |
| Neptunium | Np-237 | 10000 | 792 | Class A | 3 | 2144000 | y | 2.14E+06 | ✓ | |
| Osmium | Os-191 | 440000000 | 0.018 | Class A | 4.5 | 15.4 | d | 4.22E-02 | | Ks-23 |
| Osmium | Os-191m | 440000000 | 792 | Class A | 4.5 | 0.546 | d | 1.50E-03 | | Ks-23 |
| Osmium | Os-194 | 307330000000000 | 792 | SA | 4.5 | 6 | y | 6.00E+00 | ✓ | |
| Phosphorous | P-32 | 440000000 | 553194000 | Class A | 0.035 | 14.26 | d | 3.91E-02 | | Ks-21 |
| Phosphorous | P-33 | 440000000 | 792 | Class A | 0.035 | 25.3 | d | 6.93E-02 | | Ks-21 |
| Protactinium | Pa-231 | 47000000000 | 792 | SA | 5.5 | 32760 | y | 3.28E+04 | ✓ | |
| Protactinium | Pa-233 | 440000000 | 84600 | Class A | 5.5 | 26.967 | d | 7.39E-02 | | Ks-23 |
| Protactinium | Pa-234 | 440000000 | 792 | Class A | 5.5 | 6.7014 | h | 7.65E-04 | | Ks-23 |
| Protactinium | Pa-234m | 440000000 | 792 | Class A | 5.5 | 1.172088 | m | 2.23E-06 | | Ks-23 |
| Lead | Pb-202 | 3400000000 | 792 | SA | 19 | 52500 | y | 5.25E+04 | ✓ | |
| Lead | Pb-203 | 440000000 | 6120 | Class A | 19 | 2.1614 | d | 5.92E-03 | | Ks-23 |
| Lead | Pb-210 | 76000000000000 | 792 | SA | 19 | 22.3 | y | 2.23E+01 | ✓ | |
| Lead | Pb-214 | 440000000 | 136800000 | Class A | 19 | 26.8 | m | 5.10E-05 | | Ks-23 |
| Palladium | Pd-103 | 440000000 | 792 | Class A | 0.55 | 16.991 | d | 4.66E-02 | | Ks-22 |
| Palladium | Pd-107 | 510000000 | 792 | SA | 0.55 | 6500000 | y | 6.50E+06 | ✓ | |
| Promethium | Pm-143 | 440000000 | 918 | Class A | 6.5 | 265 | d | 7.26E-01 | | Ks-23 |
| Promethium | Pm-145 | 140000000000000 | 792 | SA | 6.5 | 17.7 | y | 1.77E+01 | ✓ | |
| Promethium | Pm-147 | 440000000 | 252000000 | Class A | 6.5 | 2.6234 | y | 2.62E+00 | ✓ | |
| Polonium | Po-208 | 440000000 | 792 | Class A | 9 | 2.9 | y | 2.90E+00 | ✓ | |
| Polonium | Po-209 | 16781000000000 | 792 | SA | 9 | 102 | y | 1.02E+02 | ✓ | |
| Polonium | Po-210 | 440000000 | 30205800 | Class A | 9 | 138.4 | d | 3.79E-01 | | Ks-23 |
| Polonium | Po-214 | 440000000 | 792 | Class A | 9 | 164.3 | us | 5.21E-12 | | Ks-23 |
| Platinum | Pt-193 | 37000000000000 | 792 | SA | 0.9 | 50 | y | 5.00E+01 | ✓ | |
| Plutonium | Pu-236 | 500 | 66600000 | Class A | 10 | 2.86 | y | 2.86E+00 | ✓ | |
| Plutonium | Pu-238 | 10000 | 0.0009 | Class A | 10 | 87.7 | y | 8.77E+01 | ✓ | |
| Plutonium | Pu-239 | 10000 | 0.018 | Class A | 10 | 24110 | y | 2.41E+04 | ✓ | |
| Plutonium | Pu-240 | 10000 | 0.018 | Class A | 10 | 6564 | y | 6.56E+03 | ✓ | |
| Plutonium | Pu-241 | 350000 | 0.018 | Class A | 10 | 14.35 | y | 1.44E+01 | ✓ | |
| Plutonium | Pu-242 | 10000 | 0.63 | Class A | 10 | 373300 | y | 3.73E+05 | ✓ | |
| Plutonium | Pu-243 | 500 | 0.018 | Class A | 10 | 4.956 | h | 5.66E-04 | | Ks-23 |

## *Table 22. List of Class A Radionuclides and Model Surrogates (Part 3)*

| ELEMENT | NUCLIDE | Maximum Concent. (pCi/gm) | Maximum Concentration (Ci/m3) | Concentration Data Source | Distribution Coefficient ($K_d$) (L/Kg) | 1/2 life | | 1/2 life (Years) | Isotope to be Modeled | Model Surrogate |
|---|---|---|---|---|---|---|---|---|---|---|
| Plutonium | Pu-244 | 500 | 0.0009 | Class A | 10 | 8.08E+07 | y | 8.08E+07 | ✓ | |
| Radium | Ra-225 | 440000000 | 792 | Class A | 10 | 14.9 | d | 4.08E-02 | | Ks-23 |
| Radium | Ra-226 | 10000 | 0.018 | Class A | 10 | 1600 | y | 1.60E+03 | ✓ | |
| Radium | Ra-228 | 272396000000000 | 490312800 | SA | 10 | 5.75 | y | 5.75E+00 | ✓ | |
| Rubidium | Rb-82 | 440000000 | 792 | Class A | 0.55 | 0.0009 | d | 2.38E-06 | | Ks-22 |
| Rubidium | Rb-83 | 440000000 | 792 | Class A | 0.55 | 86.2 | d | 2.36E-01 | | Ks-22 |
| Rubidium | Rb-84 | 440000000 | 792 | Class A | 0.55 | 32.8 | d | 8.99E-02 | | Ks-22 |
| Rubidium | Rb-86 | 440000000 | 792 | Class A | 0.55 | 18.63 | d | 5.10E-02 | | Ks-22 |
| Rhenium | Re-183 | 440000000 | 792 | Class A | 0.075 | 70 | d | 1.92E-01 | | Ks-21 |
| Rhenium | Re-184 | 440000000 | 792 | Class A | 0.075 | 38 | d | 1.04E-01 | | Ks-21 |
| Rhenium | Re-184m | 440000000 | 792 | Class A | 0.075 | 169 | d | 4.63E-01 | | Ks-21 |
| Rhenium | Re-186 | 440000000 | 792 | Class A | 0.075 | 3.719 | d | 1.02E-02 | | Ks-21 |
| Rhenium | Re-187 | 38000 | 0.0684 | Class A | 0.075 | 43500000000 | y | 4.35E+10 | ✓ | |
| Rhenium | Re-188 | 440000000 | 792 | Class A | 0.075 | 0.709 | d | 1.94E-03 | | Ks-21 |
| Rhodium | Rh-103m | 440000000 | 792 | Class A | 0.001 | 0.039 | d | 1.07E-04 | | Ks-20 |
| Ruthenium | Ru-103 | 440000000 | 792 | Class A | 5 | 39.26 | d | 1.08E-01 | | Ks-23 |
| Ruthenium | Ru-106 | 440000000 | 792 | Class A | 5 | 1.02 | y | 1.02E+00 | | Ks-26 |
| Sulfur | S-35 | 440000000 | 792 | Class A | 0.075 | 87.5 | d | 2.40E-01 | | Ks-21 |
| Antimony | Sb-122 | 440000000 | 792 | Class A | 100 | 2.7 | d | 7.40E-03 | | Ks-25 |
| Antimony | Sb-124 | 440000000 | 792 | Class A | 100 | 60.2 | d | 1.65E-01 | | Ks-25 |
| Antimony | Sb-125 | 440000000 | 792 | Class A | 100 | 2.76 | y | 2.76E+00 | | Ks-25 |
| Antimony | Sb-126 | 440000000 | 792 | Class A | 100 | 12.5 | d | 3.42E-02 | | Ks-25 |
| Antimony | Sb-126m | 440000000 | 792 | Class A | 100 | 0.013 | d | 3.61E-05 | | Ks-25 |
| Antimony | Sb-129 | 440000000 | 792 | Class A | 100 | 4.4 | h | 5.02E-04 | | Ks-25 |
| Scandium | Sc-41 | 440000000 | 792 | Class A | 10 | 0.596 | s | 1.89E-08 | | Ks-23 |
| Scandium | Sc-44 | 440000000 | 792 | Class A | 10 | 0.164 | d | 4.48E-04 | | Ks-23 |
| Scandium | Sc-46 | 440000000 | 792 | Class A | 10 | 83.8 | d | 2.30E-01 | | Ks-23 |
| Scandium | Sc-47 | 440000000 | 792 | Class A | 10 | 3.349 | d | 9.18E-03 | | Ks-23 |
| Selenium | Se-75 | 440000000 | 792 | Class A | 1 | 119.8 | d | 3.28E-01 | | Ks-23 |
| Selenium | Se-79 | 69700000000 | 125460 | SA | 1 | 65000 | y | 6.50E+04 | ✓ | |
| Selenium | Se-85 | 440000000 | 792 | Class A | 1 | 31.7 | s | 1.01E-06 | | Ks-23 |
| Silicon | Si-32 | 65000000000000 | 117000000 | SA | 0.35 | 172 | y | 1.72E+02 | ✓ | |
| Samarium | Sm-145 | 440000000 | 792 | Class A | 2.45 | 340 | d | 9.32E-01 | | Ks-23 |
| Samarium | Sm-151 | 26320000000000 | 47376000 | SA | 2.45 | 90 | y | 9.00E+01 | ✓ | |
| Samarium | Sm-153 | 440000000 | 792 | Class A | 2.45 | 1.928 | d | 5.28E-03 | | Ks-23 |
| Tin | Sn-113 | 440000000 | 792 | Class A | 50 | 115.1 | d | 3.15E-01 | | Ks-24 |
| Tin | Sn-117m | 440000000 | 792 | Class A | 50 | 13.6 | d | 3.73E-02 | | Ks-24 |
| Tin | Sn-119m | 440000000 | 792 | Class A | 50 | 293.1 | d | 8.03E-01 | | Ks-24 |
| Tin | Sn-121 | 440000000 | 792 | Class A | 50 | 1.128 | d | 3.09E-03 | | Ks-24 |
| Tin | Sn-121m | 53754000000000 | 96757200 | SA | 50 | 55 | y | 5.50E+01 | ✓ | |
| Tin | Sn-126 | 28391000000 | 51103.8 | SA | 50 | 100000 | y | 1.00E+05 | ✓ | |
| Strontium | Sr-81 | 440000000 | 792 | Class A | 0.05 | 22.3 | m | 4.24E-05 | | Ks-21 |
| Strontium | Sr-82 | 440000000 | 792 | Class A | 0.05 | 25.55 | d | 7.00E-02 | | Ks-21 |
| Strontium | Sr-85 | 440000000 | 792 | Class A | 0.05 | 64.8 | d | 1.78E-01 | | Ks-21 |
| Strontium | Sr-87m | 440000000 | 792 | Class A | 0.05 | 168.18 | m | 3.20E-04 | | Ks-21 |
| Strontium | Sr-89 | 440000000 | 792 | Class A | 0.05 | 50.53 | d | 1.38E-01 | | Ks-21 |
| Strontium | Sr-90 | 25000 | 0.045 | Class A | 0.05 | 28.78 | y | 2.88E+01 | ✓ | |
| Tantalum | Ta-182 | 440000000 | 792 | Class A | 2.2 | 114.43 | d | 3.14E-01 | | Ks-23 |
| Terbium | Tb-157 | 15000000000000 | 27000000 | SA | 6.5 | 71 | y | 7.10E+01 | ✓ | |
| Terbium | Tb-158 | 15000000000000 | 27000000 | SA | 6.5 | 180 | y | 1.80E+02 | ✓ | |
| Terbium | Tb-160 | 440000000 | 792 | Class A | 6.5 | 72.3 | d | 1.98E-01 | | Ks-23 |
| Technetium | Tc-95 | 440000000 | 792 | Class A | 0.11 | 0.833 | d | 2.28E-03 | | Ks-22 |
| Technetium | Tc-95m | 440000000 | 792 | Class A | 0.11 | 61 | d | 1.67E-01 | | Ks-22 |
| Technetium | Tc-99 | 187500 | 0.3375 | Class A | 0.11 | 211100 | y | 2.11E+05 | ✓ | |
| Technetium | Tc-99m | 440000000 | 792 | Class A | 0.11 | 0.250 | d | 6.86E-04 | | Ks-22 |
| Tellurium | Te-123 | 291 | 0.0005238 | SA | 1.25 | 1E+13 | y | 1.00E+13 | ✓ | |
| Tellurium | Te-123m | 440000000 | 792 | Class A | 1.25 | 119.7 | d | 3.28E-01 | | Ks-23 |
| Tellurium | Te-125m | 440000000 | 792 | Class A | 1.25 | 57.4 | d | 1.57E-01 | | Ks-23 |
| Tellurium | Te-129 | 440000000 | 792 | Class A | 1.25 | 0.048 | d | 1.32E-04 | | Ks-23 |
| Tellurium | Te-129m | 440000000 | 792 | Class A | 1.25 | 33.6 | d | 9.21E-02 | | Ks-23 |
| Thorium | Th-229 | 212830000000 | 383094 | SA | 10 | 7880 | y | 7.88E+03 | ✓ | |
| Thorium | Th-230 | 20628000000 | 37130.4 | SA | 10 | 75380 | y | 7.54E+04 | ✓ | |
| Thorium | Th-231 | 440000000 | 792 | Class A | 10 | 1.063 | d | 2.91E-03 | | Ks-23 |
| Thorium | Th-232 | 110000 | 0.198 | SA | 10 | 14050000000 | y | 1.41E+10 | ✓ | |
| Thorium | Th-234 | 440000000 | 792 | Class A | 10 | 24.1 | d | 6.60E-02 | | Ks-23 |
| Titanium | Ti-44 | 156350000000000 | 281430000 | SA | 10 | 63 | y | 6.30E+01 | ✓ | |
| Thallium | Tl-201 | 440000000 | 792 | Class A | 0.15 | 3.038 | d | 8.32E-03 | | Ks-22 |
| Thallium | Tl-202 | 440000000 | 792 | Class A | 0.15 | 12.23 | d | 3.35E-02 | | Ks-22 |
| Thallium | Tl-204 | 440000000 | 792 | Class A | 0.15 | 3.78 | y | 3.78E+00 | ✓ | |
| Thallium | Tl-210 | 440000000 | 792 | Class A | 0.15 | 1.3 | m | 2.47E-06 | | Ks-22 |
| Thulium | Tm-170 | 440000000 | 792 | Class A | 6.5 | 128.6 | d | 3.52E-01 | ✓ | |
| Thulium | Tm-171 | 440000000 | 792 | Class A | 6.5 | 1.92 | y | 1.92E+00 | | Ks-26 |
| Uranium | U-228 | 440000000 | 792 | Class A | 6 | 9.1 | m | 1.73E-05 | | Ks-23 |
| Uranium | U-230 | 440000000 | 792 | Class A | 6 | 20.8 | d | 5.70E-02 | | Ks-23 |
| Uranium | U-232 | 22028000000000 | 39650400 | SA | 6 | 68.9 | y | 6.89E+01 | ✓ | |
| Uranium | U-233 | 75000 | 0.135 | Class A | 6 | 159200 | y | 1.59E+05 | ✓ | |
| Uranium | U-234 | 6210000000 | 11178 | SA | 6 | 245500 | y | 2.46E+05 | ✓ | |
| Uranium | U-235 | 15500 | 0.0279 | Class A | 6 | 703800000 | y | 7.04E+08 | ✓ | |
| Uranium | U-236 | 64720000 | 116.496 | SA | 6 | 23420000 | y | 2.34E+07 | ✓ | |
| Uranium | U-238 | 336260 | 0.605268 | SA | 6 | 4470000000 | y | 4.47E+09 | ✓ | |
| Uranium | U-depleted | 370000 | 0.666 | A+ (Class A) | 6 | | | | | U-isotopes |

### *Table 22. List of Class A Radionuclides and Model Surrogates (Part 4)*

| ELEMENT | NUCLIDE | Maximum Concent. (pCi/gm) | Maximum Concentration (Ci/m3) | Concentration Data Source | Distribution Coefficient ($K_d$) (L/Kg) | 1/2 life | | 1/2 life (Years) | Isotope to be Modeled | Model Surrogate |
|---|---|---|---|---|---|---|---|---|---|---|
| Uranium | U-natural | 680000 | 1.224 | SA | 6 | | | | | U-isotopes |
| Vanadium | V-48 | 440000000 | 792 | Class A | 10 | 15.98 | d | 4.38E-02 | | Ks-23 |
| Vanadium | V-50 | 0.0511 | 9.198E-08 | SA | 10 | 1.4E+17 | y | 1.40E+17 | ✓ | |
| Tungsten | W-181 | 440000000 | 792 | Class A | 1.5 | 121.2 | d | 3.32E-01 | | Ks-23 |
| Tungsten | W-185 | 440000000 | 792 | Class A | 1.5 | 75.1 | d | 2.06E-01 | | Ks-23 |
| Tungsten | W-187 | 440000000 | 792 | Class A | 1.5 | 23.72 | h | 2.71E-03 | | Ks-23 |
| Tungsten | W-188 | 440000000 | 792 | Class A | 1.5 | 69.4 | d | 1.90E-01 | | Ks-23 |
| Xenon | Xe-127 | 440000000 | 792 | Class A | 0.001 | 36.4 | d | 9.97E-02 | | Ks-20 |
| Xenon | Xe-131m | 440000000 | 792 | Class A | 0.001 | 11.934 | d | 3.27E-02 | | Ks-20 |
| Xenon | Xe-133 | 440000000 | 792 | Class A | 0.001 | 5.245 | d | 1.44E-02 | | Ks-20 |
| Xenon | Xe-133m | 440000000 | 792 | Class A | 0.001 | 2.19 | d | 6.00E-03 | | Ks-20 |
| Yttrium | Y-88 | 440000000 | 792 | Class A | 1.7 | 106.7 | d | 2.92E-01 | | Ks-23 |
| Yttrium | Y-91 | 440000000 | 792 | Class A | 1.7 | 58.5 | d | 1.60E-01 | | Ks-23 |
| Yttrium | Y-99 | 440000000 | 792 | Class A | 1.7 | 1.47 | s | 4.66E-08 | | Ks-23 |
| Ytterbium | Yb-169 | 440000000 | 792 | Class A | 6.5 | 32.03 | d | 8.78E-02 | | Ks-23 |
| Zinc | Zn-65 | 440000000 | 792 | Class A | 0.1 | 244.3 | d | 6.69E-01 | | Ks-22 |
| Zirconium | Zr-88 | 440000000 | 792 | Class A | 10 | 83.4 | d | 2.28E-01 | | Ks-23 |
| Zirconium | Zr-93 | 2514100000 | 4525.38 | SA | 10 | 1530000 | y | 1.53E+06 | ✓ | |
| Zirconium | Zr-95 | 440000000 | 792 | Class A | 10 | 64.02 | d | 1.75E-01 | | Ks-23 |
| **SYNTHETIC (DUMMY) NUCLIDES:** | | | | | | | | | | |
| Surrogate | Ks-20 | 440000000 | 792 | | 0.001 | 1 | y | 1.00E+00 | ✓ | |
| Surrogate | Ks-21 | 440000000 | 792 | | 0.01 | 1 | y | 1.00E+00 | ✓ | |
| Surrogate | Ks-22 | 440000000 | 792 | | 0.1 | 1 | y | 1.00E+00 | ✓ | |
| Surrogate | Ks-23 | 440000000 | 792 | | 1 | 1 | y | 1.00E+00 | ✓ | |
| Surrogate | Ks-24 | 440000000 | 792 | | 50 | 4 | y | 4.00E+00 | ✓ | |
| Surrogate | Ks-25 | 440000000 | 792 | | 100 | 4 | y | 4.00E+00 | ✓ | |
| Surrogate | Ks-26 | 440000000 | 792 | | 1 | 2 | y | 2.00E+00 | ✓ | |

NOTES: Class A = Class A limits
SA = Concentration represents the Specific Activity (maximum possible concentration) of the nuclide, rounded to ≈ 4 significant digits

If the initial model results based on the Class A starting concentrations showed exceedences of GWPLs at a compliance well located 90 feet from the edge of the waste, the PATHRAE model was used to back-calculate limited starting concentrations for specific nuclides. Limiting concentrations were calculated for three nuclides in the top slope (Bk-247, Ca-41, and Cl-36) and six nuclides in the side slope (Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99). The calculated limited starting concentrations are shown in Table 23.

The waste source term concentrations used in the 0.090 cm/yr top slope and 0.168 cm/yr side slope PATHRAE models are shown in Table 24 and Table 25, respectively.

### *Table 23. Limiting Radionuclide Concentrations in CAW Cell Top Slope and Side Slope*

| NUCLIDE | Model Results for 0.090 cm/yr Top Slope | | Model Results for 0.168 cm/yr Side Slope | |
|---|---|---|---|---|
| | Concentration that meets GWPL at the Compliance Well pCi/gm | Concentration that meets GWPL at the Compliance Well Ci/m$^3$ | Concentration that meets GWPL at the Compliance Well pCi/gm | Concentration that meets GWPL at the Compliance Well Ci/m$^3$ |
| Bk-247 | 6.50E-03 | 1.17E-08 | 3.88E-03 | 6.98E-09 |
| Ca-41 | 3.53E+04 | 6.35E-02 | 3.41E+01 | 6.14E-05 |
| Cl-36 | 1.59E+01 | 2.86E-05 | 9.72E+00 | 1.75E-05 |
| I-129 | --- | --- | 2.19E+01 | 3.94E-05 |
| Re-187 | --- | --- | 1.91E+04 | 3.44E-02 |
| Tc-99 | --- | --- | 1.72E+03 | 3.10E-03 |

NOTES: Waste concentration in Ci/m$^3$ are based on a waste bulk density of 1.8 g/cm$^3$
--- indicates no reduction from Class A concentration was necessary to meet GWPLs

## *Table 24. Waste Maximum Radionuclide Source Concentrations, $K_d$s, and Fractional Release Rates, based on 0.090 cm/year Infiltration*

| | | | |
|---|---|---|---|
| Waste Characteristics: | Infiltration Rate: | 0.00090 | m/yr |
| | Waste Thickness: | 1 | m |
| | Waste Moisture Content: | 0.0501 | $cm^3/cm^3$ |
| | Waste Bulk Density: | 1.8 | $gm/cm^3$ |
| Soil Characteristics: | Soil Thickness: | 4.0725 | m |
| | Soil Moisture Content: | 0.093 | $cm^3/cm^3$ |
| | Soil Bulk Density: | 1.563 | $gm/cm^3$ |

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Actinium | Ac-227 | 7.23E+13 | 1.30E+08 | 4.5 | 1.10E-04 | 162.658 | 21.77 | y | 2.18E+01 |
| 102 | Silver | Ag-108m | 2.61E+13 | 4.69E+07 | 2.7 | 1.83E-04 | 97.995 | 418 | y | 4.18E+02 |
| 103 | Aluminum | Al-26 | 1.86E+10 | 3.35E+04 | 15 | 3.33E-05 | 539.859 | 740,000 | y | 7.40E+05 |
| 48 | Americium | Am-241 | 1.00E+04 | 1.80E-02 | 1 | 4.86E-04 | 36.924 | 432.2 | y | 4.32E+02 |
| 104 | Americium | Am-242m | 1.00E+04 | 1.80E-02 | 1 | 4.86E-04 | 36.924 | 141 | y | 1.41E+02 |
| 105 | Americium | Am-243 | 1.00E+04 | 1.80E-02 | 1 | 4.86E-04 | 36.924 | 7,370 | y | 7.37E+03 |
| 106 | Barium | Ba-133 | 2.56E+14 | 4.61E+08 | 10 | 4.99E-05 | 360.239 | 10.5 | y | 1.05E+01 |
| 107 | Beryllium | Be-10 | 2.20E+10 | 3.96E+04 | 2.5 | 1.98E-04 | 90.810 | 1,510,000 | y | 1.51E+06 |
| 108 | Bismuth | Bi-207 | 5.37E+13 | 9.66E+07 | 1 | 4.86E-04 | 36.924 | 31.55 | y | 3.16E+01 |
| 109 | Bismuth | Bi-210m | 5.68E+08 | 1.02E+03 | 1 | 4.86E-04 | 36.924 | 3,040,000 | y | 3.04E+06 |
| 110 | Berkelium | ***Bk-247*** | ***6.50E-03*** | ***1.17E-08*** | 0.001 | 1.73E-02 | 1.036 | 1,400 | y | 1.40E+03 |
| 111 | Carbon | C-14 | 5.00E+06 | 9.00E+00 | 8.52 | 5.85E-05 | 307.072 | 5,730 | y | 5.73E+03 |
| 112 | Calcium | ***Ca-41*** | ***3.53E+04*** | ***6.35E-02*** | 0.05 | 6.42E-03 | 2.796 | 103,000 | y | 1.03E+05 |
| 113 | Cadmium | Cd-113 | 4.30E-01 | 7.75E-07 | 1 | 4.86E-04 | 36.924 | 9.3.E+15 | y | 9.30E+15 |
| 114 | Cadmium | Cd-113m | 2.25E+14 | 4.04E+08 | 1 | 4.86E-04 | 36.924 | 14.1 | y | 1.41E+01 |
| 115 | Californium | Cf-249 | 1.00E+04 | 1.80E-02 | 2 | 2.47E-04 | 72.848 | 351 | y | 3.51E+02 |
| 116 | Californium | Cf-250 | 1.00E+04 | 9.00E-04 | 2 | 2.47E-04 | 72.848 | 13.08 | y | 1.31E+01 |
| 117 | Californium | Cf-251 | 1.00E+04 | 1.80E-02 | 2 | 2.47E-04 | 72.848 | 898 | y | 8.98E+02 |
| 118 | Californium | Cf-252 | 4.40E+08 | 7.92E+02 | 2 | 2.47E-04 | 72.848 | 2.65 | y | 2.65E+00 |
| 119 | Chlorine | ***Cl-36*** | ***1.59E+01*** | ***2.86E-05*** | 0.0025 | 1.65E-02 | 1.090 | 301,000 | y | 3.01E+05 |
| 120 | Curium | Cm-243 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 29 | y | 2.91E+01 |
| 50 | Curium | Cm-244 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 18 | y | 1.81E+01 |
| 121 | Curium | Cm-245 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 8,500 | y | 8.50E+03 |
| 122 | Curium | Cm-246 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 4730 | y | 4.73E+03 |
| 123 | Curium | Cm-247 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 15,600,000 | y | 1.56E+07 |
| 124 | Curium | Cm-248 | 1.00E+04 | 1.80E-02 | 93.3 | 5.36E-06 | 3352.702 | 340,000 | y | 3.40E+05 |
| 125 | Cobalt | Co-60 | 4.40E+08 | 7.92E+02 | 370 | 1.35E-06 | 13292.853 | 5 | y | 5.27E+00 |
| 126 | Cesium | Cs-135 | 1.15E+09 | 2.07E+03 | 133 | 3.76E-06 | 4778.882 | 2,300,000 | y | 2.30E+06 |
| 127 | Cesium | Cs-137 | 6.30E+05 | 1.13E+00 | 133 | 3.76E-06 | 4778.882 | 30.07 | y | 3.01E+01 |
| 128 | Europium | Eu-152 | 1.73E+14 | 3.11E+08 | 6.5 | 7.66E-05 | 234.506 | 14 | y | 1.35E+01 |
| 129 | Europium | Eu-154 | 2.70E+14 | 4.87E+08 | 6.5 | 7.66E-05 | 234.506 | 8.6 | y | 8.59E+00 |
| 130 | Europium | Eu-155 | 4.40E+08 | 7.92E+02 | 6.5 | 7.66E-05 | 234.506 | 4.76 | y | 4.76E+00 |
| 131 | Iron | Fe-55 | 4.40E+08 | 7.92E+02 | 1.4 | 3.50E-04 | 51.293 | 2.73 | y | 2.73E+00 |
| 132 | Iron | Fe-60 | 3.97E+09 | 7.15E+03 | 1.4 | 3.50E-04 | 51.293 | 1,500,000 | y | 1.50E+06 |
| 133 | Gadolinium | Gd-148 | 3.22E+13 | 5.80E+07 | 6.5 | 7.66E-05 | 234.506 | 74.6 | y | 7.46E+01 |
| 134 | Hydrogen | H-3 | 2.50E+07 | 4.50E+01 | 0.04 | 7.37E-03 | 2.437 | 12.3 | y | 1.23E+01 |
| 135 | Mercury | Hg-194 | 3.55E+12 | 6.38E+06 | 10 | 4.99E-05 | 360.239 | 444 | y | 4.44E+02 |
| 136 | Holmium | Ho-166m | 1.80E+12 | 3.24E+06 | 2.5 | 1.98E-04 | 90.810 | 1,200 | y | 1.20E+03 |
| 137 | Iodine | I-129 | 5.00E+03 | 9.00E-03 | 0.12 | 3.38E-03 | 5.311 | 15,700,000 | y | 1.57E+07 |
| 139 | Manganese | Mn-53 | 1.80E+09 | 3.24E+03 | 6.4 | 7.78E-05 | 230.913 | 3,740,000.00 | y | 3.74E+06 |
| 140 | Sodium | Na-22 | 4.40E+08 | 7.92E+02 | 1 | 4.86E-04 | 36.924 | 2.6 | y | 2.60E+00 |
| 141 | Niobium | Nb-91 | 5.78E+12 | 1.04E+07 | 1.6 | 3.07E-04 | 58.478 | 680 | y | 6.80E+02 |
| 142 | Niobium | Nb-92 | 1.12E+08 | 2.02E+02 | 1.6 | 3.07E-04 | 58.478 | 34,700,000 | y | 3.47E+07 |
| 143 | Niobium | Nb-93m | 2.63E+14 | 4.74E+08 | 1.6 | 3.07E-04 | 58.478 | 16.13 | y | 1.61E+01 |
| 144 | Niobium | Nb-94 | 1.30E+04 | 2.34E-02 | 1.6 | 3.07E-04 | 58.478 | 20,300 | y | 2.03E+04 |
| 146 | Nickel | Ni-59 | 1.40E+07 | 2.52E+01 | 10 | 4.99E-05 | 360.239 | 76,000 | y | 7.60E+04 |
| 147 | Nickel | Ni-63 | 2.20E+06 | 3.96E+00 | 10 | 4.99E-05 | 360.239 | 100.1 | y | 1.00E+02 |
| 42 | Neptunium | Np-237 | 1.00E+04 | 1.80E-02 | 3 | 1.65E-04 | 108.772 | 2,144,000 | y | 2.14E+06 |
| 148 | Osmium | Os-194 | 3.07E+14 | 5.53E+08 | 4.5 | 1.10E-04 | 162.658 | 6 | y | 6.00E+00 |
| 149 | Protactinium | Pa-231 | 4.70E+10 | 8.46E+04 | 5.5 | 9.05E-05 | 198.582 | 32,760 | y | 3.28E+04 |
| 150 | Lead | Pb-202 | 3.40E+09 | 6.12E+03 | 19 | 2.63E-05 | 683.555 | 52,500 | y | 5.25E+04 |
| 151 | Lead | Pb-210 | 7.60E+13 | 1.37E+08 | 19 | 2.63E-05 | 683.555 | 22.3 | y | 2.23E+01 |
| 152 | Palladium | Pd-107 | 5.10E+08 | 9.18E+02 | 0.55 | 8.65E-04 | 20.758 | 6,500,000 | y | 6.50E+06 |
| 153 | Promethium | Pm-145 | 1.40E+14 | 2.52E+08 | 6.5 | 7.66E-05 | 234.506 | 17.7 | y | 1.77E+01 |

## *Table 24. Waste Maximum Radionuclide Source Concentrations, Kds, and Fractional Release Rates, based on 0.090 cm/year Infiltration (Part 2)*

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 154 | Promethium | Pm-147 | 4.40E+08 | 7.92E+02 | 6.5 | 7.66E-05 | 234.506 | 2.6234 | y | 2.62E+00 |
| 155 | Polonium | Po-208 | 4.40E+08 | 7.92E+02 | 9 | 5.54E-05 | 324.315 | 2.9 | y | 2.90E+00 |
| 156 | Polonium | Po-209 | 1.68E+13 | 3.02E+07 | 9 | 5.54E-05 | 324.315 | 102 | y | 1.02E+02 |
| 157 | Platinum | Pt-193 | 3.70E+13 | 6.66E+07 | 0.9 | 5.39E-04 | 33.332 | 50 | y | 5.00E+01 |
| 158 | Plutonium | Pu-236 | 5.00E+02 | 9.00E-04 | 10 | 4.99E-05 | 360.239 | 2.86 | y | 2.86E+00 |
| 159 | Plutonium | Pu-238 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 87.7 | y | 8.77E+01 |
| 160 | Plutonium | Pu-239 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 24,110 | y | 2.41E+04 |
| 45 | Plutonium | Pu-240 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 6,564 | y | 6.56E+03 |
| 46 | Plutonium | Pu-241 | 3.50E+05 | 6.30E-01 | 10 | 4.99E-05 | 360.239 | 14.35 | y | 1.44E+01 |
| 161 | Plutonium | Pu-242 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 373,300 | y | 3.73E+05 |
| 162 | Plutonium | Pu-244 | 5.00E+02 | 9.00E-04 | 10 | 4.99E-05 | 360.239 | 80,800,000 | y | 8.08E+07 |
| 55 | Radium | Ra-226 | 1.00E+04 | 1.80E-02 | 10 | 4.99E-05 | 360.239 | 1,600 | y | 1.60E+03 |
| 163 | Radium | Ra-228 | 2.72E+14 | 4.90E+08 | 10 | 4.99E-05 | 360.239 | 5.75 | y | 5.75E+00 |
| 164 | Rhenium | Re-187 | 3.80E+04 | 6.84E-02 | 0.075 | 4.86E-03 | 3.694 | 43,500,000,000 | y | 4.35E+10 |
| 165 | Selenium | Se-79 | 6.94E+10 | 1.25E+05 | 1 | 4.86E-04 | 36.924 | 65,000 | y | 6.50E+04 |
| 166 | Silicon | Si-32 | 6.50E+13 | 1.17E+08 | 0.35 | 1.32E-03 | 13.573 | 172 | y | 1.72E+02 |
| 167 | Samarium | Sm-151 | 2.63E+13 | 4.74E+07 | 2.45 | 2.02E-04 | 89.014 | 90 | y | 9.00E+01 |
| 168 | Tin | Sn-121m | 5.38E+13 | 9.68E+07 | 50 | 9.99E-06 | 1797.196 | 55 | y | 5.50E+01 |
| 169 | Tin | Sn-126 | 2.84E+10 | 5.11E+04 | 50 | 9.99E-06 | 1797.196 | 100,000 | y | 1.00E+05 |
| 170 | Strontium | Sr-90 | 2.50E+04 | 4.50E-02 | 0.05 | 6.42E-03 | 2.796 | 28.78 | y | 2.88E+01 |
| 171 | Terbium | Tb-157 | 1.50E+13 | 2.70E+07 | 6.5 | 7.66E-05 | 234.506 | 71 | y | 7.10E+01 |
| 172 | Terbium | Tb-158 | 1.50E+13 | 2.70E+07 | 6.5 | 7.66E-05 | 234.506 | 180 | y | 1.80E+02 |
| 173 | Technetium | Tc-99 | 1.88E+05 | 3.38E-01 | 0.11 | 3.63E-03 | 4.952 | 211,100 | y | 2.11E+05 |
| 174 | Tellurium | Te-123 | 2.91E+02 | 5.24E-04 | 1.25 | 3.91E-04 | 45.905 | 1E+13 | y | 1.00E+13 |
| 175 | Thorium | Th-229 | 2.13E+11 | 3.83E+05 | 10 | 4.99E-05 | 360.239 | 7,880 | y | 7.88E+03 |
| 36 | Thorium | Th-230 | 2.06E+10 | 3.71E+04 | 10 | 4.99E-05 | 360.239 | 75,380 | y | 7.54E+04 |
| 176 | Thorium | Th-232 | 1.10E+05 | 1.98E-01 | 10 | 4.99E-05 | 360.239 | 14,050,000,000 | y | 1.41E+10 |
| 177 | Titanium | Ti-44 | 1.56E+14 | 2.81E+08 | 10 | 4.99E-05 | 360.239 | 63 | y | 6.30E+01 |
| 178 | Thallium | Tl-204 | 4.40E+08 | 7.92E+02 | 0.15 | 2.81E-03 | 6.389 | 3.78 | y | 3.78E+00 |
| 179 | Thulium | Tm-170 | 4.40E+08 | 7.92E+02 | 6.5 | 7.66E-05 | 234.506 | 128.6 | d | 3.52E-01 |
| 180 | Uranium | U-232 | 2.20E+13 | 3.97E+07 | 6 | 8.29E-05 | 216.544 | 68.9 | y | 6.89E+01 |
| 181 | Uranium | U-233 | 7.50E+04 | 1.35E-01 | 6 | 8.29E-05 | 216.544 | 159,200 | y | 1.59E+05 |
| 182 | Uranium | U-234 | 6.21E+09 | 1.12E+04 | 6 | 8.29E-05 | 216.544 | 245,500 | y | 2.46E+05 |
| 183 | Uranium | U-235 | 1.55E+04 | 2.79E-02 | 6 | 8.29E-05 | 216.544 | 703,800,000 | y | 7.04E+08 |
| 40 | Uranium | U-236 | 6.47E+07 | 1.16E+02 | 6 | 8.29E-05 | 216.544 | 23,420,000 | y | 2.34E+07 |
| 41 | Uranium | U-238 | 3.36E+05 | 6.05E-01 | 6 | 8.29E-05 | 216.544 | 4,470,000,000 | y | 4.47E+09 |
| 184 | Vanadium | V-50 | 5.11E-02 | 9.20E-08 | 10 | 4.99E-05 | 360.239 | 1.4E+17 | y | 1.40E+17 |
| 185 | Zirconium | Zr-93 | 2.51E+09 | 4.53E+03 | 10 | 4.99E-05 | 360.239 | 1,530,000 | y | 1.53E+06 |
| 186 | Surrogate | Ks-20 | 4.40E+08 | 7.92E+02 | 0.001 | 1.73E-02 | 1.036 | 1 | y | 1.00E+00 |
| 187 | Surrogate | Ks-21 | 4.40E+08 | 7.92E+02 | 0.01 | 1.32E-02 | 1.359 | 1 | y | 1.00E+00 |
| 188 | Surrogate | Ks-22 | 4.40E+08 | 7.92E+02 | 0.1 | 3.91E-03 | 4.592 | 1 | y | 1.00E+00 |
| 189 | Surrogate | Ks-23 | 4.40E+08 | 7.92E+02 | 1 | 4.86E-04 | 36.924 | 1 | y | 1.00E+00 |
| 190 | Surrogate | Ks-24 | 4.40E+08 | 7.92E+02 | 50 | 9.99E-06 | 1797.196 | 4 | y | 4.00E+00 |
| 191 | Surrogate | Ks-25 | 4.40E+08 | 7.92E+02 | 100 | 5.00E-06 | 3593.393 | 4 | y | 4.00E+00 |
| 192 | Surrogate | Ks-26 | 4.40E+08 | 7.92E+02 | 1 | 4.86E-04 | 36.924 | 2 | y | 2.00E+00 |

Note: Concentrations shown in bold and italics are model-calculated concentrations that meet on GWPLs at the compliance well

## *Table 25. Waste Maximum Radionuclide Source Concentrations, $K_d$s, and Fractional Release Rates, based on 0.168 cm/year Infiltration*

| | | | |
|---|---|---|---|
| Waste Characteristics: | Infiltration Rate: | 0.00168 | m/yr |
| | Waste Thickness: | 1 | m |
| | Waste Moisture Content: | 0.054 | $cm^3/cm^3$ |
| | Waste Bulk Density: | 1.8 | $gm/cm^3$ |
| Soil Characteristics: | Soil Thickness: | 4.072 | m |
| | Soil Moisture Content: | 0.098 | $cm^3/cm^3$ |
| | Soil Bulk Density: | 1.563 | $gm/cm^3$ |

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | Actinium | Ac-227 | 7.23E+13 | 1.30E+08 | 4.5 | 2.92E-04 | 142.361 | 21.77 | y | 2.18E+01 |
| 102 | Silver | Ag-108m | 2.61E+13 | 4.69E+07 | 2.7 | 4.84E-04 | 85.817 | 418 | y | 4.18E+02 |
| 103 | Aluminum | Al-26 | 1.86E+10 | 3.35E+04 | 15 | 8.80E-05 | 472.204 | 740,000 | y | 7.40E+05 |
| 48 | Americium | Am-241 | 1.00E+04 | 1.80E-02 | 1 | 1.28E-03 | 32.414 | 432.2 | y | 4.32E+02 |
| 104 | Americium | Am-242m | 1.00E+04 | 1.80E-02 | 1 | 1.28E-03 | 32.414 | 141 | y | 1.41E+02 |
| 105 | Americium | Am-243 | 1.00E+04 | 1.80E-02 | 1 | 1.28E-03 | 32.414 | 7,370 | y | 7.37E+03 |
| 106 | Barium | Ba-133 | 2.56E+14 | 4.61E+08 | 10 | 1.32E-04 | 315.136 | 10.5 | y | 1.05E+01 |
| 107 | Beryllium | Be-10 | 2.20E+10 | 3.96E+04 | 2.5 | 5.22E-04 | 79.534 | 1,510,000 | y | 1.51E+06 |
| 108 | Bismuth | Bi-207 | 5.37E+13 | 9.66E+07 | 1 | 1.28E-03 | 32.414 | 31.55 | y | 3.16E+01 |
| 109 | Bismuth | Bi-210m | 5.68E+08 | 1.02E+03 | 1 | 1.28E-03 | 32.414 | 3,040,000 | y | 3.04E+06 |
| 110 | Berkelium | Bk-247 | ***3.88E-03*** | ***6.98E-09*** | 0.001 | 4.03E-02 | 1.031 | 1,400 | y | 1.40E+03 |
| 111 | Carbon | C-14 | 5.00E+06 | 9.00E+00 | 8.52 | 1.55E-04 | 268.644 | 5,730 | y | 5.73E+03 |
| 112 | Calcium | Ca-41 | ***3.41E+01*** | ***6.14E-05*** | 0.05 | 1.62E-02 | 2.571 | 103,000 | y | 1.03E+05 |
| 113 | Cadmium | Cd-113 | 4.30E-01 | 7.75E-07 | 1 | 1.28E-03 | 32.414 | 9.3.E+15 | y | 9.30E+15 |
| 114 | Cadmium | Cd-113m | 2.25E+14 | 4.04E+08 | 1 | 1.28E-03 | 32.414 | 14.1 | y | 1.41E+01 |
| 115 | Californium | Cf-249 | 1.00E+04 | 1.80E-02 | 2 | 6.51E-04 | 63.827 | 351 | y | 3.51E+02 |
| 116 | Californium | Cf-250 | 1.00E+04 | 1.80E-02 | 2 | 6.51E-04 | 63.827 | 13.08 | y | 1.31E+01 |
| 117 | Californium | Cf-251 | 1.00E+04 | 1.80E-02 | 2 | 6.51E-04 | 63.827 | 898 | y | 8.98E+02 |
| 118 | Californium | Cf-252 | 4.40E+08 | 7.92E+02 | 2 | 6.51E-04 | 63.827 | 2.65 | y | 2.65E+00 |
| 119 | Chlorine | Cl-36 | ***9.72E+00*** | ***1.75E-05*** | 0.0025 | 3.85E-02 | 1.079 | 301,000 | y | 3.01E+05 |
| 120 | Curium | Cm-243 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 29 | y | 2.91E+01 |
| 50 | Curium | Cm-244 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 18 | y | 1.81E+01 |
| 121 | Curium | Cm-245 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 8,500 | y | 8.50E+03 |
| 122 | Curium | Cm-246 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 4730 | y | 4.73E+03 |
| 123 | Curium | Cm-247 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 15,600,000 | y | 1.56E+07 |
| 124 | Curium | Cm-248 | 1.00E+04 | 1.80E-02 | 93.3 | 1.42E-05 | 2931.890 | 340,000 | y | 3.40E+05 |
| 125 | Cobalt | Co-60 | 4.40E+08 | 7.92E+02 | 370 | 3.57E-06 | 11624.037 | 5 | y | 5.27E+00 |
| 126 | Cesium | Cs-135 | 1.15E+09 | 2.07E+03 | 133 | 9.94E-06 | 4179.010 | 2,300,000 | y | 2.30E+06 |
| 127 | Cesium | Cs-137 | 6.30E+05 | 1.13E+00 | 133 | 9.94E-06 | 4179.010 | 30.07 | y | 3.01E+01 |
| 128 | Europium | Eu-152 | 1.73E+14 | 3.11E+08 | 6.5 | 2.02E-04 | 205.188 | 14 | y | 1.35E+01 |
| 129 | Europium | Eu-154 | 2.70E+14 | 4.87E+08 | 6.5 | 2.02E-04 | 205.188 | 8.6 | y | 8.59E+00 |
| 130 | Europium | Eu-155 | 4.40E+08 | 7.92E+02 | 6.5 | 2.02E-04 | 205.188 | 4.76 | y | 4.76E+00 |
| 131 | Iron | Fe-55 | 4.40E+08 | 7.92E+02 | 1.4 | 9.23E-04 | 44.979 | 2.73 | y | 2.73E+00 |
| 132 | Iron | Fe-60 | 3.97E+09 | 7.15E+03 | 1.4 | 9.23E-04 | 44.979 | 1,500,000 | y | 1.50E+06 |
| 133 | Gadolinium | Gd-148 | 3.22E+13 | 5.80E+07 | 6.5 | 2.02E-04 | 205.188 | 74.6 | y | 7.46E+01 |
| 134 | Hydrogen | H-3 | 2.50E+07 | 4.50E+01 | 0.04 | 1.84E-02 | 2.257 | 12.3 | y | 1.23E+01 |
| 135 | Mercury | Hg-194 | 3.55E+12 | 6.38E+06 | 10 | 1.32E-04 | 315.136 | 444 | y | 4.44E+02 |
| 136 | Holmium | Ho-166m | 1.80E+12 | 3.24E+06 | 2.5 | 5.22E-04 | 79.534 | 1,200 | y | 1.20E+03 |
| 137 | Iodine | I-129 | ***2.19E+01*** | ***3.94E-05*** | 0.12 | 8.71E-03 | 4.770 | 15,700,000 | y | 1.57E+07 |
| 138 | Potassium | K-40 | 1.80E+09 | 3.24E+03 | 6.4 | 2.06E-04 | 202.047 | 1,277,000,000 | y | 1.28E+09 |
| 139 | Manganese | Mn-53 | 4.40E+08 | 7.92E+02 | 1 | 1.28E-03 | 32.414 | 3,740,000.00 | y | 3.74E+06 |
| 140 | Sodium | Na-22 | 5.78E+12 | 1.04E+07 | 1.6 | 8.10E-04 | 51.262 | 2.6 | y | 2.60E+00 |
| 141 | Niobium | Nb-91 | 1.12E+08 | 2.02E+02 | 1.6 | 8.10E-04 | 51.262 | 680 | y | 6.80E+02 |
| 142 | Niobium | Nb-92 | 2.63E+14 | 4.74E+08 | 1.6 | 8.10E-04 | 51.262 | 34,700,000 | y | 3.47E+07 |
| 143 | Niobium | Nb-93m | 1.30E+04 | 2.34E-02 | 1.6 | 8.10E-04 | 51.262 | 16.13 | y | 1.61E+01 |
| 144 | Niobium | Nb-94 | 7.23E+13 | 1.30E+08 | 10 | 1.32E-04 | 315.136 | 20,300 | y | 2.03E+04 |
| 146 | Nickel | Ni-59 | 1.40E+07 | 2.52E+01 | 10 | 1.32E-04 | 315.136 | 76,000 | y | 7.60E+04 |
| 147 | Nickel | Ni-63 | 2.20E+06 | 3.96E+00 | 3 | 4.36E-04 | 95.241 | 100.1 | y | 1.00E+02 |
| 42 | Neptunium | Np-237 | 1.00E+04 | 1.80E-02 | 4.5 | 2.92E-04 | 142.361 | 2,144,000 | y | 2.14E+06 |
| 148 | Osmium | Os-194 | 3.07E+14 | 5.53E+08 | 5.5 | 2.39E-04 | 173.775 | 6 | y | 6.00E+00 |
| 149 | Protactinium | Pa-231 | 4.70E+10 | 8.46E+04 | 19 | 6.95E-05 | 597.859 | 32,760 | y | 3.28E+04 |
| 150 | Lead | Pb-202 | 3.40E+09 | 6.12E+03 | 19 | 6.95E-05 | 597.859 | 52,500 | y | 5.25E+04 |
| 151 | Lead | Pb-210 | 7.60E+13 | 1.37E+08 | 0.55 | 2.27E-03 | 18.277 | 22.3 | y | 2.23E+01 |
| 152 | Palladium | Pd-107 | 5.10E+08 | 9.18E+02 | 6.5 | 2.02E-04 | 205.188 | 6,500,000 | y | 6.50E+06 |
| 153 | Promethium | Pm-145 | 1.40E+14 | 2.52E+08 | 6.5 | 2.02E-04 | 205.188 | 17.7 | y | 1.77E+01 |
| 154 | Promethium | Pm-147 | 4.40E+08 | 7.92E+02 | 9 | 1.46E-04 | 283.723 | 2.6234 | y | 2.62E+00 |
| 155 | Polonium | Po-208 | 4.40E+08 | 7.92E+02 | 4.5 | 2.92E-04 | 142.361 | 2.9 | y | 2.90E+00 |

### *Table 25. Waste Maximum Radionuclide Source Concentrations, Kds, and Fractional Release Rates, based on 0.168 cm/year Infiltration (Part 2)*

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Maximum Concentration (pCi/gm) | Maximum Concentr. (Ci/m3) | Distribution Coefficient ($K_d$) (L/Kg) | Fractional Release Rate (1/yr) | Soil Retardation Factor | 1/2 life | | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|---|---|
| 156 | Polonium | Po-209 | 1.68E+13 | 3.02E+07 | 9 | 1.46E-04 | 283.723 | 102 | y | 1.02E+02 |
| 157 | Platinum | Pt-193 | 3.70E+13 | 6.66E+07 | 0.9 | 1.42E-03 | 29.272 | 50 | y | 5.00E+01 |
| 158 | Plutonium | Pu-236 | 5.00E+02 | 9.00E-04 | 10 | 1.32E-04 | 315.136 | 2.86 | y | 2.86E+00 |
| 159 | Plutonium | Pu-238 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 87.7 | y | 8.77E+01 |
| 160 | Plutonium | Pu-239 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 24,110 | y | 2.41E+04 |
| 45 | Plutonium | Pu-240 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 6,564 | y | 6.56E+03 |
| 46 | Plutonium | Pu-241 | 3.50E+05 | 6.30E-01 | 10 | 1.32E-04 | 315.136 | 14.35 | y | 1.44E+01 |
| 161 | Plutonium | Pu-242 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 373,300 | y | 3.73E+05 |
| 162 | Plutonium | Pu-244 | 5.00E+02 | 9.00E-04 | 10 | 1.32E-04 | 315.136 | 80,800,000 | y | 8.08E+07 |
| 55 | Radium | Ra-226 | 1.00E+04 | 1.80E-02 | 10 | 1.32E-04 | 315.136 | 1,600 | y | 1.60E+03 |
| 163 | Radium | Ra-228 | 2.72E+14 | 4.90E+08 | 10 | 1.32E-04 | 315.136 | 5.75 | y | 5.75E+00 |
| 164 | Rhenium | Re-187 | ***1.91E+04*** | ***3.44E-02*** | 0.075 | 1.24E-02 | 3.356 | 43,500,000,000 | y | 4.35E+10 |
| 165 | Selenium | Se-79 | 6.94E+10 | 1.25E+05 | 1 | 1.28E-03 | 32.414 | 65,000 | y | 6.50E+04 |
| 166 | Silicon | Si-32 | 9.89E+13 | 1.78E+08 | 0.35 | 3.46E-03 | 11.995 | 172 | y | 1.72E+02 |
| 167 | Samarium | Sm-151 | 2.63E+13 | 4.74E+07 | 2.45 | 5.33E-04 | 77.963 | 90 | y | 9.00E+01 |
| 168 | Tin | Sn-121m | 5.38E+13 | 9.68E+07 | 50 | 2.64E-05 | 1571.681 | 55 | y | 5.50E+01 |
| 169 | Tin | Sn-126 | 2.84E+10 | 5.11E+04 | 50 | 2.64E-05 | 1571.681 | 100,000 | y | 1.00E+05 |
| 170 | Strontium | Sr-90 | 2.50E+04 | 4.50E-02 | 0.05 | 1.62E-02 | 2.571 | 28.78 | y | 2.88E+01 |
| 171 | Terbium | Tb-157 | 1.50E+13 | 2.70E+07 | 6.5 | 2.02E-04 | 205.188 | 71 | y | 7.10E+01 |
| 172 | Terbium | Tb-158 | 1.50E+13 | 2.70E+07 | 6.5 | 2.02E-04 | 205.188 | 180 | y | 1.80E+02 |
| 173 | Technetium | Tc-99 | ***1.72E+03*** | ***3.10E-03*** | 0.11 | 9.32E-03 | 4.455 | 211,100 | y | 2.11E+05 |
| 174 | Tellurium | Te-123 | 2.91E+02 | 5.24E-04 | 1.25 | 1.03E-03 | 40.267 | 1E+13 | y | 1.00E+13 |
| 175 | Thorium | Th-229 | 2.13E+11 | 3.83E+05 | 10 | 1.32E-04 | 315.136 | 7,880 | y | 7.88E+03 |
| 36 | Thorium | Th-230 | 2.06E+10 | 3.71E+04 | 10 | 1.32E-04 | 315.136 | 75,380 | y | 7.54E+04 |
| 176 | Thorium | Th-232 | 1.10E+05 | 1.98E-01 | 10 | 1.32E-04 | 315.136 | 14,050,000,000 | y | 1.41E+10 |
| 177 | Titanium | Ti-44 | 1.56E+14 | 2.81E+08 | 10 | 1.32E-04 | 315.136 | 63 | y | 6.30E+01 |
| 178 | Thallium | Tl-204 | 4.40E+08 | 7.92E+02 | 0.15 | 7.27E-03 | 5.712 | 3.78 | y | 3.78E+00 |
| 179 | Thulium | Tm-170 | 4.40E+08 | 7.92E+02 | 6.5 | 2.02E-04 | 205.188 | 128.6 | d | 3.52E-01 |
| 180 | Uranium | U-232 | 2.20E+13 | 3.97E+07 | 6 | 2.19E-04 | 189.482 | 68.9 | y | 6.89E+01 |
| 181 | Uranium | U-233 | 7.50E+04 | 1.35E-01 | 6 | 2.19E-04 | 189.482 | 159,200 | y | 1.59E+05 |
| 182 | Uranium | U-234 | 6.21E+09 | 1.12E+04 | 6 | 2.19E-04 | 189.482 | 245,500 | y | 2.46E+05 |
| 183 | Uranium | U-235 | 1.55E+04 | 2.79E-02 | 6 | 2.19E-04 | 189.482 | 703,800,000 | y | 7.04E+08 |
| 40 | Uranium | U-236 | 6.47E+07 | 1.16E+02 | 6 | 2.19E-04 | 189.482 | 23,420,000 | y | 2.34E+07 |
| 41 | Uranium | U-238 | 3.36E+05 | 6.05E-01 | 6 | 2.19E-04 | 189.482 | 4,470,000,000 | y | 4.47E+09 |
| 184 | Vanadium | V-50 | 5.11E-02 | 9.20E-08 | 10 | 1.32E-04 | 315.136 | 1.4E+17 | y | 1.40E+17 |
| 185 | Zirconium | Zr-93 | 2.51E+09 | 4.53E+03 | 10 | 1.32E-04 | 315.136 | 1,530,000 | y | 1.53E+06 |
| 186 | Surrogate | Ks-20 | 4.40E+08 | 7.92E+02 | 0.001 | 4.03E-02 | 1.031 | 1 | y | 1.00E+00 |
| 187 | Surrogate | Ks-21 | 4.40E+08 | 7.92E+02 | 0.01 | 3.16E-02 | 1.314 | 1 | y | 1.00E+00 |
| 188 | Surrogate | Ks-22 | 4.40E+08 | 7.92E+02 | 0.1 | 1.00E-02 | 4.141 | 1 | y | 1.00E+00 |
| 189 | Surrogate | Ks-23 | 4.40E+08 | 7.92E+02 | 1 | 1.28E-03 | 32.414 | 1 | y | 1.00E+00 |
| 190 | Surrogate | Ks-24 | 4.40E+08 | 7.92E+02 | 50 | 2.64E-05 | 1571.681 | 4 | y | 4.00E+00 |
| 191 | Surrogate | Ks-25 | 4.40E+08 | 7.92E+02 | 100 | 1.32E-05 | 3142.361 | 4 | y | 4.00E+00 |
| 192 | Surrogate | Ks-26 | 4.40E+08 | 7.92E+02 | 1 | 1.28E-03 | 32.414 | 2 | y | 2.00E+00 |

Note: Concentrations shown in bold and italics are model-calculated concentrations that meet on GWPLs at the compliance well

#### *5.1.1.2 Heavy Metals Concentrations*

The starting metals concentrations in the model were determined by calculating the maximum possible metals concentration, based on the density of each metal. Those metal densities, and corresponding concentrations in $mg/m^3$ are given in Table 26. The PATHRAE model was run using these source term concentrations in the vertical (unsaturated) model domain.

***Table 26. Maximum Possible Metals Concentrations Based on Density***

| Element | Symbol | Density (gm/cc) | Maximum Possible Metal Concentration ($mg/m^3$) |
|---|---|---|---|
| Silver | Ag | 10.5 | 1.05E+10 |
| Arsenic | As | 5.73 | 5.73E+09 |
| Barium | Ba | 3.5 | 3.50E+09 |
| Beryllium | Be | 1.848 | 1.85E+09 |
| Cadmium | Cd | 8.65 | 8.65E+09 |
| Chromium | Cr | 8.96 | 8.96E+09 |
| Copper | Cu | 8.92 | 8.92E+09 |
| Mercury | Hg | 13.54 | 1.35E+10 |
| Molybdenum | Mo | 10.22 | 1.02E+10 |
| Nickel | Ni | 8.4 | 8.40E+09 |
| Lead | Pb | 11.35 | 1.14E+10 |
| Selenium | Se | 4.79 | 4.79E+09 |
| Zinc | Zn | 7.13 | 7.13E+09 |

### *5.1.2 Waste Bulk Density*

A value of 1.8 $gm/cm^3$ was used for the bulk density of the waste. This value is consistent with previous modeling and the range of density determined by Energy*Solutions* (1.75 to 1.80 $gm/cm^3$) for the compacted, in-place waste.

### *5.1.3 Partitioning Coefficients ($K_d$)*

The partitioning coefficient (a.k.a. distribution coefficient, sorption coefficient, or $K_d$) is the equilibrium ratio of the adsorbed contaminant concentration in soil or waste (mg/kg) to the concentration in the pore water or leachate (mg/l). Higher $K_d$ values indicate that the constituent is more likely to partition to the soil and less likely to be released into groundwater.

The $K_d$ values used in modeling the fate and transport of isotopes at the Energy*Solutions* site have evolved over time, as radionuclide inventories changed and more information was obtained from the literature and from site-specific $K_d$ testing. The modeling performed for the CAW cell incorporates the current approved $K_d$ values for the site. The modeling preferentially uses 1) approved site-specific $K_d$ values, 2) the lowest measured soil $K_d$ values published in the literature, and 3) published $K_d$ values calculated from the soil:plant ratio. Approved site-specific $K_d$ values were available for Cs, Co, C-14, I-129, Np-237, Tc-99, U and Zn. The most conservative (lowest) $K_d$ values found in the literature were used for nuclides that did not have site-specific $K_d$ values, as indicated in Table 27. The soil:plant ratio was only used where actual measured soil $K_d$ values are not available, and the published $K_d$ value from the soil:plant ratio was decreased by two orders of magnitude to be conservative. The $K_d$ values and data sources for radionuclides and metals are listed in Table 27.

***Table 27. Sorption Coefficient ($K_d$) Values for Radionuclides and Metals***

*(See large tables at end of report document)*

### *5.1.4 Half Lives*

The half lives used in the modeling are shown in Table 24 and Table 25. Radionuclides were modeled using half lives identical to those used in the previous Class A cell modeling (Whetstone, 2000e). The source of the radionuclide half lives are provided in Table 28. All of the metals were modeled using a half life of $10^{14}$ years, which essentially allowed no degradation.

### *5.1.5 Fractional Release Rate*

The annual fractional release rate, or "leach rate", was calculated using the following equation (Kozak 1990):

$$L = \frac{q_{in}}{d\theta\left(1 + \frac{\rho K_d}{\theta}\right)}$$

where L = fractional annual contaminant release rate ($yr^{-1}$)
$q_{in}$ = water infiltration rate (m/yr)
$\theta$ = volumetric moisture content of waste
d = waste layer thickness (meters)
$\rho$ = waste density ($g/cm^3$)
$K_d$ = waste distribution coefficient (ml/g)

This method of determining the leachate concentration is environmentally-conservative for several reasons. First, PATHRAE assumes that the release rate is constant throughout time. The constituent is leached from the waste at a constant rate, until the initial source concentration is totally mobilized. In reality, the leach rate will decrease as the source concentration decreases. Second, the use of $K_d$ to determine contaminant release rates assumes that all of the constituent is adsorbed and will eventually be completely desorbed (or leached out) by percolating water. In reality, some of the constituent may occur in the refractory phase, which would render it less mobile. Last, the CAW cell modeling used the lowest literature $K_d$ values, for constituents without site-specific $K_d$s.

The annual fractional release rates from the waste (vertical simulation) were calculated based on the infiltration rate ($q_{in}$) from the HELP3 modeling and the moisture content ($\theta$) from the UNSAT-H modeling. The annual fractional release rates for each nuclide are shown in Table 24 for the top slope and Table 25 for the side slope.

### *5.1.6 Vertical Retardation Factor*

PATHRAE calculates retardation *internally*, using $K_d$, soil bulk density, and effective porosity:

$$R = \left(1 + \frac{\rho K_d}{\theta}\right)$$

Where:

$R_d$ = Retardation factor
$\rho$ = Soil density ($kg/m^3$)
$K_d$ = Soil-water distribution coefficient (L/kg)
$\theta_e$ = Effective soil porosity (i.e., moisture content in the vadose zone)

Externally calculated retardation factor for each modeled constituent are shown in in Table 24 for the top slope and Table 25 for the side slope. Note that the values shown are calculated externally in a spreadsheet and are not input values to the PATHRAE model.

### *5.1.7 Container Life*

The container life was set to zero, in both the horizontal and vertical PATHRAE modeling. The CAW cell modeling disregards the time required for the water to percolate through the cover, and assumes that the clay cover is immediately degraded and that water moves through the cover instantaneously.

In reality, a significant delay will occur for the time required to wet the cover and the waste, and for moisture to travel through the cell cover, waste, and liner. Although the initial waste moisture contents cannot be known with certainty due to the inherent variability in the waste and in climatic conditions while the cell is open, previous open-cell modeling suggests that drying of the waste may occur and that the moisture content in the waste at the time of cell closure may be well below the levels assumed at the start of the closed cell modeling.

## *Table 28. Radionuclide Half-Lives and Data Sources*

| Nuclide | HALF-LIFE (Years) | DATA SOURCE |
|---|---|---|
| Ag-108 | 4.5E-06 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Ag-110m | 0.684 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Al-26 | 740,000 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Am-241 | 432.2 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Am-243 | 7,370 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Au-195 | 0.510 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ba-133 | 10.51 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Be-7 | 1.46E-01 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Bi-207 | 32 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Bi-210m | 3,040,000 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Bk-247 | 1,400 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| C-14 | 5730 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Ca-45 | 0.446 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cd-109 | 1.267 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cd-113m | 14.1 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Ce-139 | 0.377 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ce-141 | 0.089 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ce-144 | 0.781 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cf-249 | 351 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Cf-250 | 13.08 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Cf-251 | 898 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Cl-36 | 301,000 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cm-242 | 0.446 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cm-243 | 29.10 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Cm-244 | 18.10 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Cm-245 | 8,500 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Cm-246 | 4,730 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Cm-247 | 15,600,000 | Kocher, David C. Radioactive Decay Data Tables, A Handbook of Decay Data for Application to Radiation Dosimetry and Radiological Assessments, Technical Information Center, US DOE |
| Cm-248 | 340,000 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Co-56 | 0.212 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Co-57 | 0.745 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Co-58 | 0.194 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Co-60 | 5.270 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Cr-51 | 0.076 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cs-134 | 2.065 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cs-135 | 2,300,000 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cs-137 | 30.07 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Cu-67 | 0.169 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Eu-152 | 13.54 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Eu-154 | 8.59 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Eu-155 | 4.76 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Fe-55 | 2.73 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Fe-59 | 0.122 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Fe-60 | 1,500,000 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Gd-148 | 74.6 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Gd-153 | 0.662 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ge-68 | 0.742 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| H-3 | 12.33 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Hf-181 | 0.116 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Hg-194 | 444 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Hg-203 | 0.128 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ho-166m | 1,200 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| I-125 | 0.163 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| I-129 | 1.57E+07 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ir-192 | 0.202 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| K-40 | 1.28E+09 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Mn-54 | 0.856 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Na-22 | 2.6 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Nb-93m | 16.13 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Nb-94 | 20,300 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Ni-59 | 76,000 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |

### *Table 28. Radionuclide Half-Lives and Data Sources (Part 2)*

| Nuclide | HALF-LIFE (Years) | DATA SOURCE |
|---|---|---|
| Ni-63 | 100 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Np-237 | 2,144,000 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Os-194 | 6 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Pb-210 | 22.30 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pm-147 | 2.62 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Po-209 | 102 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Po-210 | 0.379 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Pu-236 | 2.86 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pu-238 | 87.70 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pu-239 | 24,110 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pu-240 | 6,564 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pu-241 | 14.35 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pu-242 | 373,300 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Pu-243 | 0.00057 | Kocher, David C. Radioactive Decay Data Tables, A Handbook of Decay Data for Application to Radiation Dosimetry and Radiological Assessments, Technical Information Center, US DOE |
| Pu-244 | 80,800,000 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Ra-226 | 1,600 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ra-228 | 5.75 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Rb-83 | 0.236 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Ru-106 | 1.02 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| S-35 | 0.240 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Sb-124 | 1.65E-01 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Sb-125 | 2.76 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Sc-46 | 0.230 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Se-75 | 0.328 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Se-79 | 65,000 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Si-32 | 172 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Sm-151 | 90 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Sn-113 | 0.315 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Sn-121m | 55 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Sn-126 | 100,000 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Sr-85 | 0.178 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Sr-89 | 0.138 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Sr-90 | 28.8 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Ta-182 | 0.314 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Tc-99 | 211,100 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Th-229 | 7,880 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Th-230 | 75,380 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Th-232 | 1.41E+10 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Ti-44 | 63 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| Tl-204 | 3.78 | Integrated Data Base for 1989, Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, Prepared for U.S. Dept. of Energy. Nov. 1989. |
| Tm-170 | 0.352 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| U-232 | 68.9 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| U-233 | 159,200 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| U-234 | 245,500 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| U-235 | 7.04E+08 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| U-236 | 2.34E+07 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |
| U-238 | 4.47E+09 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Y-88 | 0.292 | F.W. Walker, et. al., "Nuclides and Isotopes, Fourteenth Edition", General Electric Co. (1989) |
| Y-91 | 0.160 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Zn-65 | 0.669 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |
| Zr-95 | 0.175 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996. |

### *5.1.8 Decay Chain Computation*

The natural uranium decay chain (U-238→Th-230→U-234) and the plutonium-241 decay chain (Pu-241→Am-241→Np-237) were calculated by the model. PATHRAE has the ability to model five other decay chains, but this option was not invoked.

The simulation of decay chains for Pu-241→Am-241→Np-237 and U-238→Th-230→Ra-226 requires that all decay chain isotopes be contained in a single model run. The vertical model run with decay contained a total of 65 isotopes. The remaining 35 isotopes were modeled in a separate run, which did not invoke the decay chain option. Also, because the decay chain calculations require each isotope in the decay chain to have a different retardation, the Ra-226 $K_d$ was changed from 10.0 to 9.99 in the vertical PATHRAE input files.

## 5.2 Vertical Input Parameters for Flow and Transport

### *5.2.1 Infiltration*

The infiltration rate through the CAW cell was determined from the HELP3 modeling described in Section 2.0 above. Two infiltration rates were used to evaluate transport. The 0.090 cm/yr infiltration rate was used to evaluate transport from the top slope, while the 0.168 cm/yr infiltration rate was used to evaluate transport from the side slope (Table 29).

***Table 29. Infiltration Rates Input to PATHRAE Model***

| MODEL CASE | INFILTRATION RATE |
|---|---|
| Top Slope – Base Case | 0.090 cm/yr |
| Side Slope – Base Case | 0.168 cm/yr |

### *5.2.2 Single Homogeneous Medium*

PATHRAE is limited to solving the contaminant transport equation in one homogeneous medium for the vertical zone and one for the horizontal zone. In reality, particles migrating out of the landfill cell along the vertical pathway may travel through the waste, the bottom clay liner, and underlying units, all of which have differing hydraulic properties.

For the vertical pathway, the characteristics of individual units were converted to a single equivalent porous medium based on the methods described below. The equivalent moisture content and soil moisture velocities were calculated using the infiltration rate from the HELP3 modeling and UNSAT-H modeling. The characteristics of the equivalent porous media for the top slope and side slope are given in Table 30 and Table 31, respectively.

The soil bulk density for the equivalent porous media (clay liner and Unit 3 sand) below the CAW cell was calculated as the thickness-weighted average using the following equation:

$$\rho_{eq} = \frac{\left(\rho_{clay} \cdot d_{clay}\right) + \left(\rho_{Unit\,2/3} \cdot d_{Unit\,2/3}\right)}{\left(d_{clay} + d_{Unit\,2/3}\right)}$$

Where $\rho =$ density
$d =$ thickness

The volumetric water content for the equivalent porous media (clay liner and underlying units) below the CAW cell was calculated as the thickness-weighted average using the following equation:

$$\theta_{eq} = \frac{\left(\theta_{clay} \cdot d_{clay}\right) + \left(\theta_{Unit2/3} \cdot d_{Unit2/3}\right)}{\left(d_{clay} + d_{Unit2/3}\right)}$$

Where $\theta =$ volumetric water content
$d =$ thickness

***Table 30. Calculation of Equivalent Porous Media Properties based on CAW Cell Top Slope Design (0.090 cm/year Infiltration)***

| Layer | Material Type | Soil Bulk Density ($g/cm^3$) | Layer Thickness (cm) | Volumetric Water Content | Infiltration (cm/day) | Vadose Velocity (cm/yr) | Vadose Velocity (m/yr) | Saturated Hydraulic Conductivity (cm/sec) | Saturated Hydraulic Conductivity (m/yr) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Waste | 1.8 | 50 | 0.0501 | 0.00025 | 1.80 | 0.018 | 5.00E-04 | 157.7 |
| 1 | Clay Liner | 1.35 | 61 | 0.4157 | 0.00025 | 0.22 | 0.002 | 1.00E-06 | 0.315 |
| 2 | Units 2&3 | 1.6 | 346.25 | 0.0362 | 0.00025 | 2.49 | 0.025 | 7.53E-04 | 237.5 |
| 1+2 | Weighted average | 1.563 | 407.25 | 0.093 | | 0.97 | 0.0097 | 6.63E-06 | 2.09 |

Notes: Waste thickness is based on midpoint of unit (1 $m^3$) block of waste above liner.
Volumetric water content from UNSAT-H model run T24_08
Infiltration from HELP3 model, Class A West cell top slope run MT6-2024
Vadose velocity = infiltration/moisture content
Vadose velocity for Clay+Unit 2/3 calculated using equation shown on page 53.
Saturated hydraulic conductivity of Units 2 and 3 is site-wide geometric mean K from Table 16.

***Table 31. Calculation of Equivalent Porous Media Properties based on CAW Cell Side Slope Design (0.168 cm/year Infiltration)***

| Layer | Material Type | Soil Bulk Density ($gm/cm^3$) | Layer Thickness (cm) | Volumetric Water Content | Infiltration (cm/day) | Vadose Velocity (cm/yr) | Vadose Velocity (m/yr) | Saturated Hydraulic Conductivity (cm/sec) | Saturated Hydraulic Conductivity (m/yr) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | Waste | 1.8 | 50 | 0.0541 | 0.00046 | 3.10 | 0.031 | 5.00E-04 | 157.7 |
| 1 | Clay Liner | 1.35 | 61 | 0.4173 | 0.00046 | 0.40 | 0.004 | 1.00E-06 | 0.315 |
| 2 | Units 2&3 | 1.6 | 346.25 | 0.0420 | 0.00046 | 4.00 | 0.040 | 7.53E-04 | 237.5 |
| 1+2 | Weighted average | 1.563 | 407.25 | 0.098 | | 1.71 | 0.0171 | 6.63E-06 | 2.09 |

Notes: Waste thickness is based on midpoint of unit (1 $m^3$) block of waste above liner.
Volumetric water content from UNSAT-H model run S18_06
Infiltration from HELP3 model, Class A West cell side slope run S18-24R2
Vadose velocity = infiltration/moisture content
Vadose velocity for Clay+Unit 2/3 calculated using equation shown on page 53.
Saturated hydraulic conductivity of Units 2 and 3 is site-wide geometric mean K from Table 16.

The saturated hydraulic conductivity of the equivalent porous media representing the clay liner and underlying units was calculated using method to calculate an equivalent vertical hydraulic conductivity for a system of layers described in Freeze and Cherry (1979):

$$K_z = \frac{d}{\sum_{i=1}^{n} d_i / K_i} = \frac{d_1 + d_2 + d_3 + \ldots d_n}{\left(\frac{d_1}{K_1} + \frac{d_2}{K_2} + \frac{d_3}{K_3} \ldots + \frac{d_n}{K_n}\right)}$$

Where $K_z$ = equivalent vertical hydraulic conductivity (L/T)
$d_i$ = thickness of the given layer (L)
$K_i$ = hydraulic conductivity of the given layer (L/T)

Applying this equation to the layered media below the CAW waste and above the capillary fringe, the equivalent saturated vertical hydraulic conductivity was calculated as follows:

$$K_{eq} = \frac{d_c + d_s}{\left(\frac{d_c}{K_c} + \frac{d_s}{K_s}\right)}$$

Where $K_{eq}$ = equivalent vertical hydraulic conductivity (L/T)
$d_c$ = thickness of the clay layer (L)
$K_c$ = saturated hydraulic conductivity of the clay layer (L/T)
$d_s$ = thickness of the Unit 2 and 3 "soil" layer to the top of the capillary fringe (L)
$K_s$ = saturated hydraulic conductivity of the Unit 2 and 3 "soil" layer (L/T)

The saturated hydraulic conductivity of the clay layer is $1 \times 10^{-6}$ cm/sec while the saturated hydraulic conductivity of Units 2 and 3 is $7.53 \times 10^{-4}$ cm/sec, as described in Section 3.5. The thickness of Units 2 and 3 from the bottom of the waste to the top of the capillary zone was determined from UNSAT-H modeling, as described in Section 3.6.2. The calculated saturated vertical hydraulic conductivity values for the equivalent porous media are shown in Table 30 and Table 31.

The fraction of saturation of a soil is determined by:

$$S = \frac{V_w}{V_v} = \frac{\theta}{n}$$

Where $S$ = fraction of saturation (unitless)
$V_w$ = volume of water
$V_v$ = volume of voids
$\theta$ = volumetric moisture content (which is a function of infiltration rate and soil properties)
$n$ = porosity

The fraction of saturation of the equivalent porous media representing the clay liner and Unit 3 sand was calculated as a weighted average value, using the following equation:

$$S = \frac{\left(\frac{\theta_c}{n_c} * d_c + \frac{\theta_s}{n_s} * d_s\right)}{(d_c + d_s)}$$

Where $S$ = fraction of saturation (unitless)
$\theta_c$ = moisture content of the clay layer (v/v, unitless)
$n_c$ = porosity of the clay layer(v/v, unitless)
$d_c$ = thickness of the clay layer (L)
$\theta_s$ = moisture content of the Unit 2 and 3 "soil" layer (v/v, unitless)
$n_s$ = porosity of the Unit 2 and 3 "soil" layer (v/v, unitless)
$d_s$ = thickness of the Unit 2 and 3 "soil" layer to the top of the capillary fringe (L)

Using the volumetric water contents and layer thicknesses shown in Table 30 and Table 31, the fraction of saturation in the vadose zone was 0.235 and 0.250 for the top slope and side slope simulations, respectively.

### *5.2.3 Aquifer Velocity*

The aquifer velocity in the vertical model was calculated according to the equation for average linear velocity in the vadose zone (Stephens, 1996):

$$v = q / \theta_e$$

where v = average linear velocity (L/T)
q = infiltration rate (L/T)
$\theta_e$ = effective water content that participates in carrying the flow ($L^3/L^3$)

In this equation, the infiltration rate (q) was determined using the HELP3 model. The moisture content (θ) was determined for each material using the UNSAT-H model, as described in Section 3.6.1.

The velocity for the layered vertical profile was calculated as a thickness-weighted average of the layered profile which included the clay liner and Unit 3 sand to the top of the capillary fringe. The velocity through the layered profile was calculated as follows:

$$v_{eq} = \frac{d_c + d_s}{\left(\frac{d_c}{v_c} + \frac{d_s}{v_s}\right)} = \frac{d_c + d_s}{\left(\frac{d_c \cdot \theta_c}{q} + \frac{d_s \cdot \theta_s}{q}\right)}$$

Where $v_{eq}$ = average linear velocity of the layered system represented by an equivalent porous medium (L/T)
$v_c$ = average linear velocity of the clay layer (L/T)
$d_c$ = thickness of the clay layer (L)
$v_s$ = average linear velocity of the Unit 2 and 3 "soil" layer (L/T)
$d_s$ = thickness of the Unit 2 and 3 "soil" layer to the top of the capillary fringe (L)
q = infiltration rate (L/T)
$\theta_c$ = effective water content in the clay ($L^3/L^3$)
$\theta_s$ = effective water content in the Unit 2 and 3 "soil" layer ($L^3/L^3$)

The vadose zone velocities calculated for the equivalent porous media (liner and silty sand) underlying the top slope and side slope simulations are 0.0097 and 0.0171 m/yr, as shown in Table 30 and Table 31.

### *5.2.4 Vertical Transport Distance*

The vertical pathway represents the distance from the bottom of the waste to the aquifer, including the 2-foot thick clay liner and excluding the capillary fringe. The distance from the bottom of the waste to the top of the aquifer is 15.40 feet, based on the cell design and the measured water levels in August 2010. Using the measured elevations adjusted for freshwater head (Table 13), and the capillary fringe height predicted by the UNSAT-H modeling (Section 3.6.2), the distance was calculated as follows:

$$\text{Adjusted Distance} = H_{clay} - H_{aq} - cf$$

$$\text{Adjusted Distance} = 4265.0 - 4249.6 - 2.04 = 13.36 \text{ feet}$$

where $H_{clay}$ = Elevation of the top of the clay (4265.0, based on engineering drawing 10014 C01)
$H_{aq}$ = Elevation of the top of the aquifer (4249.6, see Table 13)
cf = Capillary fringe (2.04 feet, determined from UNSAT-H modeling)

The PATHRAE model requires distances in meters. The 13.36 feet was converted to 4.072 meters, for the vertical transport distance.

***Table 32. Calculation of Vertical Transport Distance***

| | | |
|---|---|---|
| Top of clay elevation | 4265.00 | ft amsl |
| Water table elevation | 4249.60 | ft amsl |
| Distance to water table | 15.40 | |
| Height of capillary fringe | 2.04 | ft |
| Vertical transport distance | 13.36 | ft |
| Vertical transport distance | 4.07 | meters |

### *5.2.5 Dispersivity*

Dispersivity is an empirical index of the magnitude of variations of the pore velocities in the soil. Dispersivity in the vadose zone tends to be lower than that in the saturated zone because 1) the pore spaces through which water moves are generally of about the same size – larger and smaller pores do not participate in transport, and 2) layered heterogeneity may have an averaging effect on solute transport in the vadose zone.

- Soils with a small range of pore sizes have smaller values than those with a wide range of pore sizes (Nofziger et al, 1989). The soils below the CAW cell are moderately well sorted, indicating that dispersivity will be low.
- Values are generally less than 1 cm for laboratory columns and less than 10 cm for field soils (Rao, et al., 1987; Nofziger et al, 1989)
- Local differences in fluid velocity are evened out by layering or vertical heterogeneity (Wierenga, 1995). Dispersivity in a column filled with layered soils is half of the dispersivity measured in a column of uniformly filled with soil, as measured during unsaturated transport through 6 m deep columns (Porro and Wierenga, 1993). Similar observations were made by Roth, et al. (1991.)
- Dispersivity is dependent on the water content of the material and any change in water content which may be occurring. The highest dispersivities have been measured in soils which were fully saturated and are draining. The lowest dispersivities have been measured in soils with relatively stable moisture contents, as is expected in the long term below the CAW cell.

For these reasons, the dispersivity of 0.1 meters was applied to the 4.07 meter transport distance in the vertical PATHRAE model runs. Previous modeling performed for the LARW cell (ABC, 1997) included

sensitivity analyses using 0.2 and 0.4 meter dispersivity values. The vertical dispersivity value of 0.1 is consistent with the previously submitted and approved modeling at the site.

### *5.2.6 River Flow Rate*

The seepage rate in the vertical model runs is entered as a "river flow rate". The "river" represents the infiltrating water that is assumed to arrive at the water table (based on the conservative modeling results described in Section 2). The river flow rate was set to 0.00090 and 0.00168 $m^3$/yr for the top slope and side slope PATHRAE simulations, respectively.

## 5.3 Vertical Transport Model Results

### *5.3.1 Vertical Top Slope Analysis (0.090 cm/yr)*

The output from the vertical modeling, based on the top slope cover design infiltration rate of 0.090 cm/yr (0.036 in/yr), is shown in Table 33. A summary of peak concentrations at the water table are provided in Table 34. A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 35. None of the surrogate nuclides exceeded a benchmark standard of 1 pCi/L. These concentrations at the water table are interim results for the complete fate and transport model, and are used as starting input concentrations for the horizontal model (Section 6).

Starting concentrations that would meet GWPLs at the compliance well were calculated for Bk-247, Ca-41, and Cl-36 and are shown in Table 23. A total of 16 nuclides were carried through to the horizontal PATHRAE modeling (described in Section 6) to determine the concentrations that would meet GWPLs at a compliance well (Section 6.3.1). The 16 nuclides that were carried forward to the horizontal PATHRAE modeling included Bk-247, Ca-41, Cl-36 and thirteen additional nuclides that met GWPLs using the Class A starting concentrations.

***Table 33. Summary of Peak Concentrations at the Water Table, PATHRAE Vertical Model Results for Top Slope 0.090 cm/yr Case***

| Nuclide | Peak Concentration ($Ci/m^3$) | Peak Concentration (pCi/L) | Peak Year |
|---|---|---|---|
| H-3 | 8.61E-11 | 8.61E-02 | 357 |
| Bk-247 | 4.23E-08 | 4.23E+01 | 474 |
| Cl-36 | 1.28E-04 | 1.28E+05 | 490 |
| Sr-90 | 1.54E-08 | 1.54E+01 | 522 |
| Ca-41 | 1.61E-01 | 1.61E+08 | 868 |
| Re-187 | 1.42E-01 | 1.42E+08 | 1,068 |
| Tc-99 | 5.56E-01 | 5.56E+08 | 1,345 |
| I-129 | 1.41E-02 | 1.41E+07 | 1,426 |
| Si-32 | 1.70E+03 | 1.70E+12 | 2,230 |
| Am-242m | 2.07E-14 | 2.07E-05 | 3,829 |
| Pd-107 | 4.22E+02 | 4.22E+11 | 4,856 |
| Am-241 | 7.84E-08 | 7.84E+01 | 5,699 |
| Am-243 | 2.17E-03 | 2.17E+06 | 8,199 |
| Se-79 | 3.02E+04 | 3.02E+13 | 8,417 |
| Cd-113 | 2.05E-07 | 2.05E+02 | 8,443 |
| Bi-210m | 2.69E+02 | 2.69E+11 | 8,443 |

Ninety-six (96) of the 99 nuclides modeled met GWPLs at the water table, due to a high $K_d$ value, low starting concentration, or short half-life. (The applicable point of compliance is a monitoring well located

90 feet from the edge of the waste, and all constituents met the GWPLs at the point of compliance [Section 6.3.1]).

***Table 34. Peak Radionuclide Concentrations at the Water Table, Vertical PATHRAE Results for CAW Cell Top Slope (0.090 cm/year Infiltration)***

*(See large tables at end of report document.)*

***Table 35. Radionuclide Concentrations (pCi/L) at the Water Table, Vertical PATHRAE Model Results for the CAW Top Slope (0.090 cm/year Infiltration***

*(See large tables at end of report document.)*

### *5.3.2 Vertical Side Slope Analysis (0.168 cm/yr)*

The output from the vertical modeling, based on the side slope cover design infiltration rate of 0.168 cm/yr (0.066 in/yr), is shown in Table 36. A summary of peak concentrations at the water table are provided in Table 36. A complete listing of output times and concentrations for all nuclides that arrived at the water table is provided in Table 38. None of the surrogate nuclides exceeded a benchmark standard of 1 pCi/L. These concentrations at the water table are interim results for the complete fate and transport model, and are used as starting input concentrations for the horizontal model (Section 6).

Starting concentrations that would meet GWPLs at the compliance well were calculated for Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 and are shown in Table 23. A total of 16 nuclides were carried through to the horizontal PATHRAE modeling (described in Section 6) to determine the concentrations that would meet GWPLs at a compliance well (Section 6.3.1). The 16 nuclides that were carried forward to the horizontal PATHRAE modeling included the six nuclides with limiting concentrations and ten additional nuclides that met GWPLs using the Class A starting concentrations.

Most of the nuclides did met GWPLs at the water table, due to high $K_d$ values, low starting concentrations, or short half-lives. Example time-and-concentration curves for nuclides that peak at the water table within 1,000 years are shown in Figure 9.

***Table 36. Summary of Peak Concentrations at the Water Table, PATHRAE Vertical Model Results for 0.168 cm/yr Side Slope Case***

| Nuclide | Peak Concentration ($Ci/m^3$) | Peak Concentration (pCi/L) | Peak Year |
|---|---|---|---|
| H-3 | 1.17E-06 | 1.17E+03 | 254 |
| Bk-247 | 2.64E-08 | 2.64E+01 | 270 |
| Cl-36 | 7.37E-05 | 7.37E+04 | 279 |
| Sr-90 | 5.12E-06 | 5.12E+03 | 354 |
| Ca-41 | 1.47E-04 | 1.47E+05 | 495 |
| Re-187 | 6.72E-02 | 6.72E+07 | 609 |
| Pu-244 | 4.99E-05 | 4.99E+04 | 735 |
| Tc-99 | 4.79E-03 | 4.79E+06 | 769 |
| I-129 | 5.76E-05 | 5.76E+04 | 814 |
| Si-32 | 9.77E+04 | 9.77E+13 | 1,470 |
| Pt-193 | 2.22E-08 | 2.22E+01 | 1,704 |
| Pt-193 | 2.22E-08 | 2.22E+01 | 1,704 |
| Am-242m | 1.32E-10 | 1.32E-01 | 2,725 |
| Pd-107 | 3.95E+02 | 3.95E+11 | 2,776 |
| Pd-107 | 3.95E+02 | 3.95E+11 | 2,776 |
| Am-241 | 4.82E-06 | 4.82E+03 | 3,779 |
| Am-243 | 2.84E-03 | 2.84E+06 | 4,752 |
| Se-79 | 2.93E+04 | 2.93E+13 | 4,821 |
| Bi-210m | 2.52E+02 | 2.52E+11 | 4,835 |
| Cd-113 | 1.92E-07 | 1.92E+02 | 4,835 |
| Cf-249 | 1.46E-09 | 1.46E+00 | 5,769 |
| Nb-91 | 1.83E+03 | 1.83E+12 | 5,921 |
| Te-123 | 1.05E-04 | 1.05E+05 | 5,975 |
| Fe-60 | 1.28E+03 | 1.28E+12 | 6,659 |
| Cf-251 | 3.68E-06 | 3.68E+03 | 7,449 |
| Nb-94 | 2.85E-03 | 2.85E+06 | 7,494 |
| Nb-92 | 3.19E+01 | 3.19E+10 | 7,570 |

***Table 37. Peak Radionuclide Concentrations and Time to Exceed GWPL at the Water Table, Vertical PATHRAE Model Results for CAW Cell Side Slope (0.168 cm/year Infiltration)***

*(See large tables at end of report document.)*

***Table 38. Radionuclide Concentrations (pCi/L) at the Water Table, Vertical PATHRAE Model Results for CAW Cell Side Slope (0.168 cm/year Infiltration)***

*(See large tables at end of report document.)*

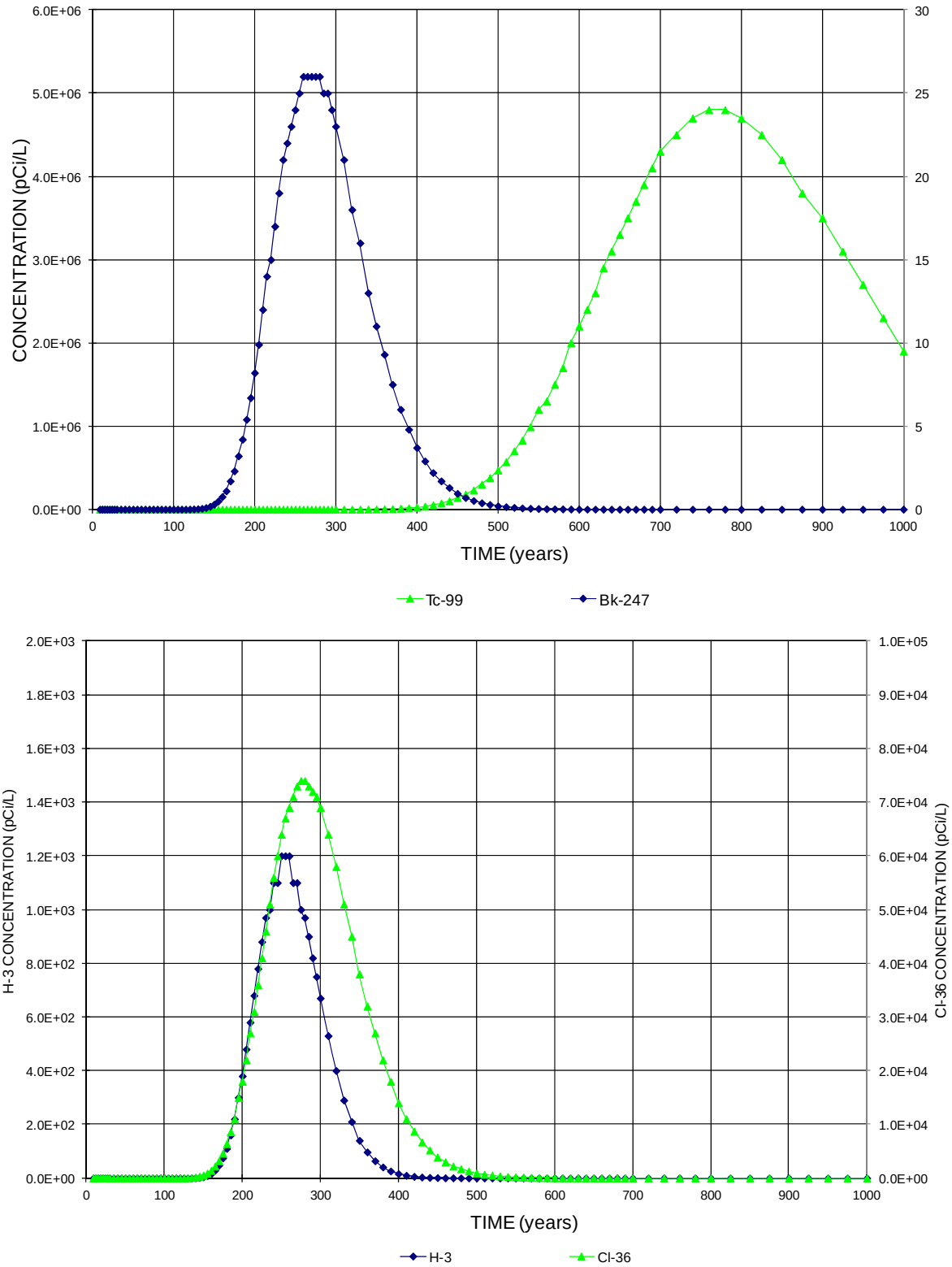



***Figure 9. Example Constituents whose Concentrations Peak at the Water Table within 1,000 Years, Vertical PATHRAE Model Output Based on 0.168 cm/year Infiltration***

### *5.3.3 Vertical Analysis for Metals*

Vertical PATHRAE modeling for metals was performed for the CAW top slope and side slope.

The top slope vertical model results indicate that none of the metals modeled would arrive or exceed GWPLs at the water within 200 years, based on an infiltration rate of 0.090 cm/yr. The concentrations at the water table predicted by the model are not subject to solubility controls. Therefore, the model results predicted by complete leaching using the lowest-literature $K_d$ values may significantly exceed the solubility of metals in groundwater at the site.

The side slope vertical model results indicate that none of the metals modeled would arrive or exceed GWPLs at the water within 200 years, based on an infiltration rate of 0.168 cm/yr. The metals modeling was not carried through to the horizontal PATHRAE modeling because all GWPLs were met at the water table.

# 6. HORIZONTAL PATHRAE FATE AND TRANSPORT MODELING

The horizontal PATHRAE fate and transport modeling uses the output from the vertical model as initial source concentrations. The arrival of nuclides at the water table is input into the horizontal model, using the discrete dispersed source method. The horizontal model uses the groundwater to a well pathway to predict concentrations at a compliance well located 90 feet from the edge of the waste.

## 6.1 Horizontal Input Parameters for Contaminant Release

### *6.1.1 Waste Source Term Concentrations*

The source term concentrations for the horizontal model were calculated from the output from the vertical model, as described in Section 4. The method involves calculating the concentration in each of the 116 "slices" using the following equation:

$$C = \frac{(C_t + C_{t+n})}{2} \cdot ((t+n) - t)$$

where:
- $C$ = Mass/activity of nuclide in a given time slice in a unit volume of fluid [Ci·yrs/m$^3$]
- $C_t$ = Output concentration at time t [Ci/m$^3$]
- $C_{t+n}$ = Output concentration at time t+n [Ci/m$^3$]
- $t$ = Time at beginning of "time slice" [years]
- $t+n$ = Time at end of "time slice" [years]
- $n$ = Duration of "time slice" [years]

The leachate concentration in water (Ci/m$^3$) was converted to a sorbate concentration on aquifer soil (Ci/m$^3$). The mass ascribed to one cubic meter of aquifer was determined using the following equation:

$$C_{aq} = \frac{C_l(q_{in})}{V_{soil}} = \frac{C_l(q_{in})}{(1\ m^3)}$$

where:
- $C_{aq}$ = Concentration of constituent sorbed onto 1 m$^3$ of aquifer soil [Ci/yr/m$^3$ soil]
- $C_l$ = Concentration in leachate (output of vertical slice) [Ci/m$^3$ water]
- $V_{soil}$ = Volume of soil [m$^3$]
- $q_{in}$ = Infiltration rate [m/yr applied to 1 m$^2$ surface area = m$^3$/yr]

### *6.1.2 Aquifer Bulk Density*

The aquifer bulk density in the horizontal model was set at the thickness weighted average bulk density shown in Table 30 (1.563 gm/cm$^3$.)

### *6.1.3 Aquifer Moisture Content*

The aquifer is saturated, with a moisture content equal to the saturated porosity of 29%. The effective porosity value of 0.29 has been used in previous modeling (DEQ, 1994), and is based on site specific data.

### *6.1.4 Partitioning Coefficients ($K_d$)*

The distribution coefficients ($K_d$s) used in the horizontal pathway were identical to those used in the vertical model. The radionuclide and metals $K_d$ values used in the modeling were summarized in Table 27.

### *6.1.5 Fractional Release Rate*

The contaminant release rate (or leach rate) for the horizontal simulation was set to 1/yr for all constituents modeled. In this manner, the entire waste concentration in each "time slice" was released

"instantaneously". The $K_d$-limited leach rate was already accounted for in the vertical simulation and the resulting time offset for the "time slices" which was input to the horizontal model.

### *6.1.6 Horizontal Retardation Factor*

PATHRAE calculates retardation *internally*, using $K_d$, soil bulk density, and effective porosity:

$$R = \left(1 + \frac{\rho K_d}{\theta}\right)$$

Where:

$R_d$ = Retardation factor
$\rho$ = Soil density (kg/m$^3$)
$K_d$ = Soil-water distribution coefficient (L/kg)
$\theta_e$ = Aquifer porosity

Externally calculated retardation factor for each modeled constituent are shown in in Table 39 for the top slope and Table 40 for the side slope. Note that the values shown are calculated externally in a spreadsheet and are not input values to the PATHRAE model.

**Table 39. Horizontal Modeling - Waste Maximum Radionuclide Source Concentrations, $K_d$s, and Fractional Release Rates, based on 0.090 cm/year Infiltration**

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Concentration | Fractional Release Rate (1/yr) | Vertical Distribution Coefficient ($K_d$) (L/Kg) | Horizontal Distribution Coefficient ($K_d$) (L/Kg) | Aquifer Retardation Factor | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|
| 48 | Americium | Am-241 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 432.2 |
| 104 | Americium | Am-242m | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 141 |
| 105 | Americium | Am-243 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 7,370 |
| 109 | Bismuth | Bi-210m | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 3,040,000 |
| 110 | Berkelium | ***Bk-247*** | See vertical model output tables | 1.0 | 0.0001 | 0.001 | 1.01 | 1,400 |
| 112 | Calcium | ***Ca-41*** | See vertical model output tables | 1.0 | 0.0001 | 0.05 | 1.27 | 103,000 |
| 113 | Cadmium | Cd-113 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 9.3.E+15 |
| 119 | Chlorine | ***Cl-36*** | See vertical model output tables | 1.0 | 0.0001 | 0.0025 | 1.01 | 301,000 |
| 134 | Hydrogen | H-3 | See vertical model output tables | 1.0 | 0.0001 | 0.04 | 1.22 | 12.3 |
| 137 | Iodine | I-129 | See vertical model output tables | 1.0 | 0.0001 | 0.12 | 1.65 | 15,700,000 |
| 152 | Palladium | Pd-107 | See vertical model output tables | 1.0 | 0.0001 | 0.55 | 3.96 | 6,500,000 |
| 164 | Rhenium | Re-187 | See vertical model output tables | 1.0 | 0.0001 | 0.075 | 1.40 | 43,500,000,000 |
| 165 | Selenium | Se-79 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 65,000 |
| 166 | Silicon | Si-32 | See vertical model output tables | 1.0 | 0.0001 | 0.35 | 2.89 | 172 |
| 170 | Strontium | Sr-90 | See vertical model output tables | 1.0 | 0.0001 | 0.05 | 1.27 | 28.78 |
| 173 | Technetium | Tc-99 | See vertical model output tables | 1.0 | 0.0001 | 0.11 | 1.59 | 211,100 |

Note: The aquifer retardation factor is calculated internally in PATHRAE, and is not input to the model from this table.

***Table 40. Horizontal Waste Maximum Radionuclide Source Concentrations, $K_d$s, and Fractional Release Rates, based on 0.168 cm/year Infiltration***

| Pathrae Isotope Number | ELEMENT | NUCLIDE | Concentration | Fractional Release Rate (1/yr) | Vertical Distribution Coefficient ($K_d$) (L/Kg) | Horizontal Distribution Coefficient ($K_d$) (L/Kg) | Aquifer Retardation Factor | 1/2 life (Years) |
|---|---|---|---|---|---|---|---|---|
| 48 | Americium | Am-241 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 432.2 |
| 104 | Americium | Am-242m | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 141 |
| 105 | Americium | Am-243 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 7,370 |
| 109 | Bismuth | Bi-210m | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 3,040,000 |
| 110 | Berkelium | Bk-247 | See vertical model output tables | 1.0 | 0.0001 | 0.001 | 1.01 | 1,400 |
| 112 | Calcium | Ca-41 | See vertical model output tables | 1.0 | 0.0001 | 0.05 | 1.27 | 103,000 |
| 113 | Cadmium | Cd-113 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 9.3.E+15 |
| 119 | Chlorine | Cl-36 | See vertical model output tables | 1.0 | 0.0001 | 0.0025 | 1.01 | 301,000 |
| 134 | Hydrogen | H-3 | See vertical model output tables | 1.0 | 0.0001 | 0.04 | 1.22 | 12.3 |
| 137 | Iodine | I-129 | See vertical model output tables | 1.0 | 0.0001 | 0.12 | 1.65 | 15,700,000 |
| 152 | Palladium | Pd-107 | See vertical model output tables | 1.0 | 0.0001 | 0.55 | 3.96 | 6,500,000 |
| 164 | Rhenium | Re-187 | See vertical model output tables | 1.0 | 0.0001 | 0.075 | 1.40 | 43,500,000,000 |
| 165 | Selenium | Se-79 | See vertical model output tables | 1.0 | 0.0001 | 1 | 6.39 | 65,000 |
| 166 | Silicon | Si-32 | See vertical model output tables | 1.0 | 0.0001 | 0.35 | 2.89 | 172 |
| 170 | Strontium | Sr-90 | See vertical model output tables | 1.0 | 0.0001 | 0.05 | 1.27 | 28.78 |
| 173 | Technetium | Tc-99 | See vertical model output tables | 1.0 | 0.0001 | 0.11 | 1.59 | 211,100 |

Note: The aquifer retardation factor is calculated internally in PATHRAE, and is not input to the model from this table.

## 6.2 Horizontal Input Parameters for Flow and Transport

### *6.2.1 Hydraulic Conductivity*

The geologic materials underlying the CAW cell include the Unit 3 sand and Unit 2 clay. As discussed in Section 3.5, the hydraulic conductivity of the shallow aquifer is 7.53 x $10^{-4}$ cm/sec, based on the 90% upper confidence level (UCL) for the Unit 3 sand and Unit 2 clay calculated from 118 slug tests conducted site-wide (Table 16). The use of the 90% UCL is more conservative than using the geometric mean hydraulic conductivity (6.16 x $10^{-4}$ cm/sec) because aquifer velocity is directly proportional to hydraulic conductivity (Section 6.2.4).

### *6.2.2 Hydraulic Gradient*

Hydraulic gradients have been calculated monthly for the unconfined shallow groundwater beneath the Energy*Solutions* site to determine compliance with the Ground Water Quality Discharge Permit (UGW450005). The Permit for the existing Class A and Class A North cells gives a maximum allowable hydraulic gradient 1.0x$10^{-3}$ ft/ft for the shallow aquifer beneath the cells. Previous and current modeling is based on this hydraulic gradient.

### *6.2.3 Effective Porosity*

The effective porosity value of 0.29 was used in the calculation of aquifer velocity for all calculations in the saturated zone / horizontal pathway.

### *6.2.4 Aquifer Average Linear Velocity*

The aquifer velocity ($v_a$) is calculated based on the Darcy equation, such that:

$$\overline{v_a} = \frac{Ki}{n_e}$$

where $v_a$ = average linear velocity in the aquifer (L/T)
K = hydraulic conductivity (L/T)
i = hydraulic gradient (L/L)
$n_e$ = aquifer effective porosity ($L^3/L^3$)

Using the effective porosity (0.29), 90% UCL hydraulic conductivity ($7.53 \times 10^{-4}$ cm/sec), and the average hydraulic gradient ($1.0 \times 10^{-3}$) described in the previous sections, the average groundwater linear velocity is 0.819 m/yr (2.7 ft/yr), as shown below:

$$\bar{v} = \frac{Ki}{n_e} = \frac{\left(7.53x10^{-4}\ \text{cm/sec}\right)\left(1.0x10^{-3}\right)}{0.29} = 2.60x10^{-6}\ \text{cm/sec} = 0.819\ \text{m/yr}$$

### *6.2.5 Horizontal Transport Distance*

The horizontal distance was modeled as the distance from the edge of the waste to the nearest compliance monitoring well. The side slope modeling used a horizontal distance of 90 ft (27.4 m).

The distance from the compliance well to the edge of the waste under the top slope was modeled using the side slope length (188 ft) plus the distance from the side slope to the well (90 ft) for a total distance of 278 feet from the waste to the compliance monitoring well. The top slope modeling used this 278 ft (84.7 m) horizontal transport distance.

### *6.2.6 Length of Perforations*

The groundwater to a well pathway requires that the length of perforations ($L_p$) variable be specified. Since the CAW cell modeling uses a 1 $m^3$ unit block of waste, the length of perforations was calculated based on infiltration rate, rather than entering the physical length (or average lengths) of well screened in the Unit 2/3 aquifer at the site.

The length of perforations was calculated based on the infiltration rate, volume of water moving through the aquifer, and aquifer porosity. First the ratio of groundwater flow (Q) to total annual seepage (q) from the CAW cell was calculated. Then the seepage from the top slope and from the side slope were converted to an aquifer thickness (or length of perforations") based on the aquifer porosity (0.29).

Groundwater flow through the aquifer (Q) was determined using the Darcy equation:

$$Q = KiA$$

Where: Q = Groundwater flow ($m^3$/yr)
i = hydraulic gradient
A = area of aquifer perpendicular to groundwater flow direction ($m^2$)

The aquifer cross sectional area was calculated based the saturated thickness of the Unit 2/3 aquifer of 17.31 feet (Table 42) and the length of the CAW cell perpendicular to the direction of groundwater flow (N40°E) of 2,910 feet (Figure 10). The aquifer hydraulic gradient of $1.0 \times 10^{-3}$ is used consistently throughout the PathRAE modeling (Section 6.2.2) and is specified in the License. Using these values, groundwater flow was calculated as 30,446 $m^3$/yr (Table 41).

***Table 41. Calculation of Aquifer Flow (Q)***

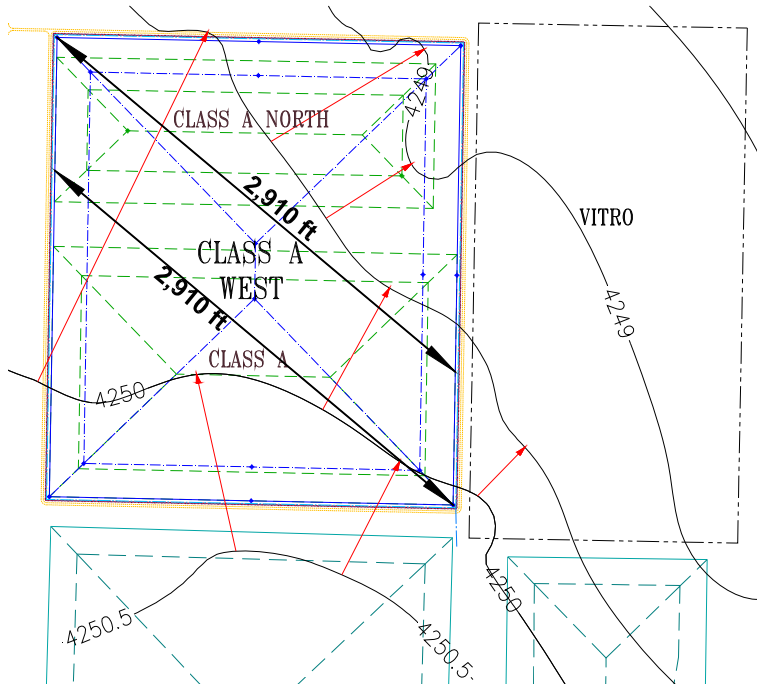
| | | | |
|---|---|---|---|
| K = | 7.53E-04 | cm/sec | Hydraulic conductivity |
| I = | 1.00E-03 | | Hydraulic gradient |
| L = | 2,910 | ft | Length of CAW cell ⊥ to N40E |
| b = | 17.31 | ft | Aquifer thickness |
| A = | 50372.1 | $ft^2$ | Cross sectional area of CAW cell ⊥ to N40E |
| A = | 4,680 | $m^2$ | Cross sectional area of CAW cell ⊥ to N40E |
| Q = | 30,445.9 | $m^3/yr$ | Aquifer flow |

### *Table 42. Saturated Thickness of the Unit 2/3 Aquifer*

| Well ID | Fresh Groundwater Elevation (ft amsl) | Top Unit 1 (ft amsl) | Saturated Thickness (ft) |
|---|---|---|---|
| GW-25 | 4250.4 | 4233.01 | 17.39 |
| GW-26 | 4250.46 | 4231.19 | 19.27 |
| GW-27 | 4250.1 | 4228.52 | 21.58 |
| GW-81 | 4249.81 | 4228.06 | 21.75 |
| GW-82 | 4249.84 | 4229.45 | 20.39 |
| GW-83 | 4249.78 | 4230.85 | 18.93 |
| GW-84 | 4249.73 | 4232.68 | 17.05 |
| GW-85 | 4249.53 | 4233.34 | 16.19 |
| GW-86 | 4249.26 | 4233.96 | 15.30 |
| GW-88 | 4249.31 | 4235.66 | 13.65 |
| GW-89 | 4249.45 | 4235.51 | 13.94 |
| GW-90 | 4249.58 | 4235.63 | 13.95 |
| GW-91 | 4249.61 | 4234.2 | 15.41 |
| GW-92 | 4250.32 | 4236.34 | 13.98 |
| GW-93 | 4250.23 | 4234.47 | 15.76 |
| GW-94 | 4250.43 | 4232.14 | 18.29 |
| GW-95 | 4250.07 | 4229.62 | 20.45 |
| GW-99 | 4250.14 | 4229.2 | 20.94 |
| GW-100 | 4249.97 | 4228.59 | 21.38 |
| GW-101 | 4249.7 | 4227.78 | 21.92 |
| GW-102 | 4249.77 | 4226.57 | 23.20 |
| GW-106 | 4249.62 | 4227.39 | 22.23 |
| GW-107 | 4249.99 | 4227.15 | 22.84 |
| GW-108 | 4249.95 | 4226.73 | 23.22 |
| GW-109 | 4249.67 | 4229.63 | 20.04 |
| GW-110 | 4249.53 | 4230.56 | 18.97 |
| GW-111 | 4249.56 | 4231.23 | 18.33 |
| GW-112 | 4249.25 | 4232.76 | 16.49 |
| GW-113 | 4249.26 | 4235.14 | 14.12 |
| GW-114 | 4249 | 4235.38 | 13.62 |
| GW-115 | 4249.26 | 4235.18 | 14.08 |
| GW-116 | 4249.03 | 4235.77 | 13.26 |
| GW-117 | 4248.88 | 4234.43 | 14.45 |
| GW-125 | 4249.24 | 4234.95 | 14.29 |
| GW-137 | 4249.05 | 4235.23 | 13.82 |
| GW-138 | 4248.94 | 4235.56 | 13.38 |
| GW-139 | 4248.72 | 4236.04 | 12.68 |
| GW-140 | 4248.81 | 4234.39 | 14.42 |
| GW-141 | 4248.78 | 4234.59 | 14.19 |
| | | Average | 17.31 |

Note: Elevation of Top of Unit 1 derived from surfaces generated for Modflow model of Energy*Solutions* site (Whetstone, 2011b).

***Figure 10. Length of Aquifer Perpendicular to Groundwater Flow***




Seepage from the CAW cell was calculated using the infiltration rates predicted by the HELP3 model (0.090 cm/yr and 0.168 cm/yr) multiplied by the area of the footprint of the top slope and side slope (382,312 $m^2$ and 157,061 $m^2$). The total seepage from CAW cell was calculated to be 607.9 $m^3$/yr (0.3056 gpm) based on conservative infiltration modeling assumptions (Section 2).

***Table 43. Calculation of Annual Seepage from the CAW Cell***

| | | |
|---|---|---|
| Top Slope area: | 4,115,170 | $ft^2$ |
| | 382,312 | $m^2$ |
| Top Slope Infiltration rate: | 0.090 | cm/yr |
| | 0.0009 | m/yr |
| Side Slope area: | 1,690,590 | $ft^2$ |
| | 157,061 | $m^2$ |
| Side Slope Infiltration rate: | 0.168 | cm/yr |
| | 0.00168 | m/yr |
| **Total seepage (q):** | **607.9** | **$m^3$/yr** |
| | **0.3056** | **gpm** |

The ratio of Q/q was calculated as:

$$Q/q = 30{,}000\ m^3/yr\ /\ 607.9\ m^3/yr = 50.08$$

Finally, the length of perforations was calculated separately for the top slope and the side slope, based on the respective infiltration rates.

$$Lp = \frac{\inf}{n_e} \cdot \frac{Q}{q}$$

The length of perforations for the top slope (0.155 m [0.51 ft]) and side slope (0.290 m [0.95 ft]) are shown in Table 44. For comparison, the length of perforations of site monitoring wells ranges from 6.5 to 15.0 ft with a mean of 10.3 ft (Table 45).

***Table 44. Calculation of Length of Perforations for PATHRAE Model Input***

| | | |
|---|---|---|
| **Top Slope Model** | | |
| inf | 0.00090 | m/yr |
| $n_e$= | 0.29 | |
| Q = | 30,445.9 | m3/yr |
| q = | 607.9 | m3/yr |
| Lp= | 15.52 | length of perforations (cm) |
| **Lp=** | **0.155** | **length of perforations (m)** |
| Lp= | 0.51 | length of perforations (ft) |
| **Side Slope Model** | | |
| inf | 0.00168 | m/yr |
| $n_e$= | 0.29 | |
| Q = | 30,445.9 | m3/yr |
| q = | 607.9 | m3/yr |
| Lp= | 28.97 | length of perforations (cm) |
| **Lp=** | **0.290** | **length of perforations (m)** |
| Lp= | 0.95 | length of perforations (ft) |

***Table 45. Length of Perforations in Monitoring Wells Surrounding the Proposed CAW Cell***

| Well ID | Ground surface elev. (ft amsl) | Total depth of boring (ft) | Elev of Bottom of Well (ft amsl) | Freshwater GW elev. (ft amsl) | Height of Water Column (ft) | Depth to top of screened interval (ft) | Depth to bottom of screened interval (ft) | Length of Screened Interval (ft) | Saturated Screened Interval (ft) |
|---|---|---|---|---|---|---|---|---|---|
| GW-81 | 4274.18 | 34.0 | 4240.18 | 4249.81 | 9.63 | 19.0 | 34.0 | 15.0 | 9.6 |
| GW-82 | 4274.35 | 34.0 | 4240.35 | 4249.84 | 9.49 | 19.0 | 34.0 | 15.0 | 9.5 |
| GW-83 | 4274.51 | 34.0 | 4240.51 | 4249.78 | 9.27 | 19.0 | 34.0 | 15.0 | 9.3 |
| GW-84 | 4274.78 | 34.0 | 4240.78 | 4249.73 | 8.95 | 19.0 | 34.0 | 15.0 | 8.9 |
| GW-85 | 4275.16 | 34.3 | 4240.86 | 4249.53 | 8.67 | 19.0 | 34.0 | 15.0 | 8.7 |
| GW-86 | 4275.83 | 39.0 | 4236.83 | 4249.26 | 12.43 | 19.0 | 34.0 | 15.0 | 12.4 |
| GW-88 | 4276.86 | 34.0 | 4242.86 | 4249.31 | 6.45 | 23.4 | 38.4 | 15.0 | 6.5 |
| GW-89 | 4276.85 | 34.0 | 4242.85 | 4249.45 | 6.60 | 19.0 | 34.0 | 15.0 | 6.6 |
| GW-90 | 4276.04 | 34.0 | 4242.04 | 4249.58 | 7.54 | 19.0 | 34.0 | 15.0 | 7.5 |
| GW-91 | 4276.04 | 34.0 | 4242.04 | 4249.61 | 7.57 | 19.0 | 34.0 | 15.0 | 7.6 |
| GW-92 | 4276.35 | 34.0 | 4242.35 | 4250.32 | 7.97 | 19.0 | 34.0 | 15.0 | 8.0 |
| GW-93 | 4275.02 | 34.0 | 4241.02 | 4250.23 | 9.21 | 19.0 | 34.0 | 15.0 | 9.2 |
| GW-94 | 4273.98 | 34.0 | 4239.98 | 4250.43 | 10.45 | 19.0 | 34.0 | 15.0 | 10.5 |
| GW-95 | 4271.57 | 29.0 | 4242.57 | 4250.07 | 7.50 | 14.0 | 29.0 | 15.0 | 7.5 |
| GW-99 | 4270.89 | 29.0 | 4241.89 | 4250.14 | 8.25 | 14.0 | 29.0 | 15.0 | 8.3 |
| GW-100 | 4271.27 | 29.0 | 4242.27 | 4249.97 | 7.70 | 14.0 | 29.0 | 15.0 | 7.7 |
| GW-101 | 4272.32 | 34.0 | 4238.32 | 4249.70 | 11.38 | 19.0 | 34.0 | 15.0 | 11.4 |
| GW-102 | 4273.17 | 34.0 | 4239.17 | 4249.77 | 10.60 | 19.0 | 34.0 | 15.0 | 10.6 |
| GW-106 | 4273.43 | 39 | 4234.43 | 4249.62 | 15.19 | 23.5 | 38.5 | 15.0 | 15.0 |
| GW-107 | 4273.47 | 39 | 4234.47 | 4249.99 | 15.52 | 23.75 | 38.75 | 15.0 | 15.0 |
| GW-108 | 4273.29 | 39 | 4234.29 | 4249.95 | 15.66 | 24 | 39 | 15.0 | 15.0 |
| GW-109 | 4273.90 | 39 | 4234.90 | 4249.67 | 14.77 | 23.5 | 38.5 | 15.0 | 14.8 |
| GW-110 | 4274.10 | 39 | 4235.10 | 4249.53 | 14.43 | 23.5 | 38.5 | 15.0 | 14.4 |
| GW-111 | 4274.40 | 39 | 4235.40 | 4249.56 | 14.16 | 23.5 | 38.5 | 15.0 | 14.2 |
| GW-112 | 4274.76 | 39 | 4235.76 | 4249.25 | 13.49 | 23.5 | 38.5 | 15.0 | 13.5 |
| GW-137 | 4274.95 | 36.0 | 4238.95 | 4249.05 | 10.10 | 20.5 | 35.5 | 15.0 | 10.1 |
| GW-138 | 4276.72 | 40.0 | 4236.72 | 4248.94 | 12.22 | 24.0 | 39.0 | 15.0 | 12.2 |
| GW-139 | 4280.08 | 39.2 | 4240.88 | 4248.72 | 7.84 | 23.7 | 38.7 | 15.0 | 7.8 |
| GW-140 | 4278.00 | 39.9 | 4238.10 | 4248.81 | 10.71 | 24.4 | 39.4 | 15.0 | 10.7 |
| GW-141 | 4277.09 | 36.0 | 4241.09 | 4248.78 | 7.69 | 20.5 | 35.5 | 15.0 | 7.7 |
| | | | | | | | | **min:** | **6.5** |
| | | | | | | | | **max:** | **15.0** |
| | | | | | | | | **average:** | **10.3** |
| | | | | | | | | **st. dev.:** | **2.8** |

## 6.3 Horizontal Transport Model Results

Horizontal PATHRAE modeling was conducted for the top slope and side slope infiltration rates. The model results are summarized in Table 46, which shows the time to exceed the GWPLs at the compliance well based on the limited starting concentrations shown in Table 23. In the results tables below, the "Year To Exceed" is conservatively reported as the next *lowest* model output time.

***Table 46. Summary of Horizontal PATHRAE Model Results—Time to Exceed GWPLs at the Compliance Monitoring Well, based on 0.090 and 0.168 cm/yr Infiltration***

| Nuclide | Top Slope 0.090 cm/yr Model Results YEAR TO EXCEED | Side Slope 0.168 cm/yr Model Results YEAR TO EXCEED |
|---|---|---|
| Am-241 | --- | -1 |
| Am-242m | --- | -1 |
| Am-243 | --- | -1 |
| Bk-247 | 500 | -1 |
| Ca-41 | 500 | 500 |
| Cl-36 | 500 | -1 |
| H-3 | -1 | -1 |
| I-129 | 700 | 500 |
| Pd-107 | --- | -1 |
| Re-187 | --- | 500 |
| Se-79 | --- | -1 |
| Si-32 | --- | 525 |
| Sr-90 | --- | -1 |
| Tc-99 | --- | 500 |

NOTES: Year to exceed GWPL reported to next lowest model output year.
-1 indicates nuclide does not exceed GWPL within the 2,000 years modeled
--- indicates nuclide was not modeled in the horizontal pathway or did not arrive at the compliance well
See Table 22 and Table 23 for starting concentrations for each model

Note that 16 nuclides from the vertical modeling were carried forward to the horizontal modeling. The PATHRAE code only produces output for nuclides that arrive at the compliance point. Therefore, several of the nuclides that were input to the horizontal model are not included by PATHRAE in the output files (described below). The output concentration of these nuclides is essentially zero.

### *6.3.1 Horizontal Top Slope Analysis (0.090 cm/yr)*

None of the nuclides modeled exceeded the GWPLs at the compliance well within 500 years, based on horizontal modeling of the top slope cover design infiltration rate of 0.090 cm/yr (0.036 in/yr). The concentrations of each constituent at each model output time are given in Table 47.

As described in Section 5.1.1.1 and listed in Table 23, the source concentrations for Bk-247, Ca-41, and Cl-36 used in the top slope model were set to the limiting concentrations that met GWPLs for 500 years at the compliance well. All other radionuclides were modeled at Class A limits or Specific Activity and met the groundwater standard for at least 500 years.

***Table 47. Radionuclide Concentrations (pCi/L) at Compliance Well, Horizontal PATHRAE Model Results for CAW Cell Top Slope (0.090 cm/year Infiltration)***

*(See large tables at end of report document.)*

### *6.3.2 Horizontal Side Slope Analysis (0.168 cm/yr)*

None of the nuclides exceeded the GWPLs at the compliance well in less than 500 years, based on the side slope cover design infiltration rate of 0.168 cm/yr (0.066 in/yr). The concentrations of each constituent at each model output time are given in Table 48.

As described in Section 5.1.1 and listed in Table 23, the source concentrations for six nuclides (Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99) in the side slope model were set to the limiting concentrations that met GWPLs for 500 years at the compliance well. All other radionuclides were modeled at Class A limits or Specific Activity and met the groundwater standard for at least 500 years.

**Table 48. Radionuclide Concentrations (pCi/L) at Compliance Well, Horizontal PATHRAE Model Results for CAW Cell Side Slope (0.168 cm/year Infiltration)**

*(See large tables at end of report document.)*

## 7. SUMMARY AND CONCLUSIONS

The infiltration, fate, and transport modeling for Energy*Solutions*' Class A West cell was based on previous modeling of the existing Class A cell. The input parameters have been selected to provide conservative (environmentally protective) estimates for infiltration through the cell and for fate and transport of constituents from the waste.

The HELP infiltration modeling results indicate that 0.090 cm/yr infiltration would occur through the CAW cell top slope, while 0.168 cm/yr would infiltrate through the side slope with an 18-inch thick Type-B filter and 24-inch rip rap cover layer. Based on these infiltration rates, moisture contents would stabilize at 0.050 v/v in the waste and 0.036 v/v in the native soil below the top slope, at 0.054 and 0.042 v/v in the waste and native soil below the side slope.

The PATHRAE fate and transport modeling for the top slope (0.090 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 278 feet from the edge of the top slope waste, provided that the concentrations of three radionuclides, Bk-247, Ca-41, and Cl-36, are received in limited concentrations of 0.0065, 35,278, and 15.9 pCi/g, respectively. All other modeled constituents would meet the groundwater standard if placed in the top slope area at Class A limits.

The PATHRAE fate and transport modeling for the side slope with an 18-inch thick Type-B filter and 24-inch thick rip rap layer (0.168 cm/yr infiltration case) indicates that all radionuclides modeled would remain below the GWPLs for at least 500 years at a compliance well located 90 feet from the edge of the waste, provided that Bk-247, Ca-41, Cl-36, I-129, Re-187, and Tc-99 are received in limited concentrations. All other modeled constituents would meet the groundwater standard if placed under the side slope at Class A limits.

The transport of heavy metals from the top slope and side slope areas was modeled using separate vertical PATHRAE model runs. The results indicated that all thirteen metals could be placed in the top slope or side slope at the maximum possible concentration based on density, and would meet GWPLs at a the water table and, by extension, at a compliance well located 90 feet from the edge of the waste for the 200-year compliance period established for heavy metals.

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***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1 | 31.5 | 38.3 | 39.2 | 26.5 | 28.7 | 36.0 | 30.0 | 34.5 | 45.3 | 31.2 | 26.7 | 25.2 | 28.3 | 34.1 | 21.2 | 34.2 | 39.0 | 45.1 | 24.7 | 16.4 | 40.6 | 36.6 | 21.8 | 26.5 | 33.9 | 39.6 | 50.3 | 29.0 | 38.1 | 33.3 | 19.6 | 30.0 | 34.8 | 35.1 | 32.8 | 36.6 | 28.6 | 14.5 | 35.8 | 32.2 | 22.7 | 29.8 | 35.0 | 27.4 | 30.7 | 22.9 |
| Jan 2 | 28.3 | 31.1 | 41.8 | 31.6 | 32.7 | 26.3 | 28.4 | 28.1 | 37.3 | 25.4 | 30.1 | 18.9 | 35.7 | 33.6 | 22.7 | 33.6 | 36.5 | 40.7 | 27.8 | 13.2 | 45.8 | 35.1 | 17.1 | 26.7 | 37.6 | 28.9 | 38.7 | 29.0 | 29.7 | 26.0 | 21.8 | 36.7 | 27.7 | 35.5 | 25.6 | 38.6 | 27.6 | 17.4 | 26.4 | 37.2 | 27.1 | 27.6 | 38.2 | 34.1 | 32.7 | 25.3 |
| Jan 3 | 28.2 | 31.3 | 37.0 | 21.3 | 34.3 | 31.3 | 40.6 | 36.2 | 23.9 | 20.3 | 38.3 | 13.4 | 27.6 | 33.7 | 30.3 | 25.8 | 33.8 | 36.9 | 32.5 | 23.3 | 40.1 | 29.1 | 20.3 | 23.6 | 37.4 | 26.1 | 27.6 | 29.1 | 34.2 | 32.2 | 18.7 | 24.9 | 31.7 | 36.4 | 25.0 | 38.2 | 30.5 | 23.4 | 27.1 | 43.1 | 36.4 | 40.2 | 38.6 | 32.8 | 30.1 | 23.3 |
| Jan 4 | 22.3 | 25.1 | 37.4 | 31.2 | 22.6 | 29.8 | 30.1 | 37.4 | 35.3 | 25.4 | 37.0 | 18.6 | 37.6 | 25.5 | 30.2 | 28.4 | 37.0 | 40.3 | 32.8 | 23.4 | 36.4 | 25.9 | 36.3 | 26.0 | 28.0 | 28.4 | 40.2 | 34.4 | 32.0 | 26.6 | 11.6 | 19.3 | 27.4 | 31.8 | 42.4 | 45.8 | 39.0 | 30.0 | 22.3 | 39.9 | 36.5 | 28.7 | 25.7 | 21.4 | 23.4 | 16.9 |
| Jan 5 | 28.3 | 33.9 | 31.7 | 27.0 | 16.2 | 18.3 | 34.6 | 30.5 | 31.7 | 19.6 | 29.5 | 18.4 | 27.9 | 27.4 | 33.8 | 36.4 | 35.0 | 29.1 | 30.1 | 31.5 | 33.6 | 33.0 | 34.1 | 30.0 | 31.6 | 30.9 | 37.5 | 35.1 | 22.2 | 26.1 | 16.3 | 27.7 | 33.6 | 39.1 | 30.6 | 37.8 | 50.5 | 28.7 | 28.2 | 39.8 | 32.0 | 23.6 | 27.7 | 15.7 | 22.8 | 13.4 |
| Jan 6 | 37.8 | 38.5 | 29.5 | 38.8 | 30.8 | 20.5 | 40.8 | 40.0 | 31.0 | 21.7 | 42.6 | 39.0 | 36.0 | 21.7 | 26.7 | 28.0 | 25.9 | 23.2 | 31.9 | 30.0 | 34.2 | 30.6 | 27.7 | 31.9 | 28.2 | 37.4 | 40.7 | 32.9 | 29.0 | 21.8 | 12.5 | 30.1 | 28.2 | 45.3 | 23.6 | 30.8 | 46.5 | 31.7 | 29.1 | 31.1 | 37.0 | 31.7 | 33.7 | 28.7 | 19.9 | 15.5 |
| Jan 7 | 30.7 | 38.3 | 34.0 | 36.2 | 38.5 | 13.6 | 30.8 | 34.8 | 34.7 | 36.0 | 35.5 | 45.9 | 32.9 | 28.5 | 38.4 | 19.6 | 25.9 | 18.2 | 43.2 | 22.9 | 37.1 | 22.2 | 25.3 | 38.4 | 25.9 | 23.1 | 32.3 | 40.5 | 23.8 | 21.8 | 7.2 | 28.7 | 23.3 | 36.0 | 23.3 | 31.7 | 29.9 | 32.9 | 14.1 | 26.0 | 33.0 | 27.1 | 26.3 | 21.2 | 29.4 | 19.3 |
| Jan 8 | 31.8 | 29.3 | 25.0 | 40.1 | 35.4 | 24.4 | 27.3 | 44.5 | 37.1 | 38.9 | 32.4 | 33.2 | 32.5 | 25.7 | 25.8 | 25.3 | 35.9 | 16.9 | 45.2 | 16.8 | 37.0 | 27.9 | 32.9 | 39.4 | 25.7 | 16.7 | 23.5 | 33.7 | 22.7 | 25.3 | 19.3 | 22.3 | 26.1 | 30.9 | 19.6 | 34.7 | 38.3 | 26.5 | 21.4 | 27.7 | 38.0 | 32.4 | 26.0 | 23.4 | 36.4 | 30.0 |
| Jan 9 | 33.3 | 19.9 | 18.0 | 32.0 | 43.3 | 22.0 | 24.5 | 43.8 | 27.5 | 38.0 | 32.3 | 28.6 | 30.6 | 22.2 | 23.5 | 28.5 | 38.1 | 24.8 | 37.6 | 28.6 | 32.0 | 33.3 | 31.5 | 30.1 | 27.7 | 20.6 | 40.1 | 30.3 | 25.1 | 28.3 | 24.3 | 27.2 | 22.7 | 25.8 | 24.3 | 35.8 | 36.8 | 26.6 | 16.7 | 37.3 | 33.3 | 22.5 | 24.7 | 21.3 | 31.9 | 31.2 |
| Jan 10 | 24.6 | 21.2 | 24.8 | 29.9 | 27.3 | 27.6 | 27.0 | 37.5 | 31.5 | 32.2 | 24.8 | 23.3 | 28.1 | 33.4 | 23.6 | 31.8 | 40.4 | 28.5 | 32.6 | 27.7 | 32.0 | 32.1 | 25.2 | 33.7 | 20.9 | 37.8 | 46.3 | 36.6 | 39.0 | 24.8 | 18.7 | 21.3 | 29.4 | 26.8 | 20.8 | 38.4 | 36.1 | 24.4 | 10.8 | 35.6 | 35.4 | 23.5 | 28.2 | 28.7 | 25.9 | 36.9 |
| Jan 11 | 30.1 | 12.5 | 35.1 | 26.4 | 34.4 | 34.4 | 24.7 | 30.9 | 19.7 | 49.3 | 33.1 | 23.6 | 34.8 | 26.4 | 17.6 | 36.2 | 31.6 | 31.1 | 24.9 | 36.6 | 35.9 | 45.6 | 27.7 | 27.2 | 25.5 | 36.8 | 44.7 | 22.0 | 27.7 | 14.1 | 15.1 | 18.3 | 31.4 | 25.4 | 25.2 | 36.6 | 35.2 | 32.5 | 10.0 | 20.2 | 38.7 | 32.5 | 30.6 | 31.3 | 34.2 | 30.4 |
| Jan 12 | 24.8 | 21.5 | 34.0 | 20.7 | 22.3 | 30.6 | 19.5 | 32.6 | 18.7 | 40.0 | 37.1 | 27.7 | 32.3 | 26.8 | 16.9 | 32.1 | 21.6 | 34.4 | 22.9 | 42.2 | 26.6 | 37.6 | 35.8 | 27.4 | 27.0 | 35.3 | 36.6 | 20.6 | 36.9 | 20.7 | 16.7 | 22.1 | 32.4 | 27.4 | 27.1 | 28.7 | 30.3 | 28.8 | 18.4 | 33.3 | 44.9 | 34.8 | 40.2 | 24.6 | 33.8 | 28.4 |
| Jan 13 | 24.6 | 11.1 | 31.3 | 17.5 | 19.9 | 33.0 | 26.7 | 33.9 | 29.0 | 38.5 | 31.4 | 17.5 | 33.8 | 23.2 | 15.2 | 29.7 | 29.7 | 24.8 | 17.0 | 27.4 | 26.9 | 29.3 | 24.3 | 24.8 | 24.4 | 31.3 | 38.8 | 17.8 | 35.8 | 25.3 | 13.8 | 36.7 | 36.3 | 21.3 | 24.6 | 24.0 | 29.5 | 34.2 | 23.0 | 36.9 | 42.8 | 34.2 | 33.3 | 21.0 | 31.6 | 26.0 |
| Jan 14 | 17.9 | 11.9 | 37.1 | 27.7 | 26.7 | 29.3 | 23.2 | 39.6 | 23.4 | 26.1 | 33.3 | 25.6 | 37.3 | 26.8 | 19.5 | 29.1 | 20.6 | 21.4 | 11.4 | 33.3 | 29.7 | 30.6 | 29.7 | 20.3 | 29.0 | 28.6 | 37.8 | 30.8 | 40.7 | 25.3 | 11.8 | 37.6 | 39.6 | 31.0 | 23.9 | 30.7 | 30.1 | 29.6 | 25.7 | 29.4 | 40.9 | 25.2 | 23.8 | 18.7 | 41.9 | 25.4 |
| Jan 15 | 13.3 | 16.6 | 34.6 | 23.4 | 22.5 | 20.4 | 29.5 | 39.5 | 25.8 | 22.9 | 18.1 | 26.7 | 37.0 | 22.0 | 19.0 | 28.6 | 30.3 | 24.7 | 25.2 | 34.8 | 41.2 | 33.8 | 30.2 | 23.5 | 26.7 | 18.2 | 36.9 | 22.3 | 38.2 | 31.2 | 21.1 | 42.1 | 43.8 | 36.2 | 19.9 | 32.3 | 25.8 | 36.8 | 30.2 | 33.8 | 40.4 | 25.9 | 19.8 | 31.5 | 32.1 | 19.0 |
| Jan 16 | 22.2 | 21.3 | 35.9 | 17.9 | 10.4 | 23.4 | 17.4 | 36.6 | 28.5 | 29.5 | 16.6 | 32.3 | 29.2 | 24.9 | 23.2 | 38.8 | 27.0 | 32.1 | 28.4 | 34.4 | 38.7 | 39.6 | 30.2 | 25.1 | 37.7 | 22.4 | 31.7 | 19.4 | 27.4 | 25.6 | 22.8 | 34.9 | 44.9 | 30.7 | 20.1 | 31.5 | 19.5 | 32.8 | 27.6 | 35.5 | 30.2 | 30.9 | 20.9 | 36.0 | 38.9 | 23.0 |
| Jan 17 | 27.2 | 26.9 | 36.3 | 16.3 | 18.9 | 24.2 | 18.9 | 30.7 | 28.7 | 31.2 | 20.5 | 26.2 | 36.6 | 31.4 | 23.2 | 36.3 | 20.3 | 31.4 | 27.9 | 29.6 | 40.2 | 40.8 | 30.0 | 25.4 | 29.0 | 18.8 | 41.5 | 22.0 | 22.5 | 24.4 | 27.3 | 43.3 | 51.6 | 32.6 | 23.4 | 41.8 | 24.6 | 17.1 | 20.1 | 39.7 | 41.3 | 36.5 | 26.8 | 35.0 | 42.8 | 23.2 |
| Jan 18 | 29.7 | 30.9 | 33.0 | 9.1 | 19.5 | 19.7 | 25.3 | 22.6 | 26.0 | 41.2 | 23.3 | 21.5 | 31.1 | 28.3 | 26.8 | 28.7 | 21.5 | 40.4 | 25.0 | 30.1 | 34.8 | 37.8 | 27.9 | 27.6 | 32.9 | 17.5 | 38.3 | 17.3 | 30.0 | 28.7 | 39.1 | 40.1 | 42.4 | 30.1 | 28.5 | 32.7 | 26.2 | 23.6 | 17.2 | 31.6 | 31.5 | 36.3 | 19.5 | 41.5 | 37.2 | 35.3 |
| Jan 19 | 43.1 | 33.4 | 31.4 | 20.9 | 15.9 | 17.4 | 33.3 | 27.4 | 31.2 | 28.7 | 18.4 | 16.9 | 29.6 | 24.3 | 34.8 | 30.7 | 23.9 | 39.0 | 28.2 | 37.1 | 36.4 | 23.9 | 28.2 | 20.3 | 35.7 | 18.3 | 39.1 | 15.4 | 22.2 | 19.2 | 24.1 | 40.0 | 31.2 | 37.0 | 30.9 | 35.9 | 17.9 | 34.1 | 32.6 | 29.7 | 30.7 | 37.0 | 22.1 | 39.7 | 46.7 | 34.0 |
| Jan 20 | 39.8 | 28.4 | 33.9 | 22.5 | 12.2 | 11.1 | 37.6 | 31.5 | 31.6 | 13.7 | 22.4 | 21.2 | 22.6 | 22.4 | 29.4 | 40.6 | 32.8 | 29.6 | 28.5 | 39.9 | 25.6 | 36.7 | 29.8 | 32.5 | 45.8 | 20.3 | 32.9 | 23.8 | 25.7 | 16.2 | 27.3 | 42.2 | 21.3 | 41.3 | 22.3 | 35.3 | 15.6 | 35.7 | 19.4 | 38.6 | 41.1 | 36.9 | 20.5 | 31.4 | 31.9 | 39.5 |
| Jan 21 | 51.5 | 33.1 | 35.3 | 19.6 | 13.3 | 22.9 | 39.0 | 33.0 | 36.8 | 26.9 | 36.8 | 23.9 | 20.7 | 20.5 | 40.9 | 35.1 | 27.4 | 22.3 | 26.4 | 33.7 | 24.0 | 18.2 | 30.6 | 24.6 | 34.8 | 20.2 | 33.8 | 21.8 | 27.6 | 18.7 | 36.4 | 34.6 | 32.0 | 30.8 | 36.3 | 21.9 | 18.0 | 45.7 | 18.1 | 38.5 | 38.5 | 23.5 | 18.0 | 29.7 | 33.2 | 34.2 |
| Jan 22 | 42.0 | 26.7 | 37.5 | 17.2 | 23.2 | 22.0 | 34.6 | 39.1 | 37.1 | 29.2 | 35.9 | 24.6 | 14.0 | 20.8 | 32.4 | 29.8 | 23.7 | 32.3 | 26.0 | 41.0 | 22.8 | 25.4 | 30.9 | 28.5 | 43.6 | 19.4 | 39.0 | 28.2 | 21.7 | 33.4 | 30.7 | 31.4 | 35.9 | 39.4 | 29.0 | 18.5 | 19.3 | 41.4 | 32.2 | 38.4 | 44.5 | 35.9 | 26.5 | 26.8 | 37.9 | 38.1 |
| Jan 23 | 42.7 | 29.4 | 31.0 | 22.3 | 34.2 | 27.8 | 43.7 | 32.8 | 31.1 | 34.6 | 37.5 | 21.2 | 27.0 | 16.4 | 29.3 | 27.4 | 31.0 | 37.8 | 16.9 | 31.0 | 19.1 | 30.6 | 25.3 | 26.3 | 29.2 | 24.2 | 36.8 | 40.6 | 29.2 | 39.0 | 30.8 | 28.0 | 25.6 | 34.0 | 35.4 | 29.2 | 19.9 | 36.8 | 35.8 | 28.7 | 36.6 | 45.2 | 18.0 | 16.7 | 33.9 | 31.3 |
| Jan 24 | 44.0 | 19.2 | 36.3 | 25.1 | 32.6 | 20.6 | 47.4 | 36.3 | 30.1 | 25.5 | 44.8 | 19.5 | 25.3 | 16.1 | 27.9 | 13.5 | 20.9 | 39.0 | 25.5 | 37.7 | 20.9 | 41.7 | 22.7 | 26.1 | 33.0 | 18.8 | 31.1 | 42.3 | 33.5 | 37.0 | 38.5 | 15.5 | 29.8 | 37.0 | 30.0 | 25.6 | 27.9 | 35.9 | 35.0 | 27.1 | 33.2 | 44.5 | 15.8 | 31.5 | 26.9 | 32.0 |
| Jan 25 | 36.3 | 23.7 | 27.8 | 33.8 | 28.1 | 22.5 | 26.1 | 31.9 | 35.2 | 25.9 | 44.3 | 25.6 | 30.2 | 29.2 | 35.3 | 14.5 | 21.9 | 36.7 | 33.2 | 32.1 | 21.6 | 33.6 | 21.8 | 27.5 | 27.8 | 27.7 | 32.5 | 39.0 | 27.4 | 30.3 | 33.8 | 18.5 | 34.6 | 36.3 | 29.4 | 30.8 | 36.1 | 36.5 | 21.2 | 41.0 | 41.1 | 37.3 | 24.1 | 34.9 | 24.6 | 45.5 |
| Jan 26 | 38.4 | 17.9 | 24.8 | 30.4 | 38.6 | 17.3 | 25.2 | 30.7 | 37.9 | 42.3 | 43.0 | 26.2 | 29.5 | 17.2 | 38.8 | 22.3 | 18.6 | 34.1 | 28.0 | 30.2 | 33.2 | 37.0 | 38.4 | 28.2 | 28.8 | 13.4 | 29.3 | 42.4 | 17.1 | 37.7 | 28.9 | 26.3 | 40.1 | 36.3 | 23.2 | 24.2 | 30.7 | 28.1 | 24.1 | 47.5 | 36.1 | 35.8 | 42.3 | 40.0 | 26.8 | 42.9 |
| Jan 27 | 40.1 | 29.4 | 20.7 | 35.6 | 39.1 | 20.7 | 18.2 | 35.0 | 37.8 | 44.6 | 34.8 | 12.8 | 37.2 | 21.5 | 30.6 | 19.4 | 30.5 | 38.3 | 43.2 | 27.3 | 28.3 | 31.7 | 37.9 | 29.8 | 29.2 | 25.4 | 31.2 | 27.9 | 17.8 | 39.3 | 23.8 | 31.1 | 39.7 | 33.6 | 20.5 | 23.0 | 33.9 | 35.4 | 24.6 | 35.2 | 30.3 | 19.8 | 40.6 | 24.8 | 34.8 | 38.2 |
| Jan 28 | 38.6 | 30.9 | 34.1 | 36.2 | 44.8 | 21.3 | 29.0 | 39.1 | 29.7 | 54.2 | 27.9 | 16.8 | 19.9 | 14.9 | 37.3 | 24.4 | 19.5 | 40.2 | 32.7 | 22.3 | 30.3 | 25.2 | 30.4 | 28.4 | 35.1 | 38.6 | 32.4 | 23.9 | 9.7 | 40.7 | 34.0 | 35.1 | 32.6 | 30.8 | 21.1 | 27.1 | 40.1 | 45.6 | 24.8 | 32.4 | 40.7 | 26.6 | 35.8 | 30.3 | 27.3 | 44.3 |
| Jan 29 | 36.0 | 25.6 | 29.5 | 43.1 | 39.6 | 33.6 | 30.1 | 45.0 | 27.2 | 43.0 | 32.7 | 27.2 | 14.8 | 16.0 | 28.8 | 38.2 | 24.8 | 25.0 | 37.4 | 36.7 | 30.1 | 23.8 | 28.9 | 28.3 | 32.3 | 38.1 | 25.4 | 26.7 | 7.9 | 35.1 | 31.6 | 43.6 | 23.6 | 28.2 | 20.9 | 33.6 | 39.7 | 45.7 | 18.1 | 34.0 | 29.2 | 23.2 | 33.1 | 31.2 | 30.9 | 42.3 |
| Jan 30 | 44.1 | 23.7 | 40.6 | 50.5 | 35.6 | 31.3 | 24.1 | 44.1 | 21.4 | 37.9 | 31.8 | 26.8 | 20.4 | 18.3 | 27.5 | 30.2 | 33.8 | 28.3 | 32.9 | 30.3 | 28.6 | 27.3 | 38.4 | 18.3 | 29.8 | 33.5 | 24.2 | 22.9 | 10.1 | 30.4 | 31.3 | 37.5 | 18.5 | 36.6 | 22.3 | 39.4 | 39.7 | 36.6 | 17.7 | 28.6 | 21.8 | 17.1 | 30.3 | 23.3 | 22.3 | 33.7 |
| Jan 31 | 39.0 | 24.4 | 44.9 | 33.1 | 42.0 | 36.9 | 24.3 | 54.6 | 19.4 | 33.8 | 35.8 | 30.1 | 32.0 | 28.7 | 41.2 | 22.3 | 27.8 | 29.3 | 43.8 | 28.5 | 23.3 | 21.8 | 39.8 | 14.2 | 24.5 | 25.0 | 22.4 | 29.3 | 10.8 | 30.0 | 33.8 | 44.0 | 23.5 | 32.0 | 30.0 | 28.7 | 33.9 | 27.4 | 19.6 | 35.3 | 34.2 | 13.8 | 33.1 | 19.8 | 11.6 | 28.2 |
| Feb 1 | 27.1 | 34.5 | 46.1 | 39.0 | 37.7 | 39.2 | 19.5 | 41.0 | 16.0 | 31.9 | 25.2 | 34.4 | 30.6 | 30.1 | 39.6 | 23.8 | 25.8 | 16.5 | 36.5 | 34.9 | 22.5 | 27.4 | 38.5 | 28.6 | 36.5 | 29.7 | 18.3 | 28.7 | 24.9 | 29.9 | 42.1 | 31.5 | 27.4 | 38.0 | 21.5 | 43.1 | 35.7 | 27.8 | 18.7 | 29.7 | 34.1 | 25.5 | 30.9 | 30.8 | 23.8 | 22.6 |
| Feb 2 | 29.6 | 28.7 | 40.9 | 35.8 | 44.9 | 36.6 | 31.4 | 39.8 | 24.0 | 45.0 | 32.2 | 18.5 | 20.5 | 29.7 | 31.7 | 32.0 | 24.5 | 14.5 | 44.3 | 33.2 | 21.2 | 22.9 | 39.9 | 32.2 | 27.0 | 23.0 | 29.2 | 29.9 | 23.5 | 20.6 | 40.1 | 33.9 | 31.5 | 41.0 | 27.7 | 34.7 | 27.5 | 23.4 | 30.1 | 29.5 | 34.1 | 22.1 | 35.3 | 19.9 | 34.9 | 18.6 |
| Feb 3 | 35.5 | 25.0 | 28.6 | 31.2 | 34.8 | 28.4 | 27.7 | 30.3 | 24.2 | 39.3 | 36.0 | 22.8 | 31.2 | 27.9 | 31.7 | 32.5 | 30.0 | 19.0 | 47.1 | 27.6 | 26.1 | 30.9 | 45.3 | 33.9 | 28.0 | 28.6 | 15.0 | 31.7 | 31.0 | 33.4 | 28.9 | 27.3 | 34.4 | 35.5 | 23.6 | 33.1 | 31.8 | 26.2 | 37.8 | 35.7 | 31.1 | 31.0 | 34.1 | 19.1 | 26.8 | 23.0 |
| Feb 4 | 22.6 | 30.9 | 29.7 | 28.0 | 26.9 | 26.6 | 34.7 | 23.6 | 30.3 | 26.0 | 44.0 | 22.0 | 24.2 | 28.7 | 30.6 | 34.5 | 24.2 | 23.6 | 41.8 | 26.1 | 29.6 | 26.1 | 44.7 | 39.9 | 21.9 | 29.0 | 7.1 | 31.3 | 36.8 | 34.5 | 26.6 | 24.6 | 36.1 | 31.6 | 31.0 | 44.3 | 26.3 | 33.9 | 31.0 | 36.7 | 32.8 | 40.3 | 39.6 | 25.6 | 33.7 | 28.6 |
| Feb 5 | 28.0 | 27.8 | 32.9 | 35.1 | 28.5 | 18.9 | 32.4 | 37.0 | 30.0 | 27.7 | 40.7 | 29.8 | 20.8 | 33.8 | 28.9 | 35.3 | 34.1 | 26.8 | 33.3 | 25.1 | 23.0 | 24.9 | 36.7 | 41.6 | 23.6 | 34.0 | 13.9 | 24.2 | 38.7 | 23.4 | 31.9 | 25.0 | 28.5 | 19.1 | 40.1 | 26.3 | 35.1 | 34.5 | 30.3 | 34.7 | 40.5 | 28.2 | 37.9 | 22.4 | 31.1 | 33.5 |
| Feb 6 | 31.5 | 24.7 | 42.0 | 27.7 | 28.1 | 33.1 | 44.8 | 37.6 | 38.6 | 42.5 | 33.6 | 32.5 | 20.5 | 29.5 | 32.2 | 19.7 | 40.1 | 16.9 | 32.1 | 37.8 | 36.2 | 14.4 | 45.9 | 25.0 | 30.9 | 39.1 | 19.5 | 16.7 | 36.0 | 28.8 | 31.0 | 25.2 | 41.7 | 23.3 | 36.1 | 24.2 | 33.2 | 23.6 | 23.9 | 37.4 | 38.0 | 24.1 | 39.7 | 27.7 | 27.4 | 31.9 |
| Feb 7 | 42.6 | 29.2 | 34.4 | 31.9 | 28.4 | 37.7 | 43.9 | 19.5 | 31.2 | 30.0 | 26.8 | 23.6 | 23.1 | 25.0 | 19.7 | 20.8 | 37.0 | 19.3 | 41.8 | 32.6 | 25.8 | 23.1 | 28.9 | 25.6 | 33.1 | 40.4 | 14.3 | 17.2 | 32.5 | 23.5 | 32.8 | 25.9 | 38.2 | 14.6 | 38.7 | 19.6 | 35.8 | 26.3 | 33.2 | 29.3 | 39.2 | 27.5 | 35.8 | 26.9 | 22.4 | 36.0 |
| Feb 8 | 43.4 | 37.4 | 37.5 | 18.1 | 28.5 | 36.9 | 38.3 | 33.2 | 33.2 | 28.0 | 30.7 | 13.8 | 19.8 | 33.3 | 19.8 | 25.7 | 38.0 | 12.1 | 39.4 | 35.3 | 28.3 | 29.8 | 37.3 | 21.9 | 39.9 | 37.3 | 26.2 | 30.2 | 32.7 | 18.4 | 31.8 | 23.0 | 40.2 | 22.8 | 33.6 | 25.2 | 49.2 | 23.7 | 40.8 | 24.9 | 30.3 | 21.5 | 42.3 | 21.5 | 17.5 | 21.0 |
| Feb 9 | 34.6 | 38.2 | 30.0 | 24.3 | 18.1 | 36.5 | 36.8 | 35.1 | 31.4 | 24.2 | 29.7 | 18.3 | 18.5 | 49.5 | 28.4 | 21.8 | 37.4 | 18.8 | 26.9 | 29.8 | 35.7 | 28.9 | 33.7 | 32.3 | 26.8 | 34.8 | 25.3 | 36.5 | 21.0 | 22.3 | 29.2 | 25.7 | 37.2 | 26.6 | 37.5 | 27.0 | 34.5 | 13.8 | 33.9 | 31.1 | 42.2 | 15.3 | 42.9 | 26.2 | 24.7 | 17.9 |
| Feb 10 | 47.8 | 41.3 | 40.1 | 17.5 | 18.3 | 36.6 | 27.5 | 28.3 | 23.9 | 33.5 | 31.0 | 20.5 | 24.7 | 51.4 | 31.0 | 30.5 | 45.0 | 24.5 | 17.6 | 38.8 | 37.3 | 34.0 | 37.5 | 29.0 | 24.9 | 34.9 | 34.0 | 39.0 | 25.0 | 28.4 | 30.2 | 30.2 | 33.2 | 36.1 | 42.2 | 26.7 | 42.7 | 17.3 | 30.2 | 28.5 | 39.3 | 29.7 | 42.3 | 30.7 | 29.2 | 27.1 |
| Feb 11 | 45.6 | 37.9 | 38.2 | 37.2 | 20.4 | 33.2 | 29.0 | 29.5 | 30.2 | 24.4 | 21.6 | 11.2 | 20.5 | 58.0 | 29.6 | 27.4 | 40.0 | 25.2 | 22.5 | 32.6 | 25.3 | 46.8 | 39.1 | 20.7 | 25.4 | 47.3 | 40.8 | 34.7 | 26.4 | 29.9 | 45.4 | 29.5 | 36.8 | 41.1 | 44.2 | 30.3 | 26.5 | 20.3 | 24.5 | 28.0 | 31.4 | 25.7 | 43.8 | 25.7 | 29.2 | 24.6 |
| Feb 12 | 45.6 | 39.5 | 42.4 | 35.0 | 22.4 | 29.8 | 28.6 | 16.5 | 39.0 | 30.1 | 20.7 | 25.3 | 25.9 | 47.6 | 23.1 | 30.5 | 33.2 | 22.2 | 19.5 | 34.8 | 33.1 | 30.8 | 30.7 | 19.7 | 21.0 | 45.5 | 47.4 | 39.1 | 21.5 | 20.4 | 43.0 | 21.6 | 37.1 | 37.5 | 51.1 | 34.9 | 24.7 | 30.9 | 18.4 | 30.6 | 29.0 | 28.0 | 32.2 | 29.2 | 41.1 | 31.3 |
| Feb 13 | 50.1 | 29.0 | 40.7 | 45.1 | 21.6 | 32.3 | 21.0 | 28.6 | 37.2 | 35.2 | 32.6 | 16.2 | 30.8 | 34.1 | 23.4 | 18.9 | 38.3 | 17.8 | 31.8 | 29.0 | 41.3 | 25.1 | 24.5 | 12.3 | 24.9 | 39.0 | 39.2 | 31.7 | 36.5 | 28.1 | 38.7 | 19.9 | 33.0 | 46.9 | 48.4 | 31.0 | 38.2 | 39.7 | 21.3 | 28.4 | 30.3 | 34.4 | 25.9 | 41.0 | 55.3 | 38.7 |
| Feb 14 | 38.4 | 19.1 | 36.9 | 50.1 | 20.8 | 31.2 | 22.1 | 37.0 | 30.9 | 30.7 | 33.6 | 30.6 | 31.8 | 35.9 | 23.9 | 17.9 | 38.3 | 22.4 | 25.7 | 25.2 | 29.2 | 28.9 | 26.0 | 24.2 | 25.5 | 51.6 | 23.9 | 25.6 | 45.7 | 35.3 | 33.5 | 29.5 | 32.3 | 55.3 | 46.2 | 27.3 | 37.1 | 38.8 | 28.4 | 30.8 | 28.2 | 29.6 | 30.4 | 38.9 | 45.4 | 40.1 |
| Feb 15 | 44.0 | 31.5 | 42.3 | 35.5 | 21.8 | 35.9 | 36.0 | 46.1 | 34.8 | 22.5 | 28.6 | 20.8 | 40.7 | 30.7 | 33.1 | 22.2 | 23.4 | 31.8 | 13.9 | 25.7 | 34.9 | 30.9 | 28.0 | 27.2 | 26.3 | 42.4 | 29.1 | 37.7 | 38.9 | 25.2 | 44.9 | 25.8 | 44.3 | 46.2 | 43.6 | 39.1 | 42.3 | 32.7 | 27.6 | 38.3 | 25.8 | 23.9 | 26.9 | 28.7 | 40.6 | 44.5 |
| Feb 16 | 42.1 | 30.5 | 32.0 | 37.3 | 21.6 | 36.8 | 31.7 | 41.3 | 42.5 | 29.5 | 24.5 | 14.3 | 41.6 | 30.4 | 29.7 | 27.6 | 29.4 | 29.1 | 19.6 | 29.3 | 29.4 | 37.4 | 33.7 | 29.3 | 30.9 | 41.8 | 23.3 | 36.1 | 44.0 | 32.4 | 40.4 | 28.5 | 41.9 | 39.2 | 30.3 | 34.2 | 31.2 | 30.5 | 21.8 | 29.3 | 21.8 | 37.7 | 42.3 | 30.4 | 37.1 | 38.2 |
| Feb 17 | 42.6 | 20.3 | 25.3 | 36.8 | 26.8 | 23.9 | 23.6 | 36.8 | 32.7 | 29.4 | 26.4 | 15.3 | 38.0 | 26.3 | 33.0 | 23.2 | 31.0 | 34.1 | 19.5 | 24.1 | 21.1 | 40.4 | 28.1 | 40.1 | 29.6 | 38.3 | 23.4 | 38.5 | 36.3 | 24.2 | 39.7 | 36.9 | 41.2 | 35.8 | 37.4 | 36.4 | 30.5 | 30.3 | 15.9 | 28.8 | 32.3 | 37.3 | 46.2 | 30.3 | 34.9 | 39.7 |
| Feb 18 | 41.9 | 21.4 | 34.9 | 37.2 | 37.3 | 36.6 | 23.1 | 39.2 | 28.3 | 42.8 | 29.4 | 25.9 | 28.5 | 30.7 | 24.1 | 32.7 | 29.4 | 30.1 | 25.0 | 26.3 | 22.7 | 24.5 | 34.2 | 37.9 | 19.1 | 37.4 | 25.8 | 38.5 | 43.8 | 22.7 | 37.6 | 32.0 | 42.6 | 37.3 | 32.0 | 36.8 | 23.5 | 29.8 | 24.6 | 25.7 | 21.0 | 37.0 | 44.7 | 29.1 | 33.3 | 29.3 |
| Feb 19 | 36.6 | 31.8 | 28.6 | 35.1 | 36.5 | 37.3 | 22.6 | 47.8 | 20.4 | 36.2 | 34.3 | 29.2 | 26.1 | 25.0 | 24.4 | 35.1 | 31.3 | 35.3 | 31.9 | 32.1 | 18.8 | 23.2 | 36.2 | 30.3 | 25.4 | 35.9 | 30.3 | 40.6 | 36.6 | 30.1 | 29.9 | 21.7 | 36.6 | 35.3 | 25.1 | 35.7 | 27.4 | 18.9 | 14.0 | 29.9 | 20.7 | 33.6 | 42.9 | 26.7 | 33.1 | 40.4 |
| Feb 20 | 43.0 | 33.2 | 29.0 | 39.3 | 44.9 | 30.1 | 20.7 | 39.6 | 29.0 | 29.6 | 29.6 | 28.6 | 22.5 | 27.6 | 40.7 | 37.7 | 23.5 | 25.1 | 38.8 | 40.2 | 19.8 | 28.8 | 32.3 | 26.5 | 20.2 | 44.4 | 40.1 | 44.0 | 24.8 | 30.9 | 25.4 | 29.9 | 37.7 | 34.4 | 25.8 | 33.7 | 34.2 | 27.9 | 16.2 | 31.3 | 18.0 | 27.3 | 29.2 | 39.9 | 30.9 | 26.7 |
| Feb 21 | 34.4 | 32.8 | 32.9 | 36.8 | 33.1 | 29.5 | 23.7 | 35.5 | 27.9 | 25.2 | 34.7 | 30.6 | 19.3 | 25.9 | 29.5 | 31.7 | 29.8 | 21.9 | 34.0 | 43.1 | 27.3 | 28.3 | 38.7 | 33.9 | 27.7 | 39.1 | 37.1 | 35.8 | 27.9 | 17.9 | 28.4 | 30.5 | 33.9 | 31.8 | 32.3 | 30.4 | 36.4 | 22.6 | 17.8 | 37.1 | 25.4 | 25.1 | 29.9 | 48.4 | 35.3 | 28.8 |
| Feb 22 | 29.0 | 23.4 | 33.1 | 50.0 | 41.9 | 40.8 | 24.1 | 43.6 | 40.9 | 30.9 | 33.9 | 39.6 | 25.1 | 28.9 | 38.9 | 30.0 | 30.7 | 25.0 | 33.3 | 42.1 | 29.3 | 38.9 | 32.4 | 23.3 | 30.5 | 32.0 | 28.9 | 38.2 | 32.3 | 32.3 | 13.9 | 29.7 | 37.4 | 32.9 | 29.9 | 43.9 | 19.1 | 25.6 | 19.6 | 32.4 | 25.5 | 15.1 | 33.7 | 38.2 | 34.4 | 31.2 |
| Feb 23 | 26.4 | 27.4 | 27.7 | 41.9 | 37.0 | 48.6 | 24.2 | 37.4 | 32.2 | 23.4 | 34.2 | 39.3 | 23.9 | 44.8 | 44.7 | 27.9 | 20.3 | 31.8 | 31.7 | 42.7 | 31.7 | 31.1 | 35.0 | 25.5 | 26.2 | 42.0 | 30.5 | 35.0 | 34.8 | 38.4 | 7.1 | 24.9 | 47.8 | 29.5 | 33.2 | 53.6 | 18.1 | 30.5 | 26.1 | 32.6 | 24.4 | 15.1 | 37.5 | 44.4 | 42.0 | 34.7 |
| Feb 24 | 35.3 | 34.6 | 24.7 | 32.4 | 43.4 | 45.5 | 33.6 | 31.3 | 32.2 | 40.9 | 29.8 | 42.5 | 29.4 | 44.2 | 30.7 | 27.4 | 22.0 | 20.6 | 34.5 | 39.6 | 32.3 | 34.7 | 27.2 | 38.9 | 34.2 | 47.6 | 29.0 | 35.1 | 16.3 | 43.5 | 30.4 | 24.5 | 54.4 | 35.8 | 49.7 | 47.4 | 23.0 | 25.9 | 34.3 | 49.1 | 30.7 | 31.5 | 43.2 | 40.6 | 39.2 | 31.3 |
| Feb 25 | 30.4 | 29.7 | 25.0 | 39.0 | 35.1 | 41.4 | 35.9 | 36.6 | 27.6 | 42.5 | 29.7 | 31.3 | 37.4 | 35.5 | 23.2 | 36.4 | 36.5 | 13.0 | 27.9 | 31.2 | 34.8 | 44.6 | 31.7 | 34.7 | 46.6 | 43.3 | 39.6 | 42.6 | 28.0 | 41.8 | 37.3 | 34.5 | 51.1 | 39.4 | 41.7 | 34.0 | 34.8 | 30.0 | 31.3 | 41.3 | 24.1 | 36.6 | 33.5 | 27.2 | 39.6 | 38.4 |
| Feb 26 | 34.2 | 24.8 | 35.7 | 32.9 | 31.6 | 41.3 | 44.6 | 46.8 | 23.7 | 49.1 | 42.7 | 35.9 | 33.4 | 40.6 | 36.8 | 41.5 | 35.9 | 12.0 | 27.8 | 33.7 | 49.9 | 39.1 | 34.3 | 36.9 | 52.2 | 31.2 | 29.9 | 46.8 | 33.8 | 27.4 | 41.8 | 39.9 | 35.2 | 36.9 | 35.3 | 33.2 | 28.4 | 27.8 | 36.2 | 43.9 | 29.0 | 43.5 | 31.3 | 23.6 | 45.7 | 40.2 |
| Feb 27 | 34.8 | 35.9 | 40.4 | 33.0 | 33.7 | 35.2 | 44.2 | 40.8 | 19.9 | 53.7 | 34.4 | 43.7 | 36.2 | 33.7 | 30.0 | 31.2 | 36.1 | 22.1 | 32.5 | 24.9 | 44.6 | 41.2 | 41.0 | 41.1 | 61.3 | 31.5 | 28.3 | 39.1 | 43.0 | 28.7 | 39.8 | 43.4 | 33.2 | 37.2 | 30.4 | 26.3 | 32.4 | 34.7 | 39.0 | 40.5 | 32.7 | 37.5 | 40.8 | 29.7 | 59.4 | 39.8 |
| Feb 28 | 36.0 | 29.1 | 42.2 | 36.6 | 34.4 | 39.8 | 49.8 | 49.6 | 23.2 | 34.1 | 36.0 | 46.9 | 33.5 | 39.9 | 33.2 | 37.7 | 30.2 | 25.3 | 26.6 | 26.9 | 32.7 | 40.0 | 39.7 | 43.6 | 43.6 | 37.3 | 37.6 | 37.7 | 44.5 | 36.6 | 27.6 | 49.9 | 25.4 | 39.7 | 34.3 | 31.9 | 43.1 | 36.2 | 28.1 | 56.2 | 34.4 | 32.4 | 50.3 | 28.4 | 53.2 | 51.8 |
| Feb 29 | 34.3 | 29.4 | 34.4 | 30.4 | 28.0 | 42.3 | 56.5 | 41.8 | 16.3 | 33.2 | 37.3 | 38.2 | 44.9 | 39.8 | 42.9 | 43.1 | 29.5 | 30.9 | 32.5 | 24.7 | 40.9 | 38.8 | 46.8 | 37.4 | 44.6 | 41.7 | 37.0 | 37.6 | 37.6 | 44.0 | 33.6 | 42.2 | 28.3 | 35.0 | 40.0 | 40.3 | 36.9 | 38.5 | 32.8 | 45.1 | 37.7 | 43.4 | 45.7 | 25.3 | 48.1 | 51.6 |
| Mar 1 | 24.6 | 27.2 | 30.5 | 30.6 | 27.8 | 44.8 | 57.0 | 37.0 | 21.4 | 31.8 | 44.3 | 45.6 | 48.6 | 29.3 | 39.7 | 40.3 | 31.8 | 30.6 | 38.8 | 31.4 | 37.2 | 31.5 | 46.1 | 42.2 | 38.0 | 30.3 | 39.8 | 31.9 | 38.6 | 37.1 | 40.5 | 46.0 | 42.6 | 41.2 | 38.7 | 39.7 | 36.8 | 34.8 | 39.1 | 44.1 | 43.1 | 49.3 | 40.7 | 27.0 | 46.4 | 46.8 |
| Mar 2 | 20.2 | 21.8 | 25.0 | 28.0 | 34.2 | 41.1 | 46.6 | 35.6 | 36.7 | 34.0 | 38.2 | 40.1 | 48.2 | 40.2 | 47.7 | 50.4 | 32.9 | 36.8 | 41.0 | 33.6 | 34.7 | 39.2 | 54.0 | 46.0 | 37.9 | 34.8 | 36.7 | 27.6 | 33.8 | 45.4 | 40.0 | 40.8 | 40.9 | 45.6 | 35.0 | 50.6 | 38.1 | 34.7 | 51.2 | 43.8 | 40.7 | 46.7 | 42.6 | 27.5 | 38.6 | 40.3 |
| Mar 3 | 38.0 | 22.2 | 44.5 | 26.8 | 37.3 | 30.6 | 53.3 | 41.0 | 35.8 | 27.6 | 46.4 | 32.5 | 42.8 | 38.7 | 42.1 | 47.1 | 33.8 | 39.4 | 35.0 | 34.3 | 38.9 | 38.9 | 52.0 | 43.6 | 36.9 | 44.3 | 37.6 | 23.1 | 34.5 | 45.1 | 46.7 | 36.6 | 41.9 | 48.7 | 39.6 | 59.0 | 33.1 | 35.3 | 57.1 | 31.2 | 41.8 | 49.1 | 30.4 | 31.6 | 28.4 | 43.5 |
| Mar 4 | 39.8 | 24.0 | 33.6 | 21.1 | 41.9 | 44.1 | 53.5 | 35.6 | 30.7 | 42.4 | 51.0 | 33.5 | 32.6 | 28.7 | 37.1 | 40.6 | 39.9 | 49.1 | 31.2 | 27.1 | 44.8 | 46.5 | 49.3 | 31.6 | 40.2 | 35.0 | 36.0 | 37.1 | 34.2 | 37.1 | 47.8 | 41.1 | 36.2 | 36.9 | 30.6 | 59.4 | 29.6 | 39.2 | 41.9 | 45.7 | 49.6 | 40.5 | 45.9 | 39.0 | 33.3 | 35.0 |
| Mar 5 | 33.7 | 39.0 | 33.8 | 32.8 | 27.8 | 39.2 | 52.2 | 29.8 | 23.8 | 42.3 | 36.4 | 35.9 | 31.8 | 39.8 | 28.2 | 45.6 | 47.5 | 43.7 | 33.9 | 29.6 | 42.9 | 39.7 | 40.1 | 35.8 | 42.3 | 39.3 | 43.6 | 31.5 | 38.3 | 43.8 | 47.2 | 38.7 | 36.7 | 26.4 | 33.7 | 45.1 | 24.3 | 35.8 | 44.5 | 35.6 | 52.6 | 41.0 | 44.2 | 41.6 | 25.3 | 30.8 |
| Mar 6 | 31.0 | 49.2 | 43.4 | 39.0 | 30.6 | 33.0 | 51.7 | 34.8 | 28.9 | 49.2 | 42.1 | 37.4 | 46.2 | 40.3 | 33.5 | 41.7 | 47.6 | 47.5 | 39.5 | 24.2 | 40.5 | 39.8 | 32.2 | 40.2 | 48.3 | 44.0 | 42.2 | 28.0 | 35.3 | 39.7 | 50.2 | 42.6 | 33.4 | 31.4 | 36.0 | 53.8 | 29.6 | 31.3 | 48.2 | 41.2 | 46.8 | 41.4 | 52.2 | 31.2 | 22.9 | 26.7 |
| Mar 7 | 44.6 | 42.0 | 40.3 | 35.1 | 36.0 | 35.0 | 46.3 | 37.6 | 33.8 | 46.0 | 44.7 | 38.2 | 43.4 | 55.5 | 27.7 | 49.4 | 48.3 | 36.4 | 31.3 | 27.1 | 47.2 | 44.4 | 31.1 | 36.6 | 48.8 | 33.8 | 34.4 | 21.3 | 44.0 | 42.8 | 41.3 | 31.8 | 40.0 | 37.4 | 47.6 | 37.3 | 38.6 | 36.5 | 37.7 | 37.1 | 49.3 | 39.8 | 44.5 | 41.5 | 38.6 | 18.1 |
| Mar 8 | 28.6 | 46.2 | 39.2 | 34.5 | 58.6 | 27.2 | 50.1 | 41.6 | 42.7 | 44.2 | 39.4 | 41.8 | 40.0 | 39.5 | 43.0 | 40.8 | 57.6 | 29.7 | 36.8 | 25.7 | 38.0 | 44.2 | 35.5 | 37.1 | 47.7 | 33.4 | 32.9 | 17.1 | 43.3 | 43.4 | 44.3 | 43.3 | 41.1 | 36.6 | 52.0 | 32.0 | 38.7 | 32.7 | 47.5 | 27.3 | 49.0 | 38.0 | 45.8 | 30.0 | 37.2 | 25.3 |
| Mar 9 | 35.4 | 41.1 | 49.6 | 38.7 | 63.0 | 23.4 | 40.8 | 36.5 | 43.4 | 44.5 | 33.8 | 38.1 | 36.2 | 39.6 | 38.7 | 42.5 | 48.8 | 32.5 | 36.5 | 19.9 | 36.2 | 50.0 | 38.1 | 36.5 | 39.8 | 38.9 | 28.6 | 17.4 | 43.3 | 41.0 | 42.6 | 39.5 | 35.6 | 43.2 | 44.8 | 31.4 | 41.3 | 29.2 | 37.9 | 35.7 | 55.6 | 28.2 | 38.7 | 26.0 | 33.3 | 31.1 |
| Mar 10 | 27.5 | 38.8 | 39.6 | 34.2 | 66.0 | 35.8 | 45.9 | 38.2 | 38.3 | 44.4 | 44.2 | 35.6 | 32.3 | 34.0 | 34.2 | 42.3 | 38.0 | 36.6 | 36.7 | 22.3 | 34.6 | 53.0 | 49.1 | 33.0 | 35.7 | 37.8 | 32.1 | 27.0 | 43.3 | 44.2 | 41.3 | 41.8 | 25.8 | 53.0 | 49.4 | 25.9 | 38.8 | 35.9 | 46.6 | 28.3 | 56.4 | 25.5 | 40.2 | 22.1 | 28.9 | 38.5 |
| Mar 11 | 29.3 | 41.3 | 30.6 | 36.2 | 59.7 | 43.2 | 47.4 | 37.7 | 37.5 | 40.5 | 44.3 | 41.0 | 36.1 | 40.4 | 25.0 | 49.9 | 42.3 | 44.7 | 31.9 | 32.3 | 38.4 | 55.2 | 51.5 | 36.0 | 36.3 | 42.9 | 21.9 | 28.1 | 45.6 | 52.4 | 30.1 | 44.3 | 18.0 | 54.2 | 44.7 | 22.0 | 36.7 | 28.9 | 29.1 | 30.4 | 68.6 | 32.6 | 48.4 | 27.3 | 30.6 | 31.5 |
| Mar 12 | 26.8 | 51.4 | 19.4 | 40.2 | 50.1 | 39.9 | 56.1 | 47.8 | 27.9 | 50.8 | 46.9 | 39.3 | 40.8 | 46.6 | 35.9 | 54.6 | 47.8 | 42.3 | 39.9 | 41.7 | 33.6 | 41.5 | 41.5 | 36.4 | 33.2 | 43.2 | 10.2 | 38.3 | 57.1 | 35.3 | 18.9 | 43.2 | 38.2 | 39.3 | 45.3 | 37.3 | 41.5 | 44.4 | 30.3 | 30.8 | 59.3 | 40.5 | 36.4 | 32.8 | 34.2 | 35.9 |
| Mar 13 | 33.1 | 53.5 | 35.6 | 30.3 | 51.2 | 34.8 | 45.1 | 41.6 | 39.1 | 49.5 | 46.6 | 41.8 | 43.5 | 57.5 | 46.9 | 44.5 | 43.4 | 43.7 | 45.5 | 47.0 | 33.1 | 43.4 | 38.9 | 40.0 | 36.4 | 41.0 | 23.0 | 36.5 | 58.3 | 35.4 | 18.9 | 44.1 | 35.7 | 44.4 | 52.0 | 49.8 | 37.6 | 51.4 | 34.1 | 32.1 | 55.1 | 46.8 | 36.7 | 40.4 | 35.2 | 36.4 |
| Mar 14 | 40.5 | 43.5 | 31.6 | 37.5 | 54.4 | 45.7 | 50.1 | 33.1 | 40.0 | 55.8 | 42.4 | 34.5 | 39.4 | 52.6 | 43.3 | 40.1 | 41.4 | 50.4 | 47.2 | 52.3 | 40.8 | 34.7 | 44.6 | 48.3 | 25.8 | 36.9 | 28.9 | 39.7 | 49.2 | 48.5 | 24.1 | 40.2 | 31.2 | 32.7 | 57.6 | 49.3 | 27.1 | 49.3 | 26.2 | 38.1 | 55.1 | 43.9 | 41.1 | 35.9 | 49.5 | 45.3 |
| Mar 15 | 47.4 | 46.4 | 38.5 | 23.7 | 60.9 | 41.8 | 33.8 | 26.4 | 35.6 | 50.9 | 52.0 | 40.4 | 43.9 | 46.2 | 44.2 | 31.2 | 37.0 | 35.0 | 55.8 | 54.7 | 57.1 | 36.4 | 41.4 | 44.0 | 28.4 | 47.0 | 31.9 | 29.3 | 46.7 | 43.6 | 38.2 | 35.2 | 25.7 | 35.4 | 59.9 | 39.7 | 31.3 | 39.2 | 27.4 | 32.7 | 55.0 | 50.6 | 35.5 | 52.0 | 34.3 | 39.7 |

**TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET**

| YEAR-> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar 16 | 41.1 | 47.0 | 34.8 | 28.7 | 60.3 | 40.1 | 44.5 | 43.3 | 43.1 | 47.1 | 53.8 | 43.8 | 50.3 | 41.2 | 50.1 | 33.0 | 40.2 | 39.4 | 55.3 | 45.5 | 64.3 | 32.7 | 40.7 | 42.4 | 35.7 | 41.7 | 47.1 | 32.8 | 49.8 | 37.0 | 45.3 | 44.1 | 37.3 | 38.9 | 52.1 | 46.5 | 28.2 | 44.3 | 43.5 | 31.5 | 47.5 | 43.9 | 37.0 | 44.0 | 54.0 | 29.3 |
| Mar 17 | 32.1 | 47.5 | 38.9 | 28.6 | 45.4 | 40.1 | 39.3 | 48.2 | 44.2 | 52.4 | 47.1 | 42.6 | 54.2 | 36.2 | 41.9 | 39.7 | 51.1 | 41.6 | 43.6 | 39.0 | 53.9 | 34.5 | 36.4 | 35.5 | 41.8 | 35.8 | 51.4 | 29.0 | 57.4 | 38.5 | 51.2 | 52.5 | 37.2 | 46.0 | 47.4 | 51.4 | 37.2 | 47.6 | 30.2 | 35.2 | 58.1 | 37.5 | 42.6 | 48.4 | 51.7 | 28.0 |
| Mar 18 | 47.3 | 31.3 | 41.0 | 42.3 | 50.9 | 37.1 | 25.0 | 53.0 | 40.1 | 43.6 | 50.0 | 38.8 | 69.6 | 49.6 | 33.4 | 35.7 | 50.9 | 41.3 | 49.6 | 40.7 | 54.6 | 32.4 | 40.6 | 41.6 | 52.2 | 29.5 | 46.6 | 30.2 | 49.4 | 44.1 | 43.7 | 62.2 | 38.9 | 47.6 | 55.6 | 59.1 | 37.1 | 53.9 | 33.4 | 30.2 | 58.6 | 44.5 | 57.7 | 45.8 | 54.9 | 38.4 |
| Mar 19 | 59.1 | 28.4 | 34.4 | 47.0 | 49.4 | 50.5 | 36.9 | 50.8 | 44.1 | 56.9 | 46.3 | 34.5 | 61.8 | 51.4 | 35.2 | 43.7 | 54.4 | 43.8 | 46.2 | 42.7 | 62.8 | 40.4 | 37.9 | 45.9 | 37.9 | 37.5 | 43.8 | 30.5 | 58.2 | 37.3 | 39.4 | 53.6 | 38.7 | 42.3 | 68.9 | 46.6 | 41.3 | 58.2 | 21.6 | 31.1 | 68.6 | 40.8 | 65.7 | 49.2 | 48.2 | 43.7 |
| Mar 20 | 47.6 | 31.6 | 38.5 | 45.9 | 47.4 | 49.3 | 27.0 | 53.9 | 47.1 | 54.5 | 43.0 | 45.3 | 46.4 | 53.4 | 44.2 | 43.3 | 49.4 | 36.9 | 55.7 | 45.2 | 54.0 | 34.6 | 43.0 | 42.9 | 39.0 | 26.4 | 33.0 | 27.7 | 56.6 | 36.8 | 41.9 | 43.4 | 46.9 | 39.2 | 50.4 | 53.8 | 37.2 | 39.2 | 29.0 | 26.5 | 66.6 | 41.6 | 56.5 | 51.1 | 49.1 | 37.1 |
| Mar 21 | 45.3 | 39.4 | 37.4 | 49.4 | 43.2 | 42.8 | 29.0 | 57.9 | 51.0 | 48.3 | 42.0 | 50.2 | 41.6 | 50.6 | 44.1 | 55.3 | 57.0 | 43.3 | 50.6 | 43.8 | 43.1 | 50.3 | 42.2 | 38.9 | 42.5 | 33.3 | 21.9 | 24.0 | 50.0 | 47.5 | 43.2 | 53.7 | 43.3 | 39.8 | 40.6 | 45.6 | 45.0 | 53.0 | 42.9 | 28.0 | 61.3 | 50.5 | 54.2 | 41.4 | 33.2 | 38.6 |
| Mar 22 | 43.4 | 35.5 | 43.9 | 35.9 | 37.1 | 56.0 | 34.6 | 54.5 | 40.1 | 50.1 | 43.4 | 42.3 | 40.3 | 43.3 | 48.7 | 44.5 | 57.5 | 41.0 | 49.4 | 31.7 | 52.3 | 57.5 | 48.1 | 34.6 | 48.5 | 44.4 | 30.0 | 30.3 | 45.1 | 45.7 | 43.1 | 43.2 | 61.1 | 42.5 | 47.7 | 45.3 | 37.3 | 41.6 | 36.2 | 37.7 | 55.5 | 52.1 | 52.7 | 49.3 | 44.4 | 45.9 |
| Mar 23 | 44.4 | 54.6 | 40.1 | 44.6 | 38.3 | 47.0 | 38.4 | 40.5 | 36.1 | 55.8 | 45.1 | 33.8 | 47.6 | 31.1 | 53.1 | 46.8 | 59.9 | 50.1 | 52.5 | 32.8 | 44.9 | 49.2 | 42.6 | 39.6 | 53.0 | 35.0 | 50.2 | 46.1 | 47.9 | 51.2 | 43.1 | 40.6 | 54.9 | 53.3 | 42.3 | 52.7 | 47.4 | 40.8 | 30.5 | 44.7 | 50.5 | 53.4 | 50.6 | 53.7 | 32.7 | 43.0 |
| Mar 24 | 54.2 | 61.7 | 49.1 | 34.9 | 38.2 | 49.2 | 47.0 | 34.5 | 46.4 | 43.2 | 53.7 | 35.5 | 44.7 | 35.0 | 52.3 | 61.4 | 62.8 | 37.2 | 37.5 | 28.2 | 47.6 | 47.5 | 51.9 | 35.6 | 54.2 | 38.7 | 51.4 | 41.4 | 42.8 | 50.0 | 38.9 | 34.8 | 53.1 | 61.7 | 48.8 | 46.4 | 47.4 | 49.3 | 28.5 | 41.0 | 47.1 | 51.6 | 47.3 | 42.0 | 46.7 | 44.4 |
| Mar 25 | 56.7 | 59.5 | 46.2 | 34.6 | 42.2 | 56.1 | 43.0 | 33.9 | 51.3 | 43.3 | 52.9 | 42.3 | 46.2 | 40.8 | 55.2 | 49.2 | 68.6 | 41.3 | 38.0 | 32.1 | 49.4 | 47.1 | 53.1 | 43.0 | 48.2 | 40.6 | 46.2 | 31.1 | 47.0 | 50.8 | 34.3 | 39.4 | 52.7 | 58.8 | 45.5 | 54.4 | 43.7 | 49.6 | 45.5 | 43.9 | 42.1 | 53.6 | 47.4 | 51.7 | 51.5 | 42.3 |
| Mar 26 | 58.5 | 60.7 | 39.6 | 28.6 | 41.4 | 50.9 | 38.0 | 34.5 | 51.6 | 48.9 | 41.0 | 41.7 | 45.6 | 41.0 | 54.0 | 53.9 | 66.9 | 51.7 | 45.4 | 36.4 | 52.9 | 46.5 | 44.5 | 41.4 | 46.1 | 46.8 | 47.6 | 40.2 | 47.1 | 55.7 | 27.2 | 47.5 | 45.9 | 52.0 | 34.4 | 45.7 | 51.9 | 63.7 | 45.4 | 45.2 | 50.6 | 48.9 | 45.6 | 56.9 | 53.8 | 34.4 |
| Mar 27 | 44.5 | 49.4 | 37.5 | 37.2 | 42.4 | 44.8 | 36.6 | 34.6 | 48.3 | 46.4 | 40.4 | 41.6 | 55.4 | 31.6 | 60.5 | 36.9 | 66.8 | 61.4 | 47.9 | 44.8 | 43.9 | 41.6 | 44.5 | 43.9 | 39.2 | 68.4 | 45.0 | 32.3 | 41.6 | 47.2 | 38.9 | 55.8 | 35.9 | 51.8 | 37.9 | 38.9 | 51.9 | 55.2 | 40.4 | 35.1 | 53.3 | 39.5 | 44.7 | 42.7 | 56.0 | 50.8 |
| Mar 28 | 52.9 | 53.1 | 27.6 | 41.7 | 36.1 | 42.7 | 42.8 | 40.8 | 55.7 | 37.2 | 43.9 | 41.6 | 57.2 | 43.7 | 66.3 | 35.6 | 62.2 | 53.0 | 42.7 | 37.7 | 40.8 | 43.2 | 39.9 | 45.7 | 49.2 | 71.4 | 39.8 | 32.3 | 51.9 | 54.8 | 45.9 | 49.9 | 34.5 | 51.1 | 47.7 | 32.7 | 45.9 | 53.9 | 46.3 | 32.5 | 64.1 | 41.1 | 37.4 | 52.7 | 42.4 | 52.6 |
| Mar 29 | 58.1 | 52.3 | 40.0 | 51.5 | 41.3 | 44.7 | 36.6 | 50.1 | 49.0 | 35.4 | 34.6 | 50.4 | 53.7 | 34.0 | 62.5 | 34.9 | 54.1 | 65.8 | 35.1 | 50.5 | 42.9 | 47.2 | 51.9 | 40.7 | 45.1 | 70.6 | 47.5 | 43.3 | 49.2 | 57.4 | 40.4 | 48.0 | 42.3 | 44.2 | 50.3 | 30.6 | 33.0 | 61.7 | 44.5 | 38.4 | 51.8 | 32.6 | 50.5 | 56.8 | 36.9 | 53.1 |
| Mar 30 | 52.6 | 56.8 | 38.2 | 50.3 | 37.7 | 46.6 | 30.7 | 51.1 | 54.4 | 45.2 | 35.6 | 54.3 | 49.6 | 41.9 | 52.9 | 46.1 | 54.3 | 69.2 | 43.7 | 47.3 | 54.7 | 43.8 | 34.9 | 42.0 | 43.9 | 54.0 | 51.6 | 48.1 | 36.3 | 42.5 | 35.2 | 47.8 | 38.5 | 46.4 | 57.7 | 38.5 | 34.7 | 65.3 | 49.7 | 45.6 | 47.3 | 33.4 | 61.4 | 55.6 | 33.0 | 53.3 |
| Mar 31 | 48.0 | 49.8 | 41.1 | 40.1 | 38.0 | 35.9 | 45.9 | 53.3 | 44.4 | 49.2 | 37.0 | 51.2 | 49.9 | 46.6 | 54.1 | 39.5 | 49.7 | 66.8 | 40.2 | 41.8 | 49.3 | 43.9 | 33.8 | 45.0 | 37.5 | 62.9 | 50.3 | 46.9 | 41.3 | 54.8 | 29.7 | 34.4 | 37.2 | 27.8 | 52.2 | 24.8 | 24.2 | 58.4 | 45.0 | 40.9 | 52.6 | 24.9 | 66.3 | 46.3 | 30.3 | 50.7 |
| Apr 1 | 61.3 | 51.9 | 43.8 | 31.0 | 29.4 | 33.6 | 53.3 | 43.0 | 34.4 | 38.3 | 28.2 | 48.8 | 48.0 | 39.6 | 49.2 | 45.0 | 57.7 | 56.9 | 30.3 | 32.7 | 57.6 | 50.6 | 35.6 | 27.2 | 38.3 | 59.8 | 55.1 | 41.7 | 46.0 | 47.0 | 43.3 | 34.7 | 31.5 | 28.2 | 35.5 | 35.5 | 33.7 | 51.3 | 43.1 | 44.7 | 58.5 | 38.6 | 58.1 | 40.5 | 36.4 | 40.8 |
| Apr 2 | 57.1 | 55.7 | 42.4 | 37.7 | 26.4 | 39.1 | 47.1 | 51.1 | 37.7 | 40.3 | 39.4 | 59.7 | 51.4 | 44.9 | 48.6 | 54.8 | 58.3 | 58.9 | 36.6 | 38.2 | 51.8 | 40.0 | 36.8 | 24.0 | 31.7 | 58.9 | 62.3 | 42.3 | 42.6 | 47.3 | 31.9 | 34.3 | 50.5 | 40.1 | 36.8 | 37.3 | 36.8 | 54.5 | 52.1 | 43.8 | 45.2 | 40.4 | 50.6 | 45.4 | 42.5 | 36.9 |
| Apr 3 | 41.7 | 52.6 | 42.2 | 44.9 | 39.1 | 46.7 | 50.7 | 33.1 | 44.3 | 35.5 | 25.4 | 56.1 | 51.9 | 46.7 | 53.5 | 63.5 | 51.3 | 49.6 | 38.7 | 36.6 | 51.1 | 42.6 | 37.4 | 28.7 | 43.9 | 43.3 | 58.8 | 40.1 | 56.7 | 47.5 | 42.0 | 46.3 | 38.8 | 34.6 | 47.6 | 47.4 | 49.2 | 44.8 | 58.4 | 53.9 | 45.7 | 49.4 | 48.7 | 37.8 | 50.6 | 33.2 |
| Apr 4 | 40.8 | 43.8 | 42.8 | 37.5 | 37.5 | 59.8 | 52.1 | 41.8 | 42.1 | 37.0 | 36.6 | 46.8 | 40.0 | 48.7 | 51.8 | 57.1 | 56.0 | 51.1 | 35.6 | 37.1 | 45.6 | 31.2 | 36.5 | 29.5 | 37.0 | 50.5 | 57.3 | 37.8 | 47.1 | 55.6 | 43.8 | 55.1 | 40.3 | 35.5 | 43.8 | 47.4 | 39.3 | 44.5 | 59.7 | 63.9 | 41.4 | 43.5 | 48.8 | 37.3 | 45.9 | 43.3 |
| Apr 5 | 32.9 | 44.5 | 38.0 | 51.8 | 34.0 | 60.2 | 52.6 | 35.3 | 44.7 | 31.6 | 44.4 | 41.5 | 42.7 | 56.7 | 47.1 | 60.0 | 40.6 | 53.2 | 40.9 | 34.1 | 60.2 | 48.2 | 38.3 | 32.0 | 28.3 | 44.5 | 64.4 | 32.3 | 41.4 | 59.2 | 43.1 | 59.2 | 35.8 | 42.5 | 45.6 | 39.9 | 46.6 | 44.4 | 55.7 | 63.6 | 44.7 | 44.1 | 62.4 | 45.6 | 49.7 | 38.6 |
| Apr 6 | 34.4 | 39.6 | 44.2 | 50.3 | 38.0 | 62.1 | 42.9 | 45.0 | 45.7 | 41.6 | 56.5 | 48.3 | 37.4 | 50.6 | 61.3 | 49.3 | 58.9 | 43.7 | 50.3 | 43.3 | 47.9 | 36.6 | 36.5 | 31.1 | 33.2 | 45.2 | 62.5 | 42.3 | 40.5 | 57.6 | 49.9 | 53.6 | 41.3 | 38.2 | 40.9 | 44.1 | 41.7 | 45.7 | 56.9 | 55.2 | 52.1 | 43.8 | 58.2 | 62.6 | 54.6 | 37.8 |
| Apr 7 | 39.5 | 47.9 | 38.2 | 52.7 | 36.3 | 59.3 | 33.5 | 53.6 | 38.8 | 41.8 | 54.8 | 54.4 | 39.1 | 45.1 | 52.0 | 52.9 | 44.7 | 44.2 | 37.6 | 46.8 | 39.8 | 45.0 | 44.5 | 33.0 | 46.3 | 46.8 | 47.6 | 43.2 | 31.7 | 42.4 | 41.3 | 64.7 | 47.3 | 44.4 | 39.2 | 42.5 | 39.7 | 53.9 | 54.4 | 46.5 | 61.9 | 54.0 | 63.2 | 53.1 | 60.3 | 37.0 |
| Apr 8 | 26.1 | 45.3 | 45.3 | 52.5 | 31.7 | 54.4 | 36.5 | 41.3 | 42.3 | 49.9 | 46.4 | 46.5 | 45.5 | 39.9 | 54.9 | 55.8 | 43.7 | 48.3 | 39.7 | 54.3 | 36.8 | 46.7 | 35.2 | 43.2 | 37.5 | 37.7 | 57.3 | 49.9 | 42.7 | 53.5 | 43.2 | 63.6 | 39.4 | 44.0 | 39.0 | 51.1 | 51.4 | 48.1 | 55.8 | 42.0 | 57.8 | 47.7 | 49.7 | 59.5 | 56.9 | 43.9 |
| Apr 9 | 46.9 | 41.2 | 47.8 | 53.5 | 41.3 | 50.5 | 40.3 | 45.0 | 56.5 | 42.6 | 34.0 | 40.8 | 42.7 | 41.0 | 52.3 | 64.8 | 49.0 | 36.0 | 42.1 | 62.1 | 39.6 | 44.0 | 36.7 | 45.4 | 42.0 | 46.1 | 62.7 | 39.8 | 47.3 | 39.1 | 36.0 | 45.6 | 32.3 | 43.5 | 36.6 | 41.2 | 59.4 | 41.3 | 51.2 | 44.6 | 53.0 | 57.9 | 59.6 | 61.7 | 65.4 | 43.1 |
| Apr 10 | 35.7 | 54.6 | 54.3 | 49.7 | 33.2 | 66.0 | 37.4 | 49.8 | 56.9 | 39.0 | 33.3 | 39.8 | 38.7 | 51.6 | 44.8 | 57.5 | 53.7 | 34.2 | 43.4 | 56.0 | 37.8 | 48.3 | 36.5 | 47.1 | 41.5 | 31.9 | 60.5 | 56.7 | 51.4 | 34.4 | 40.2 | 42.9 | 38.4 | 38.1 | 52.5 | 44.8 | 62.0 | 48.5 | 54.1 | 52.8 | 39.7 | 56.3 | 58.8 | 59.9 | 51.3 | 37.2 |
| Apr 11 | 39.3 | 68.9 | 49.4 | 42.3 | 31.1 | 59.8 | 40.7 | 49.2 | 68.3 | 47.6 | 39.2 | 40.0 | 54.3 | 56.5 | 47.5 | 55.3 | 44.9 | 33.2 | 38.4 | 66.6 | 32.2 | 48.0 | 46.0 | 50.2 | 41.9 | 33.7 | 49.1 | 44.3 | 54.4 | 34.4 | 37.9 | 61.9 | 42.6 | 34.9 | 53.0 | 48.2 | 51.0 | 48.6 | 39.3 | 54.4 | 42.1 | 54.4 | 54.9 | 61.2 | 57.2 | 54.5 |
| Apr 12 | 45.6 | 62.4 | 40.4 | 43.1 | 45.0 | 49.7 | 34.1 | 51.4 | 59.0 | 52.8 | 53.1 | 49.9 | 64.4 | 64.9 | 48.6 | 49.0 | 40.2 | 37.4 | 54.5 | 54.8 | 29.5 | 55.2 | 45.0 | 46.2 | 38.9 | 31.8 | 54.8 | 56.7 | 58.5 | 37.1 | 47.5 | 58.7 | 43.5 | 34.0 | 52.4 | 48.4 | 49.6 | 57.1 | 39.4 | 56.4 | 52.8 | 59.8 | 55.9 | 62.5 | 57.1 | 37.8 |
| Apr 13 | 53.3 | 66.4 | 52.2 | 41.6 | 37.1 | 46.7 | 44.6 | 62.9 | 54.0 | 46.8 | 58.3 | 48.9 | 61.0 | 63.7 | 58.0 | 45.5 | 49.1 | 40.5 | 56.0 | 77.2 | 24.9 | 57.2 | 46.3 | 42.7 | 34.0 | 45.0 | 52.6 | 58.0 | 60.1 | 28.0 | 43.0 | 46.5 | 49.3 | 41.6 | 64.2 | 47.8 | 54.9 | 52.9 | 30.3 | 51.6 | 51.9 | 60.0 | 46.7 | 59.7 | 63.3 | 32.9 |
| Apr 14 | 47.8 | 56.6 | 49.8 | 37.9 | 37.0 | 52.7 | 53.9 | 62.9 | 53.2 | 47.3 | 64.9 | 51.0 | 65.3 | 57.6 | 59.8 | 45.8 | 43.2 | 38.2 | 59.2 | 82.1 | 31.7 | 58.3 | 57.4 | 44.1 | 42.8 | 48.4 | 54.6 | 54.0 | 50.4 | 41.0 | 45.3 | 44.9 | 50.9 | 43.2 | 60.2 | 60.7 | 58.3 | 54.4 | 37.7 | 45.0 | 47.7 | 51.2 | 55.9 | 53.4 | 52.7 | 44.5 |
| Apr 15 | 53.9 | 50.6 | 46.8 | 36.9 | 41.1 | 53.5 | 58.0 | 57.9 | 61.9 | 51.1 | 49.7 | 52.6 | 50.7 | 54.1 | 61.2 | 48.8 | 48.4 | 49.4 | 66.6 | 68.7 | 44.7 | 67.1 | 41.8 | 55.3 | 40.7 | 49.4 | 39.2 | 45.9 | 60.6 | 51.3 | 41.2 | 34.8 | 61.5 | 43.7 | 62.4 | 53.6 | 61.3 | 55.2 | 35.9 | 49.2 | 56.7 | 52.6 | 62.1 | 45.7 | 50.4 | 56.8 |
| Apr 16 | 63.6 | 42.7 | 48.9 | 37.4 | 40.6 | 41.9 | 68.6 | 59.7 | 50.0 | 54.4 | 46.7 | 60.2 | 57.9 | 61.8 | 56.5 | 40.7 | 54.9 | 39.5 | 58.7 | 54.8 | 57.4 | 62.1 | 46.2 | 46.3 | 35.4 | 51.0 | 43.7 | 47.5 | 55.9 | 45.7 | 40.9 | 56.8 | 64.6 | 48.2 | 60.6 | 60.3 | 62.3 | 53.5 | 38.8 | 38.0 | 57.9 | 57.7 | 53.3 | 46.4 | 54.2 | 64.3 |
| Apr 17 | 66.3 | 51.2 | 62.0 | 46.3 | 42.9 | 53.5 | 59.3 | 45.3 | 47.7 | 51.2 | 49.9 | 61.1 | 53.1 | 57.5 | 58.3 | 44.2 | 45.8 | 40.9 | 49.5 | 46.6 | 60.7 | 53.3 | 45.6 | 42.2 | 50.7 | 45.5 | 48.3 | 45.8 | 59.8 | 51.0 | 35.9 | 53.9 | 60.8 | 50.1 | 55.2 | 56.5 | 52.6 | 49.6 | 38.4 | 42.1 | 61.9 | 63.1 | 56.8 | 61.8 | 55.3 | 56.0 |
| Apr 18 | 71.6 | 55.2 | 56.2 | 45.3 | 39.4 | 58.9 | 52.5 | 49.0 | 50.9 | 52.7 | 60.5 | 51.4 | 44.5 | 66.4 | 46.9 | 42.5 | 45.3 | 53.2 | 53.5 | 45.6 | 64.1 | 52.4 | 38.5 | 43.2 | 50.2 | 49.3 | 53.0 | 31.1 | 54.6 | 53.1 | 40.2 | 62.8 | 60.5 | 49.8 | 54.0 | 59.6 | 55.6 | 58.6 | 39.0 | 48.9 | 60.8 | 70.4 | 64.3 | 54.6 | 60.1 | 53.7 |
| Apr 19 | 68.8 | 44.1 | 60.8 | 58.2 | 52.1 | 49.7 | 46.3 | 54.6 | 57.3 | 60.8 | 64.8 | 45.7 | 48.9 | 57.2 | 50.8 | 51.6 | 38.9 | 40.6 | 59.5 | 48.0 | 50.5 | 55.8 | 33.3 | 40.9 | 63.2 | 61.7 | 62.3 | 38.7 | 67.6 | 60.2 | 35.3 | 64.3 | 61.1 | 46.1 | 42.2 | 55.6 | 51.4 | 65.1 | 50.6 | 51.4 | 50.4 | 64.0 | 62.4 | 47.4 | 53.0 | 54.3 |
| Apr 20 | 70.6 | 50.3 | 60.0 | 67.3 | 48.2 | 52.5 | 43.2 | 58.1 | 59.6 | 62.4 | 57.3 | 54.6 | 51.0 | 54.9 | 54.2 | 57.8 | 40.2 | 45.2 | 52.6 | 55.3 | 54.7 | 48.6 | 44.0 | 45.7 | 63.6 | 68.0 | 61.5 | 41.7 | 58.7 | 57.0 | 47.5 | 64.8 | 55.2 | 46.1 | 44.0 | 61.3 | 48.3 | 61.9 | 41.3 | 50.2 | 49.4 | 58.9 | 62.2 | 51.3 | 61.7 | 60.8 |
| Apr 21 | 55.7 | 53.3 | 62.5 | 57.1 | 58.2 | 57.3 | 56.4 | 57.5 | 52.2 | 63.7 | 63.3 | 49.2 | 46.0 | 55.1 | 53.1 | 64.7 | 40.0 | 47.1 | 52.3 | 55.5 | 47.2 | 42.9 | 45.5 | 51.3 | 60.5 | 71.7 | 55.3 | 43.5 | 49.3 | 58.5 | 50.9 | 66.0 | 51.0 | 40.1 | 46.8 | 63.8 | 47.0 | 58.3 | 45.5 | 42.5 | 50.5 | 56.4 | 59.2 | 50.3 | 65.1 | 57.2 |
| Apr 22 | 47.3 | 59.1 | 59.4 | 51.1 | 61.9 | 45.3 | 50.5 | 60.8 | 53.2 | 67.3 | 66.7 | 40.9 | 51.4 | 55.8 | 49.9 | 61.9 | 53.7 | 58.0 | 58.9 | 55.2 | 52.4 | 53.9 | 44.6 | 55.6 | 63.8 | 56.4 | 52.8 | 50.5 | 48.2 | 50.2 | 47.6 | 53.6 | 58.0 | 32.7 | 36.1 | 67.1 | 56.1 | 51.3 | 46.3 | 37.6 | 54.6 | 53.1 | 59.6 | 49.7 | 56.4 | 54.5 |
| Apr 23 | 51.2 | 64.7 | 63.7 | 50.8 | 61.4 | 40.7 | 42.9 | 47.9 | 44.9 | 63.3 | 57.7 | 40.3 | 62.8 | 57.2 | 51.3 | 51.6 | 54.0 | 46.6 | 61.4 | 49.3 | 50.3 | 55.6 | 45.0 | 51.1 | 73.2 | 66.6 | 52.3 | 47.0 | 48.0 | 53.8 | 45.9 | 58.4 | 49.7 | 35.0 | 49.8 | 67.3 | 50.7 | 48.5 | 44.9 | 43.6 | 57.6 | 57.9 | 56.7 | 41.2 | 61.2 | 54.1 |
| Apr 24 | 52.5 | 62.5 | 55.4 | 60.1 | 46.7 | 43.3 | 51.7 | 47.5 | 46.4 | 54.9 | 52.9 | 45.8 | 70.6 | 47.3 | 42.8 | 70.9 | 53.7 | 35.3 | 53.5 | 49.2 | 47.7 | 45.4 | 53.8 | 45.0 | 68.2 | 52.5 | 52.7 | 45.3 | 49.8 | 53.3 | 52.6 | 59.5 | 51.1 | 51.7 | 43.8 | 62.0 | 53.3 | 49.3 | 51.8 | 43.7 | 47.1 | 50.1 | 58.1 | 33.0 | 58.8 | 48.1 |
| Apr 25 | 45.3 | 51.0 | 63.1 | 56.0 | 46.5 | 40.7 | 46.7 | 44.1 | 51.4 | 46.3 | 57.0 | 47.0 | 71.1 | 41.5 | 40.3 | 69.6 | 58.4 | 39.9 | 58.7 | 71.4 | 48.6 | 52.1 | 53.3 | 45.5 | 62.5 | 58.2 | 46.2 | 48.3 | 42.7 | 62.3 | 56.8 | 53.7 | 54.1 | 49.2 | 55.3 | 63.3 | 58.2 | 55.7 | 56.2 | 39.6 | 47.2 | 53.0 | 53.0 | 41.1 | 62.5 | 68.7 |
| Apr 26 | 55.3 | 50.5 | 61.5 | 55.3 | 49.2 | 39.4 | 58.3 | 48.1 | 65.3 | 46.0 | 62.1 | 58.4 | 57.8 | 52.9 | 49.9 | 56.2 | 47.2 | 49.0 | 64.7 | 56.2 | 54.6 | 62.4 | 45.1 | 46.2 | 74.6 | 62.3 | 46.5 | 47.1 | 43.8 | 65.4 | 61.3 | 54.0 | 54.0 | 48.1 | 52.8 | 61.9 | 53.9 | 58.7 | 54.9 | 51.7 | 47.1 | 54.5 | 52.2 | 44.1 | 52.9 | 59.7 |
| Apr 27 | 42.9 | 39.0 | 68.1 | 48.1 | 47.9 | 51.1 | 63.7 | 49.9 | 56.3 | 43.2 | 66.3 | 61.7 | 52.0 | 48.9 | 53.5 | 48.2 | 43.7 | 51.4 | 69.4 | 68.7 | 44.3 | 49.8 | 41.3 | 58.0 | 75.5 | 52.8 | 51.9 | 52.3 | 40.0 | 73.0 | 62.4 | 58.6 | 47.3 | 50.2 | 53.1 | 64.7 | 62.2 | 52.3 | 56.2 | 61.3 | 51.5 | 73.5 | 54.7 | 40.5 | 54.1 | 55.9 |
| Apr 28 | 47.9 | 53.6 | 57.1 | 51.9 | 52.5 | 44.9 | 59.3 | 61.6 | 51.9 | 47.8 | 61.7 | 66.2 | 53.4 | 55.8 | 59.7 | 49.7 | 61.2 | 47.9 | 54.3 | 69.2 | 45.6 | 46.4 | 48.6 | 63.5 | 64.0 | 49.3 | 58.2 | 52.2 | 31.2 | 55.0 | 55.3 | 61.7 | 53.2 | 49.5 | 57.6 | 65.2 | 52.0 | 55.4 | 50.8 | 56.3 | 43.8 | 73.8 | 47.7 | 59.3 | 55.7 | 45.4 |
| Apr 29 | 54.2 | 57.4 | 53.0 | 49.7 | 60.5 | 53.9 | 54.8 | 61.3 | 52.8 | 54.2 | 64.5 | 63.1 | 49.1 | 60.4 | 49.3 | 50.7 | 60.6 | 51.8 | 60.6 | 59.6 | 38.0 | 56.6 | 58.2 | 58.9 | 62.2 | 61.7 | 57.6 | 48.5 | 55.8 | 57.2 | 44.2 | 65.3 | 57.3 | 53.5 | 57.2 | 65.5 | 47.1 | 63.5 | 43.5 | 58.7 | 44.1 | 72.4 | 46.3 | 56.9 | 53.3 | 48.5 |
| Apr 30 | 52.3 | 56.3 | 59.0 | 56.4 | 63.1 | 52.1 | 59.2 | 61.7 | 54.6 | 52.5 | 62.2 | 71.2 | 58.6 | 53.8 | 51.0 | 53.5 | 56.4 | 44.9 | 44.2 | 57.8 | 51.3 | 49.5 | 55.5 | 45.9 | 59.6 | 60.9 | 54.0 | 51.4 | 56.1 | 53.4 | 50.9 | 56.8 | 46.4 | 47.2 | 57.2 | 59.2 | 45.0 | 68.9 | 39.2 | 55.4 | 43.9 | 66.1 | 50.2 | 47.4 | 57.5 | 48.2 |
| May 1 | 55.9 | 61.4 | 51.8 | 59.2 | 52.9 | 53.6 | 55.2 | 60.0 | 54.6 | 53.5 | 56.2 | 60.6 | 57.2 | 54.5 | 57.2 | 57.8 | 55.1 | 48.6 | 50.4 | 65.6 | 62.9 | 45.6 | 51.5 | 47.8 | 59.3 | 56.3 | 46.2 | 63.2 | 48.7 | 65.1 | 55.6 | 61.5 | 52.1 | 50.1 | 57.0 | 50.3 | 57.5 | 64.6 | 50.7 | 47.1 | 48.5 | 65.6 | 58.1 | 43.0 | 46.1 | 50.5 |
| May 2 | 56.0 | 49.1 | 54.2 | 60.4 | 42.4 | 63.7 | 60.8 | 59.5 | 52.1 | 55.0 | 57.7 | 56.3 | 51.7 | 58.5 | 55.4 | 53.2 | 58.9 | 50.8 | 43.9 | 71.9 | 60.3 | 51.0 | 55.9 | 51.6 | 59.3 | 52.2 | 52.2 | 69.9 | 50.4 | 63.1 | 49.6 | 73.3 | 61.4 | 59.4 | 58.2 | 42.8 | 55.5 | 56.9 | 58.5 | 52.2 | 52.2 | 68.4 | 56.2 | 45.6 | 56.8 | 56.2 |
| May 3 | 64.2 | 60.7 | 52.0 | 66.2 | 52.9 | 61.5 | 60.3 | 60.2 | 57.6 | 55.0 | 55.9 | 57.1 | 54.3 | 61.9 | 67.2 | 50.4 | 50.5 | 59.5 | 51.2 | 65.1 | 61.0 | 56.3 | 50.3 | 51.2 | 65.5 | 46.0 | 52.4 | 54.7 | 56.6 | 64.9 | 46.6 | 61.0 | 49.9 | 51.2 | 56.4 | 49.0 | 54.5 | 52.6 | 56.5 | 48.3 | 55.0 | 67.6 | 60.8 | 44.4 | 55.5 | 51.0 |
| May 4 | 62.9 | 67.9 | 47.9 | 64.5 | 52.5 | 57.4 | 57.9 | 55.9 | 61.2 | 55.7 | 55.4 | 61.1 | 59.3 | 67.4 | 75.4 | 54.4 | 44.5 | 55.5 | 57.5 | 63.6 | 55.1 | 44.9 | 52.6 | 45.3 | 49.4 | 43.3 | 49.7 | 51.1 | 48.1 | 69.4 | 50.2 | 54.4 | 52.4 | 59.0 | 56.6 | 58.9 | 47.1 | 65.3 | 56.7 | 53.7 | 55.7 | 60.4 | 63.5 | 46.1 | 59.5 | 58.1 |
| May 5 | 60.0 | 52.8 | 61.3 | 56.3 | 55.1 | 65.6 | 53.3 | 65.9 | 62.5 | 56.4 | 52.4 | 52.0 | 54.3 | 60.2 | 62.5 | 61.0 | 50.1 | 56.0 | 57.4 | 64.3 | 51.5 | 59.8 | 64.6 | 59.8 | 52.3 | 57.1 | 47.9 | 48.3 | 47.3 | 57.2 | 49.3 | 51.5 | 49.9 | 52.9 | 59.3 | 51.1 | 51.6 | 66.7 | 51.0 | 55.7 | 53.9 | 61.9 | 51.0 | 55.6 | 51.6 | 50.8 |
| May 6 | 56.0 | 59.1 | 59.5 | 56.3 | 61.5 | 57.6 | 59.4 | 61.5 | 55.6 | 61.6 | 48.3 | 55.6 | 50.3 | 57.2 | 59.5 | 50.6 | 45.0 | 47.9 | 52.2 | 61.1 | 46.0 | 60.4 | 61.1 | 64.5 | 50.1 | 56.0 | 43.2 | 57.4 | 46.4 | 52.0 | 54.9 | 58.0 | 64.2 | 60.3 | 54.5 | 44.3 | 49.0 | 62.0 | 59.4 | 48.6 | 46.9 | 63.6 | 57.6 | 68.8 | 53.3 | 61.4 |
| May 7 | 58.9 | 64.0 | 57.3 | 60.0 | 60.4 | 55.8 | 55.4 | 64.7 | 57.7 | 68.8 | 54.2 | 61.7 | 47.9 | 56.3 | 63.9 | 64.0 | 52.9 | 55.8 | 52.8 | 57.6 | 55.6 | 69.7 | 68.4 | 61.9 | 59.7 | 62.3 | 56.6 | 47.6 | 53.1 | 62.8 | 59.3 | 47.9 | 66.1 | 62.5 | 59.7 | 43.3 | 53.0 | 55.7 | 50.4 | 42.8 | 48.3 | 59.9 | 64.1 | 65.3 | 50.6 | 57.6 |
| May 8 | 65.1 | 64.7 | 58.0 | 57.5 | 60.2 | 58.4 | 51.0 | 74.5 | 61.7 | 59.1 | 60.1 | 59.7 | 47.3 | 54.2 | 66.1 | 54.0 | 56.9 | 53.6 | 46.2 | 63.6 | 51.6 | 64.9 | 55.1 | 63.1 | 52.4 | 63.1 | 59.7 | 48.7 | 56.0 | 57.2 | 64.9 | 44.6 | 65.2 | 61.8 | 73.4 | 36.4 | 53.7 | 50.2 | 49.7 | 36.9 | 55.3 | 53.8 | 59.6 | 67.2 | 43.1 | 62.6 |
| May 9 | 55.4 | 61.7 | 59.2 | 62.9 | 58.6 | 55.7 | 54.6 | 66.7 | 55.8 | 58.0 | 63.1 | 59.1 | 50.9 | 46.2 | 60.2 | 48.3 | 52.8 | 59.1 | 47.1 | 64.2 | 57.0 | 64.4 | 58.5 | 62.6 | 55.4 | 61.4 | 64.7 | 48.5 | 56.3 | 51.7 | 66.8 | 48.6 | 59.3 | 53.9 | 60.9 | 58.5 | 62.6 | 57.6 | 48.7 | 48.0 | 60.4 | 52.1 | 62.1 | 69.4 | 52.4 | 62.6 |
| May 10 | 58.7 | 62.8 | 64.2 | 63.2 | 51.5 | 46.7 | 58.9 | 66.2 | 61.6 | 62.5 | 61.9 | 61.0 | 57.7 | 52.6 | 68.3 | 60.2 | 56.2 | 52.9 | 55.7 | 61.9 | 56.1 | 66.5 | 70.3 | 56.9 | 40.0 | 55.6 | 67.3 | 56.9 | 59.5 | 50.4 | 59.3 | 42.4 | 54.0 | 48.2 | 54.2 | 52.5 | 64.1 | 69.5 | 44.5 | 53.6 | 68.7 | 48.1 | 59.0 | 62.7 | 53.8 | 56.1 |
| May 11 | 63.6 | 60.5 | 54.2 | 68.6 | 52.4 | 58.9 | 56.1 | 72.8 | 51.8 | 59.1 | 54.0 | 59.4 | 53.9 | 46.2 | 62.5 | 59.7 | 61.4 | 54.8 | 50.2 | 55.2 | 57.0 | 53.9 | 60.4 | 66.8 | 46.6 | 60.2 | 64.3 | 52.6 | 59.5 | 49.3 | 60.4 | 46.6 | 57.6 | 46.3 | 56.7 | 53.1 | 67.3 | 68.0 | 51.1 | 55.8 | 63.3 | 46.5 | 65.7 | 61.6 | 55.2 | 56.7 |
| May 12 | 63.9 | 56.5 | 57.1 | 68.9 | 60.6 | 68.2 | 59.7 | 62.7 | 51.1 | 58.8 | 57.1 | 63.5 | 55.5 | 55.3 | 62.3 | 61.5 | 63.5 | 54.1 | 62.5 | 52.0 | 55.2 | 53.6 | 59.3 | 56.2 | 51.5 | 53.6 | 67.5 | 55.1 | 56.6 | 58.5 | 50.3 | 50.2 | 55.6 | 44.6 | 62.1 | 51.2 | 70.6 | 62.1 | 48.6 | 58.0 | 57.3 | 57.0 | 62.3 | 53.7 | 57.6 | 66.5 |
| May 13 | 59.1 | 48.9 | 58.3 | 61.6 | 64.0 | 71.1 | 58.1 | 52.3 | 57.2 | 64.4 | 54.4 | 67.5 | 57.9 | 54.3 | 69.2 | 65.0 | 72.1 | 46.7 | 59.8 | 60.3 | 57.0 | 59.4 | 53.9 | 52.7 | 49.8 | 59.7 | 61.8 | 52.2 | 58.4 | 66.2 | 58.8 | 60.1 | 53.1 | 62.6 | 53.2 | 53.5 | 68.8 | 61.7 | 55.9 | 70.5 | 64.8 | 57.4 | 68.7 | 44.8 | 65.9 | 69.6 |
| May 14 | 62.5 | 44.6 | 60.3 | 57.2 | 63.8 | 70.8 | 48.9 | 51.4 | 57.4 | 56.7 | 53.6 | 61.0 | 62.7 | 49.2 | 69.4 | 61.3 | 66.5 | 49.4 | 61.1 | 53.3 | 52.7 | 52.6 | 60.9 | 60.3 | 57.9 | 65.8 | 56.5 | 61.4 | 67.9 | 68.6 | 62.3 | 65.5 | 50.6 | 60.3 | 62.9 | 52.2 | 68.4 | 59.2 | 56.9 | 62.8 | 61.2 | 59.1 | 61.9 | 50.6 | 66.0 | 67.5 |
| May 15 | 62.2 | 41.4 | 60.6 | 67.1 | 71.1 | 70.8 | 56.4 | 58.1 | 60.3 | 58.8 | 55.1 | 55.5 | 61.7 | 54.7 | 57.7 | 66.9 | 63.0 | 60.4 | 53.7 | 56.3 | 48.9 | 48.8 | 78.3 | 49.7 | 56.4 | 62.9 | 64.4 | 55.7 | 65.6 | 65.8 | 52.9 | 65.3 | 51.2 | 58.0 | 61.7 | 68.0 | 61.4 | 59.4 | 54.0 | 71.7 | 64.2 | 55.0 | 53.1 | 54.8 | 67.5 | 59.7 |
| May 16 | 58.6 | 40.8 | 56.6 | 70.0 | 70.9 | 63.1 | 51.4 | 55.6 | 58.8 | 62.8 | 62.1 | 51.2 | 72.9 | 57.0 | 62.0 | 64.3 | 63.1 | 64.3 | 59.5 | 63.0 | 47.8 | 52.9 | 69.6 | 50.9 | 66.6 | 50.8 | 64.1 | 48.6 | 58.3 | 58.4 | 52.3 | 62.0 | 57.6 | 61.7 | 66.6 | 59.1 | 58.3 | 55.0 | 65.0 | 69.0 | 51.7 | 61.4 | 57.8 | 57.1 | 60.7 | 57.2 |
| May 17 | 60.9 | 45.6 | 60.4 | 66.8 | 62.4 | 67.8 | 58.8 | 64.6 | 61.0 | 65.8 | 60.4 | 61.1 | 67.1 | 66.1 | 60.6 | 57.3 | 63.2 | 66.5 | 62.4 | 63.4 | 62.2 | 57.4 | 75.8 | 54.3 | 61.6 | 51.2 | 55.8 | 51.7 | 65.9 | 55.4 | 57.8 | 63.1 | 57.1 | 62.5 | 70.9 | 66.9 | 57.1 | 62.6 | 68.7 | 71.8 | 54.1 | 58.8 | 67.3 | 54.0 | 57.8 | 58.0 |
| May 18 | 57.9 | 50.8 | 55.6 | 60.3 | 53.6 | 68.5 | 64.6 | 68.8 | 59.4 | 65.6 | 61.5 | 55.8 | 74.3 | 70.9 | 64.5 | 57.3 | 63.8 | 63.4 | 66.6 | 59.7 | 64.6 | 64.7 | 71.8 | 56.6 | 59.6 | 48.1 | 70.2 | 49.5 | 63.9 | 59.5 | 58.3 | 72.4 | 68.4 | 64.7 | 71.1 | 67.1 | 58.4 | 67.0 | 66.8 | 78.4 | 59.3 | 62.5 | 60.3 | 52.9 | 59.3 | 60.6 |
| May 19 | 60.1 | 60.7 | 51.9 | 57.6 | 60.7 | 74.9 | 68.0 | 61.6 | 55.1 | 67.8 | 62.8 | 60.6 | 70.3 | 72.8 | 57.2 | 56.4 | 59.3 | 49.8 | 59.0 | 60.0 | 62.7 | 59.6 | 70.2 | 57.6 | 53.6 | 54.4 | 66.5 | 55.0 | 63.8 | 56.9 | 64.6 | 69.4 | 68.9 | 68.9 | 73.2 | 63.7 | 64.8 | 67.9 | 56.9 | 69.3 | 49.9 | 64.3 | 63.4 | 60.7 | 60.5 | 57.9 |
| May 20 | 53.0 | 56.2 | 54.1 | 53.0 | 60.0 | 73.2 | 62.0 | 57.8 | 59.2 | 60.3 | 66.7 | 64.9 | 71.4 | 79.6 | 61.2 | 57.1 | 59.5 | 58.3 | 53.6 | 59.3 | 59.5 | 63.1 | 62.6 | 62.0 | 49.4 | 58.7 | 64.3 | 58.8 | 63.0 | 59.7 | 62.2 | 74.2 | 68.9 | 60.4 | 67.5 | 59.6 | 60.9 | 69.3 | 53.9 | 62.3 | 56.2 | 57.2 | 64.7 | 62.4 | 66.6 | 59.8 |
| May 21 | 61.8 | 62.6 | 61.8 | 55.8 | 57.7 | 64.7 | 64.1 | 48.9 | 60.7 | 54.5 | 76.5 | 64.8 | 66.5 | 70.3 | 55.9 | 61.6 | 68.2 | 54.2 | 56.9 | 63.3 | 72.1 | 59.3 | 60.6 | 62.8 | 58.2 | 73.8 | 59.0 | 61.1 | 55.2 | 65.9 | 61.2 | 75.7 | 67.9 | 67.1 | 64.6 | 55.5 | 54.7 | 69.9 | 54.1 | 57.2 | 56.5 | 59.5 | 56.1 | 65.8 | 64.4 | 67.6 |
| May 22 | 62.5 | 60.3 | 64.0 | 60.9 | 64.9 | 61.1 | 60.9 | 49.1 | 67.8 | 58.4 | 71.8 | 53.1 | 68.6 | 66.2 | 73.6 | 61.7 | 61.0 | 56.4 | 56.7 | 61.2 | 73.0 | 57.5 | 60.3 | 58.1 | 58.1 | 79.7 | 59.0 | 57.3 | 58.1 | 63.7 | 59.9 | 68.6 | 72.7 | 70.1 | 66.2 | 54.3 | 60.2 | 70.6 | 60.5 | 66.1 | 48.8 | 57.3 | 50.1 | 60.2 | 66.8 | 66.4 |
| May 23 | 51.7 | 55.4 | 64.3 | 63.1 | 61.9 | 62.9 | 60.3 | 55.2 | 67.0 | 66.8 | 71.0 | 58.8 | 65.5 | 66.1 | 71.2 | 64.8 | 61.0 | 65.2 | 51.5 | 61.4 | 77.5 | 61.1 | 67.2 | 54.9 | 62.7 | 82.8 | 63.6 | 56.9 | 66.2 | 65.6 | 61.6 | 59.2 | 59.7 | 67.4 | 69.6 | 55.1 | 65.9 | 70.6 | 65.5 | 60.1 | 54.2 | 60.2 | 50.5 | 57.7 | 62.6 | 60.0 |
| May 24 | 57.7 | 55.5 | 63.9 | 61.4 | 72.4 | 68.3 | 49.9 | 50.7 | 62.7 | 62.0 | 71.0 | 64.7 | 67.3 | 61.6 | 60.7 | 58.4 | 54.4 | 69.4 | 64.8 | 69.3 | 71.7 | 57.7 | 56.7 | 53.6 | 59.1 | 72.8 | 55.0 | 62.7 | 61.9 | 65.1 | 66.1 | 61.5 | 59.4 | 60.3 | 64.2 | 57.8 | 61.5 | 74.0 | 71.6 | 67.4 | 52.8 | 57.7 | 51.5 | 65.2 | 64.3 | 67.7 |
| May 25 | 53.7 | 62.3 | 61.5 | 58.8 | 72.9 | 59.7 | 47.4 | 56.7 | 55.8 | 65.6 | 69.9 | 56.0 | 69.0 | 66.7 | 61.4 | 57.2 | 57.4 | 81.0 | 61.1 | 63.0 | 71.3 | 56.1 | 53.1 | 58.6 | 54.9 | 66.8 | 65.4 | 60.1 | 66.5 | 63.6 | 65.5 | 66.7 | 66.2 | 64.4 | 71.5 | 48.9 | 74.7 | 65.7 | 72.9 | 66.5 | 51.8 | 57.5 | 63.9 | 62.9 | 73.3 | 69.1 |
| May 26 | 62.6 | 62.3 | 58.4 | 51.2 | 64.2 | 66.2 | 57.4 | 62.3 | 65.6 | 65.5 | 67.0 | 53.7 | 62.9 | 65.2 | 72.1 | 63.1 | 65.7 | 75.4 | 62.4 | 59.6 | 67.2 | 62.6 | 54.1 | 56.9 | 55.5 | 63.9 | 65.6 | 58.7 | 71.4 | 65.9 | 68.5 | 61.6 | 63.5 | 60.1 | 72.5 | 50.0 | 65.7 | 75.3 | 71.7 | 74.4 | 53.4 | 59.0 | 63.5 | 58.5 | 66.8 | 69.9 |
| May 27 | 65.9 | 64.3 | 58.2 | 47.6 | 71.1 | 60.0 | 58.5 | 50.4 | 63.4 | 55.8 | 67.8 | 57.2 | 57.0 | 68.9 | 71.1 | 73.4 | 71.7 | 77.3 | 63.6 | 65.2 | 70.3 | 64.9 | 55.6 | 60.6 | 54.5 | 62.5 | 64.8 | 66.0 | 65.3 | 68.6 | 71.6 | 59.9 | 63.3 | 66.5 | 78.9 | 54.5 | 67.1 | 64.6 | 65.6 | 71.5 | 54.6 | 57.0 | 60.3 | 71.2 | 64.4 | 68.2 |
| May 28 | 65.1 | 52.7 | 67.5 | 53.0 | 67.7 | 66.8 | 69.0 | 51.8 | 64.6 | 65.2 | 64.3 | 60.9 | 59.6 | 60.2 | 62.7 | 72.4 | 76.4 | 80.2 | 68.4 | 68.8 | 58.7 | 64.6 | 56.7 | 69.9 | 47.8 | 60.4 | 70.4 | 72.7 | 69.5 | 62.5 | 68.5 | 57.4 | 67.7 | 61.4 | 71.2 | 57.2 | 60.2 | 66.4 | 72.8 | 67.6 | 62.8 | 56.6 | 59.7 | 64.5 | 69.5 | 75.4 |
| May 29 | 73.0 | 59.7 | 66.9 | 52.5 | 71.1 | 68.6 | 75.2 | 62.8 | 67.2 | 63.2 | 63.7 | 67.1 | 67.4 | 66.4 | 59.7 | 70.6 | 77.2 | 80.4 | 62.9 | 65.9 | 60.8 | 58.5 | 62.3 | 68.5 | 50.3 | 70.1 | 68.5 | 74.2 | 77.8 | 62.1 | 65.9 | 55.7 | 70.1 | 61.0 | 64.9 | 63.2 | 63.2 | 66.3 | 68.8 | 64.4 | 70.6 | 65.0 | 56.9 | 59.5 | 69.4 | 70.6 |

### *TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET*

| YEAR-> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May 30 | 70.9 | 58.7 | 71.0 | 58.1 | 65.9 | 63.8 | 69.9 | 66.4 | 73.1 | 60.6 | 67.1 | 52.9 | 63.1 | 68.9 | 64.5 | 67.5 | 75.7 | 75.2 | 63.7 | 69.4 | 63.4 | 60.1 | 64.2 | 71.3 | 57.1 | 71.8 | 72.4 | 70.8 | 78.7 | 64.0 | 64.0 | 61.8 | 74.0 | 64.5 | 69.2 | 67.0 | 61.0 | 64.5 | 71.1 | 54.3 | 68.4 | 64.0 | 66.4 | 55.1 | 66.4 | 76.2 |
| May 31 | 72.4 | 63.3 | 76.2 | 60.3 | 61.4 | 73.4 | 70.1 | 62.2 | 73.1 | 66.4 | 69.4 | 54.1 | 67.2 | 58.7 | 73.3 | 62.0 | 74.3 | 69.1 | 64.7 | 57.4 | 67.4 | 56.0 | 65.9 | 75.9 | 57.9 | 72.8 | 67.3 | 70.9 | 73.9 | 65.6 | 62.6 | 64.0 | 64.5 | 65.0 | 66.9 | 71.2 | 72.6 | 66.6 | 65.7 | 55.9 | 71.2 | 68.6 | 72.8 | 56.2 | 67.5 | 68.5 |
| Jun 1 | 83.2 | 60.0 | 76.3 | 58.2 | 62.8 | 73.5 | 70.4 | 61.7 | 80.7 | 62.1 | 78.2 | 59.9 | 72.5 | 69.5 | 74.7 | 63.9 | 77.5 | 66.4 | 64.2 | 51.0 | 66.1 | 63.3 | 65.3 | 79.6 | 66.3 | 73.4 | 71.8 | 76.8 | 69.7 | 66.1 | 57.2 | 67.6 | 61.9 | 65.7 | 70.1 | 66.2 | 76.2 | 68.6 | 52.9 | 52.7 | 69.3 | 72.1 | 70.4 | 58.6 | 59.2 | 60.6 |
| Jun 2 | 73.7 | 56.2 | 76.8 | 61.2 | 67.5 | 69.8 | 68.5 | 69.9 | 77.7 | 69.0 | 78.4 | 62.8 | 70.4 | 70.4 | 74.1 | 65.2 | 70.5 | 69.6 | 60.6 | 57.6 | 65.7 | 67.4 | 66.9 | 81.0 | 71.9 | 73.8 | 69.5 | 66.9 | 62.8 | 66.6 | 60.8 | 63.2 | 59.4 | 71.1 | 69.0 | 71.1 | 77.9 | 67.5 | 57.5 | 49.5 | 72.8 | 68.3 | 66.4 | 61.0 | 59.9 | 58.5 |
| Jun 3 | 65.7 | 55.5 | 70.8 | 68.4 | 64.7 | 64.3 | 66.0 | 65.5 | 79.6 | 63.9 | 74.2 | 66.6 | 69.7 | 68.4 | 67.9 | 62.4 | 72.4 | 63.6 | 63.6 | 57.4 | 63.4 | 66.6 | 60.6 | 73.4 | 69.0 | 71.0 | 70.7 | 71.0 | 66.2 | 68.5 | 61.5 | 65.1 | 59.0 | 73.4 | 73.7 | 69.5 | 67.1 | 60.8 | 64.3 | 63.7 | 74.0 | 71.7 | 70.3 | 57.1 | 63.3 | 74.9 |
| Jun 4 | 68.5 | 63.5 | 79.6 | 70.2 | 61.8 | 63.1 | 62.9 | 69.5 | 75.9 | 68.1 | 72.9 | 69.8 | 68.7 | 71.3 | 70.2 | 61.9 | 77.4 | 64.9 | 64.4 | 59.3 | 70.6 | 66.1 | 67.9 | 70.5 | 75.4 | 75.8 | 68.0 | 62.9 | 69.8 | 70.2 | 57.8 | 69.2 | 64.3 | 73.9 | 75.2 | 68.8 | 64.5 | 64.3 | 60.0 | 67.1 | 65.3 | 68.6 | 68.0 | 69.3 | 59.9 | 77.7 |
| Jun 5 | 75.0 | 64.8 | 71.8 | 70.8 | 64.4 | 60.5 | 62.8 | 68.6 | 76.5 | 67.5 | 70.2 | 67.8 | 68.9 | 75.3 | 67.8 | 69.7 | 73.8 | 67.0 | 62.7 | 66.8 | 70.4 | 64.6 | 63.5 | 62.9 | 74.8 | 68.0 | 61.7 | 69.7 | 72.2 | 62.7 | 67.8 | 65.4 | 66.1 | 76.5 | 72.6 | 75.5 | 70.2 | 69.1 | 60.0 | 71.0 | 69.8 | 67.8 | 64.5 | 63.9 | 60.9 | 75.2 |
| Jun 6 | 74.9 | 66.6 | 67.6 | 68.2 | 64.9 | 66.9 | 66.7 | 72.7 | 81.3 | 70.7 | 58.7 | 67.8 | 69.9 | 76.9 | 65.4 | 72.1 | 71.4 | 68.5 | 59.9 | 72.7 | 69.7 | 72.9 | 62.4 | 64.5 | 70.5 | 69.8 | 67.8 | 59.0 | 76.6 | 69.1 | 72.2 | 73.0 | 71.2 | 76.7 | 70.9 | 71.1 | 60.0 | 61.5 | 68.6 | 70.4 | 70.1 | 72.8 | 66.7 | 69.5 | 67.8 | 72.8 |
| Jun 7 | 74.3 | 66.9 | 62.9 | 64.8 | 62.6 | 72.7 | 68.8 | 75.2 | 72.0 | 72.5 | 62.7 | 64.8 | 73.4 | 80.6 | 66.9 | 72.3 | 63.9 | 71.4 | 55.7 | 60.2 | 72.0 | 75.5 | 65.0 | 69.3 | 67.5 | 71.7 | 64.9 | 59.9 | 76.1 | 63.6 | 72.5 | 70.7 | 70.1 | 68.2 | 67.7 | 67.6 | 62.5 | 62.3 | 67.3 | 60.8 | 66.2 | 77.1 | 54.1 | 70.5 | 72.3 | 71.6 |
| Jun 8 | 73.8 | 77.8 | 58.9 | 66.7 | 69.8 | 71.2 | 70.0 | 76.5 | 69.2 | 74.6 | 59.0 | 61.3 | 75.4 | 70.9 | 71.6 | 76.6 | 60.3 | 74.0 | 58.6 | 63.9 | 63.6 | 70.0 | 60.9 | 73.7 | 66.2 | 73.7 | 71.6 | 64.7 | 67.4 | 65.9 | 73.1 | 69.9 | 66.3 | 63.3 | 64.2 | 65.0 | 61.7 | 65.5 | 65.9 | 65.2 | 61.6 | 71.6 | 70.3 | 66.8 | 72.3 | 78.3 |
| Jun 9 | 73.7 | 75.9 | 63.7 | 65.2 | 78.8 | 68.7 | 66.4 | 70.3 | 70.3 | 77.9 | 67.1 | 66.4 | 66.2 | 67.3 | 71.3 | 68.4 | 65.0 | 66.6 | 71.1 | 59.4 | 66.6 | 73.6 | 67.2 | 78.0 | 60.8 | 75.7 | 67.5 | 63.6 | 71.6 | 63.6 | 71.6 | 66.0 | 64.7 | 64.3 | 66.0 | 69.3 | 66.0 | 68.2 | 64.9 | 72.5 | 63.5 | 75.4 | 69.5 | 70.2 | 71.6 | 67.6 |
| Jun 10 | 71.2 | 68.8 | 59.6 | 63.6 | 77.6 | 68.1 | 74.9 | 68.8 | 62.9 | 74.4 | 74.8 | 66.6 | 64.3 | 64.1 | 72.7 | 72.9 | 54.5 | 69.8 | 72.5 | 62.4 | 71.2 | 76.7 | 63.9 | 80.3 | 63.4 | 74.3 | 71.7 | 65.2 | 76.1 | 64.5 | 71.2 | 70.4 | 63.7 | 64.3 | 71.2 | 76.0 | 71.2 | 58.4 | 68.3 | 60.4 | 65.1 | 74.8 | 71.6 | 73.8 | 72.4 | 69.1 |
| Jun 11 | 76.8 | 69.0 | 59.3 | 67.5 | 81.4 | 62.7 | 70.2 | 64.8 | 58.3 | 73.5 | 75.6 | 71.7 | 66.2 | 66.2 | 72.0 | 74.8 | 56.0 | 59.8 | 75.8 | 64.6 | 65.0 | 71.6 | 63.4 | 80.0 | 66.3 | 74.1 | 71.0 | 67.0 | 72.6 | 64.1 | 67.9 | 70.9 | 64.6 | 69.5 | 75.8 | 71.2 | 62.7 | 63.2 | 72.7 | 72.8 | 64.8 | 70.6 | 75.8 | 66.4 | 75.7 | 68.5 |
| Jun 12 | 67.5 | 64.7 | 58.6 | 68.8 | 73.7 | 60.9 | 69.6 | 68.2 | 60.8 | 75.9 | 68.4 | 71.1 | 69.3 | 66.1 | 73.7 | 72.4 | 49.9 | 53.7 | 75.0 | 67.9 | 65.3 | 69.0 | 64.2 | 80.0 | 64.9 | 80.1 | 74.9 | 68.6 | 72.9 | 70.4 | 75.8 | 77.5 | 65.6 | 63.6 | 71.6 | 70.1 | 63.7 | 70.3 | 74.7 | 77.1 | 70.1 | 65.7 | 79.8 | 69.5 | 72.3 | 68.9 |
| Jun 13 | 63.8 | 67.7 | 55.8 | 69.9 | 62.0 | 61.1 | 65.3 | 62.2 | 76.3 | 73.5 | 73.6 | 68.4 | 63.2 | 68.1 | 73.0 | 68.7 | 57.8 | 59.9 | 71.8 | 71.6 | 66.5 | 73.5 | 65.7 | 79.3 | 60.5 | 77.7 | 76.5 | 70.2 | 66.6 | 80.7 | 70.3 | 65.7 | 66.5 | 67.0 | 79.1 | 71.4 | 66.0 | 64.6 | 67.9 | 76.8 | 73.4 | 69.0 | 72.2 | 66.3 | 66.1 | 67.2 |
| Jun 14 | 64.7 | 64.6 | 60.6 | 72.0 | 64.6 | 69.0 | 67.6 | 62.7 | 75.8 | 78.2 | 73.1 | 66.1 | 72.4 | 68.8 | 79.8 | 69.3 | 61.5 | 66.7 | 70.4 | 69.4 | 69.4 | 75.0 | 63.0 | 75.7 | 68.8 | 79.3 | 76.3 | 63.9 | 69.5 | 76.9 | 67.9 | 65.1 | 65.4 | 73.5 | 78.1 | 79.1 | 69.2 | 68.1 | 71.0 | 76.5 | 69.6 | 65.4 | 75.8 | 64.4 | 63.6 | 68.3 |
| Jun 15 | 68.4 | 63.4 | 69.8 | 65.5 | 71.0 | 70.8 | 66.6 | 65.9 | 76.2 | 74.9 | 71.1 | 68.0 | 76.3 | 63.0 | 69.5 | 60.8 | 69.3 | 65.0 | 73.1 | 65.2 | 76.0 | 67.6 | 66.2 | 75.9 | 64.0 | 74.0 | 77.0 | 62.0 | 72.4 | 78.7 | 61.6 | 70.8 | 63.2 | 73.8 | 73.2 | 80.2 | 74.6 | 65.4 | 73.7 | 70.4 | 69.9 | 66.6 | 73.8 | 63.0 | 59.1 | 63.3 |
| Jun 16 | 76.2 | 61.4 | 67.3 | 71.1 | 68.9 | 71.2 | 65.4 | 74.2 | 69.9 | 78.1 | 71.3 | 67.8 | 65.8 | 57.9 | 68.6 | 69.1 | 71.6 | 63.9 | 71.7 | 68.2 | 66.5 | 68.5 | 70.7 | 74.9 | 71.3 | 77.8 | 69.1 | 61.4 | 69.0 | 77.7 | 66.3 | 71.2 | 70.0 | 65.0 | 77.0 | 73.3 | 71.5 | 67.2 | 73.6 | 71.4 | 64.4 | 66.0 | 72.4 | 63.8 | 65.0 | 63.6 |
| Jun 17 | 80.8 | 61.2 | 65.4 | 72.9 | 72.7 | 69.4 | 68.9 | 79.5 | 76.9 | 75.3 | 68.0 | 78.0 | 62.6 | 55.5 | 76.9 | 62.6 | 71.7 | 71.1 | 75.6 | 78.1 | 67.8 | 70.4 | 75.8 | 75.1 | 74.0 | 77.2 | 67.2 | 65.2 | 68.3 | 73.3 | 62.9 | 71.9 | 70.1 | 68.8 | 77.8 | 71.1 | 77.3 | 65.4 | 73.7 | 74.5 | 65.1 | 72.8 | 77.4 | 69.8 | 67.1 | 67.9 |
| Jun 18 | 70.8 | 67.9 | 67.7 | 66.7 | 67.7 | 69.9 | 73.0 | 80.0 | 77.6 | 78.3 | 74.9 | 78.5 | 65.1 | 57.2 | 72.5 | 70.5 | 76.1 | 68.5 | 72.2 | 79.0 | 65.8 | 72.9 | 74.8 | 74.9 | 69.7 | 73.7 | 66.8 | 78.7 | 77.5 | 73.4 | 61.3 | 63.9 | 68.2 | 66.0 | 71.4 | 75.9 | 84.5 | 62.5 | 65.8 | 77.8 | 66.3 | 74.0 | 74.3 | 74.8 | 68.9 | 69.9 |
| Jun 19 | 74.4 | 71.1 | 68.8 | 73.8 | 67.7 | 75.9 | 73.1 | 77.1 | 71.0 | 79.9 | 72.3 | 80.8 | 60.6 | 60.3 | 73.1 | 71.1 | 79.2 | 75.4 | 72.3 | 70.6 | 71.4 | 71.5 | 72.9 | 72.1 | 82.2 | 67.6 | 66.0 | 77.6 | 79.9 | 74.5 | 58.2 | 70.2 | 66.0 | 70.4 | 67.9 | 69.8 | 83.0 | 67.2 | 64.2 | 72.5 | 70.3 | 70.9 | 72.4 | 75.1 | 63.0 | 64.8 |
| Jun 20 | 75.5 | 73.7 | 68.9 | 67.9 | 66.5 | 65.4 | 72.8 | 74.9 | 66.5 | 78.6 | 76.0 | 80.1 | 61.1 | 56.7 | 71.8 | 68.8 | 81.6 | 74.4 | 77.1 | 78.8 | 67.9 | 63.4 | 73.5 | 71.3 | 77.2 | 66.8 | 71.4 | 77.4 | 76.7 | 66.5 | 60.6 | 65.8 | 61.3 | 71.2 | 62.3 | 70.1 | 80.3 | 67.0 | 64.8 | 70.7 | 75.9 | 68.9 | 73.1 | 73.7 | 70.7 | 66.1 |
| Jun 21 | 76.5 | 77.7 | 73.5 | 61.0 | 68.0 | 67.2 | 71.6 | 75.9 | 69.0 | 80.8 | 70.0 | 79.4 | 69.8 | 63.8 | 75.5 | 63.8 | 79.5 | 73.4 | 70.4 | 84.6 | 69.2 | 64.4 | 78.9 | 74.4 | 78.2 | 77.5 | 74.7 | 74.5 | 74.3 | 64.4 | 63.9 | 64.4 | 65.5 | 64.4 | 55.5 | 66.7 | 84.1 | 70.6 | 65.0 | 66.0 | 71.0 | 70.7 | 77.7 | 74.5 | 62.3 | 69.3 |
| Jun 22 | 74.7 | 74.9 | 73.6 | 72.9 | 71.7 | 64.5 | 73.0 | 69.0 | 68.6 | 81.0 | 73.9 | 79.2 | 63.7 | 57.2 | 73.4 | 67.1 | 76.6 | 77.0 | 67.8 | 80.5 | 73.5 | 61.3 | 76.9 | 70.7 | 73.2 | 73.8 | 74.6 | 81.8 | 73.4 | 63.4 | 64.8 | 69.4 | 67.6 | 71.2 | 58.8 | 73.6 | 84.2 | 66.6 | 69.5 | 72.0 | 67.2 | 69.1 | 76.5 | 73.0 | 71.8 | 76.5 |
| Jun 23 | 76.1 | 77.0 | 65.1 | 76.5 | 70.8 | 68.6 | 72.3 | 80.7 | 71.3 | 71.6 | 75.3 | 68.5 | 68.2 | 62.1 | 71.9 | 63.2 | 79.0 | 75.1 | 67.4 | 64.6 | 71.3 | 67.1 | 72.3 | 77.0 | 68.9 | 74.2 | 72.5 | 79.5 | 72.6 | 68.7 | 68.5 | 68.0 | 68.5 | 69.1 | 57.1 | 71.9 | 80.9 | 63.5 | 74.4 | 70.6 | 69.4 | 65.5 | 73.5 | 77.3 | 72.9 | 77.0 |
| Jun 24 | 76.1 | 73.5 | 63.8 | 72.4 | 67.7 | 67.5 | 74.7 | 78.4 | 63.7 | 70.1 | 75.7 | 74.8 | 66.2 | 61.0 | 72.1 | 66.9 | 70.7 | 76.5 | 70.9 | 71.5 | 71.2 | 66.4 | 71.5 | 80.4 | 72.3 | 72.4 | 70.7 | 79.3 | 80.6 | 64.6 | 70.9 | 70.9 | 72.4 | 69.0 | 56.8 | 74.0 | 82.3 | 71.2 | 71.8 | 67.7 | 63.1 | 69.1 | 69.4 | 79.5 | 66.2 | 75.1 |
| Jun 25 | 78.4 | 68.6 | 76.5 | 75.1 | 64.2 | 73.7 | 78.8 | 76.2 | 67.8 | 72.2 | 75.2 | 79.4 | 67.6 | 60.2 | 76.0 | 71.1 | 68.2 | 72.3 | 71.9 | 68.5 | 70.0 | 67.7 | 73.2 | 74.6 | 73.6 | 74.4 | 75.0 | 75.2 | 81.0 | 69.1 | 70.4 | 69.8 | 67.0 | 71.5 | 69.6 | 72.2 | 82.3 | 74.3 | 72.3 | 71.8 | 68.6 | 63.9 | 73.6 | 78.8 | 60.3 | 75.6 |
| Jun 26 | 74.1 | 65.0 | 75.9 | 76.4 | 67.0 | 74.0 | 74.6 | 75.8 | 73.2 | 78.4 | 74.0 | 77.2 | 73.0 | 69.1 | 74.3 | 71.5 | 70.7 | 69.1 | 66.3 | 71.5 | 77.1 | 62.8 | 70.4 | 77.6 | 71.4 | 73.9 | 79.4 | 74.0 | 79.0 | 69.5 | 75.4 | 71.8 | 71.9 | 71.7 | 70.0 | 70.6 | 78.3 | 77.8 | 70.3 | 67.3 | 70.5 | 63.5 | 73.9 | 79.5 | 66.5 | 77.2 |
| Jun 27 | 67.5 | 73.0 | 68.1 | 74.6 | 66.5 | 73.4 | 75.6 | 76.3 | 72.0 | 75.9 | 76.2 | 73.3 | 76.6 | 65.4 | 75.0 | 71.4 | 67.6 | 72.2 | 68.7 | 74.7 | 73.0 | 70.6 | 76.4 | 76.1 | 72.8 | 72.7 | 71.8 | 70.4 | 78.9 | 69.8 | 75.7 | 79.8 | 75.9 | 76.4 | 71.6 | 76.5 | 73.0 | 75.6 | 65.3 | 71.9 | 71.7 | 66.3 | 76.0 | 79.3 | 69.5 | 79.4 |
| Jun 28 | 75.2 | 77.2 | 67.2 | 73.7 | 68.7 | 77.2 | 80.2 | 71.6 | 70.9 | 73.2 | 76.0 | 75.2 | 75.9 | 67.8 | 72.4 | 66.7 | 71.5 | 72.4 | 66.8 | 76.3 | 68.5 | 74.1 | 78.3 | 71.7 | 73.1 | 75.6 | 76.3 | 71.7 | 76.5 | 67.8 | 75.8 | 78.0 | 71.9 | 72.4 | 71.7 | 76.9 | 72.4 | 77.2 | 70.8 | 66.6 | 67.7 | 65.8 | 74.6 | 79.4 | 75.4 | 71.6 |
| Jun 29 | 70.1 | 82.0 | 67.8 | 74.8 | 69.8 | 74.4 | 69.2 | 69.5 | 75.2 | 72.9 | 73.3 | 79.4 | 72.3 | 72.0 | 75.2 | 74.0 | 77.2 | 75.8 | 70.9 | 77.5 | 75.5 | 67.7 | 76.2 | 72.5 | 74.8 | 73.2 | 73.3 | 69.1 | 69.7 | 70.8 | 66.1 | 75.8 | 74.9 | 67.4 | 72.8 | 81.2 | 76.4 | 80.3 | 72.3 | 76.6 | 65.3 | 70.7 | 73.9 | 77.3 | 79.3 | 76.2 |
| Jun 30 | 72.3 | 80.9 | 72.3 | 73.8 | 74.0 | 79.4 | 76.8 | 72.3 | 81.6 | 75.5 | 78.6 | 81.1 | 80.6 | 79.0 | 84.5 | 72.9 | 85.4 | 76.1 | 77.3 | 78.3 | 78.2 | 83.7 | 87.0 | 73.8 | 75.0 | 86.9 | 80.4 | 78.5 | 80.4 | 78.8 | 74.8 | 76.1 | 79.5 | 77.8 | 78.1 | 73.8 | 77.0 | 87.2 | 83.6 | 78.8 | 70.8 | 71.1 | 79.3 | 77.0 | 88.7 | 81.2 |
| Jul 1 | 77.0 | 84.0 | 76.6 | 84.8 | 75.0 | 75.8 | 80.7 | 81.0 | 88.1 | 77.1 | 75.2 | 95.1 | 84.7 | 79.9 | 80.7 | 86.3 | 86.9 | 76.0 | 79.0 | 82.3 | 72.4 | 84.5 | 79.8 | 80.4 | 78.7 | 85.7 | 79.1 | 85.0 | 81.2 | 72.3 | 77.6 | 86.2 | 74.9 | 81.1 | 76.5 | 79.5 | 79.8 | 84.4 | 83.0 | 81.1 | 74.7 | 76.0 | 76.2 | 75.7 | 91.4 | 74.0 |
| Jul 2 | 76.2 | 81.9 | 67.1 | 84.8 | 75.3 | 74.9 | 79.8 | 79.3 | 90.2 | 78.9 | 76.2 | 90.7 | 84.1 | 76.6 | 82.8 | 84.3 | 84.1 | 80.6 | 76.3 | 83.2 | 79.4 | 89.4 | 77.0 | 81.6 | 77.4 | 84.1 | 81.3 | 86.0 | 85.7 | 73.8 | 78.8 | 84.1 | 72.4 | 77.7 | 75.8 | 81.0 | 74.4 | 78.4 | 77.6 | 84.7 | 85.4 | 73.8 | 79.0 | 74.8 | 91.5 | 77.9 |
| Jul 3 | 77.1 | 81.8 | 72.0 | 83.8 | 73.8 | 78.4 | 78.7 | 78.0 | 83.8 | 65.9 | 81.4 | 80.0 | 81.1 | 77.7 | 81.8 | 85.2 | 82.2 | 82.0 | 77.4 | 76.9 | 78.2 | 91.2 | 80.1 | 77.2 | 75.9 | 75.9 | 86.1 | 75.4 | 83.6 | 80.0 | 78.2 | 86.9 | 70.6 | 79.4 | 74.8 | 80.2 | 76.6 | 84.9 | 80.9 | 83.8 | 82.2 | 72.8 | 79.2 | 80.6 | 83.1 | 75.3 |
| Jul 4 | 81.6 | 84.8 | 75.3 | 79.6 | 77.8 | 82.4 | 78.5 | 80.1 | 86.3 | 80.1 | 76.8 | 81.4 | 76.5 | 77.4 | 79.9 | 80.6 | 77.6 | 77.9 | 84.6 | 80.1 | 78.9 | 84.4 | 79.6 | 73.3 | 83.5 | 78.0 | 81.3 | 78.9 | 84.9 | 75.0 | 78.8 | 85.5 | 76.6 | 77.7 | 66.9 | 84.2 | 80.3 | 87.0 | 81.5 | 85.1 | 84.4 | 74.1 | 76.6 | 82.4 | 80.3 | 77.5 |
| Jul 5 | 83.9 | 84.3 | 81.3 | 82.0 | 80.0 | 85.8 | 78.3 | 85.9 | 82.0 | 71.7 | 78.5 | 82.2 | 80.5 | 76.2 | 72.6 | 81.6 | 75.7 | 80.5 | 82.6 | 78.6 | 78.6 | 86.8 | 80.1 | 80.7 | 86.2 | 80.7 | 74.3 | 77.3 | 79.6 | 71.7 | 77.6 | 90.0 | 75.6 | 75.7 | 77.5 | 83.1 | 77.8 | 83.3 | 86.1 | 83.2 | 81.1 | 77.9 | 74.6 | 80.3 | 80.8 | 80.9 |
| Jul 6 | 82.9 | 80.6 | 79.8 | 74.2 | 82.9 | 84.7 | 78.5 | 81.7 | 82.9 | 73.8 | 78.0 | 82.9 | 77.8 | 78.0 | 82.0 | 78.9 | 74.2 | 86.6 | 81.5 | 81.8 | 83.4 | 83.3 | 80.4 | 87.3 | 88.1 | 85.6 | 77.0 | 76.7 | 81.5 | 72.6 | 80.4 | 78.8 | 80.1 | 79.5 | 80.8 | 81.3 | 76.7 | 76.5 | 83.8 | 76.5 | 79.3 | 80.5 | 75.0 | 76.1 | 76.7 | 80.1 |
| Jul 7 | 85.4 | 84.6 | 77.8 | 78.2 | 78.7 | 78.8 | 80.0 | 82.0 | 79.6 | 71.3 | 82.6 | 82.8 | 84.1 | 78.3 | 85.7 | 83.9 | 80.1 | 80.2 | 81.5 | 83.3 | 84.2 | 79.9 | 83.6 | 88.0 | 82.3 | 87.8 | 74.2 | 74.7 | 83.7 | 72.9 | 72.8 | 77.4 | 77.1 | 81.2 | 77.4 | 81.3 | 71.5 | 77.5 | 81.5 | 77.2 | 75.3 | 82.2 | 76.3 | 77.3 | 80.5 | 87.3 |
| Jul 8 | 80.8 | 86.9 | 85.8 | 77.8 | 78.5 | 83.2 | 78.8 | 82.0 | 82.1 | 74.2 | 83.6 | 75.8 | 78.2 | 77.7 | 86.0 | 81.3 | 77.5 | 79.5 | 80.5 | 79.2 | 81.2 | 78.7 | 83.7 | 81.5 | 81.5 | 86.3 | 75.4 | 70.8 | 81.2 | 74.1 | 73.0 | 72.3 | 80.0 | 83.8 | 72.1 | 80.4 | 77.8 | 76.6 | 83.0 | 78.9 | 75.9 | 86.7 | 82.2 | 80.9 | 74.5 | 82.1 |
| Jul 9 | 84.4 | 87.7 | 80.3 | 81.8 | 81.7 | 77.8 | 84.7 | 83.6 | 80.6 | 75.8 | 83.1 | 78.7 | 78.7 | 75.8 | 82.2 | 79.0 | 77.1 | 81.5 | 81.0 | 80.5 | 79.1 | 79.0 | 84.1 | 79.7 | 83.1 | 77.4 | 78.9 | 64.5 | 80.6 | 74.7 | 83.3 | 73.6 | 79.1 | 84.3 | 72.9 | 82.4 | 72.8 | 77.7 | 83.5 | 79.5 | 77.1 | 83.6 | 81.2 | 77.5 | 76.1 | 75.7 |
| Jul 10 | 82.8 | 91.1 | 72.5 | 82.5 | 75.4 | 79.0 | 84.9 | 83.8 | 76.6 | 76.0 | 86.6 | 79.3 | 84.0 | 78.7 | 79.0 | 76.0 | 75.1 | 72.6 | 85.5 | 80.1 | 73.5 | 74.8 | 80.8 | 78.9 | 77.4 | 81.1 | 79.7 | 71.0 | 78.5 | 72.0 | 82.4 | 80.8 | 80.8 | 81.0 | 81.6 | 80.5 | 70.4 | 82.1 | 86.9 | 80.9 | 82.8 | 83.6 | 78.5 | 80.6 | 82.5 | 75.7 |
| Jul 11 | 81.8 | 85.5 | 73.9 | 78.9 | 78.1 | 78.8 | 78.8 | 81.1 | 76.2 | 77.5 | 86.0 | 81.9 | 86.2 | 82.2 | 79.4 | 79.6 | 77.8 | 75.5 | 79.2 | 80.5 | 80.8 | 72.5 | 83.6 | 78.6 | 78.8 | 83.4 | 82.6 | 78.7 | 78.4 | 79.2 | 81.4 | 82.0 | 82.2 | 75.9 | 81.9 | 81.8 | 75.0 | 70.5 | 87.6 | 80.3 | 84.1 | 87.2 | 76.1 | 87.3 | 77.4 | 78.9 |
| Jul 12 | 87.2 | 87.2 | 76.8 | 78.5 | 78.3 | 79.0 | 86.2 | 80.7 | 78.8 | 79.0 | 83.6 | 80.0 | 86.8 | 85.6 | 76.8 | 79.5 | 73.9 | 78.7 | 78.2 | 73.5 | 76.0 | 75.0 | 85.2 | 77.1 | 79.1 | 80.5 | 90.1 | 78.5 | 87.7 | 81.0 | 77.9 | 79.2 | 80.8 | 85.1 | 85.5 | 79.4 | 74.7 | 74.2 | 84.9 | 82.6 | 82.6 | 78.7 | 80.3 | 84.2 | 81.9 | 82.9 |
| Jul 13 | 89.3 | 80.3 | 78.7 | 87.6 | 84.0 | 79.0 | 87.0 | 77.4 | 87.2 | 75.4 | 83.8 | 82.7 | 84.9 | 82.7 | 78.3 | 79.2 | 80.2 | 80.2 | 78.4 | 79.0 | 80.7 | 80.4 | 83.2 | 76.3 | 81.7 | 82.7 | 88.2 | 77.2 | 87.0 | 80.4 | 85.0 | 79.5 | 83.8 | 81.8 | 85.9 | 84.5 | 76.0 | 75.4 | 80.6 | 82.9 | 84.0 | 86.4 | 82.4 | 86.3 | 74.7 | 83.4 |
| Jul 14 | 90.4 | 80.1 | 82.7 | 86.3 | 83.4 | 81.0 | 83.5 | 77.5 | 84.6 | 76.4 | 73.3 | 82.8 | 81.3 | 81.8 | 80.7 | 80.8 | 76.8 | 80.9 | 80.9 | 81.6 | 81.5 | 83.7 | 81.4 | 77.3 | 81.0 | 77.7 | 81.0 | 79.7 | 79.2 | 71.9 | 83.8 | 86.1 | 82.5 | 77.7 | 87.6 | 88.5 | 78.4 | 76.0 | 84.8 | 82.9 | 84.4 | 88.5 | 85.6 | 83.2 | 77.2 | 76.9 |
| Jul 15 | 88.1 | 79.4 | 81.7 | 83.9 | 83.9 | 76.3 | 80.6 | 77.7 | 82.6 | 79.2 | 78.0 | 83.7 | 80.8 | 77.3 | 83.9 | 73.5 | 80.8 | 83.2 | 80.6 | 74.4 | 86.0 | 76.2 | 77.1 | 76.8 | 82.3 | 79.2 | 83.4 | 77.4 | 79.2 | 77.6 | 81.2 | 86.1 | 83.0 | 76.5 | 82.2 | 83.4 | 79.1 | 74.7 | 85.0 | 82.3 | 85.6 | 86.0 | 85.1 | 83.9 | 76.0 | 72.5 |
| Jul 16 | 85.6 | 73.4 | 84.4 | 84.3 | 83.9 | 75.8 | 77.0 | 75.2 | 75.0 | 77.0 | 79.5 | 81.2 | 81.7 | 81.2 | 81.9 | 78.2 | 81.7 | 78.6 | 81.6 | 82.4 | 77.1 | 75.1 | 74.0 | 77.3 | 78.4 | 83.3 | 76.7 | 73.5 | 77.8 | 71.4 | 83.3 | 83.5 | 84.3 | 78.6 | 83.5 | 80.5 | 80.9 | 74.0 | 82.5 | 80.3 | 85.3 | 81.3 | 84.7 | 79.8 | 75.0 | 71.6 |
| Jul 17 | 87.1 | 82.2 | 81.2 | 81.4 | 85.8 | 75.7 | 75.9 | 78.1 | 80.2 | 76.8 | 73.9 | 73.7 | 85.7 | 82.9 | 82.8 | 78.2 | 82.3 | 81.2 | 82.3 | 80.6 | 80.3 | 79.2 | 71.5 | 79.3 | 83.4 | 79.6 | 76.5 | 76.1 | 82.6 | 80.0 | 84.3 | 82.4 | 79.4 | 80.3 | 87.0 | 79.9 | 73.6 | 76.9 | 88.2 | 77.5 | 79.4 | 76.0 | 84.0 | 77.7 | 77.4 | 76.0 |
| Jul 18 | 85.3 | 80.1 | 85.3 | 84.7 | 88.3 | 73.4 | 81.0 | 81.5 | 75.2 | 76.9 | 78.8 | 82.1 | 83.6 | 82.3 | 89.2 | 85.4 | 84.1 | 78.9 | 80.9 | 82.2 | 81.7 | 78.8 | 72.9 | 79.0 | 77.9 | 80.4 | 81.6 | 78.2 | 80.9 | 79.2 | 81.3 | 83.7 | 75.2 | 81.1 | 89.9 | 78.5 | 75.7 | 77.1 | 88.2 | 76.8 | 80.4 | 77.3 | 83.0 | 77.2 | 80.7 | 79.2 |
| Jul 19 | 88.1 | 78.2 | 88.5 | 79.2 | 79.5 | 78.7 | 80.2 | 83.7 | 74.3 | 70.8 | 78.5 | 81.8 | 79.1 | 83.2 | 87.0 | 83.6 | 81.8 | 81.5 | 83.3 | 81.4 | 82.0 | 81.1 | 74.5 | 74.9 | 80.1 | 83.6 | 80.8 | 81.1 | 76.7 | 80.5 | 77.5 | 80.6 | 77.3 | 85.0 | 90.2 | 82.2 | 75.3 | 73.8 | 83.8 | 78.0 | 81.3 | 74.6 | 80.8 | 72.6 | 80.1 | 81.8 |
| Jul 20 | 87.1 | 79.4 | 87.5 | 80.1 | 80.3 | 84.2 | 75.9 | 81.8 | 77.8 | 76.4 | 74.8 | 76.2 | 78.6 | 83.6 | 85.5 | 85.9 | 82.6 | 82.3 | 77.3 | 81.2 | 79.9 | 77.2 | 71.2 | 82.8 | 79.1 | 83.3 | 84.7 | 83.2 | 76.2 | 80.7 | 78.3 | 80.9 | 80.1 | 84.5 | 79.5 | 84.9 | 79.5 | 82.8 | 80.8 | 80.6 | 76.8 | 76.1 | 87.2 | 75.2 | 80.6 | 77.5 |
| Jul 21 | 88.5 | 80.6 | 85.8 | 77.1 | 78.6 | 82.9 | 80.2 | 72.9 | 82.9 | 78.2 | 71.1 | 80.3 | 80.5 | 83.4 | 80.6 | 81.1 | 79.7 | 79.3 | 75.6 | 77.5 | 83.6 | 79.1 | 72.3 | 79.1 | 78.0 | 79.5 | 81.1 | 79.5 | 75.6 | 84.3 | 81.5 | 83.5 | 82.9 | 87.6 | 81.6 | 83.4 | 75.4 | 81.4 | 74.8 | 79.2 | 78.8 | 79.6 | 89.0 | 79.3 | 79.8 | 81.8 |
| Jul 22 | 87.9 | 84.6 | 85.2 | 78.9 | 81.6 | 81.5 | 80.5 | 76.2 | 82.9 | 80.6 | 74.8 | 80.3 | 81.0 | 83.7 | 85.5 | 77.6 | 79.0 | 77.5 | 80.4 | 76.2 | 79.3 | 77.7 | 81.9 | 78.3 | 81.4 | 79.0 | 83.9 | 75.9 | 75.7 | 81.2 | 79.1 | 83.5 | 85.2 | 83.2 | 80.0 | 84.1 | 75.8 | 83.8 | 77.5 | 77.0 | 78.4 | 76.1 | 87.9 | 75.1 | 75.6 | 70.6 |
| Jul 23 | 83.1 | 83.1 | 78.7 | 81.8 | 83.0 | 85.2 | 82.7 | 81.4 | 80.3 | 73.0 | 72.4 | 78.3 | 80.5 | 83.0 | 86.9 | 77.2 | 78.9 | 71.3 | 79.4 | 71.0 | 78.5 | 73.5 | 75.4 | 72.6 | 79.7 | 83.5 | 78.1 | 81.3 | 79.1 | 87.3 | 80.5 | 83.5 | 88.2 | 88.0 | 82.3 | 82.8 | 77.7 | 81.9 | 77.7 | 78.6 | 80.8 | 73.7 | 89.2 | 79.2 | 78.1 | 71.2 |
| Jul 24 | 81.3 | 80.5 | 81.0 | 80.5 | 78.6 | 83.7 | 79.4 | 75.3 | 82.2 | 71.0 | 70.4 | 77.8 | 81.9 | 79.2 | 83.6 | 81.2 | 79.0 | 76.2 | 76.9 | 71.5 | 73.7 | 78.2 | 81.0 | 79.8 | 77.5 | 76.1 | 80.6 | 80.9 | 78.4 | 82.2 | 77.9 | 78.2 | 86.8 | 88.5 | 81.9 | 77.3 | 82.1 | 85.1 | 72.2 | 84.9 | 82.8 | 71.7 | 88.0 | 72.7 | 79.5 | 80.0 |
| Jul 25 | 81.4 | 83.9 | 73.7 | 80.7 | 81.6 | 85.4 | 76.9 | 74.7 | 83.1 | 78.4 | 78.0 | 82.1 | 82.0 | 73.8 | 81.0 | 81.4 | 75.2 | 72.3 | 75.9 | 73.6 | 81.2 | 80.0 | 82.2 | 81.5 | 78.6 | 80.2 | 81.5 | 81.0 | 82.7 | 78.4 | 78.8 | 76.3 | 91.0 | 86.3 | 78.4 | 76.4 | 73.7 | 85.6 | 72.8 | 82.6 | 80.9 | 78.1 | 85.4 | 75.2 | 74.7 | 83.6 |
| Jul 26 | 78.4 | 83.8 | 79.0 | 78.7 | 80.5 | 86.8 | 74.0 | 78.9 | 77.8 | 78.3 | 77.5 | 80.4 | 77.6 | 69.5 | 77.0 | 78.2 | 76.4 | 70.0 | 73.9 | 74.5 | 85.9 | 73.8 | 74.4 | 80.7 | 81.7 | 85.9 | 82.5 | 81.9 | 89.3 | 81.5 | 81.1 | 74.9 | 83.0 | 85.8 | 77.9 | 75.7 | 79.5 | 82.2 | 75.5 | 82.5 | 76.6 | 81.2 | 86.3 | 78.6 | 74.1 | 82.2 |
| Jul 27 | 74.3 | 79.1 | 77.4 | 78.4 | 79.7 | 87.9 | 71.0 | 81.7 | 74.5 | 75.6 | 76.2 | 79.8 | 82.4 | 66.2 | 83.2 | 79.3 | 73.3 | 67.5 | 71.2 | 77.1 | 87.3 | 74.2 | 80.8 | 80.1 | 85.3 | 87.3 | 81.6 | 81.7 | 92.4 | 82.5 | 73.2 | 76.7 | 88.2 | 78.4 | 72.2 | 73.9 | 83.3 | 75.3 | 80.3 | 81.5 | 77.8 | 84.5 | 79.0 | 79.4 | 73.2 | 81.6 |
| Jul 28 | 68.9 | 84.0 | 79.4 | 83.0 | 80.3 | 82.1 | 76.4 | 81.5 | 76.7 | 81.3 | 73.2 | 79.3 | 80.0 | 66.1 | 79.5 | 83.8 | 74.0 | 68.0 | 78.5 | 68.9 | 83.4 | 79.0 | 79.6 | 82.7 | 84.6 | 86.3 | 78.0 | 82.6 | 88.9 | 83.9 | 72.2 | 74.3 | 83.7 | 79.9 | 82.1 | 76.2 | 79.8 | 82.9 | 79.1 | 77.2 | 78.3 | 84.8 | 73.5 | 76.6 | 68.7 | 80.0 |
| Jul 29 | 71.4 | 83.2 | 80.8 | 82.0 | 81.3 | 75.9 | 73.2 | 82.0 | 79.9 | 83.8 | 74.0 | 77.0 | 79.8 | 76.0 | 81.1 | 84.4 | 78.6 | 77.7 | 74.2 | 75.6 | 78.8 | 78.5 | 75.5 | 77.4 | 90.6 | 82.5 | 76.1 | 81.8 | 88.5 | 83.6 | 71.8 | 78.1 | 80.6 | 80.2 | 85.4 | 77.0 | 86.2 | 81.8 | 78.5 | 84.1 | 74.9 | 81.9 | 76.4 | 78.2 | 70.1 | 81.3 |
| Jul 30 | 74.0 | 80.3 | 82.0 | 78.3 | 81.5 | 82.7 | 83.6 | 83.2 | 83.7 | 78.1 | 75.2 | 79.9 | 79.2 | 78.8 | 84.9 | 78.1 | 79.6 | 83.6 | 76.2 | 71.2 | 80.2 | 80.5 | 71.4 | 80.5 | 86.2 | 77.6 | 77.8 | 86.3 | 85.8 | 82.4 | 75.9 | 79.7 | 84.7 | 81.2 | 91.2 | 78.9 | 88.2 | 71.9 | 78.8 | 84.1 | 73.7 | 81.3 | 77.7 | 74.7 | 75.7 | 78.3 |
| Jul 31 | 74.7 | 76.6 | 77.8 | 78.3 | 87.0 | 81.6 | 80.6 | 83.1 | 84.5 | 83.0 | 78.4 | 84.3 | 78.9 | 78.7 | 84.4 | 82.5 | 79.7 | 81.5 | 72.9 | 77.7 | 79.2 | 81.9 | 73.4 | 82.7 | 80.4 | 82.2 | 84.6 | 82.8 | 87.5 | 79.1 | 79.6 | 79.0 | 76.7 | 80.5 | 85.5 | 76.5 | 85.6 | 72.3 | 73.9 | 85.0 | 77.9 | 80.6 | 73.6 | 76.6 | 73.5 | 84.8 |
| Aug 1 | 75.1 | 78.4 | 76.9 | 78.8 | 88.5 | 84.1 | 79.8 | 80.9 | 83.0 | 85.1 | 79.3 | 87.3 | 79.0 | 81.6 | 82.3 | 73.7 | 78.5 | 79.8 | 74.6 | 75.3 | 75.4 | 81.0 | 76.9 | 86.1 | 82.8 | 86.5 | 80.2 | 89.4 | 80.4 | 77.7 | 77.9 | 70.7 | 79.8 | 78.4 | 81.7 | 81.8 | 88.2 | 77.8 | 69.3 | 83.8 | 76.5 | 79.4 | 70.9 | 81.4 | 73.7 | 86.3 |
| Aug 2 | 72.1 | 79.6 | 70.0 | 74.6 | 80.4 | 75.7 | 82.0 | 83.4 | 81.5 | 73.7 | 80.6 | 84.3 | 77.9 | 81.0 | 87.5 | 79.7 | 74.3 | 76.3 | 77.6 | 80.7 | 75.4 | 80.5 | 80.0 | 84.4 | 80.8 | 77.5 | 83.1 | 89.6 | 79.4 | 78.3 | 79.3 | 71.7 | 81.3 | 76.9 | 88.1 | 78.0 | 80.6 | 77.9 | 71.4 | 80.9 | 77.7 | 75.0 | 69.7 | 80.4 | 71.5 | 81.9 |
| Aug 3 | 70.6 | 81.2 | 75.4 | 80.6 | 78.3 | 86.4 | 77.4 | 80.1 | 77.2 | 75.5 | 83.2 | 84.5 | 78.0 | 82.7 | 89.0 | 79.6 | 84.4 | 84.7 | 82.6 | 82.2 | 78.9 | 80.6 | 73.7 | 79.4 | 81.2 | 72.5 | 76.7 | 83.1 | 84.1 | 72.9 | 76.1 | 71.7 | 82.5 | 78.2 | 82.8 | 81.0 | 79.2 | 75.3 | 74.0 | 80.1 | 74.2 | 78.7 | 73.6 | 81.4 | 72.6 | 84.6 |
| Aug 4 | 66.2 | 74.6 | 78.7 | 80.7 | 80.2 | 77.9 | 80.8 | 76.5 | 80.8 | 81.6 | 78.3 | 87.3 | 72.7 | 82.6 | 91.5 | 79.3 | 85.1 | 80.6 | 85.6 | 82.2 | 79.1 | 79.2 | 72.9 | 83.4 | 84.7 | 76.4 | 77.7 | 83.5 | 83.7 | 79.1 | 79.3 | 68.3 | 80.4 | 79.2 | 79.2 | 76.8 | 79.9 | 78.7 | 76.1 | 83.5 | 75.9 | 80.2 | 78.3 | 76.6 | 64.5 | 89.3 |
| Aug 5 | 69.9 | 72.4 | 79.3 | 79.1 | 76.7 | 79.4 | 76.3 | 73.3 | 76.7 | 74.9 | 83.4 | 83.7 | 75.2 | 84.1 | 90.0 | 75.4 | 84.2 | 86.7 | 82.2 | 78.7 | 76.4 | 83.6 | 67.6 | 81.4 | 85.2 | 77.8 | 72.4 | 82.2 | 80.5 | 74.4 | 72.7 | 71.0 | 76.8 | 78.6 | 79.1 | 78.9 | 77.2 | 78.3 | 80.8 | 85.1 | 84.6 | 85.1 | 78.2 | 74.0 | 64.2 | 83.3 |
| Aug 6 | 73.9 | 75.0 | 71.8 | 83.8 | 74.2 | 84.0 | 81.3 | 76.0 | 67.1 | 75.0 | 81.0 | 77.4 | 72.2 | 87.6 | 84.7 | 73.1 | 85.2 | 81.4 | 78.6 | 77.5 | 80.5 | 79.6 | 73.3 | 80.0 | 82.4 | 82.1 | 72.9 | 77.3 | 81.5 | 71.1 | 72.5 | 78.7 | 77.1 | 72.7 | 85.3 | 73.4 | 74.8 | 79.4 | 79.9 | 90.6 | 84.0 | 79.7 | 67.1 | 72.1 | 70.4 | 86.1 |
| Aug 7 | 75.8 | 74.6 | 79.4 | 83.5 | 79.8 | 83.9 | 82.0 | 77.4 | 71.2 | 74.7 | 79.1 | 81.5 | 81.3 | 80.4 | 81.2 | 71.0 | 78.4 | 87.9 | 74.5 | 75.9 | 83.5 | 81.4 | 75.9 | 76.8 | 79.7 | 79.8 | 70.5 | 79.7 | 83.9 | 75.0 | 67.9 | 75.6 | 79.3 | 77.9 | 85.7 | 72.7 | 71.6 | 83.9 | 76.6 | 86.4 | 83.0 | 79.3 | 70.1 | 71.6 | 69.9 | 87.1 |
| Aug 8 | 77.8 | 84.8 | 77.4 | 73.8 | 77.5 | 79.3 | 75.0 | 77.9 | 75.3 | 71.3 | 85.6 | 77.1 | 84.5 | 78.7 | 84.9 | 72.7 | 85.9 | 84.7 | 75.9 | 81.4 | 82.4 | 84.0 | 72.6 | 78.5 | 80.7 | 77.1 | 69.6 | 74.4 | 82.8 | 66.2 | 72.5 | 78.6 | 81.2 | 81.9 | 75.0 | 83.0 | 72.6 | 78.5 | 82.9 | 76.3 | 77.9 | 75.7 | 76.8 | 70.8 | 65.9 | 87.1 |
| Aug 9 | 86.8 | 80.5 | 72.3 | 72.2 | 77.3 | 75.8 | 77.0 | 73.8 | 74.5 | 74.5 | 82.7 | 77.0 | 81.2 | 78.0 | 82.2 | 73.1 | 83.8 | 81.4 | 79.1 | 80.3 | 75.3 | 84.2 | 75.3 | 75.8 | 75.6 | 82.8 | 75.2 | 79.8 | 76.6 | 73.8 | 78.6 | 79.0 | 77.8 | 77.0 | 82.9 | 79.9 | 77.8 | 77.9 | 74.5 | 78.0 | 78.1 | 76.5 | 77.7 | 68.9 | 70.2 | 85.7 |
| Aug 10 | 82.1 | 72.7 | 72.6 | 77.0 | 79.3 | 80.9 | 72.2 | 74.0 | 68.8 | 71.4 | 80.0 | 82.8 | 77.2 | 78.4 | 83.4 | 67.3 | 83.8 | 76.6 | 78.2 | 75.7 | 75.4 | 77.4 | 71.0 | 75.4 | 72.7 | 80.2 | 76.1 | 73.7 | 79.9 | 75.3 | 80.7 | 80.1 | 75.1 | 68.6 | 85.7 | 77.9 | 77.9 | 82.6 | 74.1 | 83.4 | 78.6 | 78.6 | 79.9 | 72.4 | 73.8 | 81.4 |
| Aug 11 | 84.1 | 75.1 | 72.2 | 76.4 | 77.0 | 70.5 | 77.5 | 73.7 | 75.7 | 74.3 | 86.4 | 83.5 | 82.0 | 79.8 | 79.4 | 69.0 | 84.3 | 78.5 | 78.2 | 75.7 | 73.9 | 85.8 | 73.8 | 78.7 | 74.5 | 79.4 | 78.1 | 76.1 | 77.4 | 73.0 | 73.7 | 79.1 | 73.5 | 72.6 | 73.6 | 74.7 | 72.6 | 84.2 | 77.1 | 77.4 | 76.7 | 76.8 | 75.1 | 70.6 | 80.9 | 81.0 |
| Aug 12 | 70.9 | 72.4 | 73.7 | 74.6 | 77.7 | 74.5 | 75.2 | 71.0 | 72.9 | 77.0 | 81.2 | 83.0 | 83.5 | 74.8 | 75.0 | 72.0 | 83.0 | 79.5 | 78.5 | 66.7 | 76.0 | 83.8 | 74.9 | 77.2 | 72.0 | 78.3 | 76.0 | 76.5 | 74.3 | 74.2 | 79.1 | 81.8 | 75.5 | 80.2 | 74.8 | 76.7 | 70.8 | 74.4 | 74.5 | 78.5 | 75.3 | 79.0 | 80.3 | 72.9 | 76.6 | 79.2 |

*TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET*

| YEAR-> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug 13 | 70.1 | 81.4 | 73.6 | 77.0 | 82.4 | 75.9 | 74.9 | 74.1 | 73.3 | 76.1 | 82.1 | 81.5 | 87.6 | 75.2 | 75.9 | 71.4 | 78.8 | 82.8 | 76.4 | 77.1 | 77.9 | 77.4 | 83.0 | 74.2 | 74.9 | 74.5 | 72.2 | 72.9 | 78.7 | 79.2 | 76.0 | 79.4 | 80.7 | 73.2 | 73.4 | 77.4 | 74.7 | 70.9 | 73.3 | 76.3 | 71.5 | 73.0 | 82.1 | 71.9 | 76.6 | 80.8 |
| Aug 14 | 65.3 | 70.0 | 76.0 | 77.1 | 86.5 | 77.7 | 75.7 | 73.7 | 69.0 | 75.8 | 81.2 | 83.2 | 85.2 | 75.1 | 73.9 | 71.8 | 74.5 | 74.4 | 83.0 | 73.6 | 84.1 | 83.6 | 76.8 | 70.9 | 74.5 | 79.3 | 79.7 | 67.0 | 75.5 | 74.2 | 78.0 | 89.2 | 73.2 | 73.6 | 63.5 | 77.6 | 76.2 | 73.8 | 77.1 | 84.0 | 81.7 | 76.3 | 78.1 | 76.0 | 72.3 | 81.6 |
| Aug 15 | 64.9 | 76.3 | 74.7 | 74.1 | 81.6 | 76.8 | 74.2 | 76.6 | 67.1 | 74.6 | 78.6 | 83.1 | 82.5 | 71.0 | 79.1 | 76.1 | 75.6 | 76.8 | 78.3 | 79.9 | 79.9 | 83.2 | 82.4 | 77.3 | 77.2 | 77.6 | 84.3 | 72.6 | 75.5 | 72.1 | 78.9 | 91.4 | 73.9 | 72.2 | 70.9 | 76.1 | 70.4 | 76.8 | 73.8 | 78.4 | 71.0 | 72.6 | 73.8 | 75.3 | 76.4 | 81.3 |
| Aug 16 | 68.9 | 72.5 | 70.8 | 75.0 | 85.3 | 78.9 | 76.8 | 79.7 | 67.0 | 69.0 | 79.6 | 79.0 | 87.3 | 73.4 | 80.2 | 77.9 | 78.7 | 72.8 | 75.5 | 83.0 | 79.2 | 75.7 | 78.0 | 74.6 | 78.2 | 78.2 | 79.2 | 73.8 | 73.5 | 73.1 | 78.3 | 90.8 | 78.5 | 69.7 | 68.0 | 78.4 | 79.7 | 79.8 | 76.2 | 74.4 | 69.5 | 65.1 | 78.3 | 73.5 | 75.8 | 85.7 |
| Aug 17 | 77.4 | 78.0 | 72.6 | 74.0 | 80.0 | 78.9 | 76.8 | 76.4 | 69.0 | 76.4 | 75.1 | 80.8 | 84.1 | 76.1 | 79.6 | 66.9 | 77.5 | 67.3 | 77.6 | 89.0 | 88.3 | 71.5 | 82.5 | 79.3 | 77.5 | 78.9 | 78.3 | 68.9 | 70.7 | 70.7 | 77.0 | 89.3 | 80.7 | 72.6 | 70.6 | 75.9 | 76.3 | 81.0 | 75.2 | 65.1 | 72.8 | 65.7 | 79.8 | 70.5 | 75.3 | 80.3 |
| Aug 18 | 73.0 | 77.9 | 74.3 | 74.7 | 79.0 | 76.3 | 81.1 | 81.9 | 71.8 | 77.4 | 75.5 | 77.1 | 75.0 | 77.8 | 70.8 | 71.3 | 66.7 | 72.1 | 78.9 | 85.8 | 88.1 | 78.0 | 74.3 | 78.4 | 71.6 | 77.2 | 74.2 | 71.6 | 71.6 | 69.8 | 76.8 | 87.5 | 78.3 | 69.9 | 68.1 | 79.7 | 81.8 | 85.2 | 76.7 | 68.8 | 77.2 | 63.4 | 77.4 | 77.3 | 78.4 | 77.9 |
| Aug 19 | 67.1 | 77.3 | 81.5 | 69.2 | 80.9 | 76.4 | 83.1 | 85.6 | 77.1 | 81.2 | 81.6 | 75.1 | 65.1 | 75.6 | 75.7 | 68.6 | 67.3 | 72.2 | 78.8 | 84.8 | 84.6 | 73.5 | 72.1 | 76.7 | 74.3 | 75.0 | 78.5 | 68.3 | 73.2 | 63.8 | 75.4 | 82.1 | 76.0 | 76.7 | 73.3 | 81.7 | 84.4 | 79.3 | 76.5 | 68.0 | 71.7 | 67.0 | 77.5 | 80.1 | 75.6 | 79.9 |
| Aug 20 | 72.0 | 71.7 | 71.4 | 69.1 | 80.3 | 72.7 | 78.9 | 86.2 | 83.9 | 81.6 | 79.3 | 70.2 | 65.7 | 75.5 | 84.8 | 74.6 | 74.7 | 74.4 | 76.3 | 83.3 | 84.9 | 71.9 | 78.7 | 86.4 | 72.0 | 71.6 | 78.5 | 68.2 | 75.1 | 72.9 | 76.8 | 81.7 | 70.0 | 75.1 | 70.9 | 80.2 | 85.1 | 76.7 | 77.6 | 60.7 | 76.9 | 67.5 | 82.0 | 77.1 | 73.9 | 79.4 |
| Aug 21 | 76.7 | 76.6 | 68.0 | 74.1 | 75.7 | 74.2 | 84.0 | 88.3 | 87.6 | 74.1 | 79.4 | 73.0 | 74.2 | 79.9 | 79.9 | 78.3 | 72.8 | 77.8 | 80.4 | 76.0 | 80.4 | 71.2 | 71.2 | 84.2 | 69.3 | 70.0 | 76.1 | 71.3 | 80.2 | 75.5 | 74.0 | 76.0 | 69.2 | 80.9 | 72.0 | 78.4 | 77.4 | 73.3 | 69.1 | 64.0 | 83.2 | 70.8 | 77.5 | 78.9 | 75.8 | 73.6 |
| Aug 22 | 72.5 | 80.8 | 72.2 | 72.6 | 73.3 | 74.9 | 79.1 | 77.8 | 79.1 | 76.5 | 71.2 | 75.1 | 73.8 | 75.2 | 80.4 | 75.5 | 75.2 | 79.7 | 84.2 | 81.3 | 81.7 | 73.9 | 76.1 | 84.6 | 65.3 | 69.1 | 72.4 | 67.3 | 77.9 | 75.6 | 78.4 | 80.1 | 74.3 | 83.5 | 72.0 | 76.9 | 76.6 | 75.5 | 72.8 | 67.7 | 78.8 | 74.1 | 73.3 | 76.6 | 78.5 | 79.3 |
| Aug 23 | 77.6 | 77.9 | 74.1 | 71.5 | 69.8 | 68.7 | 77.9 | 82.3 | 81.2 | 83.9 | 77.5 | 76.6 | 73.2 | 70.0 | 74.5 | 75.0 | 78.2 | 76.1 | 85.6 | 81.8 | 84.1 | 72.0 | 85.0 | 88.0 | 68.2 | 72.2 | 73.4 | 70.2 | 80.2 | 74.9 | 80.1 | 78.3 | 70.5 | 84.5 | 68.9 | 74.3 | 77.2 | 76.4 | 68.7 | 68.3 | 79.4 | 72.0 | 68.9 | 75.9 | 69.3 | 73.4 |
| Aug 24 | 77.3 | 74.1 | 74.2 | 82.6 | 64.7 | 75.4 | 75.2 | 74.2 | 77.8 | 86.2 | 75.0 | 72.4 | 71.1 | 78.9 | 67.0 | 78.6 | 79.0 | 73.9 | 75.1 | 75.7 | 79.5 | 73.0 | 83.4 | 86.4 | 77.5 | 70.9 | 81.9 | 68.5 | 80.3 | 77.5 | 71.2 | 74.8 | 72.6 | 78.7 | 72.8 | 71.4 | 76.5 | 67.4 | 70.2 | 71.0 | 75.8 | 70.4 | 77.7 | 75.3 | 74.8 | 73.0 |
| Aug 25 | 74.1 | 72.3 | 64.2 | 80.4 | 64.0 | 71.9 | 79.1 | 79.9 | 77.4 | 85.3 | 66.5 | 75.1 | 68.5 | 81.8 | 75.6 | 75.6 | 79.7 | 75.2 | 70.5 | 72.4 | 74.7 | 71.2 | 75.8 | 82.2 | 75.3 | 69.6 | 75.7 | 72.3 | 69.9 | 78.1 | 84.6 | 72.9 | 77.2 | 74.2 | 76.4 | 75.7 | 80.3 | 67.8 | 69.8 | 73.6 | 81.2 | 75.0 | 77.6 | 67.8 | 66.6 | 70.4 |
| Aug 26 | 73.4 | 72.2 | 65.2 | 81.6 | 65.4 | 72.9 | 78.0 | 77.6 | 82.8 | 78.2 | 73.4 | 71.9 | 67.2 | 75.1 | 76.3 | 84.7 | 75.4 | 78.6 | 63.6 | 75.0 | 65.0 | 72.3 | 73.1 | 79.3 | 74.0 | 63.8 | 83.6 | 72.5 | 73.6 | 71.0 | 78.2 | 75.4 | 76.2 | 65.8 | 77.3 | 72.1 | 69.6 | 62.3 | 67.7 | 79.3 | 81.9 | 82.5 | 80.3 | 61.2 | 71.0 | 74.3 |
| Aug 27 | 70.7 | 75.7 | 68.4 | 76.3 | 63.8 | 77.4 | 82.9 | 74.6 | 72.5 | 76.7 | 68.2 | 66.2 | 77.1 | 76.0 | 76.7 | 77.5 | 76.1 | 69.6 | 66.2 | 74.7 | 71.4 | 71.3 | 71.0 | 78.1 | 76.5 | 71.6 | 80.7 | 71.7 | 75.5 | 70.9 | 72.7 | 77.6 | 77.9 | 69.4 | 71.8 | 70.7 | 70.2 | 70.4 | 73.0 | 80.1 | 77.0 | 84.1 | 83.5 | 61.6 | 71.8 | 78.9 |
| Aug 28 | 67.4 | 72.9 | 66.6 | 66.4 | 70.0 | 73.1 | 86.2 | 70.5 | 66.6 | 80.5 | 64.8 | 70.4 | 74.0 | 74.8 | 74.3 | 69.2 | 73.3 | 69.9 | 67.6 | 71.0 | 69.6 | 69.1 | 72.4 | 75.7 | 83.7 | 76.9 | 79.6 | 72.0 | 80.6 | 68.6 | 77.2 | 71.4 | 78.2 | 73.5 | 74.5 | 73.7 | 70.7 | 69.8 | 77.5 | 68.5 | 81.2 | 78.4 | 81.0 | 64.5 | 78.1 | 83.4 |
| Aug 29 | 67.1 | 70.7 | 56.7 | 70.6 | 67.9 | 71.2 | 82.9 | 71.0 | 76.9 | 79.7 | 68.1 | 67.0 | 73.9 | 66.7 | 69.9 | 66.0 | 73.9 | 70.3 | 66.9 | 71.5 | 65.5 | 71.1 | 70.8 | 73.0 | 86.6 | 60.9 | 76.9 | 71.0 | 83.2 | 74.3 | 75.1 | 76.2 | 75.6 | 74.7 | 65.7 | 82.0 | 71.0 | 72.5 | 72.2 | 79.1 | 79.7 | 71.0 | 76.0 | 72.7 | 79.7 | 82.6 |
| Aug 30 | 65.1 | 77.9 | 61.5 | 66.6 | 69.0 | 78.8 | 77.1 | 67.7 | 72.1 | 74.9 | 68.5 | 58.4 | 64.0 | 70.3 | 71.1 | 71.3 | 77.9 | 70.3 | 66.5 | 67.5 | 69.9 | 73.6 | 69.0 | 83.3 | 85.5 | 66.4 | 73.8 | 69.4 | 82.4 | 71.0 | 74.0 | 74.8 | 70.7 | 79.4 | 65.8 | 82.8 | 73.0 | 75.7 | 73.3 | 75.0 | 72.5 | 75.5 | 74.4 | 73.0 | 73.4 | 85.8 |
| Aug 31 | 59.1 | 78.0 | 53.2 | 79.3 | 73.6 | 68.2 | 67.9 | 69.0 | 74.8 | 69.9 | 56.7 | 63.0 | 65.6 | 65.2 | 71.2 | 71.4 | 72.7 | 62.7 | 65.1 | 65.3 | 71.5 | 73.5 | 70.0 | 83.3 | 71.4 | 62.4 | 69.1 | 63.5 | 68.7 | 62.6 | 68.2 | 71.8 | 61.2 | 76.5 | 59.9 | 77.8 | 68.7 | 68.6 | 60.8 | 79.2 | 72.4 | 75.2 | 75.1 | 76.1 | 78.8 | 78.8 |
| Sep 1 | 61.2 | 80.6 | 56.0 | 74.1 | 70.9 | 71.5 | 69.3 | 67.6 | 84.1 | 68.6 | 67.2 | 58.8 | 62.8 | 73.0 | 67.9 | 67.2 | 72.8 | 65.5 | 69.1 | 57.0 | 70.7 | 74.1 | 69.9 | 76.7 | 75.1 | 66.9 | 66.5 | 71.0 | 69.9 | 58.0 | 66.3 | 67.9 | 64.3 | 70.4 | 60.5 | 72.8 | 73.5 | 74.3 | 60.4 | 73.1 | 69.2 | 67.4 | 73.5 | 73.0 | 75.3 | 80.4 |
| Sep 2 | 62.7 | 78.2 | 59.4 | 74.1 | 67.1 | 74.0 | 66.5 | 62.2 | 84.1 | 61.6 | 62.4 | 61.9 | 62.9 | 73.8 | 66.9 | 64.8 | 69.5 | 66.7 | 78.7 | 55.5 | 66.5 | 71.6 | 72.2 | 73.9 | 69.3 | 64.1 | 66.8 | 68.1 | 69.5 | 60.7 | 69.9 | 68.7 | 70.6 | 77.2 | 54.0 | 73.6 | 71.1 | 73.0 | 70.8 | 72.2 | 71.1 | 76.5 | 74.2 | 68.7 | 80.2 | 74.5 |
| Sep 3 | 69.0 | 76.2 | 59.0 | 70.9 | 60.5 | 64.9 | 66.1 | 65.8 | 80.5 | 62.4 | 59.5 | 71.5 | 67.5 | 71.1 | 71.8 | 65.3 | 75.4 | 67.6 | 77.3 | 69.2 | 77.4 | 68.7 | 77.0 | 68.1 | 68.1 | 64.2 | 66.5 | 77.8 | 58.3 | 62.4 | 66.9 | 59.0 | 66.7 | 82.5 | 58.9 | 76.3 | 77.0 | 62.5 | 67.4 | 65.1 | 63.9 | 78.9 | 66.9 | 67.1 | 78.9 | 77.7 |
| Sep 4 | 56.7 | 74.2 | 63.4 | 63.3 | 54.2 | 61.7 | 68.4 | 68.6 | 79.0 | 60.9 | 65.2 | 68.4 | 66.3 | 69.9 | 65.5 | 67.1 | 80.9 | 70.1 | 85.7 | 70.7 | 72.7 | 74.6 | 71.8 | 65.7 | 72.3 | 70.4 | 66.8 | 74.8 | 66.0 | 73.2 | 67.7 | 54.2 | 65.4 | 81.1 | 60.1 | 72.6 | 70.5 | 64.3 | 64.6 | 72.5 | 61.4 | 78.8 | 68.0 | 67.4 | 70.6 | 73.7 |
| Sep 5 | 56.6 | 73.4 | 73.1 | 58.3 | 53.4 | 65.0 | 67.6 | 64.6 | 73.8 | 60.2 | 58.2 | 68.3 | 70.3 | 72.4 | 63.3 | 62.2 | 75.4 | 75.0 | 82.8 | 75.4 | 69.1 | 72.9 | 72.5 | 68.0 | 69.3 | 68.5 | 70.5 | 68.6 | 68.3 | 67.5 | 62.3 | 61.9 | 63.4 | 78.2 | 62.7 | 72.0 | 65.2 | 67.7 | 62.5 | 69.0 | 62.5 | 67.7 | 69.1 | 69.4 | 70.8 | 69.5 |
| Sep 6 | 55.6 | 70.3 | 72.8 | 64.4 | 47.8 | 61.6 | 65.1 | 64.3 | 68.5 | 63.8 | 58.2 | 72.4 | 73.2 | 66.3 | 69.8 | 69.5 | 80.4 | 68.3 | 68.4 | 76.4 | 67.4 | 72.9 | 73.5 | 70.5 | 62.7 | 80.6 | 73.4 | 73.7 | 72.1 | 59.8 | 61.6 | 64.7 | 60.3 | 82.3 | 65.1 | 77.4 | 73.4 | 67.4 | 63.9 | 65.8 | 69.9 | 65.4 | 67.6 | 64.9 | 83.7 | 63.3 |
| Sep 7 | 52.2 | 66.8 | 68.1 | 67.3 | 57.8 | 65.1 | 64.5 | 67.0 | 69.7 | 62.4 | 63.1 | 70.9 | 69.4 | 70.4 | 73.7 | 67.9 | 75.8 | 77.0 | 65.5 | 71.3 | 64.0 | 70.3 | 77.7 | 64.0 | 61.5 | 78.8 | 64.9 | 67.9 | 66.9 | 56.6 | 58.7 | 66.7 | 63.4 | 78.0 | 63.6 | 71.0 | 70.1 | 68.4 | 63.9 | 71.2 | 65.8 | 65.2 | 71.2 | 64.0 | 79.2 | 51.8 |
| Sep 8 | 52.1 | 68.5 | 59.6 | 51.2 | 65.3 | 61.8 | 71.8 | 70.1 | 62.2 | 68.8 | 63.9 | 69.0 | 69.1 | 63.7 | 71.4 | 70.4 | 68.8 | 80.5 | 67.3 | 70.7 | 60.4 | 64.6 | 71.9 | 65.8 | 58.7 | 75.6 | 72.5 | 60.1 | 70.0 | 66.3 | 57.3 | 57.0 | 60.6 | 72.7 | 71.8 | 68.1 | 61.7 | 68.0 | 61.2 | 76.7 | 67.1 | 62.0 | 64.7 | 64.1 | 76.4 | 59.6 |
| Sep 9 | 52.9 | 70.2 | 61.9 | 49.4 | 71.0 | 73.0 | 66.6 | 75.0 | 61.9 | 70.9 | 72.4 | 62.3 | 71.0 | 65.0 | 78.3 | 63.2 | 73.3 | 78.0 | 67.1 | 71.1 | 63.1 | 65.5 | 73.9 | 68.0 | 56.2 | 75.9 | 71.7 | 66.2 | 72.2 | 69.6 | 60.0 | 59.3 | 55.9 | 67.1 | 66.4 | 73.5 | 61.3 | 66.3 | 63.3 | 66.9 | 65.9 | 66.7 | 61.1 | 69.9 | 73.1 | 57.8 |
| Sep 10 | 58.8 | 63.8 | 63.5 | 50.2 | 64.8 | 57.0 | 63.7 | 69.3 | 63.3 | 73.7 | 70.5 | 64.3 | 68.0 | 59.4 | 81.9 | 58.0 | 70.5 | 65.7 | 58.8 | 63.8 | 76.2 | 69.3 | 72.2 | 66.6 | 71.9 | 74.9 | 63.6 | 65.9 | 73.5 | 66.3 | 56.2 | 57.2 | 54.1 | 61.5 | 65.5 | 70.1 | 63.1 | 73.3 | 71.3 | 58.4 | 69.1 | 61.1 | 63.2 | 74.8 | 78.5 | 58.0 |
| Sep 11 | 60.2 | 76.3 | 61.4 | 54.1 | 65.7 | 70.0 | 65.7 | 72.9 | 68.4 | 77.1 | 71.8 | 66.3 | 70.1 | 53.0 | 76.0 | 58.4 | 72.7 | 74.7 | 61.5 | 68.3 | 66.1 | 69.0 | 68.7 | 69.5 | 67.1 | 77.6 | 60.1 | 67.3 | 61.6 | 75.3 | 58.3 | 65.2 | 59.2 | 69.0 | 69.0 | 67.0 | 53.8 | 78.3 | 69.5 | 55.6 | 69.8 | 63.6 | 69.5 | 66.7 | 69.9 | 55.3 |
| Sep 12 | 50.0 | 81.2 | 58.9 | 54.8 | 56.0 | 64.2 | 62.2 | 62.4 | 61.7 | 68.4 | 74.2 | 72.8 | 72.8 | 54.6 | 69.7 | 65.2 | 66.9 | 74.5 | 66.9 | 70.1 | 59.7 | 67.1 | 72.7 | 66.7 | 65.2 | 71.3 | 59.3 | 57.1 | 67.3 | 75.6 | 61.5 | 62.9 | 65.5 | 71.0 | 65.6 | 72.8 | 70.7 | 79.0 | 75.1 | 56.0 | 67.4 | 69.0 | 68.8 | 62.6 | 70.4 | 63.2 |
| Sep 13 | 53.5 | 67.2 | 64.5 | 58.9 | 57.0 | 62.6 | 61.9 | 55.7 | 62.1 | 63.2 | 66.2 | 69.5 | 61.6 | 60.2 | 69.6 | 63.8 | 67.0 | 77.4 | 67.3 | 69.8 | 65.4 | 72.0 | 70.1 | 60.1 | 70.7 | 66.4 | 66.5 | 66.0 | 64.6 | 72.7 | 59.1 | 70.6 | 60.2 | 70.5 | 61.7 | 72.7 | 73.1 | 70.6 | 66.9 | 63.0 | 72.8 | 65.8 | 65.2 | 60.2 | 67.0 | 58.5 |
| Sep 14 | 54.8 | 61.9 | 60.0 | 65.0 | 52.0 | 61.9 | 55.0 | 58.5 | 76.1 | 79.5 | 62.3 | 70.3 | 64.0 | 57.2 | 64.5 | 59.3 | 65.3 | 60.2 | 53.8 | 68.2 | 66.0 | 65.4 | 78.4 | 63.6 | 75.2 | 60.2 | 68.0 | 63.8 | 62.4 | 74.8 | 51.1 | 62.8 | 63.8 | 65.1 | 64.9 | 64.2 | 71.5 | 70.8 | 60.7 | 71.6 | 71.8 | 68.0 | 60.2 | 58.2 | 73.3 | 64.3 |
| Sep 15 | 56.3 | 61.2 | 55.0 | 64.7 | 60.4 | 65.1 | 62.2 | 62.4 | 71.8 | 73.9 | 54.6 | 61.4 | 67.6 | 63.1 | 68.6 | 65.7 | 57.8 | 63.9 | 59.0 | 70.1 | 70.1 | 68.5 | 77.3 | 73.7 | 72.0 | 63.0 | 67.1 | 73.8 | 57.2 | 76.5 | 60.4 | 65.0 | 74.0 | 61.6 | 71.3 | 66.1 | 72.7 | 69.5 | 65.1 | 76.8 | 74.7 | 68.5 | 63.0 | 69.6 | 74.1 | 64.9 |
| Sep 16 | 68.6 | 64.5 | 57.8 | 70.8 | 69.7 | 66.1 | 65.2 | 58.8 | 67.4 | 70.3 | 57.0 | 60.5 | 79.2 | 71.1 | 61.7 | 64.7 | 52.1 | 62.0 | 61.4 | 63.3 | 65.1 | 75.8 | 70.1 | 68.1 | 67.6 | 58.2 | 75.7 | 69.0 | 66.3 | 71.7 | 53.7 | 68.6 | 66.6 | 74.6 | 67.9 | 71.0 | 68.9 | 61.5 | 59.3 | 73.7 | 75.9 | 68.5 | 56.7 | 72.6 | 69.0 | 61.1 |
| Sep 17 | 66.1 | 61.2 | 56.7 | 68.5 | 69.9 | 68.5 | 70.5 | 56.5 | 68.7 | 72.7 | 61.2 | 64.4 | 71.2 | 66.5 | 65.9 | 54.4 | 56.1 | 64.8 | 65.4 | 68.1 | 63.2 | 70.2 | 66.8 | 66.2 | 77.4 | 65.2 | 71.7 | 70.1 | 64.9 | 67.2 | 55.2 | 64.8 | 69.7 | 76.7 | 63.6 | 70.0 | 69.6 | 58.1 | 63.7 | 58.6 | 78.3 | 65.8 | 60.5 | 75.6 | 70.8 | 60.0 |
| Sep 18 | 66.4 | 60.3 | 60.8 | 75.0 | 65.1 | 76.6 | 64.1 | 57.4 | 60.1 | 69.8 | 60.3 | 61.6 | 64.3 | 64.2 | 56.7 | 51.2 | 58.4 | 59.2 | 70.7 | 61.7 | 59.5 | 60.4 | 60.9 | 62.5 | 67.3 | 66.0 | 67.3 | 71.8 | 70.7 | 60.3 | 60.4 | 58.2 | 64.1 | 68.9 | 58.3 | 69.5 | 71.0 | 66.2 | 70.3 | 63.7 | 68.8 | 64.8 | 67.0 | 67.9 | 65.1 | 56.2 |
| Sep 19 | 65.0 | 60.3 | 57.0 | 70.3 | 62.8 | 67.3 | 66.5 | 58.6 | 54.0 | 65.2 | 61.5 | 58.1 | 69.4 | 56.2 | 58.5 | 60.9 | 48.6 | 57.5 | 67.7 | 59.6 | 59.7 | 54.1 | 59.1 | 65.2 | 77.7 | 57.7 | 62.2 | 70.4 | 68.3 | 68.9 | 64.0 | 67.4 | 61.1 | 60.8 | 58.1 | 69.6 | 67.7 | 63.2 | 71.1 | 59.4 | 71.3 | 62.2 | 65.2 | 73.8 | 64.2 | 58.1 |
| Sep 20 | 60.9 | 63.1 | 57.7 | 75.1 | 58.6 | 75.9 | 62.2 | 56.1 | 54.8 | 61.0 | 57.3 | 50.5 | 72.0 | 55.3 | 54.5 | 65.3 | 56.0 | 62.3 | 51.5 | 66.6 | 62.7 | 61.3 | 56.5 | 57.5 | 74.9 | 48.1 | 59.5 | 69.4 | 72.2 | 67.1 | 55.9 | 58.9 | 62.3 | 68.0 | 50.9 | 74.0 | 73.5 | 60.8 | 70.4 | 65.1 | 73.4 | 67.4 | 63.6 | 67.8 | 67.5 | 56.5 |
| Sep 21 | 64.1 | 55.9 | 55.2 | 67.9 | 56.6 | 66.9 | 56.0 | 59.6 | 63.0 | 68.9 | 61.3 | 55.7 | 76.2 | 56.5 | 60.4 | 58.3 | 60.0 | 62.9 | 50.0 | 70.2 | 71.7 | 58.9 | 56.2 | 55.5 | 72.8 | 56.5 | 57.3 | 67.1 | 63.4 | 55.9 | 57.7 | 55.2 | 65.7 | 59.8 | 54.6 | 74.9 | 63.7 | 53.9 | 71.4 | 65.0 | 73.0 | 70.0 | 62.1 | 71.4 | 60.8 | 64.3 |
| Sep 22 | 62.2 | 59.5 | 58.9 | 68.4 | 49.6 | 65.0 | 73.0 | 64.7 | 68.4 | 59.8 | 52.9 | 54.8 | 71.0 | 76.4 | 63.1 | 60.0 | 57.7 | 68.2 | 59.3 | 59.3 | 67.0 | 65.5 | 46.8 | 54.7 | 72.7 | 56.1 | 53.6 | 55.7 | 65.5 | 59.6 | 62.0 | 51.8 | 58.2 | 62.2 | 48.1 | 68.6 | 65.4 | 66.1 | 61.0 | 62.2 | 69.9 | 66.2 | 64.0 | 71.9 | 52.3 | 58.9 |
| Sep 23 | 66.8 | 66.6 | 53.5 | 69.8 | 50.7 | 56.7 | 67.5 | 60.8 | 61.7 | 57.9 | 57.7 | 57.1 | 63.5 | 74.1 | 65.9 | 64.0 | 66.2 | 59.9 | 55.4 | 68.2 | 67.6 | 67.0 | 48.4 | 52.0 | 73.7 | 58.4 | 49.3 | 55.4 | 63.9 | 52.7 | 59.3 | 55.7 | 52.6 | 60.2 | 48.2 | 62.3 | 65.8 | 61.7 | 62.3 | 58.5 | 70.0 | 69.0 | 56.5 | 70.5 | 62.7 | 62.7 |
| Sep 24 | 59.1 | 66.7 | 50.1 | 73.9 | 60.3 | 60.9 | 62.1 | 57.7 | 56.1 | 52.0 | 68.9 | 55.5 | 71.9 | 68.0 | 74.8 | 60.5 | 67.0 | 66.7 | 54.2 | 72.0 | 65.2 | 60.8 | 48.1 | 64.5 | 75.5 | 51.7 | 54.6 | 57.0 | 65.3 | 51.0 | 68.0 | 55.1 | 53.1 | 56.3 | 60.3 | 60.7 | 67.2 | 55.2 | 60.7 | 57.3 | 67.5 | 61.9 | 59.5 | 66.7 | 56.2 | 61.7 |
| Sep 25 | 53.7 | 51.8 | 49.2 | 68.6 | 55.8 | 53.3 | 58.6 | 54.4 | 51.6 | 58.4 | 62.2 | 54.6 | 71.2 | 67.0 | 67.2 | 71.4 | 58.9 | 74.5 | 56.5 | 72.6 | 71.9 | 51.1 | 51.3 | 69.3 | 62.6 | 53.8 | 50.7 | 56.4 | 73.8 | 50.2 | 59.0 | 51.2 | 62.6 | 54.2 | 66.7 | 63.0 | 67.8 | 54.9 | 66.6 | 62.2 | 75.2 | 63.6 | 70.7 | 69.8 | 68.8 | 57.0 |
| Sep 26 | 68.6 | 60.8 | 53.0 | 69.9 | 51.8 | 48.4 | 55.4 | 58.3 | 57.0 | 67.4 | 58.1 | 57.8 | 68.1 | 61.6 | 55.7 | 71.9 | 65.9 | 74.2 | 48.8 | 80.9 | 66.9 | 64.5 | 63.1 | 54.7 | 59.6 | 60.8 | 57.6 | 58.4 | 81.2 | 62.6 | 54.1 | 51.7 | 50.9 | 52.9 | 60.4 | 61.6 | 72.4 | 54.0 | 75.9 | 63.3 | 72.6 | 60.2 | 68.5 | 68.2 | 80.6 | 60.7 |
| Sep 27 | 60.5 | 60.2 | 55.0 | 62.7 | 58.2 | 53.8 | 51.4 | 58.9 | 59.9 | 68.3 | 57.3 | 61.2 | 63.4 | 55.4 | 53.6 | 63.3 | 68.1 | 76.3 | 57.5 | 68.9 | 60.5 | 59.1 | 59.6 | 52.7 | 57.2 | 63.8 | 62.7 | 58.5 | 69.6 | 52.6 | 58.0 | 47.5 | 61.9 | 44.3 | 54.1 | 65.0 | 71.3 | 48.9 | 64.5 | 62.1 | 68.5 | 63.0 | 56.9 | 67.5 | 79.3 | 63.8 |
| Sep 28 | 71.1 | 55.9 | 56.8 | 67.1 | 61.2 | 61.8 | 55.4 | 57.3 | 66.4 | 63.5 | 48.7 | 60.7 | 56.3 | 62.4 | 45.6 | 68.7 | 67.8 | 74.6 | 55.8 | 64.4 | 66.4 | 58.1 | 53.9 | 50.2 | 55.9 | 65.4 | 70.1 | 43.9 | 74.9 | 49.8 | 50.8 | 51.1 | 59.4 | 39.4 | 51.3 | 53.2 | 69.7 | 56.0 | 73.3 | 64.6 | 70.2 | 58.9 | 52.5 | 66.0 | 70.7 | 66.2 |
| Sep 29 | 59.2 | 54.7 | 54.0 | 74.0 | 61.3 | 61.3 | 50.6 | 49.5 | 58.2 | 47.3 | 54.4 | 58.3 | 60.4 | 58.9 | 44.4 | 61.9 | 63.0 | 73.3 | 54.6 | 62.6 | 61.4 | 56.9 | 60.4 | 55.2 | 56.9 | 68.7 | 58.4 | 55.2 | 63.0 | 51.6 | 48.7 | 51.1 | 71.2 | 46.9 | 52.2 | 60.8 | 71.7 | 50.1 | 74.6 | 57.1 | 58.9 | 57.6 | 49.2 | 60.5 | 61.4 | 62.8 |
| Sep 30 | 55.0 | 46.6 | 57.0 | 80.0 | 62.7 | 53.3 | 48.6 | 43.7 | 53.3 | 46.0 | 48.6 | 49.4 | 63.4 | 55.1 | 61.2 | 52.0 | 59.5 | 75.9 | 49.4 | 54.8 | 59.1 | 63.1 | 48.5 | 58.3 | 56.3 | 50.5 | 47.6 | 52.3 | 63.7 | 53.8 | 52.5 | 56.9 | 68.6 | 56.4 | 61.4 | 65.8 | 68.8 | 54.6 | 73.1 | 56.2 | 43.6 | 48.8 | 47.8 | 61.1 | 51.0 | 51.2 |
| Oct 1 | 51.7 | 46.5 | 55.3 | 60.6 | 74.4 | 56.7 | 55.4 | 38.1 | 49.1 | 50.3 | 52.8 | 48.8 | 57.5 | 60.1 | 64.4 | 46.3 | 63.8 | 70.1 | 55.5 | 48.2 | 58.7 | 58.5 | 46.9 | 59.4 | 47.9 | 57.4 | 41.7 | 50.0 | 55.0 | 55.1 | 51.2 | 45.5 | 65.2 | 64.4 | 58.3 | 57.4 | 67.6 | 52.2 | 68.1 | 43.8 | 48.3 | 59.3 | 44.1 | 54.6 | 46.5 | 57.7 |
| Oct 2 | 51.4 | 55.2 | 55.4 | 61.8 | 75.4 | 50.4 | 57.9 | 41.0 | 47.4 | 60.1 | 40.5 | 42.9 | 57.0 | 55.9 | 62.1 | 47.2 | 57.5 | 56.1 | 52.5 | 46.3 | 56.0 | 55.9 | 60.6 | 50.0 | 58.4 | 54.5 | 44.1 | 49.6 | 49.6 | 61.1 | 50.8 | 41.2 | 64.7 | 64.9 | 53.9 | 58.0 | 67.8 | 41.9 | 55.9 | 33.4 | 60.4 | 53.4 | 41.6 | 63.1 | 46.6 | 53.5 |
| Oct 3 | 66.0 | 46.7 | 51.9 | 62.7 | 65.5 | 41.5 | 51.7 | 47.1 | 59.3 | 65.1 | 44.8 | 39.9 | 59.5 | 53.0 | 58.4 | 49.2 | 62.0 | 53.1 | 44.7 | 51.6 | 44.4 | 46.2 | 54.9 | 50.1 | 51.8 | 56.7 | 53.3 | 49.8 | 51.5 | 61.6 | 39.8 | 41.6 | 69.0 | 52.5 | 51.1 | 58.9 | 60.0 | 46.6 | 47.3 | 44.4 | 51.6 | 49.0 | 45.6 | 72.9 | 55.2 | 51.1 |
| Oct 4 | 55.6 | 50.4 | 63.3 | 59.6 | 69.1 | 45.5 | 52.4 | 48.5 | 46.8 | 65.5 | 35.7 | 33.2 | 65.5 | 56.7 | 67.3 | 51.2 | 62.8 | 54.1 | 38.2 | 50.8 | 56.4 | 53.4 | 51.5 | 51.6 | 49.2 | 53.8 | 45.6 | 47.6 | 52.5 | 59.8 | 42.5 | 44.7 | 62.0 | 54.7 | 52.0 | 64.0 | 53.8 | 53.7 | 57.5 | 45.0 | 51.9 | 39.5 | 57.2 | 66.4 | 56.9 | 51.2 |
| Oct 5 | 57.6 | 48.7 | 62.6 | 55.2 | 72.7 | 47.7 | 55.5 | 47.2 | 40.6 | 60.0 | 38.3 | 34.9 | 59.9 | 48.9 | 65.2 | 44.9 | 61.7 | 52.7 | 46.2 | 48.8 | 47.8 | 51.2 | 50.8 | 44.5 | 53.3 | 55.1 | 49.0 | 43.7 | 53.5 | 61.4 | 45.1 | 50.8 | 61.7 | 59.4 | 49.5 | 65.1 | 47.7 | 46.9 | 54.3 | 44.7 | 51.8 | 40.3 | 67.1 | 61.6 | 56.1 | 65.6 |
| Oct 6 | 61.9 | 52.3 | 52.2 | 42.8 | 57.9 | 46.2 | 51.8 | 50.4 | 40.9 | 61.4 | 44.4 | 39.7 | 62.1 | 46.0 | 56.4 | 36.5 | 56.3 | 53.9 | 48.2 | 48.9 | 54.0 | 47.4 | 59.0 | 43.0 | 50.2 | 68.8 | 43.4 | 44.3 | 51.8 | 53.5 | 48.7 | 46.7 | 51.3 | 67.5 | 38.8 | 42.2 | 48.4 | 43.2 | 54.0 | 51.0 | 51.6 | 44.5 | 52.8 | 62.2 | 54.7 | 67.5 |
| Oct 7 | 56.5 | 52.6 | 61.8 | 40.0 | 53.4 | 51.9 | 49.1 | 67.1 | 42.7 | 61.8 | 41.5 | 33.6 | 61.2 | 42.8 | 48.4 | 44.6 | 59.5 | 60.2 | 56.9 | 56.4 | 56.1 | 59.6 | 54.0 | 47.0 | 49.0 | 60.0 | 48.7 | 45.9 | 47.6 | 47.9 | 40.0 | 52.6 | 50.2 | 56.8 | 49.4 | 47.7 | 46.2 | 45.0 | 54.8 | 60.4 | 42.7 | 46.7 | 43.0 | 66.4 | 50.9 | 59.9 |
| Oct 8 | 66.9 | 50.6 | 55.3 | 45.1 | 62.9 | 50.3 | 57.4 | 62.5 | 47.5 | 49.7 | 50.1 | 40.9 | 53.5 | 41.6 | 53.0 | 44.9 | 67.9 | 66.5 | 59.9 | 52.8 | 53.2 | 53.6 | 48.2 | 52.2 | 62.7 | 54.2 | 56.0 | 36.5 | 46.3 | 44.7 | 59.3 | 58.1 | 50.2 | 55.9 | 42.3 | 47.5 | 40.4 | 49.4 | 61.5 | 60.8 | 47.1 | 51.9 | 44.6 | 67.2 | 49.3 | 62.2 |
| Oct 9 | 66.8 | 50.1 | 57.0 | 52.1 | 53.2 | 46.2 | 54.5 | 59.1 | 56.1 | 50.5 | 44.8 | 36.6 | 53.0 | 37.4 | 48.6 | 53.1 | 58.9 | 63.0 | 56.6 | 56.0 | 55.5 | 44.9 | 49.1 | 47.1 | 51.4 | 53.5 | 62.6 | 37.9 | 49.1 | 44.4 | 51.9 | 57.7 | 50.2 | 49.0 | 48.5 | 49.2 | 51.4 | 52.7 | 59.9 | 52.0 | 53.5 | 56.0 | 60.5 | 56.6 | 46.3 | 63.0 |
| Oct 10 | 65.4 | 45.1 | 62.5 | 58.5 | 49.6 | 54.9 | 56.0 | 55.6 | 59.5 | 47.6 | 40.5 | 31.3 | 54.2 | 41.8 | 48.9 | 61.6 | 63.9 | 63.7 | 57.5 | 69.5 | 62.5 | 50.5 | 55.6 | 38.5 | 42.6 | 55.0 | 48.5 | 31.2 | 56.7 | 41.2 | 60.3 | 52.0 | 47.8 | 39.5 | 47.3 | 48.4 | 42.2 | 59.3 | 46.5 | 46.5 | 48.6 | 50.2 | 58.5 | 61.1 | 47.6 | 53.2 |
| Oct 11 | 65.6 | 49.5 | 65.7 | 61.1 | 53.7 | 50.0 | 47.6 | 55.4 | 57.1 | 45.9 | 51.7 | 31.4 | 52.3 | 41.3 | 45.7 | 53.2 | 60.2 | 49.4 | 52.5 | 64.4 | 65.8 | 54.8 | 46.4 | 38.7 | 48.7 | 49.0 | 45.1 | 34.1 | 46.0 | 44.2 | 59.4 | 50.6 | 40.8 | 33.4 | 46.7 | 47.1 | 45.6 | 52.8 | 34.4 | 47.7 | 56.0 | 50.9 | 58.4 | 46.2 | 49.3 | 58.4 |
| Oct 12 | 55.0 | 56.1 | 57.6 | 56.7 | 59.0 | 50.2 | 61.1 | 56.2 | 46.8 | 50.9 | 48.3 | 39.9 | 48.4 | 50.7 | 48.8 | 44.1 | 57.2 | 56.5 | 50.0 | 57.6 | 66.5 | 52.4 | 48.3 | 40.1 | 46.3 | 54.4 | 52.2 | 27.7 | 45.5 | 48.7 | 58.0 | 47.0 | 40.3 | 48.3 | 54.5 | 52.4 | 49.5 | 50.8 | 45.5 | 43.6 | 50.7 | 57.0 | 54.9 | 56.5 | 48.5 | 46.5 |
| Oct 13 | 50.7 | 63.9 | 61.3 | 54.3 | 56.9 | 52.7 | 40.7 | 57.1 | 52.6 | 56.2 | 51.1 | 34.4 | 57.4 | 56.2 | 50.8 | 42.5 | 46.3 | 62.1 | 54.8 | 57.5 | 57.8 | 57.5 | 52.6 | 53.5 | 42.1 | 52.0 | 39.2 | 33.9 | 50.7 | 46.0 | 52.7 | 60.5 | 49.6 | 46.8 | 47.6 | 57.8 | 55.9 | 52.2 | 54.2 | 48.1 | 48.5 | 52.5 | 50.7 | 58.6 | 48.2 | 49.2 |
| Oct 14 | 54.1 | 71.3 | 66.4 | 60.5 | 53.4 | 41.7 | 38.5 | 54.8 | 62.6 | 53.7 | 43.7 | 37.2 | 52.4 | 54.6 | 42.1 | 48.0 | 55.9 | 71.9 | 54.2 | 55.5 | 57.7 | 57.0 | 56.0 | 63.2 | 42.9 | 47.1 | 32.8 | 40.3 | 47.9 | 56.5 | 60.1 | 53.6 | 55.2 | 44.7 | 53.4 | 51.5 | 48.9 | 46.7 | 58.1 | 48.4 | 43.5 | 51.7 | 48.0 | 58.1 | 50.1 | 53.1 |
| Oct 15 | 56.0 | 65.8 | 49.0 | 66.1 | 44.3 | 46.7 | 44.0 | 59.0 | 59.3 | 65.9 | 51.9 | 37.3 | 52.4 | 53.5 | 40.7 | 42.4 | 59.5 | 67.3 | 44.3 | 46.8 | 55.1 | 61.8 | 51.0 | 51.8 | 45.9 | 53.4 | 40.9 | 39.5 | 37.3 | 58.1 | 41.2 | 60.9 | 45.5 | 42.7 | 51.4 | 42.2 | 44.6 | 40.4 | 39.4 | 46.8 | 45.3 | 56.8 | 52.3 | 67.2 | 50.7 | 53.0 |
| Oct 16 | 47.0 | 64.5 | 54.7 | 61.5 | 49.5 | 46.5 | 38.6 | 63.1 | 62.2 | 65.6 | 50.4 | 41.7 | 44.5 | 64.2 | 38.0 | 51.1 | 55.5 | 61.0 | 47.1 | 44.3 | 46.1 | 55.2 | 55.1 | 57.5 | 44.9 | 62.6 | 47.2 | 40.2 | 49.0 | 53.6 | 48.8 | 46.3 | 43.7 | 36.0 | 57.1 | 35.0 | 46.2 | 49.9 | 42.1 | 59.0 | 37.9 | 53.2 | 61.8 | 61.6 | 50.7 | 48.9 |
| Oct 17 | 51.6 | 60.7 | 60.8 | 57.1 | 44.0 | 44.4 | 38.1 | 62.5 | 48.8 | 55.0 | 41.9 | 52.0 | 32.1 | 54.9 | 32.3 | 50.0 | 65.4 | 59.6 | 43.2 | 51.4 | 54.0 | 64.4 | 51.9 | 45.6 | 40.7 | 53.3 | 43.4 | 51.9 | 48.3 | 56.9 | 46.9 | 50.6 | 44.2 | 38.5 | 58.2 | 40.1 | 50.2 | 40.6 | 39.1 | 67.2 | 42.4 | 54.3 | 47.8 | 53.9 | 46.3 | 56.7 |
| Oct 18 | 48.7 | 64.2 | 43.0 | 49.7 | 34.3 | 40.7 | 57.1 | 64.7 | 54.2 | 42.6 | 38.5 | 50.7 | 32.7 | 53.9 | 29.7 | 37.4 | 64.1 | 63.5 | 34.0 | 45.5 | 59.7 | 52.5 | 52.9 | 42.0 | 40.0 | 38.5 | 47.1 | 48.4 | 54.3 | 62.7 | 54.2 | 56.3 | 45.2 | 46.5 | 61.0 | 45.8 | 48.4 | 44.3 | 46.0 | 66.4 | 38.9 | 40.1 | 45.7 | 56.5 | 47.3 | 67.5 |
| Oct 19 | 44.8 | 62.2 | 33.2 | 45.2 | 39.6 | 32.6 | 52.4 | 77.7 | 52.9 | 46.4 | 44.3 | 45.4 | 43.8 | 49.6 | 44.1 | 48.0 | 66.6 | 68.6 | 32.5 | 46.4 | 47.3 | 47.7 | 49.9 | 51.7 | 42.1 | 35.8 | 42.3 | 49.7 | 41.4 | 54.6 | 40.3 | 49.2 | 42.4 | 44.8 | 68.3 | 38.3 | 53.5 | 45.2 | 54.1 | 61.3 | 51.5 | 41.8 | 44.4 | 60.1 | 45.5 | 50.6 |
| Oct 20 | 52.9 | 60.4 | 30.8 | 36.3 | 36.9 | 34.4 | 52.1 | 73.5 | 47.9 | 46.3 | 44.8 | 56.2 | 41.4 | 43.1 | 38.8 | 58.6 | 47.3 | 52.1 | 24.5 | 40.3 | 50.8 | 44.6 | 41.4 | 42.6 | 40.9 | 36.0 | 45.4 | 51.2 | 47.2 | 43.1 | 38.3 | 45.3 | 55.9 | 42.2 | 55.3 | 34.2 | 58.5 | 49.9 | 52.6 | 54.3 | 43.7 | 39.3 | 37.0 | 54.1 | 49.4 | 42.5 |
| Oct 21 | 42.9 | 54.4 | 23.3 | 44.3 | 28.8 | 35.1 | 51.8 | 73.0 | 45.3 | 41.0 | 39.8 | 47.9 | 45.8 | 33.0 | 37.7 | 54.9 | 51.8 | 38.7 | 35.0 | 44.7 | 60.4 | 41.3 | 38.9 | 46.2 | 53.4 | 41.0 | 51.9 | 45.6 | 47.7 | 47.2 | 39.5 | 38.4 | 54.1 | 42.4 | 59.3 | 34.0 | 61.5 | 50.3 | 51.3 | 53.8 | 47.8 | 46.9 | 52.8 | 49.7 | 38.8 | 55.9 |
| Oct 22 | 40.4 | 45.7 | 19.0 | 53.1 | 33.2 | 40.3 | 34.2 | 75.2 | 55.7 | 36.7 | 43.2 | 46.2 | 43.5 | 40.4 | 37.1 | 50.8 | 56.0 | 37.4 | 33.0 | 53.5 | 58.3 | 41.6 | 43.4 | 56.2 | 42.6 | 57.5 | 47.1 | 43.6 | 42.3 | 48.5 | 27.3 | 42.4 | 57.1 | 43.6 | 58.8 | 39.7 | 57.7 | 36.6 | 48.4 | 47.1 | 38.4 | 50.0 | 48.5 | 36.4 | 31.4 | 55.4 |
| Oct 23 | 40.5 | 43.0 | 29.5 | 54.6 | 35.5 | 46.0 | 42.0 | 59.4 | 50.6 | 45.7 | 51.5 | 59.8 | 43.2 | 49.1 | 40.8 | 48.2 | 47.1 | 39.2 | 45.0 | 50.0 | 55.1 | 44.7 | 40.3 | 51.7 | 42.6 | 57.2 | 35.2 | 57.3 | 53.3 | 44.8 | 34.7 | 43.8 | 46.8 | 32.8 | 49.8 | 32.1 | 56.1 | 31.5 | 48.5 | 37.4 | 39.3 | 52.6 | 46.5 | 30.7 | 45.5 | 51.0 |
| Oct 24 | 42.4 | 39.8 | 38.5 | 48.5 | 36.0 | 51.5 | 48.6 | 50.9 | 49.4 | 50.6 | 56.0 | 46.5 | 52.0 | 57.0 | 33.2 | 48.2 | 33.1 | 29.5 | 45.3 | 60.0 | 58.1 | 50.7 | 36.4 | 45.9 | 32.4 | 56.0 | 41.9 | 47.0 | 47.0 | 42.6 | 34.3 | 42.9 | 51.8 | 40.3 | 52.2 | 43.3 | 61.4 | 32.4 | 46.4 | 42.1 | 33.5 | 54.6 | 47.3 | 35.9 | 50.3 | 38.7 |
| Oct 25 | 52.9 | 44.8 | 44.0 | 36.7 | 45.1 | 43.9 | 43.7 | 56.8 | 50.2 | 47.4 | 60.7 | 37.8 | 46.7 | 48.3 | 35.6 | 38.3 | 46.8 | 23.0 | 43.3 | 59.8 | 58.4 | 45.3 | 44.3 | 29.7 | 27.8 | 42.1 | 49.6 | 47.2 | 48.7 | 45.4 | 44.2 | 43.6 | 53.0 | 45.3 | 45.6 | 41.3 | 53.1 | 37.9 | 48.3 | 53.8 | 37.3 | 69.8 | 60.0 | 31.7 | 50.0 | 43.7 |
| Oct 26 | 54.9 | 52.0 | 44.9 | 38.1 | 38.5 | 33.8 | 36.1 | 41.3 | 55.2 | 36.1 | 60.3 | 32.6 | 39.1 | 47.2 | 45.1 | 49.6 | 35.5 | 28.6 | 47.0 | 57.8 | 53.7 | 42.3 | 46.0 | 38.0 | 29.6 | 50.5 | 55.3 | 41.6 | 50.8 | 47.2 | 38.2 | 31.4 | 39.4 | 48.1 | 49.3 | 44.4 | 51.3 | 40.1 | 53.3 | 52.1 | 32.1 | 74.7 | 57.9 | 38.1 | 41.9 | 40.0 |

***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 27 | 45.1 | 47.6 | 47.9 | 44.9 | 43.3 | 32.6 | 29.0 | 36.7 | 44.8 | 29.5 | 48.3 | 33.5 | 54.4 | 47.2 | 48.2 | 55.6 | 31.2 | 41.1 | 47.4 | 65.4 | 56.4 | 42.2 | 60.7 | 38.0 | 27.1 | 37.7 | 55.8 | 46.9 | 52.9 | 49.1 | 50.3 | 31.6 | 33.6 | 45.1 | 46.4 | 35.2 | 48.7 | 48.7 | 47.7 | 54.1 | 33.2 | 55.0 | 61.5 | 47.7 | 40.6 | 35.9 |
| Oct 28 | 51.5 | 40.8 | 48.2 | 39.6 | 40.7 | 33.0 | 24.8 | 35.8 | 50.1 | 35.1 | 40.6 | 31.9 | 54.3 | 44.8 | 51.1 | 55.0 | 38.9 | 49.2 | 40.8 | 62.9 | 55.5 | 52.3 | 47.0 | 52.3 | 35.2 | 44.4 | 58.5 | 49.7 | 46.8 | 51.8 | 49.6 | 28.8 | 26.8 | 42.1 | 42.2 | 42.2 | 54.9 | 51.0 | 50.8 | 46.6 | 31.1 | 48.9 | 58.3 | 44.1 | 48.3 | 41.7 |
| Oct 29 | 48.6 | 38.8 | 38.6 | 46.6 | 39.9 | 41.7 | 28.1 | 28.1 | 53.1 | 41.4 | 36.0 | 38.3 | 50.4 | 35.7 | 61.4 | 53.0 | 46.9 | 45.1 | 43.2 | 62.4 | 48.2 | 45.6 | 49.8 | 46.1 | 45.8 | 42.9 | 57.4 | 51.9 | 43.7 | 51.5 | 51.9 | 37.0 | 36.7 | 38.9 | 43.6 | 44.1 | 56.6 | 40.7 | 45.9 | 41.8 | 35.6 | 51.1 | 50.4 | 38.2 | 56.1 | 46.8 |
| Oct 30 | 54.2 | 41.4 | 46.6 | 36.9 | 41.8 | 33.6 | 27.1 | 38.2 | 56.7 | 43.9 | 37.7 | 41.4 | 51.9 | 39.7 | 52.5 | 44.5 | 39.5 | 48.9 | 36.6 | 56.0 | 55.6 | 58.7 | 48.4 | 45.0 | 43.3 | 48.1 | 67.7 | 40.3 | 33.7 | 37.8 | 49.1 | 44.2 | 27.6 | 30.6 | 36.7 | 44.1 | 59.6 | 42.6 | 50.6 | 49.6 | 27.4 | 59.2 | 54.2 | 35.2 | 48.7 | 41.4 |
| Oct 31 | 54.5 | 37.1 | 51.1 | 33.3 | 45.2 | 40.5 | 29.6 | 39.8 | 56.7 | 44.8 | 42.8 | 37.2 | 45.6 | 43.2 | 38.9 | 38.1 | 42.9 | 46.3 | 43.6 | 62.9 | 48.4 | 42.4 | 51.2 | 41.5 | 48.3 | 52.3 | 60.5 | 34.6 | 27.8 | 33.2 | 47.7 | 46.0 | 30.2 | 29.8 | 41.6 | 39.7 | 39.9 | 41.1 | 43.5 | 59.6 | 25.7 | 54.5 | 37.7 | 38.1 | 48.1 | 39.9 |
| Nov 1 | 47.9 | 36.2 | 44.1 | 31.4 | 46.3 | 44.8 | 29.4 | 39.9 | 35.3 | 37.9 | 53.3 | 40.2 | 41.9 | 39.4 | 32.3 | 48.7 | 37.8 | 49.5 | 41.6 | 47.8 | 47.5 | 46.7 | 50.4 | 29.2 | 47.1 | 53.6 | 56.1 | 32.5 | 27.2 | 48.8 | 45.6 | 48.9 | 30.8 | 43.0 | 39.8 | 39.5 | 40.4 | 52.4 | 45.3 | 43.6 | 28.0 | 38.9 | 40.1 | 20.9 | 61.8 | 46.4 |
| Nov 2 | 48.3 | 38.4 | 44.1 | 37.5 | 52.5 | 42.5 | 31.7 | 32.0 | 41.6 | 34.2 | 45.7 | 44.6 | 43.6 | 36.4 | 38.1 | 40.2 | 37.9 | 44.0 | 43.1 | 34.2 | 53.3 | 36.4 | 47.2 | 35.4 | 43.9 | 49.6 | 49.9 | 32.3 | 29.9 | 50.0 | 37.7 | 53.8 | 24.6 | 44.5 | 38.8 | 37.6 | 36.7 | 51.0 | 41.7 | 44.0 | 26.6 | 28.7 | 39.9 | 26.7 | 59.7 | 53.3 |
| Nov 3 | 53.5 | 47.7 | 35.2 | 53.4 | 47.0 | 45.6 | 35.3 | 22.3 | 41.3 | 39.6 | 53.4 | 42.1 | 41.7 | 36.2 | 53.0 | 33.1 | 52.8 | 43.5 | 53.2 | 31.8 | 43.6 | 36.8 | 44.5 | 33.0 | 48.7 | 34.0 | 45.6 | 29.9 | 40.9 | 46.3 | 37.6 | 55.0 | 17.3 | 52.1 | 56.4 | 37.6 | 32.9 | 44.8 | 38.8 | 41.8 | 23.0 | 29.0 | 34.6 | 30.9 | 65.9 | 54.7 |
| Nov 4 | 49.6 | 46.5 | 45.4 | 46.2 | 48.5 | 47.3 | 32.2 | 39.4 | 32.0 | 47.4 | 56.0 | 43.3 | 45.4 | 30.5 | 45.7 | 28.2 | 53.1 | 41.9 | 43.1 | 27.6 | 40.1 | 36.0 | 38.3 | 38.7 | 42.3 | 38.3 | 44.9 | 39.7 | 38.2 | 40.6 | 33.7 | 54.1 | 12.9 | 55.6 | 48.5 | 37.6 | 38.0 | 38.8 | 39.7 | 45.0 | 37.5 | 39.1 | 38.1 | 38.7 | 62.6 | 39.6 |
| Nov 5 | 47.7 | 46.7 | 50.0 | 52.9 | 34.4 | 50.1 | 34.7 | 34.8 | 29.2 | 45.9 | 57.1 | 47.2 | 46.6 | 20.1 | 31.1 | 29.1 | 48.0 | 44.1 | 46.7 | 29.5 | 38.4 | 28.2 | 40.4 | 37.7 | 46.9 | 40.4 | 37.9 | 40.2 | 34.7 | 34.4 | 31.1 | 61.8 | 16.6 | 49.8 | 42.1 | 40.4 | 33.0 | 46.6 | 37.1 | 41.8 | 30.2 | 39.5 | 46.1 | 38.3 | 52.7 | 38.0 |
| Nov 6 | 50.1 | 43.5 | 62.2 | 47.2 | 34.2 | 49.8 | 28.7 | 41.2 | 36.7 | 47.9 | 34.4 | 58.5 | 41.1 | 37.1 | 48.0 | 22.8 | 41.8 | 51.2 | 46.2 | 35.3 | 41.5 | 28.3 | 39.8 | 34.6 | 41.8 | 46.2 | 43.6 | 33.6 | 29.7 | 32.7 | 38.3 | 56.8 | 26.1 | 41.4 | 45.9 | 38.6 | 42.2 | 49.5 | 38.0 | 55.6 | 30.4 | 40.2 | 42.2 | 38.4 | 49.2 | 36.3 |
| Nov 7 | 53.2 | 42.1 | 44.0 | 52.7 | 29.5 | 51.0 | 36.5 | 49.1 | 43.8 | 39.3 | 49.5 | 56.3 | 35.7 | 38.6 | 45.2 | 27.7 | 41.1 | 44.3 | 46.1 | 29.5 | 45.1 | 27.6 | 44.6 | 35.3 | 32.4 | 53.2 | 28.4 | 37.5 | 23.8 | 36.9 | 39.8 | 47.5 | 33.0 | 43.2 | 38.9 | 31.6 | 50.9 | 40.7 | 44.3 | 49.9 | 44.7 | 39.9 | 45.7 | 49.6 | 57.4 | 39.6 |
| Nov 8 | 55.2 | 26.1 | 32.1 | 57.0 | 31.5 | 46.2 | 33.4 | 41.2 | 42.3 | 30.7 | 45.5 | 64.3 | 36.7 | 31.2 | 45.2 | 27.5 | 32.0 | 41.1 | 38.2 | 26.7 | 40.6 | 32.5 | 45.2 | 37.6 | 37.2 | 52.2 | 24.4 | 20.2 | 19.1 | 39.6 | 40.4 | 54.8 | 27.8 | 47.2 | 37.1 | 30.8 | 50.5 | 45.0 | 41.7 | 47.0 | 34.5 | 43.6 | 57.4 | 47.9 | 54.0 | 30.2 |
| Nov 9 | 58.1 | 42.2 | 31.5 | 61.3 | 32.2 | 45.8 | 35.5 | 36.8 | 31.8 | 27.5 | 46.1 | 56.5 | 37.2 | 39.6 | 29.3 | 34.7 | 42.7 | 44.0 | 40.0 | 23.6 | 34.3 | 39.3 | 36.3 | 43.5 | 30.7 | 51.5 | 21.2 | 21.7 | 30.2 | 41.9 | 44.7 | 44.1 | 38.3 | 34.3 | 45.5 | 36.5 | 46.5 | 50.3 | 43.5 | 53.9 | 38.0 | 46.3 | 55.1 | 47.6 | 54.7 | 17.1 |
| Nov 10 | 58.7 | 44.2 | 35.6 | 51.9 | 34.5 | 44.4 | 29.7 | 48.4 | 35.3 | 31.5 | 42.8 | 49.3 | 39.2 | 33.9 | 32.3 | 33.7 | 30.6 | 46.4 | 29.5 | 25.8 | 33.8 | 50.2 | 35.4 | 47.1 | 29.7 | 41.0 | 23.5 | 33.3 | 31.8 | 36.2 | 51.3 | 38.3 | 30.7 | 37.8 | 42.9 | 38.8 | 34.6 | 50.6 | 48.7 | 39.3 | 28.4 | 41.1 | 48.9 | 43.9 | 58.9 | 30.5 |
| Nov 11 | 56.2 | 38.3 | 43.8 | 45.3 | 35.0 | 39.5 | 37.4 | 37.8 | 29.2 | 32.3 | 43.8 | 52.5 | 43.2 | 27.8 | 43.5 | 27.3 | 27.5 | 46.1 | 35.2 | 23.1 | 31.9 | 41.2 | 28.2 | 45.1 | 36.4 | 22.9 | 23.2 | 32.2 | 36.9 | 34.2 | 47.6 | 30.6 | 31.2 | 30.9 | 43.5 | 35.9 | 37.9 | 56.0 | 40.9 | 43.4 | 23.4 | 46.5 | 51.2 | 38.5 | 47.7 | 36.9 |
| Nov 12 | 46.0 | 25.5 | 46.9 | 55.3 | 38.8 | 38.1 | 48.9 | 37.5 | 35.1 | 27.3 | 43.0 | 54.8 | 48.5 | 31.4 | 47.8 | 37.1 | 29.5 | 44.9 | 35.4 | 28.7 | 34.5 | 45.7 | 26.8 | 42.8 | 46.7 | 30.1 | 29.0 | 27.4 | 42.1 | 32.9 | 55.9 | 36.9 | 33.9 | 47.1 | 42.5 | 24.7 | 35.5 | 41.0 | 33.8 | 35.3 | 34.1 | 41.7 | 54.2 | 35.4 | 41.1 | 32.2 |
| Nov 13 | 41.0 | 31.7 | 35.4 | 45.6 | 44.7 | 43.7 | 45.1 | 45.0 | 34.5 | 21.6 | 33.0 | 49.6 | 52.9 | 30.7 | 51.0 | 51.3 | 30.4 | 50.3 | 37.1 | 20.5 | 43.7 | 37.3 | 42.9 | 44.2 | 51.1 | 34.1 | 48.7 | 21.7 | 42.1 | 30.9 | 46.4 | 44.3 | 36.3 | 41.2 | 27.7 | 29.0 | 27.3 | 39.8 | 29.1 | 42.4 | 42.6 | 33.0 | 37.5 | 31.2 | 39.5 | 31.4 |
| Nov 14 | 56.3 | 42.0 | 41.1 | 36.1 | 44.6 | 47.7 | 48.9 | 50.7 | 37.9 | 29.8 | 38.9 | 45.5 | 28.7 | 37.1 | 37.2 | 54.9 | 32.1 | 47.1 | 38.3 | 23.3 | 40.8 | 41.6 | 41.7 | 31.4 | 56.2 | 25.1 | 39.0 | 32.7 | 33.0 | 41.6 | 46.3 | 43.0 | 24.5 | 50.4 | 23.7 | 31.2 | 34.2 | 27.1 | 21.3 | 35.8 | 47.7 | 40.3 | 36.1 | 42.6 | 43.6 | 38.4 |
| Nov 15 | 54.9 | 44.9 | 43.7 | 37.4 | 45.4 | 36.8 | 45.2 | 50.3 | 50.3 | 25.7 | 39.9 | 51.9 | 32.7 | 28.7 | 29.2 | 57.3 | 19.7 | 41.2 | 35.0 | 32.9 | 41.9 | 42.6 | 37.0 | 25.2 | 30.0 | 31.8 | 36.6 | 30.4 | 25.1 | 41.8 | 41.8 | 35.8 | 36.1 | 39.1 | 30.5 | 30.6 | 38.9 | 22.4 | 18.5 | 28.1 | 34.4 | 26.4 | 27.9 | 39.7 | 34.3 | 28.5 |
| Nov 16 | 48.5 | 39.3 | 53.1 | 27.9 | 47.3 | 47.4 | 36.3 | 40.8 | 41.9 | 43.3 | 36.6 | 34.4 | 31.7 | 23.1 | 18.9 | 66.0 | 27.7 | 27.1 | 29.7 | 48.3 | 42.8 | 46.3 | 42.8 | 17.7 | 29.1 | 40.8 | 36.6 | 30.7 | 31.0 | 34.3 | 28.2 | 35.7 | 27.2 | 34.2 | 31.9 | 37.2 | 37.0 | 29.2 | 26.7 | 27.3 | 33.4 | 34.4 | 23.7 | 38.9 | 50.3 | 36.8 |
| Nov 17 | 37.7 | 39.5 | 44.7 | 22.1 | 54.9 | 45.0 | 31.9 | 26.3 | 34.7 | 34.5 | 40.6 | 42.8 | 28.5 | 18.3 | 25.8 | 63.5 | 36.7 | 32.3 | 31.2 | 43.4 | 43.2 | 48.8 | 34.2 | 30.3 | 26.1 | 46.5 | 39.1 | 38.2 | 23.8 | 30.5 | 30.3 | 37.0 | 33.1 | 37.5 | 40.8 | 42.7 | 47.1 | 35.0 | 31.6 | 22.8 | 33.9 | 43.8 | 28.9 | 31.3 | 48.1 | 28.0 |
| Nov 18 | 45.1 | 37.8 | 41.1 | 31.4 | 47.4 | 43.6 | 37.1 | 30.8 | 37.7 | 28.3 | 44.1 | 38.1 | 27.2 | 27.7 | 25.8 | 47.0 | 24.6 | 37.7 | 34.4 | 38.3 | 38.8 | 44.3 | 34.5 | 31.9 | 28.8 | 34.8 | 45.8 | 34.9 | 37.1 | 24.7 | 21.2 | 37.0 | 27.5 | 33.7 | 35.4 | 45.0 | 56.3 | 33.8 | 32.3 | 20.7 | 36.1 | 34.5 | 33.1 | 35.8 | 46.1 | 28.8 |
| Nov 19 | 45.6 | 42.3 | 39.8 | 32.1 | 54.5 | 42.3 | 37.5 | 36.2 | 34.3 | 30.7 | 41.4 | 34.3 | 28.5 | 25.3 | 36.6 | 36.0 | 23.2 | 47.3 | 38.7 | 49.6 | 34.2 | 38.8 | 45.4 | 39.1 | 31.1 | 39.4 | 47.6 | 30.1 | 31.3 | 18.1 | 23.3 | 30.8 | 31.3 | 42.3 | 33.1 | 43.8 | 62.7 | 33.8 | 26.3 | 31.7 | 25.9 | 29.4 | 29.4 | 26.3 | 38.2 | 31.6 |
| Nov 20 | 34.0 | 40.2 | 38.8 | 35.2 | 51.9 | 38.4 | 37.5 | 35.1 | 41.4 | 29.1 | 43.3 | 46.5 | 40.5 | 16.1 | 43.0 | 29.7 | 26.9 | 54.0 | 28.2 | 44.4 | 37.3 | 34.9 | 36.6 | 44.0 | 39.3 | 35.9 | 40.7 | 32.9 | 30.0 | 36.1 | 33.2 | 35.7 | 27.3 | 39.9 | 34.2 | 42.9 | 50.4 | 32.4 | 26.8 | 39.6 | 24.8 | 37.4 | 38.6 | 27.8 | 37.8 | 39.1 |
| Nov 21 | 32.8 | 42.3 | 23.2 | 45.0 | 43.9 | 33.7 | 41.3 | 43.3 | 43.4 | 30.1 | 36.9 | 40.1 | 34.6 | 14.6 | 40.0 | 37.8 | 21.2 | 45.0 | 34.3 | 53.3 | 42.5 | 33.1 | 35.6 | 35.6 | 46.4 | 34.8 | 38.7 | 34.9 | 26.9 | 32.2 | 35.1 | 45.0 | 21.9 | 27.6 | 42.6 | 49.5 | 51.5 | 43.3 | 39.9 | 44.7 | 40.2 | 28.0 | 49.1 | 20.9 | 43.9 | 42.3 |
| Nov 22 | 23.8 | 28.7 | 32.7 | 38.2 | 44.3 | 27.8 | 38.3 | 47.5 | 39.0 | 34.1 | 44.0 | 45.2 | 34.8 | 23.9 | 37.3 | 25.9 | 12.6 | 39.3 | 23.3 | 50.6 | 44.0 | 42.9 | 48.2 | 40.4 | 48.1 | 41.5 | 33.9 | 36.8 | 37.1 | 36.7 | 46.2 | 35.6 | 33.9 | 42.7 | 28.9 | 39.0 | 47.0 | 34.4 | 32.6 | 32.8 | 40.2 | 18.5 | 39.1 | 15.4 | 29.0 | 35.8 |
| Nov 23 | 29.9 | 21.9 | 23.6 | 35.5 | 49.6 | 31.2 | 50.2 | 41.6 | 44.6 | 41.7 | 38.8 | 42.5 | 21.8 | 40.9 | 37.4 | 23.0 | 24.8 | 43.0 | 27.4 | 45.2 | 46.7 | 36.8 | 43.9 | 44.3 | 56.3 | 29.3 | 49.6 | 34.5 | 34.6 | 36.9 | 32.9 | 29.0 | 35.9 | 45.1 | 18.3 | 37.5 | 34.9 | 31.5 | 26.2 | 41.9 | 32.7 | 20.9 | 39.0 | 23.3 | 31.7 | 37.8 |
| Nov 24 | 37.3 | 37.9 | 37.1 | 23.7 | 50.0 | 22.5 | 43.9 | 35.6 | 56.0 | 40.6 | 42.4 | 33.1 | 19.1 | 38.0 | 42.7 | 26.7 | 38.4 | 40.4 | 32.0 | 44.8 | 44.8 | 36.5 | 40.7 | 34.8 | 45.3 | 35.8 | 46.2 | 42.3 | 34.5 | 26.3 | 50.6 | 21.4 | 38.5 | 39.4 | 27.8 | 39.0 | 26.0 | 36.2 | 19.8 | 32.6 | 30.6 | 11.9 | 47.8 | 23.9 | 22.8 | 48.7 |
| Nov 25 | 42.7 | 33.4 | 43.8 | 39.7 | 42.9 | 28.2 | 46.7 | 35.7 | 45.1 | 27.1 | 37.6 | 40.9 | 23.4 | 45.1 | 44.4 | 26.1 | 36.4 | 42.3 | 29.3 | 26.3 | 43.4 | 39.4 | 51.7 | 29.7 | 29.2 | 41.6 | 37.5 | 36.9 | 32.2 | 37.4 | 45.6 | 15.6 | 32.1 | 30.8 | 30.6 | 31.7 | 21.7 | 29.1 | 22.2 | 30.5 | 30.9 | 12.9 | 53.2 | 25.6 | 32.4 | 38.9 |
| Nov 26 | 27.9 | 41.6 | 41.4 | 42.7 | 50.2 | 26.5 | 39.7 | 38.0 | 36.0 | 28.6 | 46.2 | 34.2 | 15.3 | 41.0 | 34.5 | 23.0 | 33.5 | 41.9 | 24.6 | 23.4 | 43.9 | 30.3 | 43.5 | 35.7 | 31.1 | 38.3 | 39.8 | 46.5 | 22.8 | 35.6 | 33.0 | 15.5 | 26.7 | 31.8 | 29.8 | 29.6 | 40.5 | 27.4 | 25.0 | 35.8 | 34.1 | 25.3 | 53.4 | 33.7 | 23.6 | 18.1 |
| Nov 27 | 32.9 | 48.3 | 27.8 | 37.7 | 47.4 | 30.8 | 34.0 | 29.9 | 26.7 | 34.5 | 34.4 | 35.5 | 7.4 | 39.9 | 34.8 | 26.5 | 33.1 | 46.4 | 34.8 | 33.0 | 42.0 | 33.8 | 37.3 | 21.8 | 29.0 | 41.5 | 31.8 | 51.6 | 40.0 | 37.5 | 35.0 | 22.9 | 28.3 | 35.4 | 24.7 | 28.5 | 33.9 | 33.9 | 31.3 | 30.4 | 46.0 | 31.1 | 49.4 | 28.9 | 32.2 | 18.4 |
| Nov 28 | 44.6 | 49.4 | 14.9 | 27.6 | 51.9 | 33.4 | 37.9 | 27.8 | 21.4 | 37.4 | 26.0 | 26.2 | 14.5 | 50.0 | 28.7 | 28.8 | 24.6 | 39.8 | 48.5 | 34.9 | 33.7 | 32.4 | 30.7 | 32.0 | 20.4 | 36.4 | 31.2 | 45.1 | 38.8 | 38.7 | 33.3 | 24.5 | 35.5 | 30.9 | 21.0 | 20.4 | 28.0 | 33.6 | 40.9 | 31.2 | 42.4 | 27.4 | 44.8 | 26.5 | 27.0 | 20.2 |
| Nov 29 | 32.2 | 44.8 | 27.2 | 26.5 | 47.4 | 35.7 | 45.8 | 33.8 | 23.7 | 39.5 | 25.5 | 47.2 | 27.6 | 49.3 | 31.7 | 42.0 | 28.3 | 33.1 | 43.1 | 28.4 | 27.6 | 23.4 | 25.9 | 30.6 | 26.3 | 33.7 | 35.7 | 35.4 | 35.8 | 21.8 | 41.4 | 16.0 | 23.4 | 32.0 | 15.4 | 18.7 | 21.0 | 26.7 | 33.4 | 31.5 | 42.7 | 24.8 | 54.4 | 26.8 | 23.7 | 19.9 |
| Nov 30 | 39.3 | 46.3 | 25.9 | 33.9 | 34.9 | 27.1 | 50.3 | 33.9 | 36.6 | 28.6 | 28.0 | 43.4 | 42.2 | 50.3 | 31.6 | 37.9 | 27.1 | 23.7 | 43.9 | 27.0 | 21.6 | 23.1 | 29.6 | 31.1 | 22.0 | 44.1 | 46.7 | 31.3 | 35.3 | 22.8 | 33.8 | 21.2 | 19.2 | 37.6 | 18.8 | 28.4 | 27.3 | 25.5 | 29.0 | 30.2 | 46.0 | 29.2 | 42.4 | 27.9 | 24.3 | 20.7 |
| Dec 1 | 26.6 | 46.6 | 30.3 | 27.1 | 30.2 | 28.8 | 47.9 | 15.3 | 28.5 | 31.4 | 20.1 | 38.1 | 35.8 | 36.0 | 33.3 | 47.3 | 28.9 | 14.9 | 42.5 | 40.8 | 27.7 | 14.2 | 34.2 | 24.6 | 27.7 | 38.3 | 49.4 | 32.9 | 35.5 | 17.5 | 31.2 | 20.7 | 22.2 | 30.9 | 23.2 | 31.6 | 29.0 | 22.7 | 23.7 | 30.7 | 38.1 | 25.5 | 42.3 | 34.8 | 37.9 | 20.2 |
| Dec 2 | 30.3 | 53.6 | 30.9 | 30.7 | 29.4 | 33.2 | 48.7 | 14.4 | 21.5 | 30.9 | 13.6 | 27.1 | 31.2 | 31.9 | 26.7 | 40.8 | 31.2 | 18.7 | 35.0 | 33.8 | 28.9 | 30.5 | 34.6 | 30.3 | 26.9 | 29.7 | 50.9 | 28.5 | 32.0 | 34.3 | 37.1 | 27.0 | 15.4 | 35.9 | 22.3 | 36.3 | 33.7 | 22.2 | 29.1 | 13.4 | 39.7 | 22.2 | 29.7 | 37.6 | 41.0 | 22.5 |
| Dec 3 | 28.1 | 38.3 | 20.7 | 32.5 | 24.2 | 28.4 | 41.6 | 27.8 | 27.4 | 18.9 | 17.4 | 28.3 | 32.9 | 27.6 | 34.8 | 33.3 | 31.3 | 21.5 | 32.5 | 33.5 | 23.3 | 32.8 | 34.7 | 33.0 | 34.5 | 31.3 | 55.2 | 20.5 | 20.6 | 38.0 | 28.8 | 22.5 | 19.9 | 38.3 | 31.1 | 39.4 | 25.3 | 25.8 | 27.6 | 16.8 | 46.0 | 13.8 | 29.1 | 42.3 | 32.6 | 29.4 |
| Dec 4 | 29.2 | 25.5 | 20.2 | 19.6 | 36.1 | 30.4 | 25.1 | 20.4 | 24.4 | 21.6 | 20.5 | 26.3 | 41.5 | 31.1 | 37.9 | 44.0 | 29.7 | 20.3 | 26.2 | 31.4 | 27.1 | 32.1 | 21.6 | 42.7 | 28.9 | 37.1 | 51.6 | 9.3 | 22.2 | 40.7 | 35.6 | 27.0 | 20.1 | 26.7 | 31.9 | 43.0 | 37.5 | 32.6 | 23.1 | 18.3 | 32.9 | 16.4 | 27.9 | 36.2 | 23.5 | 33.6 |
| Dec 5 | 37.4 | 30.0 | 7.1 | 31.8 | 32.7 | 30.3 | 24.1 | 29.9 | 28.4 | 26.7 | 39.3 | 33.4 | 40.4 | 32.4 | 28.9 | 43.2 | 25.0 | 29.7 | 18.6 | 34.3 | 18.3 | 19.2 | 29.0 | 32.3 | 18.7 | 30.2 | 49.7 | 16.5 | 23.3 | 23.3 | 39.8 | 40.5 | 13.3 | 24.9 | 25.9 | 40.7 | 30.6 | 34.4 | 26.5 | 21.9 | 27.2 | 14.9 | 30.5 | 19.4 | 31.9 | 29.8 |
| Dec 6 | 31.4 | 31.5 | 7.8 | 26.2 | 40.0 | 30.4 | 20.6 | 34.0 | 22.0 | 26.7 | 34.9 | 27.0 | 34.7 | 36.6 | 31.5 | 50.2 | 25.4 | 33.7 | 12.7 | 33.7 | 25.2 | 20.0 | 30.2 | 24.8 | 37.1 | 35.5 | 43.8 | 26.7 | 20.1 | 29.2 | 41.7 | 25.6 | 17.4 | 19.0 | 17.0 | 26.4 | 24.3 | 26.7 | 32.8 | 24.3 | 26.4 | 13.5 | 27.8 | 26.7 | 37.5 | 32.9 |
| Dec 7 | 33.3 | 18.7 | 13.2 | 27.2 | 30.8 | 28.2 | 21.8 | 32.2 | 23.6 | 24.2 | 42.1 | 41.1 | 41.9 | 38.1 | 20.2 | 45.0 | 35.2 | 29.9 | 12.5 | 31.3 | 35.0 | 25.0 | 31.2 | 18.7 | 32.2 | 22.3 | 34.2 | 27.9 | 30.1 | 33.2 | 36.4 | 26.5 | 15.9 | 21.8 | 20.5 | 25.1 | 25.9 | 37.2 | 28.3 | 27.4 | 26.6 | 13.3 | 25.0 | 26.2 | 40.3 | 36.9 |
| Dec 8 | 32.3 | 14.1 | 11.9 | 22.1 | 35.1 | 20.0 | 23.8 | 30.6 | 22.2 | 23.0 | 34.0 | 44.8 | 44.2 | 37.2 | 16.7 | 43.1 | 32.3 | 26.6 | 25.2 | 31.9 | 35.9 | 30.4 | 37.8 | 17.1 | 30.3 | 19.6 | 22.2 | 30.2 | 32.0 | 21.5 | 34.9 | 27.3 | 26.2 | 35.2 | 32.8 | 33.2 | 22.0 | 25.9 | 19.7 | 23.1 | 33.3 | 15.0 | 34.7 | 25.5 | 35.5 | 41.9 |
| Dec 9 | 22.9 | 10.7 | 19.0 | 19.3 | 35.7 | 29.6 | 15.6 | 23.6 | 25.6 | 22.6 | 24.6 | 34.8 | 34.8 | 32.2 | 32.0 | 23.5 | 35.8 | 16.9 | 31.8 | 28.6 | 34.8 | 23.5 | 45.1 | 20.6 | 27.8 | 19.6 | 25.6 | 25.8 | 27.1 | 27.3 | 37.1 | 32.8 | 16.0 | 27.3 | 31.9 | 31.6 | 20.5 | 26.7 | 33.4 | 23.3 | 41.6 | 25.0 | 16.1 | 31.7 | 30.7 | 43.4 |
| Dec 10 | 18.8 | 17.5 | 29.7 | 14.5 | 34.6 | 29.2 | 18.6 | 17.8 | 22.6 | 29.3 | 26.5 | 26.5 | 27.2 | 28.9 | 23.9 | 19.2 | 32.4 | 22.2 | 23.4 | 32.9 | 20.6 | 25.5 | 38.1 | 15.5 | 25.2 | 17.7 | 24.2 | 18.3 | 35.7 | 23.6 | 33.5 | 40.3 | 12.9 | 33.6 | 25.0 | 33.7 | 22.7 | 28.5 | 25.9 | 32.0 | 47.0 | 23.9 | 19.8 | 40.7 | 32.3 | 28.0 |
| Dec 11 | 12.6 | 12.1 | 31.4 | 19.3 | 31.4 | 19.8 | 21.0 | 20.0 | 29.2 | 15.7 | 25.7 | 37.2 | 34.2 | 33.6 | 30.4 | 15.6 | 26.9 | 24.2 | 27.5 | 30.7 | 29.7 | 24.7 | 41.2 | 19.8 | 21.1 | 21.9 | 37.5 | 25.0 | 28.1 | 26.5 | 30.7 | 30.2 | 20.3 | 34.4 | 17.6 | 24.7 | 24.0 | 24.7 | 27.9 | 32.9 | 45.8 | 33.2 | 22.6 | 37.5 | 19.7 | 20.6 |
| Dec 12 | 9.5 | 13.2 | 23.6 | 25.5 | 42.5 | 26.1 | 23.9 | 27.8 | 39.1 | 25.3 | 28.3 | 31.1 | 33.7 | 27.2 | 24.4 | 18.5 | 33.5 | 18.8 | 31.9 | 37.4 | 25.0 | 21.8 | 36.1 | 14.6 | 16.9 | 28.4 | 36.8 | 23.9 | 19.0 | 31.5 | 32.1 | 40.7 | 19.1 | 32.0 | 9.9 | 16.9 | 20.2 | 20.9 | 28.5 | 36.0 | 29.0 | 34.7 | 28.9 | 38.1 | 25.8 | 13.4 |
| Dec 13 | 7.8 | 20.0 | 23.4 | 25.9 | 41.8 | 20.3 | 21.1 | 18.9 | 22.6 | 25.0 | 31.7 | 31.8 | 18.2 | 25.7 | 33.8 | 21.3 | 29.5 | 9.1 | 30.1 | 43.2 | 26.4 | 23.7 | 40.0 | 15.2 | 18.6 | 32.1 | 31.3 | 17.1 | 22.1 | 35.0 | 33.7 | 32.9 | 22.3 | 28.2 | 13.2 | 28.4 | 24.2 | 22.6 | 33.1 | 36.4 | 29.5 | 35.0 | 26.9 | 26.2 | 29.2 | 21.6 |
| Dec 14 | 23.5 | 15.1 | 20.3 | 32.3 | 36.3 | 22.7 | 27.8 | 23.1 | 21.3 | 34.1 | 27.6 | 36.0 | 20.8 | 26.3 | 35.1 | 29.1 | 33.6 | 17.4 | 30.4 | 31.6 | 17.7 | 29.7 | 35.6 | 27.5 | 23.7 | 34.5 | 36.4 | 19.0 | 12.6 | 32.2 | 43.9 | 38.0 | 24.3 | 29.7 | 14.5 | 23.2 | 19.4 | 30.5 | 32.2 | 47.4 | 38.1 | 34.3 | 26.5 | 34.8 | 28.7 | 18.1 |
| Dec 15 | 35.3 | 15.9 | 31.0 | 23.0 | 31.4 | 25.2 | 28.4 | 27.6 | 17.7 | 25.1 | 25.2 | 23.8 | 24.2 | 22.6 | 30.1 | 34.1 | 36.6 | 19.4 | 18.3 | 37.6 | 23.6 | 29.3 | 37.2 | 32.4 | 23.7 | 39.5 | 28.4 | 18.9 | 15.5 | 46.1 | 48.0 | 39.5 | 23.4 | 33.7 | 14.0 | 27.1 | 20.3 | 26.9 | 20.0 | 43.8 | 42.5 | 22.8 | 17.8 | 22.8 | 30.8 | 36.3 |
| Dec 16 | 40.7 | 30.0 | 22.2 | 17.5 | 28.5 | 24.6 | 27.4 | 15.2 | 26.7 | 30.2 | 28.2 | 25.2 | 20.2 | 25.2 | 26.6 | 26.9 | 39.0 | 22.4 | 19.0 | 27.6 | 25.9 | 29.4 | 29.2 | 23.5 | 18.5 | 34.9 | 25.5 | 18.4 | 25.0 | 43.4 | 35.5 | 42.0 | 17.0 | 28.1 | 22.3 | 17.7 | 33.6 | 27.8 | 8.1 | 44.9 | 32.5 | 23.5 | 20.4 | 28.8 | 39.9 | 29.0 |
| Dec 17 | 22.7 | 20.2 | 21.4 | 17.2 | 36.8 | 17.7 | 29.6 | 10.2 | 21.6 | 27.7 | 22.9 | 27.4 | 27.4 | 29.1 | 16.4 | 15.4 | 30.8 | 15.9 | 18.0 | 32.4 | 35.2 | 27.6 | 34.5 | 28.9 | 19.6 | 22.0 | 31.9 | 13.2 | 28.6 | 35.6 | 29.3 | 45.5 | 16.7 | 36.5 | 8.5 | 18.3 | 28.0 | 26.5 | 13.4 | 48.4 | 22.3 | 25.6 | 31.3 | 27.1 | 34.5 | 24.9 |
| Dec 18 | 21.3 | 12.9 | 20.3 | 18.5 | 24.5 | 25.4 | 36.0 | 12.0 | 23.0 | 23.7 | 14.7 | 21.3 | 23.5 | 19.5 | 26.1 | 21.0 | 26.2 | 19.9 | 18.9 | 24.2 | 26.7 | 20.5 | 33.3 | 24.3 | 12.1 | 12.9 | 29.5 | 15.8 | 20.7 | 38.1 | 29.0 | 38.4 | 27.0 | 43.7 | 22.6 | 29.0 | 22.4 | 26.9 | 20.9 | 47.5 | 27.3 | 36.2 | 25.7 | 35.1 | 43.1 | 23.8 |
| Dec 19 | 9.9 | 20.7 | 23.1 | 14.1 | 20.9 | 16.1 | 42.8 | 2.5 | 29.0 | 28.1 | 19.5 | 38.2 | 21.9 | 17.2 | 35.9 | 17.3 | 16.0 | 30.1 | 18.3 | 30.7 | 17.6 | 20.4 | 22.3 | 37.1 | 17.7 | 14.9 | 31.0 | 30.1 | 16.4 | 38.6 | 32.8 | 35.0 | 28.3 | 26.2 | 21.5 | 35.6 | 29.0 | 40.0 | 24.7 | 30.1 | 28.6 | 44.0 | 27.6 | 45.1 | 40.7 | 17.3 |
| Dec 20 | 13.3 | 18.3 | 27.0 | 13.1 | 26.1 | 30.0 | 32.1 | 7.1 | 38.7 | 23.0 | 30.0 | 44.2 | 23.4 | 19.4 | 31.0 | 22.8 | 29.3 | 27.7 | 15.1 | 35.7 | 20.4 | 22.5 | 24.6 | 23.0 | 20.7 | 17.6 | 46.0 | 35.9 | 30.3 | 40.4 | 33.4 | 29.4 | 29.7 | 18.4 | 32.4 | 39.3 | 21.7 | 40.4 | 32.3 | 32.6 | 29.6 | 40.1 | 32.3 | 28.6 | 37.4 | 28.3 |
| Dec 21 | 27.9 | 28.1 | 27.5 | 21.1 | 16.2 | 22.4 | 30.7 | 25.5 | 25.0 | 13.0 | 30.2 | 29.0 | 18.1 | 22.2 | 37.3 | 15.6 | 34.4 | 24.0 | 26.5 | 35.7 | 21.3 | 18.1 | 18.3 | 16.9 | 19.9 | 19.6 | 39.8 | 29.4 | 27.6 | 31.7 | 31.2 | 27.5 | 23.1 | 16.2 | 25.8 | 38.2 | 31.5 | 47.4 | 24.8 | 27.8 | 29.3 | 31.6 | 29.4 | 20.1 | 39.0 | 33.2 |
| Dec 22 | 36.4 | 32.2 | 29.0 | 41.8 | 19.6 | 17.3 | 30.6 | 13.6 | 28.8 | 19.8 | 25.6 | 31.8 | 21.0 | 21.2 | 29.3 | 17.3 | 28.2 | 38.1 | 32.8 | 36.0 | 32.4 | 24.6 | 28.7 | 19.4 | 14.0 | 26.9 | 34.0 | 28.6 | 17.1 | 32.7 | 28.1 | 23.5 | 27.4 | 27.0 | 32.2 | 35.7 | 32.1 | 36.5 | 27.5 | 34.8 | 28.4 | 29.9 | 29.0 | 26.0 | 37.2 | 30.6 |
| Dec 23 | 42.8 | 29.4 | 34.3 | 34.8 | 24.2 | 17.8 | 26.0 | 19.2 | 25.4 | 18.1 | 18.4 | 29.8 | 23.0 | 27.5 | 17.7 | 18.7 | 21.4 | 41.0 | 36.5 | 31.1 | 33.0 | 24.8 | 37.2 | 14.6 | 11.5 | 33.2 | 25.3 | 25.8 | 28.2 | 34.8 | 27.1 | 34.5 | 20.4 | 22.4 | 30.1 | 42.0 | 13.7 | 30.6 | 28.3 | 23.5 | 22.5 | 20.9 | 24.6 | 31.4 | 39.6 | 25.6 |
| Dec 24 | 41.5 | 26.1 | 36.2 | 39.9 | 22.7 | 19.9 | 34.8 | 20.1 | 15.8 | 12.6 | 20.0 | 23.6 | 18.6 | 29.1 | 23.5 | 26.3 | 29.2 | 38.7 | 31.5 | 21.3 | 30.7 | 26.7 | 26.8 | 25.5 | 4.8 | 31.9 | 37.5 | 24.3 | 24.8 | 25.7 | 25.1 | 28.3 | 11.5 | 26.9 | 24.9 | 34.6 | 22.4 | 26.5 | 18.4 | 31.5 | 22.2 | 14.3 | 28.4 | 22.3 | 37.9 | 26.4 |
| Dec 25 | 39.3 | 20.1 | 37.5 | 31.9 | 27.8 | 30.0 | 38.0 | 19.2 | 14.1 | 15.0 | 19.0 | 15.1 | 25.0 | 26.1 | 23.0 | 25.2 | 21.0 | 28.3 | 32.9 | 27.0 | 25.9 | 17.2 | 28.7 | 27.3 | 18.3 | 22.5 | 32.0 | 17.5 | 33.7 | 34.4 | 25.3 | 23.2 | 18.0 | 29.1 | 15.2 | 41.6 | 24.5 | 27.8 | 27.8 | 29.4 | 29.9 | 18.5 | 31.0 | 18.4 | 39.0 | 31.9 |
| Dec 26 | 38.7 | 12.8 | 14.3 | 30.5 | 22.5 | 29.8 | 36.5 | 26.0 | 4.2 | 13.3 | 19.7 | 18.1 | 33.6 | 26.2 | 17.8 | 30.0 | 20.9 | 34.4 | 27.7 | 20.9 | 27.7 | 19.6 | 30.4 | 37.2 | 29.2 | 34.7 | 30.7 | 28.1 | 25.5 | 29.0 | 27.9 | 19.1 | 22.1 | 24.0 | 19.7 | 29.7 | 27.9 | 29.6 | 21.9 | 30.0 | 25.0 | 19.0 | 39.9 | 11.9 | 38.4 | 31.8 |
| Dec 27 | 47.8 | 6.0 | 18.4 | 30.4 | 26.6 | 27.7 | 26.0 | 30.5 | 5.9 | 18.6 | 21.5 | 26.1 | 30.7 | 23.3 | 22.5 | 37.7 | 12.0 | 30.3 | 27.4 | 19.8 | 34.9 | 23.7 | 30.0 | 44.1 | 27.3 | 22.0 | 26.3 | 36.3 | 17.1 | 24.1 | 25.7 | 13.6 | 27.3 | 23.4 | 36.3 | 17.1 | 28.8 | 19.2 | 31.2 | 23.0 | 20.4 | 22.6 | 28.5 | 17.6 | 25.7 | 29.3 |
| Dec 28 | 43.2 | 18.1 | 13.2 | 24.3 | 30.4 | 25.0 | 21.8 | 31.8 | 5.8 | 19.7 | 19.3 | 14.2 | 35.1 | 17.6 | 26.0 | 37.0 | 21.1 | 28.5 | 26.0 | 16.4 | 37.5 | 20.6 | 27.0 | 41.2 | 25.6 | 30.5 | 21.3 | 23.5 | 25.0 | 18.9 | 23.1 | 22.1 | 25.6 | 28.8 | 34.9 | 12.4 | 18.8 | 29.3 | 30.0 | 17.2 | 21.4 | 25.1 | 20.3 | 24.9 | 27.1 | 26.8 |
| Dec 29 | 43.7 | 32.1 | 14.3 | 24.1 | 23.1 | 30.0 | 21.2 | 30.2 | 15.2 | 28.0 | 18.5 | 17.1 | 29.6 | 13.9 | 33.5 | 30.1 | 27.9 | 31.9 | 20.6 | 36.5 | 30.3 | 11.5 | 25.8 | 34.3 | 21.1 | 37.1 | 24.7 | 22.2 | 19.4 | 26.8 | 20.5 | 29.7 | 30.8 | 27.5 | 33.5 | 6.8 | 18.3 | 21.5 | 30.1 | 11.6 | 16.8 | 27.3 | 18.2 | 22.4 | 14.4 | 31.2 |
| Dec 30 | 28.5 | 33.4 | 18.6 | 22.6 | 35.5 | 24.3 | 25.9 | 32.5 | 26.1 | 33.9 | 23.7 | 17.5 | 25.4 | 13.4 | 33.3 | 23.1 | 27.5 | 22.1 | 11.1 | 35.6 | 26.5 | 20.2 | 29.1 | 28.2 | 27.8 | 45.2 | 29.0 | 15.9 | 26.6 | 24.2 | 27.5 | 31.1 | 30.3 | 27.1 | 36.7 | 15.6 | 14.3 | 25.7 | 22.5 | 9.1 | 25.8 | 33.8 | 16.9 | 22.9 | 15.9 | 24.2 |
| Dec 31 | 0.0 | 0.0 | 0.0 | 25.5 | 25.5 | 25.5 | 25.5 | 27.5 | 27.5 | 27.5 | 27.5 | 15.0 | 15.0 | 15.0 | 15.0 | 28.9 | 28.9 | 28.9 | 28.9 | 33.4 | 33.4 | 33.4 | 33.4 | 28.6 | 28.6 | 28.6 | 28.6 | 23.8 | 23.8 | 23.8 | 23.8 | 35.4 | 35.4 | 35.4 | 35.4 | 15.7 | 15.7 | 15.7 | 15.7 | 15.8 | 15.8 | 15.8 | 15.8 | 22.1 | 22.1 | 22.1 |
| Mean | 34.6 | 51.5 | 50.6 | 51.4 | 51.5 | 51.3 | 51.5 | 52.5 | 51.6 | 51.9 | 51.9 | 50.8 | 52.1 | 50.8 | 52.6 | 51.5 | 52.5 | 51.7 | 50.6 | 52.3 | 52.7 | 51.6 | 51.9 | 50.7 | 50.9 | 52.8 | 52.7 | 49.1 | 51.8 | 51.3 | 50.1 | 52.0 | 50.4 | 51.9 | 51.6 | 52.4 | 52.1 | 51.9 | 49.7 | 52.0 | 52.6 | 51.5 | 53.6 | 51.2 | 53.1 | 51.7 |
| Min | 7.8 | 6.0 | 7.1 | 9.1 | 10.4 | 11.1 | 15.6 | 2.5 | 4.2 | 12.6 | 13.6 | 11.2 | 7.4 | 13.4 | 15.0 | 13.5 | 12.0 | 9.1 | 11.1 | 13.2 | 17.6 | 11.5 | 17.1 | 12.3 | 4.8 | 12.9 | 7.1 | 9.3 | 7.9 | 14.1 | 7.1 | 13.6 | 11.5 | 14.6 | 8.5 | 6.8 | 13.7 | 13.8 | 8.1 | 9.1 | 15.8 | 11.9 | 15.8 | 11.9 | 11.6 | 13.4 |
| Max | 90.4 | 91.1 | 88.5 | 87.6 | 88.5 | 87.9 | 87.0 | 88.3 | 90.2 | 86.2 | 86.6 | 95.1 | 87.6 | 87.6 | 91.5 | 86.3 | 86.9 | 87.9 | 85.7 | 89.0 | 88.3 | 91.2 | 87.0 | 88.0 | 90.6 | 87.8 | 90.1 | 89.6 | 92.4 | 87.3 | 85.0 | 91.4 | 91.0 | 88.5 | 91.2 | 88.5 | 88.2 | 87.2 | 88.2 | 90.6 | 85.6 | 88.5 | 89.2 | 87.3 | 91.5 | 89.3 |

### TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

| YEAR-> | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1 | 32.7 | 31.2 | 15.5 | 37.2 | 21.8 | 30.5 | 30.7 | 24.5 | 31.2 | 35.9 | 28.7 | 34.6 | 37.1 | 23.2 | 20.1 | 38.3 | 43.1 | 26.3 | 23.6 | 25.7 | 37.2 | 32.3 | 29.5 | 23.8 | 30.4 | 17.6 | 20.8 | 27.0 | 37.2 | 21.8 | 28.5 | 38.7 | 30.1 | 25.4 | 23.9 | 25.6 | 35.0 | 49.0 | 33.4 | 18.6 | 26.9 | 16.6 | 35.4 | 41.2 | 22.8 | 16.3 |
| Jan 2 | 33.3 | 26.3 | 21.3 | 34.5 | 36.5 | 29.2 | 27.4 | 26.0 | 26.5 | 30.1 | 26.1 | 27.5 | 39.5 | 29.8 | 17.6 | 31.5 | 46.5 | 24.9 | 28.7 | 33.8 | 41.5 | 25.7 | 26.6 | 16.5 | 31.8 | 27.0 | 29.9 | 28.0 | 32.0 | 15.5 | 26.1 | 41.5 | 20.6 | 30.6 | 28.3 | 38.1 | 32.0 | 47.7 | 33.0 | 19.1 | 24.5 | 33.1 | 25.8 | 42.0 | 32.9 | 16.8 |
| Jan 3 | 36.6 | 28.0 | 27.5 | 31.9 | 33.9 | 37.8 | 31.0 | 32.2 | 22.6 | 16.8 | 25.6 | 24.0 | 42.2 | 28.2 | 18.8 | 20.9 | 47.8 | 31.5 | 28.9 | 39.0 | 35.3 | 27.8 | 33.9 | 24.3 | 36.9 | 26.9 | 20.4 | 28.3 | 24.4 | 19.0 | 33.8 | 36.4 | 31.4 | 34.2 | 28.9 | 34.2 | 26.1 | 52.1 | 39.5 | 24.0 | 39.8 | 35.3 | 23.8 | 40.5 | 32.2 | 28.3 |
| Jan 4 | 36.1 | 41.5 | 15.6 | 29.8 | 31.6 | 28.3 | 35.9 | 37.9 | 34.1 | 20.9 | 22.5 | 25.0 | 34.2 | 24.7 | 28.6 | 33.7 | 35.4 | 35.0 | 19.9 | 33.2 | 37.9 | 28.4 | 38.3 | 32.6 | 32.2 | 29.6 | 17.1 | 29.9 | 40.2 | 26.3 | 44.0 | 38.9 | 28.4 | 39.9 | 30.7 | 18.7 | 30.2 | 40.0 | 33.4 | 19.1 | 33.4 | 34.2 | 34.4 | 26.6 | 36.9 | 27.5 |
| Jan 5 | 35.0 | 42.1 | 18.4 | 31.8 | 32.0 | 38.5 | 28.8 | 31.8 | 28.6 | 26.0 | 35.4 | 19.1 | 27.1 | 28.1 | 22.4 | 25.9 | 35.3 | 38.5 | 24.9 | 34.6 | 37.5 | 23.8 | 26.6 | 21.5 | 27.9 | 37.9 | 22.8 | 24.2 | 34.9 | 22.9 | 37.3 | 39.0 | 32.3 | 37.2 | 24.8 | 17.5 | 27.3 | 32.2 | 30.0 | 28.8 | 31.9 | 36.1 | 35.5 | 27.6 | 32.1 | 32.6 |
| Jan 6 | 38.6 | 44.4 | 8.2 | 34.8 | 34.1 | 41.5 | 35.1 | 30.9 | 25.4 | 34.3 | 30.9 | 20.5 | 21.6 | 26.6 | 25.2 | 25.7 | 25.6 | 41.0 | 23.8 | 25.7 | 38.7 | 29.1 | 27.3 | 19.4 | 24.7 | 35.6 | 22.3 | 21.5 | 42.6 | 21.5 | 26.7 | 42.7 | 37.8 | 30.2 | 19.0 | 15.0 | 16.6 | 25.2 | 32.0 | 22.4 | 37.3 | 32.2 | 41.1 | 29.6 | 29.2 | 27.5 |
| Jan 7 | 26.8 | 35.1 | 8.9 | 18.5 | 37.4 | 41.2 | 32.7 | 31.2 | 27.0 | 16.1 | 23.3 | 23.6 | 26.5 | 18.2 | 27.1 | 34.1 | 19.0 | 41.6 | 36.7 | 22.0 | 36.1 | 22.6 | 27.4 | 23.3 | 22.1 | 39.8 | 25.7 | 28.8 | 29.2 | 28.6 | 32.7 | 37.0 | 27.8 | 32.2 | 19.6 | 11.6 | 16.8 | 26.5 | 22.6 | 20.1 | 40.2 | 27.9 | 34.8 | 29.4 | 31.4 | 32.8 |
| Jan 8 | 34.5 | 25.8 | 16.7 | 16.6 | 34.5 | 31.9 | 33.1 | 30.9 | 25.9 | 25.9 | 31.7 | 24.6 | 35.0 | 21.5 | 21.6 | 28.6 | 16.5 | 39.2 | 31.3 | 22.6 | 34.5 | 23.1 | 29.2 | 19.5 | 30.6 | 28.8 | 25.2 | 30.3 | 23.3 | 29.6 | 28.8 | 28.7 | 31.0 | 34.0 | 21.5 | 14.4 | 19.5 | 35.0 | 17.1 | 27.1 | 31.0 | 33.4 | 30.1 | 25.7 | 16.4 | 25.2 |
| Jan 9 | 41.7 | 26.0 | 30.6 | 23.4 | 35.2 | 37.9 | 27.4 | 29.0 | 26.6 | 19.5 | 29.2 | 21.1 | 28.8 | 21.4 | 21.7 | 23.2 | 17.0 | 29.9 | 33.4 | 20.6 | 40.5 | 23.4 | 30.8 | 22.8 | 25.0 | 38.1 | 23.8 | 29.5 | 20.7 | 28.3 | 31.7 | 19.6 | 25.7 | 33.8 | 21.9 | 14.8 | 27.5 | 35.1 | 25.1 | 23.5 | 34.0 | 23.7 | 31.7 | 26.1 | 13.6 | 41.5 |
| Jan 10 | 28.3 | 21.0 | 23.7 | 22.2 | 39.1 | 34.7 | 31.3 | 25.1 | 28.6 | 29.6 | 33.0 | 22.9 | 26.6 | 34.6 | 17.0 | 25.8 | 18.9 | 28.7 | 36.6 | 31.1 | 29.0 | 23.3 | 26.2 | 34.3 | 24.5 | 42.0 | 16.3 | 28.3 | 20.3 | 22.3 | 22.8 | 26.1 | 22.7 | 35.4 | 24.4 | 8.2 | 14.9 | 32.4 | 35.4 | 29.1 | 39.9 | 29.3 | 30.0 | 33.4 | 19.5 | 39.8 |
| Jan 11 | 28.9 | 33.3 | 30.8 | 28.3 | 40.3 | 27.3 | 36.3 | 26.5 | 21.3 | 33.6 | 41.0 | 29.5 | 28.1 | 33.4 | 18.0 | 25.0 | 10.9 | 28.6 | 34.4 | 32.6 | 27.7 | 24.2 | 23.1 | 43.2 | 20.1 | 33.7 | 26.3 | 26.1 | 29.3 | 29.4 | 24.7 | 20.5 | 28.8 | 32.5 | 13.8 | 8.8 | 19.8 | 31.7 | 33.4 | 34.9 | 28.3 | 30.3 | 34.5 | 39.4 | 19.8 | 31.2 |
| Jan 12 | 38.8 | 30.1 | 35.8 | 20.2 | 40.4 | 40.2 | 42.7 | 26.8 | 24.4 | 40.6 | 37.6 | 37.7 | 26.8 | 32.8 | 24.4 | 27.0 | 24.5 | 22.0 | 37.8 | 38.2 | 31.4 | 22.2 | 34.0 | 35.9 | 13.8 | 31.5 | 26.4 | 30.4 | 25.7 | 19.9 | 26.2 | 17.0 | 25.7 | 24.5 | 24.8 | 19.9 | 26.2 | 33.4 | 30.2 | 23.7 | 38.6 | 35.2 | 31.0 | 38.5 | 28.0 | 37.2 |
| Jan 13 | 37.0 | 26.1 | 36.2 | 14.4 | 34.9 | 27.2 | 28.2 | 14.0 | 17.4 | 43.1 | 36.5 | 24.5 | 17.9 | 31.4 | 19.6 | 39.6 | 32.5 | 31.0 | 34.9 | 37.5 | 37.3 | 28.2 | 32.9 | 46.8 | 25.1 | 39.1 | 26.4 | 32.3 | 23.6 | 23.0 | 31.5 | 15.2 | 24.5 | 22.5 | 27.4 | 24.2 | 30.1 | 36.7 | 36.0 | 30.3 | 31.3 | 31.3 | 26.6 | 40.8 | 23.6 | 27.7 |
| Jan 14 | 31.1 | 20.2 | 30.4 | 21.6 | 25.1 | 33.2 | 42.2 | 20.2 | 27.5 | 38.2 | 29.1 | 32.0 | 32.1 | 35.8 | 16.1 | 27.4 | 30.9 | 39.4 | 37.8 | 28.9 | 39.8 | 41.6 | 26.4 | 40.3 | 16.4 | 43.5 | 20.3 | 24.0 | 26.4 | 23.7 | 28.0 | 19.0 | 23.3 | 30.8 | 32.5 | 28.6 | 31.0 | 45.0 | 37.8 | 19.9 | 27.0 | 25.5 | 24.5 | 45.5 | 26.9 | 33.4 |
| Jan 15 | 22.1 | 26.2 | 28.7 | 14.5 | 18.9 | 34.4 | 23.3 | 28.6 | 22.9 | 33.5 | 37.3 | 34.8 | 33.1 | 35.6 | 20.3 | 29.3 | 30.4 | 31.6 | 41.4 | 36.1 | 30.5 | 36.5 | 38.6 | 43.0 | 28.8 | 39.8 | 28.7 | 29.8 | 24.4 | 26.4 | 31.5 | 33.7 | 33.6 | 30.4 | 20.9 | 24.3 | 23.8 | 31.5 | 44.5 | 16.0 | 27.1 | 31.5 | 18.8 | 39.4 | 22.5 | 37.5 |
| Jan 16 | 21.2 | 27.8 | 26.2 | 20.5 | 20.6 | 35.9 | 32.0 | 32.8 | 14.2 | 36.7 | 34.3 | 38.9 | 22.8 | 35.7 | 24.8 | 41.6 | 22.3 | 36.1 | 27.2 | 30.3 | 26.3 | 30.3 | 38.7 | 42.5 | 25.3 | 35.5 | 35.8 | 22.8 | 34.2 | 26.7 | 35.2 | 40.2 | 30.6 | 34.0 | 22.5 | 20.1 | 18.3 | 34.0 | 43.6 | 11.6 | 23.8 | 18.8 | 27.8 | 27.0 | 20.9 | 28.9 |
| Jan 17 | 14.9 | 32.9 | 30.2 | 25.8 | 17.8 | 37.9 | 32.0 | 32.6 | 21.9 | 23.7 | 39.3 | 28.5 | 22.0 | 28.4 | 42.6 | 40.7 | 33.1 | 35.8 | 30.9 | 19.7 | 29.6 | 24.5 | 40.9 | 45.1 | 31.0 | 32.5 | 29.7 | 26.0 | 35.2 | 31.2 | 38.9 | 42.4 | 31.2 | 34.7 | 27.3 | 20.0 | 20.9 | 24.7 | 31.4 | 29.8 | 28.2 | 20.9 | 31.6 | 30.6 | 18.0 | 21.5 |
| Jan 18 | 9.4 | 34.6 | 28.5 | 26.6 | 25.8 | 39.5 | 33.4 | 33.5 | 22.0 | 23.4 | 46.7 | 32.5 | 20.7 | 26.7 | 34.7 | 33.8 | 30.9 | 29.6 | 29.2 | 21.2 | 32.4 | 35.2 | 28.0 | 31.8 | 27.2 | 39.6 | 41.2 | 21.7 | 28.1 | 29.0 | 34.9 | 44.6 | 33.5 | 33.6 | 36.3 | 13.4 | 31.9 | 30.6 | 24.6 | 30.8 | 27.7 | 15.0 | 22.1 | 30.3 | 24.6 | 20.9 |
| Jan 19 | 22.2 | 34.8 | 26.3 | 31.9 | 19.0 | 26.2 | 28.7 | 38.3 | 26.8 | 27.2 | 44.6 | 36.7 | 34.3 | 29.5 | 19.1 | 37.0 | 26.8 | 25.0 | 23.7 | 21.4 | 19.2 | 35.8 | 24.0 | 29.9 | 23.1 | 25.6 | 37.4 | 24.5 | 27.5 | 23.5 | 30.3 | 28.2 | 28.7 | 36.4 | 25.8 | 22.4 | 23.7 | 22.2 | 14.0 | 21.6 | 34.3 | 31.6 | 17.4 | 24.8 | 24.9 | 22.4 |
| Jan 20 | 16.5 | 23.9 | 30.4 | 37.2 | 20.1 | 19.2 | 24.9 | 40.9 | 32.3 | 26.4 | 43.2 | 40.8 | 34.9 | 30.5 | 26.0 | 33.6 | 28.9 | 10.2 | 32.4 | 28.4 | 18.4 | 33.2 | 24.0 | 29.0 | 23.5 | 27.0 | 35.1 | 22.9 | 25.4 | 32.3 | 34.3 | 28.6 | 35.3 | 29.6 | 37.5 | 27.4 | 28.5 | 29.0 | 18.7 | 27.3 | 33.6 | 25.3 | 21.9 | 22.5 | 28.8 | 26.5 |
| Jan 21 | 23.0 | 18.7 | 30.2 | 31.9 | 8.9 | 28.5 | 31.5 | 35.9 | 29.6 | 25.5 | 33.6 | 20.1 | 39.4 | 20.5 | 26.2 | 33.4 | 33.6 | 13.8 | 35.5 | 33.2 | 17.9 | 19.3 | 33.0 | 23.0 | 18.4 | 21.3 | 35.5 | 15.6 | 33.1 | 32.1 | 32.0 | 25.7 | 40.7 | 25.3 | 26.4 | 27.5 | 32.6 | 22.8 | 23.4 | 22.9 | 33.7 | 26.1 | 24.8 | 26.7 | 24.6 | 32.3 |
| Jan 22 | 17.9 | 20.8 | 39.3 | 36.0 | 10.1 | 32.3 | 23.3 | 34.7 | 28.0 | 26.5 | 32.9 | 33.2 | 30.8 | 24.6 | 27.6 | 35.1 | 35.7 | 25.8 | 35.2 | 33.6 | 16.4 | 22.4 | 29.1 | 28.5 | 30.3 | 29.6 | 38.4 | 26.8 | 35.3 | 34.9 | 19.9 | 23.5 | 42.5 | 29.9 | 28.1 | 17.0 | 34.3 | 15.7 | 20.2 | 18.9 | 29.3 | 21.5 | 33.2 | 33.3 | 28.5 | 35.3 |
| Jan 23 | 21.3 | 18.8 | 47.9 | 34.3 | 21.7 | 29.9 | 19.3 | 40.4 | 32.2 | 31.4 | 25.0 | 31.2 | 32.8 | 27.8 | 23.9 | 36.9 | 22.0 | 29.4 | 32.6 | 30.8 | 21.9 | 18.5 | 38.3 | 36.9 | 30.9 | 35.0 | 30.9 | 30.0 | 35.7 | 33.9 | 29.6 | 22.9 | 36.0 | 32.8 | 30.8 | 17.3 | 25.8 | 26.7 | 29.8 | 24.2 | 29.8 | 16.2 | 38.2 | 43.5 | 35.9 | 27.6 |
| Jan 24 | 23.6 | 19.9 | 42.4 | 24.5 | 25.0 | 33.3 | 30.6 | 34.4 | 26.8 | 24.5 | 19.0 | 24.8 | 22.3 | 20.7 | 22.3 | 27.3 | 25.7 | 29.3 | 41.0 | 38.1 | 10.7 | 26.6 | 36.7 | 45.0 | 33.1 | 35.6 | 20.4 | 29.0 | 32.0 | 31.6 | 31.1 | 25.8 | 31.6 | 44.7 | 29.8 | 18.8 | 17.4 | 20.3 | 33.6 | 23.9 | 28.7 | 15.4 | 30.8 | 35.0 | 36.0 | 28.4 |
| Jan 25 | 35.5 | 30.8 | 38.3 | 29.2 | 20.6 | 34.1 | 20.6 | 39.7 | 21.4 | 35.3 | 22.7 | 23.5 | 16.1 | 20.1 | 39.5 | 30.8 | 21.7 | 32.7 | 49.9 | 31.3 | 23.6 | 23.2 | 35.9 | 43.2 | 33.8 | 26.8 | 16.4 | 19.6 | 28.8 | 34.1 | 39.4 | 27.5 | 25.8 | 39.4 | 31.4 | 9.6 | 25.6 | 21.0 | 25.3 | 26.1 | 22.9 | 21.4 | 32.6 | 30.7 | 31.9 | 19.1 |
| Jan 26 | 35.0 | 40.8 | 31.8 | 35.0 | 16.9 | 23.9 | 19.2 | 31.3 | 13.1 | 40.7 | 28.6 | 26.4 | 20.5 | 14.6 | 45.3 | 35.5 | 28.3 | 25.8 | 44.0 | 29.2 | 26.5 | 17.3 | 21.6 | 37.6 | 27.9 | 40.0 | 12.1 | 15.4 | 29.5 | 33.0 | 41.0 | 29.1 | 22.1 | 25.4 | 30.4 | 24.2 | 28.7 | 29.7 | 30.3 | 32.8 | 21.6 | 17.9 | 37.0 | 29.4 | 40.8 | 16.6 |
| Jan 27 | 31.3 | 37.3 | 26.0 | 29.0 | 24.0 | 26.0 | 22.5 | 23.4 | 15.5 | 29.2 | 27.4 | 27.2 | 16.3 | 18.4 | 46.8 | 30.5 | 24.8 | 30.9 | 45.0 | 20.3 | 22.8 | 25.0 | 25.5 | 38.1 | 33.9 | 33.8 | 14.4 | 12.5 | 32.8 | 35.7 | 35.7 | 31.1 | 24.5 | 25.3 | 29.3 | 21.1 | 25.6 | 35.6 | 27.0 | 35.3 | 32.0 | 23.6 | 40.3 | 17.3 | 46.6 | 12.1 |
| Jan 28 | 26.3 | 41.6 | 27.3 | 26.2 | 29.5 | 32.8 | 20.1 | 34.0 | 17.5 | 22.6 | 33.8 | 27.7 | 13.8 | 26.6 | 32.5 | 32.4 | 14.7 | 26.0 | 29.8 | 24.7 | 18.6 | 13.2 | 21.7 | 39.9 | 29.5 | 34.4 | 13.8 | 17.1 | 41.7 | 26.7 | 37.3 | 31.1 | 32.2 | 25.0 | 29.9 | 19.2 | 27.0 | 24.6 | 23.0 | 35.3 | 24.6 | 19.9 | 37.2 | 28.5 | 31.7 | 17.8 |
| Jan 29 | 25.1 | 41.7 | 36.8 | 26.4 | 28.7 | 22.8 | 27.0 | 33.4 | 22.5 | 33.1 | 38.6 | 27.7 | 18.5 | 19.8 | 36.7 | 37.7 | 16.2 | 25.2 | 22.6 | 24.1 | 11.6 | 21.8 | 35.0 | 34.1 | 24.8 | 45.5 | 21.7 | 23.3 | 35.1 | 24.8 | 29.1 | 32.1 | 40.9 | 19.0 | 24.7 | 25.9 | 30.8 | 33.2 | 18.6 | 35.1 | 20.4 | 14.1 | 31.3 | 34.4 | 34.7 | 13.5 |
| Jan 30 | 23.8 | 32.8 | 29.4 | 34.1 | 35.5 | 16.9 | 19.8 | 21.2 | 24.8 | 34.6 | 35.9 | 25.5 | 21.4 | 20.2 | 28.6 | 30.3 | 19.6 | 17.6 | 19.8 | 23.7 | 9.0 | 35.7 | 31.2 | 37.6 | 25.5 | 45.5 | 18.7 | 28.6 | 33.6 | 16.8 | 31.7 | 30.4 | 34.2 | 13.8 | 14.6 | 28.1 | 22.9 | 22.3 | 25.1 | 28.5 | 25.3 | 21.7 | 38.5 | 24.7 | 34.3 | 17.9 |
| Jan 31 | 31.3 | 29.3 | 33.2 | 38.2 | 41.9 | 26.4 | 26.0 | 18.6 | 22.0 | 37.5 | 29.4 | 22.4 | 22.4 | 29.0 | 36.2 | 26.6 | 22.3 | 23.5 | 21.0 | 34.7 | 18.8 | 23.3 | 22.9 | 29.5 | 23.2 | 38.1 | 19.2 | 32.1 | 33.0 | 24.1 | 33.9 | 23.5 | 40.6 | 15.6 | 19.4 | 25.2 | 19.1 | 27.1 | 21.0 | 36.3 | 26.7 | 23.0 | 43.6 | 36.0 | 29.7 | 13.6 |
| Feb 1 | 26.1 | 38.6 | 42.2 | 29.2 | 38.5 | 27.2 | 32.3 | 19.1 | 23.6 | 31.2 | 31.1 | 25.3 | 25.3 | 23.8 | 23.5 | 32.9 | 30.0 | 27.2 | 28.2 | 29.8 | 35.6 | 25.9 | 31.4 | 25.4 | 20.8 | 22.2 | 20.9 | 33.8 | 31.9 | 21.9 | 34.1 | 22.0 | 37.1 | 13.4 | 27.9 | 28.4 | 17.6 | 22.4 | 26.4 | 44.0 | 32.7 | 18.2 | 44.2 | 28.4 | 28.6 | 19.9 |
| Feb 2 | 31.3 | 41.1 | 30.5 | 30.9 | 37.4 | 35.1 | 29.5 | 16.3 | 29.9 | 23.5 | 31.8 | 22.1 | 24.1 | 24.9 | 20.3 | 25.2 | 26.8 | 20.0 | 34.8 | 23.7 | 26.5 | 27.4 | 40.4 | 18.9 | 18.1 | 34.3 | 29.2 | 34.4 | 45.0 | 24.4 | 29.6 | 22.3 | 32.9 | 21.9 | 21.1 | 25.1 | 23.4 | 20.5 | 41.2 | 29.2 | 29.8 | 19.3 | 31.7 | 38.6 | 26.1 | 23.8 |
| Feb 3 | 29.0 | 38.7 | 22.4 | 29.8 | 47.6 | 35.4 | 31.1 | 24.7 | 27.1 | 20.5 | 31.4 | 25.6 | 20.5 | 33.8 | 15.3 | 28.6 | 29.2 | 31.0 | 28.9 | 29.9 | 35.6 | 29.5 | 38.5 | 22.6 | 23.2 | 33.7 | 38.0 | 35.4 | 42.9 | 23.8 | 37.3 | 37.2 | 27.1 | 22.7 | 25.2 | 22.7 | 29.9 | 20.6 | 41.1 | 34.8 | 32.3 | 24.2 | 25.9 | 28.9 | 31.7 | 18.0 |
| Feb 4 | 39.8 | 34.8 | 32.7 | 30.0 | 32.8 | 37.8 | 39.9 | 31.3 | 30.2 | 28.9 | 32.5 | 23.0 | 21.0 | 36.5 | 25.2 | 29.5 | 23.1 | 29.5 | 36.2 | 23.3 | 40.8 | 34.9 | 24.8 | 15.2 | 33.4 | 40.1 | 29.7 | 34.7 | 43.1 | 22.7 | 31.2 | 33.9 | 21.5 | 33.2 | 24.8 | 13.8 | 31.6 | 22.8 | 31.4 | 35.2 | 27.1 | 27.2 | 32.1 | 21.9 | 25.8 | 21.0 |
| Feb 5 | 38.4 | 38.9 | 24.8 | 26.5 | 33.9 | 35.7 | 37.3 | 29.2 | 34.6 | 29.3 | 31.9 | 28.1 | 27.7 | 34.1 | 26.1 | 32.7 | 21.1 | 30.4 | 34.1 | 13.3 | 32.8 | 31.9 | 44.3 | 29.0 | 32.0 | 37.6 | 23.4 | 25.0 | 36.9 | 24.6 | 38.2 | 22.8 | 22.0 | 35.7 | 24.7 | 12.2 | 32.4 | 24.4 | 39.8 | 24.1 | 29.0 | 32.2 | 35.7 | 26.3 | 31.0 | 18.5 |
| Feb 6 | 31.4 | 36.0 | 29.2 | 33.0 | 39.3 | 27.1 | 44.1 | 28.5 | 46.3 | 21.9 | 30.4 | 32.8 | 30.3 | 34.8 | 31.1 | 38.8 | 30.0 | 19.8 | 37.1 | 9.0 | 22.9 | 24.3 | 44.3 | 35.6 | 30.1 | 39.9 | 24.0 | 22.8 | 38.7 | 28.5 | 34.7 | 27.7 | 24.6 | 40.5 | 30.6 | 14.0 | 31.6 | 26.9 | 30.1 | 32.5 | 22.9 | 32.1 | 30.0 | 26.6 | 21.5 | 26.9 |
| Feb 7 | 40.2 | 36.6 | 41.3 | 28.8 | 40.1 | 25.8 | 37.9 | 37.3 | 35.3 | 20.6 | 33.4 | 32.9 | 34.9 | 45.6 | 22.4 | 36.6 | 31.6 | 20.7 | 53.9 | 12.8 | 26.6 | 24.9 | 50.0 | 36.2 | 27.1 | 27.4 | 40.1 | 19.0 | 47.0 | 43.2 | 35.6 | 31.6 | 23.7 | 25.4 | 30.5 | 22.1 | 31.4 | 33.7 | 39.9 | 37.4 | 24.6 | 25.6 | 29.2 | 20.9 | 25.4 | 22.0 |
| Feb 8 | 37.3 | 35.9 | 45.8 | 28.5 | 33.9 | 15.0 | 25.2 | 47.0 | 34.5 | 22.4 | 40.1 | 49.9 | 28.0 | 37.5 | 27.5 | 31.4 | 33.6 | 23.9 | 40.7 | 20.8 | 38.1 | 14.3 | 40.9 | 27.8 | 31.1 | 29.8 | 33.2 | 34.1 | 37.1 | 39.1 | 39.5 | 31.2 | 22.4 | 31.9 | 31.3 | 21.3 | 28.5 | 32.5 | 32.8 | 37.8 | 21.1 | 30.0 | 25.4 | 22.2 | 27.5 | 13.6 |
| Feb 9 | 30.9 | 40.8 | 47.4 | 27.5 | 29.3 | 24.7 | 27.2 | 43.0 | 19.4 | 22.7 | 22.3 | 34.6 | 22.8 | 26.9 | 32.8 | 24.8 | 35.9 | 27.6 | 25.4 | 21.8 | 32.7 | 26.8 | 43.9 | 23.0 | 39.2 | 37.1 | 38.0 | 32.4 | 34.3 | 49.6 | 37.6 | 28.1 | 16.6 | 30.6 | 42.6 | 19.0 | 25.0 | 32.0 | 42.6 | 42.3 | 21.8 | 34.2 | 25.7 | 30.3 | 23.7 | 19.4 |
| Feb 10 | 35.6 | 36.2 | 36.9 | 25.1 | 23.0 | 18.4 | 23.5 | 33.8 | 25.0 | 26.9 | 26.0 | 33.5 | 22.5 | 25.4 | 47.6 | 26.1 | 22.8 | 36.9 | 34.5 | 21.8 | 26.3 | 30.8 | 49.8 | 28.3 | 37.0 | 28.4 | 29.4 | 32.1 | 42.1 | 43.8 | 41.8 | 26.8 | 17.9 | 38.8 | 33.0 | 21.7 | 24.5 | 34.3 | 32.2 | 42.9 | 18.8 | 32.0 | 32.9 | 39.1 | 19.7 | 23.8 |
| Feb 11 | 34.5 | 34.6 | 33.2 | 30.3 | 11.7 | 26.2 | 21.9 | 47.8 | 27.6 | 20.4 | 29.2 | 36.6 | 18.8 | 30.9 | 36.4 | 30.4 | 39.4 | 31.5 | 40.1 | 29.5 | 27.3 | 28.9 | 51.4 | 35.3 | 34.8 | 31.7 | 43.2 | 28.8 | 35.1 | 39.6 | 49.3 | 28.9 | 29.6 | 39.8 | 50.5 | 30.3 | 23.3 | 29.4 | 40.9 | 48.1 | 16.7 | 44.7 | 26.7 | 33.8 | 18.0 | 26.0 |
| Feb 12 | 26.0 | 23.4 | 26.3 | 32.3 | 26.4 | 19.5 | 25.9 | 35.3 | 30.8 | 28.1 | 28.7 | 26.3 | 24.6 | 39.4 | 28.4 | 27.8 | 44.6 | 25.8 | 44.2 | 20.7 | 22.7 | 36.8 | 44.2 | 39.2 | 42.1 | 35.5 | 52.4 | 29.5 | 31.5 | 35.1 | 36.3 | 21.0 | 34.2 | 26.4 | 34.8 | 34.4 | 28.6 | 27.0 | 51.5 | 40.3 | 18.4 | 61.0 | 30.4 | 39.2 | 16.8 | 26.8 |
| Feb 13 | 27.8 | 24.7 | 27.2 | 39.3 | 27.9 | 18.4 | 27.9 | 42.3 | 27.1 | 24.8 | 29.2 | 31.0 | 29.3 | 44.5 | 30.1 | 23.2 | 44.7 | 26.6 | 46.2 | 33.6 | 26.5 | 22.8 | 40.5 | 33.2 | 40.9 | 29.9 | 40.7 | 36.0 | 27.3 | 36.2 | 36.0 | 31.1 | 35.3 | 29.3 | 31.7 | 32.4 | 25.2 | 26.3 | 44.8 | 26.3 | 22.1 | 46.0 | 24.9 | 42.1 | 13.7 | 40.4 |
| Feb 14 | 35.2 | 18.0 | 27.5 | 47.6 | 28.5 | 27.1 | 32.2 | 50.9 | 28.8 | 29.5 | 49.0 | 52.0 | 24.0 | 48.7 | 25.2 | 25.6 | 41.0 | 29.3 | 42.1 | 31.3 | 24.8 | 16.8 | 29.0 | 27.7 | 32.3 | 31.7 | 37.9 | 30.7 | 27.4 | 36.2 | 31.7 | 30.5 | 29.0 | 36.6 | 24.5 | 42.0 | 29.2 | 37.5 | 43.3 | 22.8 | 25.5 | 46.2 | 27.4 | 30.8 | 16.0 | 38.5 |
| Feb 15 | 38.8 | 30.4 | 22.8 | 43.6 | 27.7 | 27.8 | 37.7 | 46.2 | 35.0 | 24.1 | 41.0 | 54.7 | 30.5 | 44.4 | 17.6 | 24.2 | 40.8 | 27.6 | 29.9 | 40.3 | 29.9 | 11.5 | 18.7 | 22.9 | 24.1 | 24.7 | 44.2 | 26.9 | 31.3 | 36.8 | 34.3 | 36.1 | 29.5 | 34.6 | 35.3 | 29.5 | 25.1 | 32.6 | 41.7 | 24.6 | 17.3 | 48.2 | 22.3 | 40.3 | 26.2 | 37.3 |
| Feb 16 | 34.3 | 19.8 | 26.8 | 46.6 | 32.9 | 30.1 | 35.0 | 39.5 | 33.3 | 29.1 | 46.1 | 48.5 | 34.3 | 38.6 | 23.9 | 22.0 | 38.9 | 18.3 | 42.7 | 32.6 | 32.0 | 12.5 | 23.7 | 22.1 | 27.8 | 34.1 | 43.3 | 24.9 | 32.0 | 41.4 | 38.7 | 23.2 | 27.5 | 38.5 | 39.4 | 28.1 | 26.9 | 39.9 | 37.2 | 27.6 | 9.0 | 47.9 | 29.9 | 32.6 | 39.3 | 44.9 |
| Feb 17 | 36.8 | 18.3 | 28.7 | 49.7 | 34.6 | 26.1 | 37.9 | 36.7 | 26.2 | 21.7 | 26.1 | 46.7 | 31.5 | 47.1 | 23.1 | 24.7 | 41.0 | 25.2 | 45.5 | 30.3 | 26.2 | 23.0 | 25.9 | 33.2 | 28.5 | 30.5 | 47.7 | 30.3 | 35.6 | 32.1 | 39.5 | 34.7 | 23.3 | 39.8 | 37.2 | 37.7 | 22.7 | 51.5 | 36.9 | 34.8 | 21.8 | 49.2 | 40.1 | 43.2 | 46.5 | 36.7 |
| Feb 18 | 33.1 | 21.4 | 37.6 | 41.9 | 34.0 | 24.7 | 38.6 | 31.4 | 33.7 | 30.0 | 39.5 | 35.0 | 33.8 | 48.3 | 26.1 | 30.3 | 43.7 | 28.2 | 48.5 | 32.4 | 28.2 | 25.9 | 33.6 | 38.0 | 24.4 | 30.3 | 40.7 | 33.9 | 45.6 | 39.9 | 47.8 | 33.1 | 22.3 | 38.6 | 39.4 | 30.8 | 24.0 | 50.8 | 30.5 | 37.8 | 25.4 | 53.9 | 39.7 | 31.9 | 31.5 | 41.1 |
| Feb 19 | 39.6 | 40.2 | 23.2 | 42.6 | 41.6 | 24.9 | 29.7 | 37.4 | 34.4 | 23.5 | 37.4 | 28.5 | 34.2 | 55.4 | 30.4 | 32.3 | 36.6 | 34.5 | 45.2 | 27.8 | 29.8 | 23.1 | 36.8 | 33.9 | 39.7 | 29.2 | 40.0 | 27.9 | 41.5 | 47.5 | 41.2 | 29.3 | 19.4 | 25.1 | 33.1 | 30.4 | 25.9 | 46.5 | 29.6 | 39.6 | 30.7 | 42.7 | 39.6 | 36.3 | 27.1 | 39.0 |
| Feb 20 | 36.6 | 32.8 | 20.2 | 36.6 | 38.2 | 21.5 | 47.0 | 42.0 | 29.4 | 29.0 | 37.8 | 25.6 | 31.3 | 43.6 | 41.7 | 23.6 | 39.4 | 28.2 | 40.0 | 25.9 | 22.2 | 27.1 | 33.2 | 37.3 | 43.2 | 24.9 | 36.0 | 33.0 | 40.9 | 39.8 | 33.2 | 42.1 | 24.0 | 29.5 | 40.7 | 32.7 | 33.6 | 29.4 | 31.0 | 44.1 | 38.1 | 47.2 | 44.8 | 26.2 | 34.1 | 33.2 |
| Feb 21 | 23.6 | 25.7 | 26.2 | 43.9 | 26.0 | 20.6 | 43.8 | 41.0 | 33.5 | 37.2 | 41.3 | 29.9 | 29.5 | 42.7 | 41.9 | 28.2 | 37.0 | 33.5 | 31.7 | 25.9 | 22.0 | 34.0 | 20.6 | 42.0 | 36.5 | 26.1 | 37.1 | 33.3 | 38.4 | 37.5 | 36.1 | 26.9 | 27.2 | 35.7 | 41.3 | 27.3 | 34.8 | 30.1 | 31.6 | 41.6 | 23.9 | 40.9 | 41.1 | 22.6 | 38.5 | 35.6 |
| Feb 22 | 28.1 | 48.3 | 26.5 | 36.0 | 23.5 | 26.1 | 52.9 | 37.1 | 33.2 | 39.4 | 44.4 | 34.4 | 36.2 | 49.0 | 37.9 | 30.7 | 28.8 | 30.8 | 31.9 | 30.6 | 30.2 | 39.7 | 17.0 | 44.4 | 44.1 | 25.7 | 25.9 | 35.1 | 37.8 | 28.0 | 29.5 | 36.9 | 31.5 | 37.0 | 36.5 | 32.5 | 30.3 | 31.7 | 23.2 | 30.1 | 33.4 | 45.5 | 30.0 | 33.4 | 31.9 | 43.4 |
| Feb 23 | 23.7 | 46.3 | 35.7 | 33.1 | 30.9 | 32.8 | 43.7 | 40.9 | 42.5 | 36.8 | 40.6 | 40.8 | 33.5 | 53.8 | 40.6 | 30.7 | 21.6 | 21.5 | 27.2 | 34.2 | 27.4 | 33.5 | 27.7 | 40.4 | 36.1 | 17.9 | 25.0 | 29.4 | 44.3 | 25.7 | 41.9 | 33.4 | 27.5 | 29.4 | 19.1 | 31.9 | 29.5 | 30.7 | 25.3 | 37.4 | 27.1 | 38.8 | 40.6 | 37.0 | 29.8 | 51.6 |
| Feb 24 | 34.2 | 37.5 | 21.7 | 37.9 | 32.4 | 23.1 | 43.5 | 40.8 | 34.6 | 43.8 | 44.7 | 25.9 | 40.3 | 37.3 | 38.5 | 39.3 | 22.4 | 22.1 | 30.6 | 36.1 | 18.7 | 36.8 | 39.6 | 35.5 | 38.0 | 14.5 | 24.4 | 27.2 | 40.9 | 47.7 | 39.0 | 31.1 | 34.8 | 42.6 | 21.4 | 27.2 | 25.6 | 28.3 | 36.9 | 33.9 | 24.4 | 33.1 | 41.7 | 36.5 | 20.0 | 48.9 |
| Feb 25 | 33.1 | 41.1 | 21.3 | 37.9 | 36.6 | 30.2 | 38.2 | 37.8 | 30.6 | 49.6 | 30.7 | 26.8 | 34.1 | 28.7 | 37.5 | 34.2 | 24.9 | 31.5 | 32.6 | 30.4 | 26.3 | 37.7 | 42.1 | 35.2 | 29.9 | 12.2 | 19.6 | 34.0 | 31.5 | 41.5 | 31.2 | 36.3 | 34.0 | 45.2 | 25.2 | 38.5 | 28.6 | 31.4 | 31.5 | 25.3 | 30.1 | 32.8 | 39.0 | 32.4 | 21.7 | 49.5 |
| Feb 26 | 17.3 | 33.8 | 23.2 | 35.0 | 40.5 | 38.3 | 33.7 | 41.0 | 32.9 | 42.1 | 31.7 | 32.9 | 49.8 | 22.6 | 48.4 | 42.6 | 21.1 | 35.7 | 37.5 | 38.5 | 29.4 | 30.0 | 43.9 | 36.4 | 36.5 | 22.5 | 23.7 | 38.0 | 36.1 | 53.0 | 40.6 | 25.8 | 35.6 | 44.3 | 32.4 | 37.0 | 24.8 | 39.7 | 46.2 | 39.4 | 43.4 | 37.5 | 40.2 | 34.0 | 33.5 | 42.2 |
| Feb 27 | 20.0 | 39.6 | 24.4 | 29.9 | 45.6 | 46.6 | 34.6 | 42.3 | 34.4 | 41.2 | 41.8 | 32.9 | 36.2 | 26.3 | 51.5 | 41.0 | 25.7 | 31.1 | 34.8 | 25.6 | 36.3 | 40.0 | 38.7 | 27.5 | 35.8 | 27.5 | 29.3 | 31.3 | 31.9 | 52.5 | 40.3 | 26.6 | 25.6 | 39.4 | 33.9 | 43.9 | 28.5 | 31.0 | 39.5 | 29.4 | 46.9 | 34.3 | 46.8 | 27.7 | 24.5 | 41.2 |
| Feb 28 | 20.0 | 39.1 | 20.1 | 21.8 | 42.7 | 48.2 | 28.7 | 44.1 | 22.2 | 37.1 | 39.7 | 38.4 | 29.1 | 32.3 | 49.8 | 36.3 | 30.8 | 32.8 | 32.2 | 35.4 | 29.1 | 42.7 | 47.2 | 29.3 | 41.6 | 25.7 | 22.1 | 35.6 | 27.0 | 42.8 | 46.7 | 21.2 | 38.0 | 33.5 | 38.6 | 42.3 | 30.6 | 35.6 | 35.7 | 41.2 | 44.5 | 44.4 | 35.5 | 40.9 | 40.5 | 48.3 |
| Feb 29 | 24.8 | 35.6 | 31.6 | 25.3 | 40.6 | 47.8 | 29.2 | 38.8 | 27.1 | 54.6 | 42.1 | 46.7 | 34.9 | 27.7 | 47.6 | 31.0 | 32.7 | 38.6 | 36.7 | 38.6 | 29.8 | 37.6 | 46.4 | 28.9 | 35.0 | 34.8 | 38.1 | 34.0 | 36.0 | 39.7 | 48.0 | 30.6 | 52.7 | 33.8 | 34.4 | 35.7 | 29.5 | 44.5 | 46.8 | 42.3 | 51.4 | 48.7 | 44.4 | 47.4 | 53.2 | 43.5 |
| Mar 1 | 19.8 | 33.9 | 25.4 | 28.0 | 35.3 | 48.6 | 31.1 | 37.3 | 28.1 | 45.0 | 44.0 | 49.5 | 37.0 | 38.6 | 40.7 | 28.6 | 32.7 | 50.6 | 29.8 | 27.7 | 34.6 | 35.9 | 33.0 | 34.3 | 30.1 | 35.5 | 34.7 | 35.9 | 48.1 | 36.4 | 30.8 | 31.7 | 50.6 | 44.4 | 40.0 | 38.8 | 37.3 | 39.2 | 34.6 | 48.1 | 46.9 | 33.3 | 48.3 | 39.2 | 47.5 | 42.3 |
| Mar 2 | 33.3 | 26.7 | 34.7 | 37.5 | 31.7 | 59.1 | 41.0 | 40.5 | 42.3 | 39.0 | 27.9 | 42.5 | 46.8 | 30.8 | 48.3 | 28.9 | 35.7 | 54.7 | 32.9 | 40.2 | 47.3 | 38.8 | 20.8 | 31.0 | 40.9 | 35.3 | 43.5 | 31.4 | 34.0 | 48.3 | 24.0 | 42.1 | 53.9 | 36.0 | 30.7 | 35.7 | 30.4 | 35.4 | 33.1 | 46.6 | 43.3 | 34.0 | 37.5 | 36.4 | 47.1 | 53.4 |
| Mar 3 | 40.3 | 38.2 | 31.5 | 41.4 | 40.2 | 54.1 | 32.7 | 36.1 | 38.4 | 46.7 | 29.7 | 36.1 | 56.4 | 16.2 | 51.9 | 33.8 | 43.0 | 41.0 | 34.7 | 50.8 | 51.1 | 35.9 | 25.8 | 34.0 | 40.9 | 34.7 | 41.0 | 38.3 | 32.3 | 50.7 | 18.6 | 36.2 | 55.7 | 33.7 | 27.5 | 36.8 | 33.3 | 31.5 | 31.8 | 40.5 | 52.9 | 34.2 | 42.2 | 42.8 | 43.6 | 46.4 |
| Mar 4 | 24.5 | 38.6 | 42.1 | 40.7 | 30.5 | 52.1 | 32.4 | 27.7 | 37.4 | 42.3 | 36.2 | 36.8 | 47.7 | 23.3 | 56.2 | 25.5 | 38.9 | 35.4 | 40.0 | 46.6 | 57.2 | 38.1 | 30.7 | 28.2 | 46.7 | 34.6 | 44.8 | 44.1 | 24.3 | 39.9 | 24.9 | 47.8 | 56.0 | 42.6 | 34.9 | 33.6 | 24.9 | 36.3 | 31.4 | 41.8 | 45.7 | 28.2 | 45.8 | 43.5 | 33.9 | 42.6 |
| Mar 5 | 28.0 | 36.9 | 52.3 | 38.1 | 45.4 | 42.0 | 33.4 | 37.8 | 39.2 | 30.4 | 32.4 | 35.5 | 45.7 | 29.6 | 49.4 | 28.7 | 40.2 | 52.9 | 33.2 | 57.6 | 48.3 | 38.3 | 29.3 | 28.5 | 57.0 | 33.8 | 47.3 | 39.2 | 37.0 | 34.5 | 38.9 | 56.1 | 38.5 | 43.6 | 30.2 | 31.9 | 25.2 | 27.3 | 37.3 | 37.0 | 39.2 | 38.5 | 46.5 | 39.9 | 29.6 | 32.9 |
| Mar 6 | 33.0 | 39.6 | 41.9 | 43.9 | 50.0 | 31.2 | 40.1 | 46.8 | 44.2 | 22.8 | 36.1 | 38.8 | 37.3 | 33.4 | 58.4 | 22.1 | 35.5 | 34.8 | 41.8 | 57.0 | 32.8 | 43.8 | 32.8 | 33.0 | 51.1 | 37.2 | 47.4 | 40.2 | 40.1 | 40.4 | 39.1 | 52.6 | 40.6 | 31.7 | 35.1 | 36.8 | 24.2 | 34.5 | 24.3 | 39.4 | 47.7 | 36.8 | 45.3 | 50.3 | 36.5 | 33.2 |
| Mar 7 | 38.6 | 31.9 | 49.6 | 42.3 | 43.6 | 38.2 | 33.9 | 44.7 | 55.0 | 30.0 | 33.1 | 39.7 | 26.9 | 41.7 | 56.0 | 18.9 | 26.8 | 39.3 | 47.3 | 50.9 | 36.9 | 52.7 | 32.2 | 26.7 | 47.3 | 40.6 | 42.7 | 37.1 | 44.0 | 41.6 | 36.1 | 59.0 | 44.5 | 37.4 | 41.1 | 38.7 | 34.2 | 33.5 | 14.8 | 36.2 | 43.1 | 31.8 | 45.5 | 44.5 | 38.3 | 40.7 |
| Mar 8 | 30.8 | 35.9 | 54.7 | 38.4 | 42.2 | 33.7 | 29.5 | 48.1 | 40.6 | 37.1 | 43.3 | 33.0 | 29.2 | 44.4 | 55.9 | 22.4 | 15.3 | 47.4 | 33.5 | 46.8 | 50.5 | 51.1 | 26.2 | 28.5 | 38.0 | 41.1 | 38.6 | 34.0 | 44.0 | 51.7 | 42.3 | 59.2 | 44.5 | 41.2 | 42.9 | 47.8 | 33.0 | 37.0 | 14.9 | 31.3 | 47.7 | 34.7 | 38.8 | 36.7 | 27.7 | 44.1 |
| Mar 9 | 30.5 | 37.0 | 40.1 | 43.6 | 40.4 | 37.9 | 44.3 | 39.1 | 44.7 | 39.9 | 38.5 | 36.2 | 28.7 | 52.1 | 45.4 | 28.8 | 27.2 | 56.4 | 35.6 | 43.3 | 39.5 | 45.9 | 18.7 | 34.6 | 38.6 | 50.3 | 30.9 | 32.4 | 30.0 | 41.3 | 39.2 | 60.9 | 39.2 | 43.5 | 50.2 | 53.9 | 18.2 | 34.9 | 19.2 | 29.7 | 37.6 | 42.7 | 31.7 | 45.0 | 38.6 | 34.2 |
| Mar 10 | 20.5 | 46.7 | 48.6 | 34.4 | 27.5 | 46.7 | 46.6 | 38.5 | 35.2 | 42.0 | 36.7 | 49.8 | 37.8 | 49.9 | 37.6 | 24.5 | 34.0 | 58.8 | 28.4 | 31.2 | 42.5 | 36.0 | 24.0 | 32.3 | 30.1 | 52.5 | 34.0 | 53.9 | 31.2 | 34.2 | 42.8 | 55.1 | 46.5 | 34.9 | 43.9 | 46.1 | 30.6 | 42.7 | 28.4 | 23.9 | 22.5 | 44.7 | 39.1 | 51.5 | 29.5 | 39.3 |
| Mar 11 | 22.3 | 49.3 | 47.3 | 48.7 | 28.3 | 27.2 | 57.7 | 41.8 | 43.9 | 39.0 | 32.8 | 37.8 | 45.0 | 46.6 | 43.0 | 31.9 | 39.7 | 56.5 | 37.6 | 29.4 | 31.3 | 33.9 | 38.8 | 36.2 | 33.2 | 42.8 | 29.3 | 44.1 | 34.4 | 48.8 | 46.6 | 46.1 | 49.1 | 35.9 | 39.5 | 35.3 | 26.8 | 46.0 | 24.6 | 18.5 | 36.6 | 45.2 | 31.8 | 45.2 | 33.8 | 41.4 |
| Mar 12 | 21.1 | 53.0 | 42.3 | 42.8 | 35.2 | 15.8 | 50.2 | 47.0 | 41.1 | 33.9 | 42.3 | 26.4 | 46.3 | 43.3 | 45.0 | 39.3 | 35.1 | 54.7 | 38.7 | 31.0 | 38.2 | 35.2 | 42.0 | 26.8 | 49.3 | 46.7 | 36.9 | 42.3 | 32.7 | 46.5 | 47.3 | 39.6 | 43.4 | 35.4 | 50.0 | 39.7 | 31.7 | 32.2 | 28.0 | 18.9 | 44.4 | 50.8 | 33.9 | 42.3 | 40.3 | 42.8 |
| Mar 13 | 21.0 | 56.2 | 31.8 | 43.4 | 37.0 | 24.0 | 46.8 | 55.7 | 41.0 | 43.9 | 36.7 | 26.1 | 40.6 | 41.9 | 44.3 | 40.0 | 35.2 | 48.9 | 40.9 | 32.4 | 34.7 | 41.9 | 40.3 | 31.2 | 45.9 | 53.8 | 27.6 | 44.9 | 36.2 | 49.9 | 61.0 | 43.8 | 51.6 | 28.2 | 40.6 | 38.8 | 34.8 | 42.7 | 25.8 | 18.0 | 53.5 | 36.6 | 36.8 | 41.9 | 40.9 | 39.3 |
| Mar 14 | 27.6 | 43.7 | 45.2 | 47.0 | 30.6 | 29.4 | 46.2 | 44.1 | 52.5 | 43.2 | 37.5 | 29.4 | 43.7 | 43.5 | 44.1 | 34.0 | 42.2 | 52.8 | 46.0 | 31.6 | 37.6 | 45.6 | 39.6 | 38.0 | 45.4 | 47.0 | 25.9 | 46.4 | 37.9 | 40.3 | 41.2 | 48.3 | 47.9 | 29.0 | 39.6 | 40.0 | 40.0 | 36.3 | 37.9 | 20.5 | 47.5 | 35.6 | 34.4 | 42.8 | 39.7 | 39.3 |
| Mar 15 | 23.0 | 40.0 | 32.6 | 46.5 | 42.5 | 40.3 | 38.3 | 38.5 | 39.4 | 39.0 | 36.0 | 33.1 | 49.6 | 34.9 | 48.7 | 37.2 | 55.4 | 43.5 | 36.2 | 33.6 | 44.7 | 41.6 | 41.2 | 35.0 | 46.7 | 50.9 | 18.3 | 48.3 | 39.1 | 37.7 | 39.4 | 48.2 | 61.5 | 32.4 | 29.0 | 46.2 | 34.3 | 36.6 | 35.0 | 33.6 | 43.1 | 41.5 | 37.1 | 50.6 | 31.0 | 39.5 |

### *TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET*

| YEAR-> | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar 16 | 36.7 | 35.3 | 34.9 | 45.8 | 37.4 | 48.4 | 34.9 | 42.8 | 37.0 | 44.5 | 32.2 | 34.8 | 62.1 | 35.0 | 50.0 | 36.6 | 57.9 | 38.1 | 23.5 | 32.9 | 46.0 | 38.5 | 38.0 | 36.4 | 44.5 | 55.5 | 26.6 | 39.1 | 38.8 | 38.6 | 39.0 | 42.5 | 51.4 | 35.7 | 36.9 | 49.6 | 39.6 | 36.2 | 43.4 | 37.2 | 44.7 | 25.5 | 55.7 | 40.2 | 41.2 | 30.7 |
| Mar 17 | 38.7 | 23.8 | 51.9 | 37.0 | 37.6 | 51.8 | 28.2 | 48.2 | 43.6 | 53.0 | 34.0 | 39.1 | 59.0 | 26.7 | 47.8 | 44.1 | 56.5 | 24.1 | 43.0 | 35.8 | 35.8 | 40.5 | 42.6 | 32.0 | 49.7 | 41.7 | 32.4 | 48.4 | 37.5 | 30.3 | 38.5 | 51.7 | 52.1 | 38.9 | 56.5 | 51.4 | 39.0 | 33.3 | 46.1 | 39.2 | 34.2 | 33.3 | 53.2 | 42.6 | 50.3 | 43.8 |
| Mar 18 | 41.5 | 30.8 | 46.9 | 34.9 | 44.5 | 52.6 | 26.1 | 39.3 | 48.3 | 44.1 | 33.9 | 43.1 | 55.1 | 33.3 | 46.3 | 46.1 | 49.0 | 31.3 | 40.5 | 42.3 | 36.1 | 40.7 | 36.6 | 31.8 | 40.9 | 46.2 | 33.2 | 42.3 | 31.8 | 27.2 | 47.8 | 53.9 | 57.1 | 35.7 | 62.9 | 55.2 | 37.5 | 37.8 | 38.4 | 32.3 | 40.0 | 44.9 | 54.9 | 46.0 | 43.1 | 37.5 |
| Mar 19 | 43.2 | 36.9 | 49.9 | 38.1 | 33.8 | 53.7 | 32.5 | 53.6 | 55.1 | 51.8 | 40.6 | 34.4 | 54.8 | 42.0 | 51.9 | 52.6 | 38.5 | 23.9 | 40.8 | 42.7 | 27.8 | 41.6 | 41.7 | 45.3 | 44.5 | 44.6 | 49.5 | 43.5 | 31.7 | 30.0 | 55.8 | 53.6 | 50.8 | 42.5 | 57.1 | 45.3 | 38.3 | 42.4 | 36.6 | 24.7 | 29.5 | 45.3 | 65.7 | 40.2 | 47.4 | 36.2 |
| Mar 20 | 42.4 | 51.3 | 41.2 | 33.8 | 38.2 | 59.7 | 27.2 | 52.0 | 36.2 | 38.3 | 38.5 | 29.7 | 39.8 | 29.6 | 49.8 | 57.6 | 45.3 | 34.7 | 42.0 | 50.9 | 32.2 | 39.0 | 55.5 | 47.4 | 37.4 | 43.7 | 59.9 | 55.0 | 27.8 | 34.5 | 52.7 | 44.6 | 42.5 | 37.7 | 45.8 | 38.7 | 44.7 | 30.9 | 37.8 | 36.7 | 38.6 | 39.6 | 64.3 | 39.6 | 37.7 | 37.7 |
| Mar 21 | 43.1 | 43.0 | 27.7 | 37.1 | 37.0 | 50.5 | 39.8 | 56.6 | 51.5 | 31.6 | 45.3 | 27.1 | 45.4 | 42.3 | 47.6 | 37.2 | 47.0 | 39.3 | 40.7 | 57.5 | 31.8 | 35.2 | 58.9 | 42.9 | 36.9 | 54.3 | 57.4 | 38.8 | 25.4 | 41.6 | 43.8 | 44.5 | 53.1 | 39.5 | 48.1 | 40.6 | 34.8 | 32.8 | 27.0 | 32.2 | 39.1 | 33.2 | 63.7 | 47.6 | 39.9 | 29.7 |
| Mar 22 | 43.4 | 34.9 | 30.8 | 44.6 | 45.1 | 59.2 | 37.6 | 49.8 | 55.4 | 45.1 | 47.2 | 28.8 | 51.7 | 49.1 | 34.2 | 44.6 | 32.9 | 36.2 | 49.4 | 40.0 | 47.7 | 39.2 | 53.7 | 43.9 | 41.5 | 48.0 | 51.5 | 41.3 | 37.6 | 38.4 | 46.4 | 49.0 | 46.9 | 36.4 | 53.8 | 47.7 | 38.3 | 52.4 | 32.4 | 36.2 | 40.9 | 48.0 | 65.7 | 48.5 | 31.8 | 32.2 |
| Mar 23 | 44.0 | 36.4 | 32.9 | 44.6 | 43.3 | 55.8 | 34.2 | 57.9 | 37.5 | 41.1 | 31.4 | 33.3 | 53.9 | 49.5 | 38.6 | 44.5 | 34.7 | 43.7 | 46.8 | 53.4 | 51.2 | 42.6 | 47.1 | 49.6 | 34.8 | 47.2 | 51.4 | 44.5 | 33.9 | 28.6 | 54.0 | 53.4 | 43.5 | 43.2 | 48.9 | 42.6 | 43.8 | 58.9 | 33.4 | 45.6 | 41.9 | 58.1 | 53.0 | 54.8 | 42.5 | 37.0 |
| Mar 24 | 49.8 | 45.2 | 26.4 | 48.5 | 30.5 | 47.5 | 32.6 | 51.8 | 33.1 | 42.6 | 38.4 | 29.8 | 53.8 | 49.8 | 43.5 | 45.6 | 41.5 | 53.4 | 47.4 | 37.7 | 61.4 | 27.4 | 52.1 | 41.3 | 40.8 | 50.4 | 50.4 | 42.1 | 45.5 | 30.0 | 62.1 | 45.0 | 35.4 | 54.4 | 47.1 | 46.9 | 38.2 | 48.5 | 36.5 | 42.0 | 45.3 | 56.3 | 44.5 | 43.4 | 53.4 | 35.7 |
| Mar 25 | 48.7 | 33.4 | 28.8 | 39.5 | 35.1 | 52.2 | 46.8 | 56.5 | 22.9 | 48.0 | 37.8 | 39.5 | 61.0 | 31.7 | 42.5 | 35.7 | 44.6 | 49.0 | 36.9 | 50.0 | 60.5 | 31.2 | 37.7 | 46.6 | 50.6 | 63.4 | 47.8 | 49.8 | 43.5 | 30.3 | 58.7 | 50.8 | 31.6 | 51.5 | 43.2 | 50.9 | 43.7 | 58.9 | 40.5 | 38.8 | 39.2 | 54.1 | 46.2 | 50.6 | 51.1 | 34.8 |
| Mar 26 | 52.9 | 31.2 | 39.6 | 29.5 | 40.8 | 47.0 | 40.6 | 47.4 | 21.8 | 48.1 | 33.5 | 42.2 | 54.9 | 33.6 | 44.0 | 38.7 | 39.8 | 50.5 | 48.0 | 54.7 | 54.9 | 36.4 | 40.6 | 47.5 | 57.0 | 53.6 | 43.2 | 47.0 | 44.6 | 30.2 | 54.2 | 39.3 | 35.1 | 56.2 | 60.9 | 44.6 | 47.0 | 57.2 | 39.8 | 44.2 | 36.6 | 56.2 | 56.1 | 50.6 | 52.5 | 42.9 |
| Mar 27 | 58.8 | 38.7 | 39.2 | 37.0 | 51.7 | 57.3 | 48.8 | 44.7 | 35.6 | 32.8 | 32.0 | 43.7 | 53.5 | 37.6 | 43.5 | 41.5 | 37.0 | 37.3 | 49.8 | 60.8 | 47.8 | 40.7 | 37.3 | 51.5 | 40.7 | 50.4 | 40.2 | 36.1 | 34.0 | 31.7 | 58.5 | 40.0 | 48.3 | 53.7 | 63.1 | 57.0 | 57.4 | 54.9 | 42.4 | 41.0 | 38.8 | 40.0 | 44.2 | 61.2 | 63.0 | 39.8 |
| Mar 28 | 42.0 | 53.1 | 43.5 | 43.1 | 47.1 | 45.0 | 43.7 | 50.1 | 46.6 | 38.3 | 34.2 | 39.9 | 47.6 | 34.8 | 52.1 | 42.7 | 42.7 | 37.7 | 50.8 | 61.5 | 50.8 | 37.9 | 44.2 | 55.5 | 55.9 | 41.9 | 31.4 | 50.5 | 43.4 | 27.1 | 48.4 | 43.4 | 43.1 | 54.8 | 61.6 | 60.2 | 52.4 | 47.5 | 38.0 | 53.8 | 36.6 | 51.4 | 43.6 | 46.9 | 61.2 | 41.9 |
| Mar 29 | 43.3 | 51.5 | 46.6 | 56.1 | 42.3 | 60.0 | 48.7 | 39.1 | 45.0 | 36.7 | 50.2 | 48.9 | 39.7 | 42.3 | 55.2 | 50.7 | 41.6 | 46.9 | 52.5 | 56.8 | 54.8 | 39.9 | 51.2 | 42.2 | 54.0 | 34.4 | 31.0 | 58.7 | 35.6 | 29.5 | 45.0 | 58.7 | 44.4 | 58.4 | 59.5 | 60.1 | 51.7 | 43.7 | 34.7 | 47.5 | 50.3 | 49.8 | 43.2 | 52.8 | 51.7 | 47.7 |
| Mar 30 | 45.2 | 35.3 | 52.4 | 56.5 | 41.2 | 60.2 | 46.0 | 36.1 | 47.7 | 38.9 | 56.4 | 51.4 | 53.7 | 38.5 | 54.8 | 57.1 | 39.6 | 46.2 | 41.5 | 53.5 | 47.2 | 44.5 | 56.3 | 40.3 | 58.7 | 38.8 | 40.0 | 57.3 | 27.3 | 35.1 | 59.7 | 49.4 | 38.0 | 53.6 | 63.3 | 54.0 | 40.9 | 42.8 | 31.4 | 55.3 | 61.5 | 39.6 | 42.9 | 38.4 | 40.6 | 49.8 |
| Mar 31 | 54.8 | 37.0 | 43.1 | 52.9 | 43.8 | 52.3 | 34.6 | 41.0 | 41.2 | 46.2 | 41.0 | 37.5 | 47.2 | 39.9 | 43.9 | 50.3 | 26.7 | 36.3 | 34.6 | 48.0 | 34.6 | 53.2 | 55.8 | 44.2 | 50.3 | 45.3 | 51.4 | 51.2 | 33.6 | 36.8 | 57.4 | 53.7 | 29.8 | 59.1 | 56.9 | 56.4 | 52.4 | 49.2 | 39.0 | 46.4 | 54.3 | 50.5 | 46.7 | 43.3 | 30.9 | 48.0 |
| Apr 1 | 59.2 | 38.6 | 50.6 | 51.0 | 40.7 | 51.5 | 39.6 | 33.6 | 42.6 | 46.5 | 42.3 | 26.1 | 45.1 | 38.9 | 54.4 | 48.2 | 40.5 | 39.4 | 43.0 | 52.7 | 31.2 | 41.9 | 57.9 | 45.2 | 55.1 | 40.1 | 49.0 | 43.4 | 43.1 | 44.6 | 33.3 | 48.4 | 38.4 | 47.9 | 55.0 | 45.9 | 46.2 | 29.6 | 35.5 | 47.2 | 59.1 | 60.6 | 54.1 | 43.2 | 38.0 | 41.7 |
| Apr 2 | 57.2 | 40.3 | 47.1 | 51.7 | 38.8 | 60.5 | 33.5 | 28.0 | 45.7 | 47.2 | 49.0 | 27.4 | 34.9 | 50.9 | 67.3 | 43.8 | 31.3 | 43.2 | 37.5 | 42.8 | 33.3 | 42.2 | 59.8 | 39.4 | 50.0 | 48.1 | 67.1 | 56.5 | 45.5 | 49.9 | 49.6 | 37.1 | 41.6 | 34.5 | 58.8 | 55.5 | 49.2 | 36.8 | 27.1 | 50.3 | 62.1 | 47.7 | 60.3 | 48.0 | 45.9 | 52.8 |
| Apr 3 | 50.0 | 48.4 | 48.4 | 44.5 | 43.6 | 51.6 | 55.3 | 32.5 | 46.9 | 52.5 | 43.5 | 34.9 | 34.4 | 55.9 | 65.9 | 38.3 | 30.3 | 46.9 | 32.1 | 50.2 | 58.9 | 36.7 | 49.1 | 38.4 | 42.7 | 41.2 | 67.8 | 44.1 | 35.2 | 42.0 | 49.8 | 35.0 | 41.0 | 49.3 | 59.3 | 52.0 | 60.6 | 31.1 | 25.5 | 42.1 | 55.3 | 48.7 | 58.6 | 37.3 | 50.6 | 53.6 |
| Apr 4 | 50.2 | 49.7 | 47.6 | 48.9 | 45.0 | 54.7 | 53.6 | 33.2 | 30.3 | 53.0 | 38.4 | 43.4 | 30.9 | 58.4 | 60.7 | 44.1 | 38.0 | 45.7 | 48.1 | 48.5 | 62.5 | 51.0 | 47.0 | 39.3 | 49.7 | 49.4 | 56.2 | 45.2 | 37.6 | 53.0 | 40.0 | 38.3 | 51.3 | 52.8 | 59.1 | 56.2 | 56.1 | 25.9 | 26.1 | 46.9 | 48.6 | 65.0 | 62.0 | 44.3 | 43.2 | 53.8 |
| Apr 5 | 52.3 | 43.9 | 38.0 | 44.8 | 49.8 | 46.0 | 48.3 | 40.5 | 29.5 | 46.6 | 37.5 | 39.4 | 39.6 | 63.5 | 61.5 | 46.1 | 32.3 | 37.6 | 56.4 | 52.7 | 70.8 | 44.5 | 42.8 | 40.8 | 41.1 | 49.3 | 55.2 | 55.2 | 46.0 | 61.9 | 40.7 | 38.0 | 52.9 | 45.6 | 47.9 | 52.7 | 55.0 | 34.3 | 31.0 | 46.8 | 45.6 | 42.0 | 42.1 | 49.3 | 56.4 | 65.7 |
| Apr 6 | 45.6 | 40.7 | 35.9 | 46.4 | 53.3 | 46.7 | 47.7 | 46.2 | 34.7 | 47.6 | 35.6 | 43.3 | 45.6 | 54.0 | 51.9 | 33.3 | 34.3 | 42.0 | 39.8 | 50.0 | 63.1 | 41.1 | 53.7 | 55.1 | 44.2 | 55.8 | 50.4 | 46.6 | 47.0 | 63.3 | 28.4 | 40.3 | 56.0 | 38.4 | 44.6 | 45.4 | 50.0 | 47.9 | 33.7 | 56.6 | 50.7 | 41.8 | 47.8 | 57.7 | 48.9 | 68.7 |
| Apr 7 | 32.7 | 27.3 | 34.6 | 42.5 | 42.2 | 58.3 | 36.0 | 44.3 | 51.3 | 52.7 | 42.9 | 46.7 | 50.8 | 48.6 | 60.1 | 37.6 | 33.8 | 34.6 | 35.4 | 54.3 | 61.3 | 44.9 | 43.9 | 42.4 | 48.0 | 40.1 | 39.5 | 48.0 | 48.8 | 51.0 | 40.2 | 48.0 | 51.0 | 42.3 | 43.6 | 46.1 | 45.4 | 53.5 | 31.2 | 54.8 | 59.4 | 43.8 | 54.6 | 48.4 | 47.0 | 63.2 |
| Apr 8 | 38.6 | 36.1 | 39.0 | 41.4 | 35.2 | 46.1 | 41.1 | 44.4 | 38.4 | 40.3 | 35.0 | 53.5 | 52.1 | 35.6 | 60.4 | 36.7 | 36.4 | 45.5 | 43.7 | 58.2 | 60.2 | 41.3 | 38.6 | 51.8 | 42.7 | 54.2 | 44.3 | 53.0 | 41.2 | 56.2 | 38.8 | 57.2 | 53.1 | 30.8 | 32.1 | 48.9 | 56.7 | 39.6 | 36.5 | 62.5 | 56.6 | 47.7 | 54.5 | 51.0 | 48.8 | 64.6 |
| Apr 9 | 33.9 | 37.8 | 46.5 | 42.7 | 41.9 | 42.6 | 54.3 | 43.6 | 52.0 | 43.6 | 44.4 | 46.4 | 56.1 | 36.0 | 57.6 | 44.9 | 51.3 | 48.8 | 45.2 | 54.6 | 64.9 | 44.6 | 38.3 | 58.3 | 29.4 | 60.3 | 61.8 | 57.7 | 47.8 | 58.5 | 44.9 | 61.1 | 40.3 | 24.9 | 37.1 | 40.0 | 61.2 | 50.8 | 42.5 | 61.8 | 65.4 | 44.8 | 39.1 | 49.9 | 44.2 | 55.6 |
| Apr 10 | 40.7 | 46.1 | 48.8 | 57.4 | 42.9 | 39.1 | 49.0 | 44.2 | 47.5 | 44.7 | 52.8 | 46.6 | 57.3 | 36.6 | 57.2 | 50.5 | 57.7 | 43.7 | 42.2 | 57.4 | 51.8 | 40.9 | 43.8 | 56.0 | 36.0 | 61.5 | 55.4 | 61.8 | 53.7 | 61.4 | 51.9 | 62.2 | 48.6 | 36.1 | 51.7 | 41.7 | 58.8 | 52.0 | 46.4 | 50.8 | 50.8 | 46.0 | 43.8 | 53.2 | 56.0 | 47.9 |
| Apr 11 | 44.9 | 51.0 | 42.4 | 60.5 | 43.3 | 46.8 | 43.1 | 36.6 | 46.5 | 42.5 | 60.0 | 45.2 | 53.1 | 34.4 | 62.1 | 53.4 | 51.2 | 53.5 | 36.2 | 60.1 | 56.5 | 44.3 | 46.8 | 45.0 | 44.3 | 55.3 | 36.5 | 46.4 | 53.1 | 57.3 | 50.4 | 64.5 | 50.8 | 28.1 | 45.7 | 56.9 | 58.3 | 61.4 | 47.2 | 37.7 | 51.8 | 45.4 | 40.5 | 55.8 | 45.9 | 41.8 |
| Apr 12 | 45.3 | 49.7 | 35.0 | 59.0 | 53.7 | 47.1 | 36.0 | 37.0 | 39.6 | 39.3 | 59.1 | 36.4 | 57.4 | 31.8 | 56.3 | 45.5 | 48.7 | 54.5 | 38.0 | 52.2 | 60.3 | 40.0 | 57.9 | 39.2 | 52.0 | 49.5 | 30.0 | 45.6 | 59.0 | 59.2 | 59.0 | 58.8 | 41.8 | 33.3 | 47.1 | 50.4 | 57.2 | 58.6 | 48.7 | 39.2 | 45.0 | 44.2 | 47.9 | 64.0 | 52.2 | 39.0 |
| Apr 13 | 40.8 | 52.9 | 33.6 | 58.1 | 50.9 | 45.9 | 43.5 | 42.4 | 37.0 | 44.8 | 57.2 | 38.3 | 45.0 | 37.4 | 52.4 | 44.8 | 43.8 | 62.6 | 42.2 | 45.9 | 46.0 | 43.4 | 66.8 | 48.7 | 39.6 | 60.0 | 42.7 | 49.8 | 60.9 | 59.4 | 44.7 | 66.7 | 39.8 | 41.0 | 47.0 | 42.4 | 51.0 | 56.5 | 55.0 | 41.8 | 39.1 | 54.1 | 42.5 | 66.9 | 55.1 | 31.9 |
| Apr 14 | 51.4 | 54.3 | 42.1 | 47.2 | 57.0 | 55.1 | 39.4 | 52.1 | 40.9 | 33.7 | 56.3 | 45.3 | 41.0 | 37.6 | 46.5 | 44.1 | 52.0 | 65.4 | 52.6 | 49.1 | 43.2 | 40.9 | 69.8 | 47.8 | 44.2 | 57.9 | 46.4 | 49.8 | 52.2 | 61.7 | 52.6 | 59.4 | 50.4 | 50.2 | 53.4 | 57.3 | 50.2 | 55.0 | 41.7 | 54.2 | 54.3 | 53.5 | 37.0 | 56.5 | 57.8 | 42.5 |
| Apr 15 | 50.8 | 45.7 | 43.1 | 49.9 | 54.5 | 56.2 | 48.7 | 43.2 | 37.9 | 47.2 | 53.9 | 48.4 | 48.7 | 49.0 | 54.7 | 55.2 | 56.3 | 63.0 | 57.2 | 56.4 | 37.8 | 45.8 | 74.3 | 48.4 | 39.3 | 56.0 | 58.7 | 47.9 | 59.8 | 50.9 | 52.9 | 62.1 | 53.2 | 50.9 | 58.5 | 59.4 | 52.9 | 58.5 | 52.5 | 52.5 | 51.4 | 57.7 | 34.8 | 68.2 | 47.2 | 41.9 |
| Apr 16 | 48.1 | 43.8 | 37.3 | 54.1 | 57.7 | 51.7 | 41.4 | 48.4 | 50.6 | 48.9 | 44.3 | 54.3 | 62.2 | 43.9 | 49.0 | 50.0 | 60.1 | 53.4 | 53.5 | 59.4 | 35.8 | 57.6 | 80.4 | 54.1 | 50.7 | 52.0 | 51.2 | 44.3 | 71.3 | 52.0 | 42.2 | 60.3 | 60.0 | 42.7 | 48.9 | 62.4 | 45.1 | 42.7 | 55.2 | 49.5 | 47.8 | 67.9 | 42.1 | 57.6 | 40.7 | 36.7 |
| Apr 17 | 55.1 | 63.2 | 41.5 | 56.5 | 51.2 | 47.1 | 37.8 | 52.9 | 45.7 | 44.2 | 49.5 | 52.9 | 50.7 | 50.5 | 62.8 | 47.2 | 53.6 | 43.9 | 56.2 | 44.4 | 50.0 | 54.9 | 79.8 | 53.5 | 51.8 | 62.4 | 50.3 | 48.0 | 64.4 | 49.1 | 38.3 | 53.7 | 62.6 | 45.1 | 44.3 | 53.8 | 56.3 | 38.6 | 50.1 | 48.9 | 46.0 | 73.7 | 42.4 | 57.1 | 45.7 | 39.5 |
| Apr 18 | 62.2 | 58.0 | 39.6 | 59.9 | 53.2 | 44.5 | 41.3 | 52.3 | 38.8 | 49.4 | 51.1 | 46.6 | 47.5 | 53.6 | 62.0 | 52.2 | 54.2 | 54.5 | 58.4 | 45.7 | 53.5 | 49.9 | 79.9 | 47.2 | 39.1 | 59.3 | 49.1 | 34.3 | 58.0 | 62.1 | 42.7 | 52.6 | 59.3 | 52.0 | 43.4 | 50.2 | 63.5 | 45.3 | 48.7 | 42.4 | 55.1 | 65.3 | 52.9 | 69.0 | 36.6 | 50.5 |
| Apr 19 | 53.1 | 52.1 | 44.3 | 66.1 | 56.0 | 43.7 | 32.2 | 55.1 | 35.8 | 48.7 | 46.3 | 49.9 | 42.2 | 53.6 | 55.5 | 60.1 | 54.7 | 58.0 | 42.5 | 39.9 | 52.0 | 53.1 | 72.1 | 45.4 | 44.2 | 52.9 | 49.5 | 44.7 | 63.7 | 53.2 | 46.8 | 43.0 | 60.1 | 64.1 | 37.1 | 48.1 | 61.8 | 47.9 | 58.7 | 48.8 | 49.1 | 58.7 | 45.7 | 70.1 | 37.7 | 52.9 |
| Apr 20 | 47.2 | 52.6 | 46.9 | 59.4 | 59.0 | 46.9 | 42.1 | 49.6 | 44.2 | 60.4 | 58.2 | 49.0 | 32.6 | 54.8 | 51.9 | 55.2 | 57.0 | 48.2 | 44.7 | 45.5 | 56.6 | 52.9 | 65.4 | 45.0 | 40.1 | 53.9 | 56.7 | 44.9 | 57.9 | 55.2 | 56.2 | 43.7 | 60.0 | 63.0 | 44.5 | 52.3 | 67.5 | 60.5 | 56.2 | 54.0 | 46.0 | 57.0 | 39.1 | 69.1 | 43.8 | 49.5 |
| Apr 21 | 54.8 | 55.5 | 40.4 | 62.2 | 64.1 | 41.0 | 47.9 | 49.2 | 45.0 | 51.6 | 48.1 | 48.2 | 38.3 | 51.7 | 51.0 | 55.6 | 66.1 | 44.4 | 40.7 | 51.6 | 59.1 | 48.2 | 61.1 | 61.8 | 45.1 | 52.0 | 63.2 | 44.8 | 56.1 | 57.1 | 56.0 | 48.9 | 57.3 | 55.1 | 40.3 | 54.7 | 69.1 | 57.1 | 63.7 | 56.7 | 58.9 | 57.0 | 39.4 | 67.2 | 41.0 | 47.2 |
| Apr 22 | 53.7 | 64.7 | 49.8 | 58.8 | 61.9 | 40.3 | 44.6 | 54.1 | 47.4 | 55.4 | 54.9 | 48.4 | 36.6 | 43.8 | 51.4 | 56.4 | 68.4 | 57.3 | 63.7 | 52.3 | 50.4 | 51.4 | 56.2 | 53.9 | 39.3 | 60.4 | 55.5 | 45.9 | 54.0 | 56.1 | 44.4 | 47.4 | 56.3 | 39.5 | 45.3 | 55.0 | 60.1 | 64.4 | 56.0 | 54.8 | 47.3 | 53.0 | 46.8 | 59.7 | 40.1 | 37.2 |
| Apr 23 | 52.9 | 64.9 | 52.7 | 52.7 | 67.5 | 37.0 | 51.8 | 52.5 | 53.9 | 66.7 | 51.0 | 50.4 | 51.9 | 48.1 | 52.8 | 58.5 | 52.8 | 53.9 | 63.8 | 54.1 | 50.9 | 57.6 | 49.4 | 52.6 | 43.3 | 52.0 | 67.2 | 46.7 | 48.4 | 51.4 | 52.4 | 45.3 | 45.0 | 50.5 | 56.1 | 66.8 | 67.7 | 70.4 | 52.6 | 49.8 | 52.0 | 50.0 | 45.5 | 60.7 | 44.9 | 47.3 |
| Apr 24 | 57.8 | 68.6 | 50.1 | 58.7 | 64.8 | 40.0 | 47.6 | 50.3 | 44.6 | 51.5 | 58.2 | 52.4 | 49.2 | 41.6 | 51.1 | 51.5 | 57.4 | 48.0 | 60.9 | 47.8 | 49.5 | 57.3 | 50.3 | 53.9 | 44.9 | 55.5 | 57.7 | 57.0 | 39.6 | 53.6 | 46.1 | 52.7 | 53.8 | 61.3 | 59.6 | 63.8 | 61.3 | 68.5 | 53.7 | 49.5 | 50.6 | 55.0 | 41.8 | 63.4 | 51.4 | 53.5 |
| Apr 25 | 57.9 | 60.5 | 47.2 | 69.8 | 48.6 | 47.1 | 50.0 | 59.0 | 57.9 | 55.6 | 55.9 | 47.4 | 41.2 | 48.8 | 51.4 | 50.2 | 58.0 | 49.7 | 52.6 | 52.7 | 55.4 | 52.3 | 56.7 | 43.4 | 33.7 | 54.7 | 65.9 | 51.8 | 38.4 | 49.9 | 50.2 | 56.0 | 58.8 | 56.5 | 59.5 | 58.8 | 60.1 | 55.7 | 46.2 | 48.4 | 54.6 | 54.4 | 47.5 | 73.1 | 47.9 | 55.4 |
| Apr 26 | 54.8 | 47.5 | 58.7 | 81.4 | 55.3 | 48.7 | 51.6 | 47.5 | 63.1 | 58.7 | 60.0 | 48.0 | 49.5 | 47.3 | 48.3 | 45.2 | 46.7 | 46.3 | 53.9 | 41.7 | 55.7 | 58.9 | 53.8 | 49.1 | 44.9 | 62.1 | 60.8 | 52.6 | 35.5 | 49.0 | 46.0 | 50.9 | 64.2 | 60.7 | 60.9 | 50.4 | 57.0 | 63.1 | 49.5 | 60.4 | 49.8 | 49.0 | 49.5 | 70.0 | 58.6 | 44.7 |
| Apr 27 | 51.1 | 51.0 | 59.4 | 64.2 | 55.9 | 41.6 | 43.2 | 45.0 | 61.9 | 53.9 | 57.5 | 44.8 | 64.1 | 46.6 | 43.8 | 51.3 | 44.6 | 63.0 | 62.9 | 37.7 | 62.7 | 52.5 | 49.0 | 54.5 | 50.8 | 62.5 | 58.5 | 49.1 | 47.8 | 44.3 | 49.9 | 57.2 | 51.5 | 57.1 | 55.3 | 55.1 | 54.4 | 63.7 | 59.8 | 65.4 | 55.0 | 49.6 | 52.4 | 63.3 | 62.6 | 47.4 |
| Apr 28 | 51.2 | 53.3 | 52.9 | 50.4 | 56.3 | 49.4 | 45.5 | 43.4 | 55.7 | 57.4 | 50.2 | 50.3 | 59.7 | 46.4 | 54.1 | 52.2 | 49.9 | 66.4 | 58.1 | 48.0 | 57.9 | 44.8 | 37.5 | 46.8 | 54.1 | 59.7 | 66.4 | 56.3 | 46.0 | 37.3 | 48.6 | 51.0 | 50.9 | 50.3 | 59.0 | 50.6 | 55.7 | 59.6 | 58.8 | 60.5 | 52.7 | 49.3 | 48.1 | 63.6 | 58.0 | 52.4 |
| Apr 29 | 53.9 | 58.5 | 56.3 | 61.0 | 51.7 | 51.5 | 53.1 | 52.4 | 61.1 | 59.9 | 44.6 | 48.6 | 57.9 | 47.0 | 42.7 | 57.0 | 56.6 | 66.8 | 52.8 | 49.5 | 62.7 | 47.5 | 44.9 | 59.0 | 60.8 | 56.6 | 65.1 | 54.7 | 49.1 | 43.0 | 53.9 | 60.6 | 51.6 | 50.9 | 58.7 | 51.3 | 59.1 | 61.8 | 55.8 | 57.7 | 57.5 | 53.6 | 61.1 | 57.8 | 49.5 | 52.2 |
| Apr 30 | 54.0 | 47.8 | 62.7 | 57.4 | 55.5 | 59.5 | 63.9 | 49.2 | 52.1 | 61.2 | 49.7 | 51.8 | 57.1 | 52.2 | 43.1 | 61.2 | 47.9 | 60.6 | 50.1 | 49.1 | 51.1 | 52.2 | 43.5 | 53.3 | 60.4 | 55.2 | 59.9 | 56.6 | 48.0 | 50.4 | 63.3 | 53.4 | 54.0 | 54.4 | 61.1 | 44.9 | 49.0 | 56.6 | 55.9 | 48.0 | 52.2 | 52.9 | 62.2 | 55.6 | 55.0 | 58.7 |
| May 1 | 51.1 | 53.1 | 58.2 | 69.0 | 53.0 | 59.1 | 66.8 | 36.7 | 62.5 | 55.5 | 56.5 | 68.6 | 50.9 | 55.1 | 46.5 | 53.7 | 52.3 | 55.1 | 53.4 | 43.9 | 59.1 | 51.5 | 39.7 | 57.2 | 63.9 | 61.1 | 44.7 | 51.5 | 56.4 | 62.1 | 55.8 | 60.2 | 47.5 | 48.5 | 53.0 | 49.8 | 61.1 | 58.5 | 49.8 | 44.1 | 51.9 | 52.0 | 64.8 | 55.6 | 57.9 | 60.9 |
| May 2 | 61.0 | 56.2 | 62.0 | 65.8 | 63.8 | 57.8 | 63.0 | 43.9 | 57.7 | 54.4 | 64.2 | 56.0 | 50.7 | 55.0 | 42.8 | 64.6 | 44.3 | 53.6 | 54.3 | 43.8 | 50.4 | 65.5 | 40.0 | 54.4 | 55.4 | 59.4 | 33.9 | 48.4 | 60.4 | 59.7 | 54.6 | 58.3 | 54.2 | 51.6 | 53.8 | 57.5 | 48.1 | 56.9 | 50.1 | 41.5 | 53.3 | 53.0 | 66.5 | 50.6 | 62.6 | 62.7 |
| May 3 | 68.1 | 43.5 | 48.8 | 57.1 | 52.8 | 58.1 | 65.1 | 56.7 | 65.5 | 51.0 | 50.7 | 44.5 | 58.2 | 65.2 | 45.2 | 60.0 | 43.3 | 45.0 | 61.6 | 43.7 | 60.6 | 64.6 | 48.8 | 61.9 | 55.0 | 70.8 | 39.5 | 44.7 | 53.4 | 55.0 | 49.3 | 57.0 | 62.3 | 49.5 | 57.2 | 63.0 | 39.0 | 68.5 | 39.1 | 46.1 | 46.3 | 51.7 | 64.9 | 56.3 | 58.8 | 67.3 |
| May 4 | 74.0 | 36.9 | 48.1 | 64.0 | 51.8 | 58.7 | 65.8 | 57.7 | 67.9 | 49.6 | 49.2 | 50.1 | 60.9 | 57.9 | 47.1 | 59.3 | 49.3 | 49.3 | 50.2 | 49.7 | 57.8 | 61.9 | 60.6 | 54.2 | 62.6 | 64.7 | 47.4 | 41.7 | 49.6 | 49.5 | 53.1 | 53.6 | 70.7 | 65.1 | 58.7 | 55.4 | 45.7 | 68.1 | 50.9 | 55.9 | 45.4 | 55.5 | 62.8 | 52.4 | 64.5 | 65.9 |
| May 5 | 72.0 | 37.7 | 62.8 | 63.5 | 56.6 | 58.9 | 58.1 | 66.5 | 55.7 | 69.0 | 45.4 | 51.0 | 57.2 | 60.2 | 55.1 | 64.2 | 40.1 | 52.7 | 48.3 | 53.8 | 64.4 | 60.7 | 63.3 | 45.2 | 48.7 | 63.8 | 48.8 | 52.1 | 50.1 | 59.0 | 63.2 | 49.0 | 58.4 | 60.0 | 65.4 | 55.6 | 46.5 | 67.4 | 61.5 | 49.4 | 40.0 | 55.9 | 70.9 | 62.1 | 58.4 | 61.9 |
| May 6 | 81.9 | 47.5 | 68.0 | 58.1 | 55.4 | 64.2 | 57.8 | 66.7 | 57.3 | 74.4 | 49.7 | 48.9 | 60.0 | 54.0 | 55.8 | 61.3 | 51.6 | 52.9 | 53.6 | 55.6 | 59.7 | 60.3 | 61.7 | 49.4 | 53.3 | 68.6 | 53.3 | 63.1 | 54.6 | 59.3 | 59.7 | 58.2 | 69.6 | 57.2 | 64.8 | 62.8 | 50.8 | 65.8 | 54.3 | 52.1 | 47.2 | 48.5 | 61.7 | 62.2 | 59.0 | 69.3 |
| May 7 | 80.6 | 54.2 | 74.9 | 50.7 | 51.8 | 67.1 | 53.5 | 64.7 | 56.4 | 67.3 | 43.4 | 51.5 | 59.6 | 54.8 | 61.0 | 60.9 | 57.4 | 50.3 | 50.3 | 57.7 | 56.3 | 59.5 | 62.8 | 57.1 | 52.4 | 61.6 | 62.8 | 57.8 | 66.7 | 60.3 | 70.3 | 47.2 | 54.9 | 63.3 | 71.2 | 55.1 | 42.1 | 69.2 | 56.2 | 53.3 | 39.2 | 56.0 | 64.9 | 57.8 | 70.8 | 66.8 |
| May 8 | 79.6 | 50.6 | 75.7 | 49.0 | 51.5 | 74.6 | 58.0 | 50.6 | 54.5 | 59.7 | 52.1 | 56.6 | 51.8 | 56.6 | 59.6 | 52.4 | 63.5 | 60.4 | 54.2 | 49.8 | 60.1 | 59.0 | 62.9 | 51.5 | 50.8 | 54.4 | 54.0 | 49.9 | 68.3 | 57.2 | 67.4 | 49.1 | 63.0 | 59.2 | 71.3 | 64.9 | 49.4 | 66.9 | 55.9 | 50.2 | 41.8 | 54.4 | 71.7 | 62.8 | 60.0 | 67.2 |
| May 9 | 78.0 | 52.6 | 64.9 | 50.1 | 58.5 | 68.9 | 56.5 | 52.1 | 57.0 | 74.8 | 48.3 | 49.1 | 49.7 | 70.3 | 64.2 | 49.2 | 66.0 | 56.8 | 60.3 | 58.3 | 57.1 | 64.6 | 56.4 | 56.4 | 61.0 | 41.6 | 51.9 | 55.4 | 78.8 | 64.2 | 63.4 | 54.3 | 55.2 | 65.0 | 64.2 | 61.4 | 59.0 | 67.1 | 51.0 | 56.5 | 54.1 | 60.2 | 60.7 | 58.6 | 70.9 | 75.6 |
| May 10 | 65.5 | 59.0 | 59.2 | 57.2 | 54.4 | 60.2 | 55.7 | 48.8 | 51.6 | 78.0 | 45.2 | 42.5 | 48.0 | 66.6 | 66.6 | 48.9 | 64.1 | 53.5 | 65.1 | 65.4 | 65.3 | 66.5 | 54.7 | 58.8 | 63.9 | 58.6 | 45.1 | 65.3 | 70.7 | 54.4 | 61.5 | 54.3 | 55.8 | 57.2 | 57.8 | 54.2 | 59.7 | 66.2 | 50.7 | 52.6 | 49.0 | 53.3 | 55.6 | 63.4 | 67.5 | 80.0 |
| May 11 | 62.7 | 58.2 | 60.1 | 58.9 | 58.1 | 59.2 | 60.0 | 55.5 | 57.2 | 73.6 | 50.6 | 40.0 | 42.2 | 80.4 | 61.2 | 64.1 | 64.8 | 63.7 | 63.6 | 62.7 | 57.6 | 73.0 | 59.9 | 46.5 | 61.1 | 51.9 | 46.4 | 56.1 | 62.3 | 55.8 | 60.8 | 60.4 | 58.9 | 64.1 | 58.3 | 56.8 | 58.7 | 70.6 | 63.9 | 57.1 | 55.0 | 57.0 | 60.6 | 62.7 | 63.1 | 67.5 |
| May 12 | 57.8 | 57.6 | 59.8 | 58.2 | 58.6 | 64.0 | 58.9 | 59.2 | 57.2 | 67.0 | 54.0 | 60.2 | 49.0 | 77.4 | 74.1 | 55.3 | 69.7 | 61.3 | 54.9 | 60.6 | 50.5 | 69.9 | 57.6 | 48.7 | 62.5 | 52.9 | 44.1 | 55.6 | 59.3 | 64.2 | 65.4 | 54.6 | 63.9 | 59.8 | 57.0 | 43.8 | 66.8 | 74.5 | 60.8 | 59.5 | 62.2 | 51.6 | 61.7 | 58.0 | 61.3 | 61.6 |
| May 13 | 54.2 | 60.1 | 48.4 | 65.1 | 58.5 | 56.5 | 64.9 | 57.0 | 61.0 | 57.2 | 56.9 | 66.1 | 38.8 | 79.1 | 64.4 | 62.9 | 62.7 | 63.7 | 60.0 | 62.4 | 52.7 | 65.0 | 59.0 | 45.0 | 58.4 | 51.9 | 42.1 | 53.3 | 55.0 | 58.8 | 70.5 | 55.7 | 61.3 | 58.2 | 58.1 | 55.1 | 66.4 | 80.2 | 65.8 | 76.9 | 66.8 | 59.0 | 67.9 | 58.8 | 63.7 | 67.7 |
| May 14 | 57.8 | 61.1 | 53.4 | 67.1 | 52.9 | 62.4 | 62.7 | 63.7 | 54.6 | 54.4 | 59.3 | 57.4 | 38.5 | 70.6 | 60.1 | 62.6 | 59.1 | 56.5 | 56.7 | 65.0 | 58.3 | 71.8 | 60.8 | 41.4 | 60.6 | 56.6 | 45.9 | 49.5 | 54.7 | 55.4 | 62.6 | 49.5 | 66.4 | 56.0 | 67.1 | 67.7 | 54.5 | 71.0 | 68.5 | 72.8 | 64.1 | 57.8 | 63.6 | 57.4 | 59.8 | 59.7 |
| May 15 | 48.7 | 58.3 | 55.9 | 67.7 | 58.6 | 62.9 | 62.0 | 52.8 | 55.0 | 59.7 | 52.7 | 62.7 | 46.8 | 73.1 | 62.0 | 67.7 | 68.2 | 64.2 | 55.0 | 64.0 | 59.9 | 74.3 | 66.2 | 57.5 | 61.8 | 61.5 | 54.9 | 56.6 | 61.0 | 57.7 | 67.9 | 50.7 | 65.0 | 57.2 | 70.0 | 62.8 | 48.6 | 81.7 | 61.1 | 69.3 | 55.2 | 58.2 | 58.4 | 63.1 | 59.7 | 64.3 |
| May 16 | 56.7 | 58.7 | 56.8 | 67.8 | 64.4 | 53.4 | 58.0 | 53.2 | 55.7 | 53.5 | 47.6 | 62.4 | 51.4 | 64.9 | 63.5 | 66.7 | 72.2 | 64.8 | 68.7 | 62.9 | 60.5 | 76.3 | 65.1 | 55.8 | 49.3 | 61.3 | 48.5 | 62.0 | 65.7 | 50.8 | 66.4 | 48.3 | 65.9 | 53.0 | 64.3 | 59.2 | 52.1 | 75.8 | 52.2 | 66.9 | 59.9 | 58.5 | 60.3 | 59.9 | 53.9 | 77.9 |
| May 17 | 61.5 | 61.0 | 60.0 | 57.2 | 59.5 | 57.2 | 53.3 | 61.1 | 56.1 | 50.1 | 55.9 | 50.4 | 49.9 | 65.3 | 63.4 | 54.5 | 59.5 | 64.0 | 66.7 | 62.2 | 52.5 | 72.1 | 66.0 | 59.0 | 56.8 | 56.7 | 49.5 | 66.4 | 66.4 | 56.8 | 58.9 | 49.4 | 57.3 | 60.9 | 58.6 | 61.6 | 60.2 | 68.2 | 53.7 | 65.7 | 58.7 | 52.5 | 62.3 | 60.9 | 59.5 | 73.2 |
| May 18 | 62.2 | 69.5 | 67.3 | 52.7 | 64.2 | 48.7 | 49.5 | 56.2 | 57.8 | 55.2 | 67.2 | 60.3 | 53.2 | 66.5 | 72.2 | 49.3 | 58.4 | 58.8 | 57.4 | 56.5 | 59.5 | 67.5 | 70.1 | 51.5 | 57.2 | 63.8 | 50.5 | 63.1 | 56.8 | 58.0 | 58.9 | 52.4 | 65.2 | 62.7 | 60.4 | 54.6 | 65.4 | 72.7 | 66.3 | 62.8 | 62.6 | 62.1 | 69.8 | 54.5 | 63.4 | 74.4 |
| May 19 | 66.0 | 65.9 | 61.2 | 54.0 | 64.9 | 58.0 | 49.2 | 57.9 | 60.7 | 60.0 | 69.1 | 58.2 | 52.9 | 55.7 | 58.6 | 63.4 | 71.1 | 67.9 | 66.0 | 63.9 | 57.7 | 65.2 | 66.2 | 46.6 | 60.2 | 73.5 | 51.0 | 66.5 | 65.3 | 62.9 | 61.5 | 52.5 | 56.2 | 54.0 | 68.9 | 55.6 | 62.0 | 66.1 | 65.5 | 68.4 | 64.9 | 53.6 | 61.5 | 63.1 | 61.7 | 60.6 |
| May 20 | 62.5 | 65.9 | 59.0 | 63.4 | 67.5 | 59.5 | 56.9 | 61.0 | 65.4 | 66.6 | 71.8 | 58.0 | 56.0 | 57.5 | 47.2 | 62.6 | 76.1 | 63.2 | 61.5 | 64.7 | 62.6 | 68.4 | 64.2 | 52.2 | 57.7 | 69.6 | 46.8 | 65.5 | 69.7 | 61.9 | 57.6 | 50.0 | 56.6 | 50.5 | 67.5 | 64.8 | 70.5 | 74.4 | 62.6 | 69.9 | 57.7 | 54.1 | 57.2 | 54.1 | 68.0 | 59.9 |
| May 21 | 57.9 | 66.0 | 57.7 | 54.0 | 61.2 | 53.1 | 53.2 | 62.4 | 69.0 | 72.7 | 72.9 | 54.0 | 63.7 | 58.3 | 51.0 | 66.9 | 76.7 | 63.8 | 64.9 | 69.8 | 63.8 | 62.8 | 63.9 | 58.1 | 73.2 | 65.8 | 59.5 | 67.3 | 66.3 | 73.2 | 63.3 | 60.5 | 48.4 | 60.7 | 67.2 | 68.2 | 65.7 | 59.8 | 65.6 | 68.0 | 68.1 | 54.9 | 60.0 | 61.0 | 70.8 | 55.1 |
| May 22 | 60.0 | 58.3 | 64.4 | 66.9 | 70.5 | 45.8 | 57.7 | 68.5 | 63.1 | 80.6 | 61.4 | 61.5 | 70.4 | 51.1 | 54.0 | 66.5 | 79.0 | 62.9 | 69.5 | 71.6 | 59.6 | 65.6 | 61.9 | 62.7 | 66.5 | 71.2 | 56.6 | 72.4 | 73.0 | 68.9 | 65.4 | 62.2 | 60.7 | 60.3 | 60.6 | 69.1 | 66.3 | 68.1 | 59.5 | 72.0 | 74.8 | 49.7 | 56.2 | 59.2 | 69.6 | 61.1 |
| May 23 | 57.9 | 63.9 | 59.7 | 54.3 | 63.5 | 51.5 | 59.4 | 69.7 | 58.0 | 82.4 | 67.6 | 55.4 | 54.1 | 57.6 | 57.5 | 56.5 | 67.4 | 62.1 | 63.5 | 69.0 | 64.6 | 57.5 | 65.5 | 66.3 | 61.6 | 67.3 | 54.0 | 74.4 | 75.4 | 68.6 | 60.8 | 69.3 | 60.9 | 58.9 | 69.3 | 66.8 | 64.2 | 67.5 | 59.3 | 70.9 | 73.8 | 52.8 | 62.4 | 66.0 | 66.2 | 57.1 |
| May 24 | 70.3 | 69.1 | 61.7 | 55.2 | 65.2 | 60.7 | 67.9 | 63.6 | 65.9 | 77.2 | 62.3 | 59.1 | 55.6 | 55.6 | 63.0 | 69.8 | 67.0 | 65.0 | 60.3 | 66.2 | 64.4 | 53.6 | 66.1 | 72.6 | 62.8 | 65.3 | 62.6 | 73.4 | 70.8 | 69.3 | 61.1 | 70.0 | 57.9 | 63.6 | 64.3 | 68.4 | 69.9 | 64.5 | 60.3 | 67.4 | 79.4 | 61.8 | 59.0 | 64.5 | 49.3 | 62.3 |
| May 25 | 57.7 | 70.6 | 56.7 | 53.2 | 67.5 | 58.3 | 72.2 | 65.4 | 70.3 | 80.8 | 70.7 | 59.8 | 59.1 | 62.8 | 57.5 | 65.1 | 60.1 | 61.3 | 65.6 | 60.3 | 63.1 | 59.1 | 60.2 | 65.3 | 63.2 | 61.8 | 69.6 | 64.1 | 62.9 | 71.2 | 59.4 | 70.9 | 62.0 | 66.8 | 67.3 | 61.4 | 77.2 | 65.9 | 67.4 | 68.9 | 75.9 | 60.9 | 58.2 | 75.3 | 55.2 | 68.8 |
| May 26 | 61.5 | 67.5 | 57.3 | 56.2 | 69.8 | 60.0 | 69.5 | 58.3 | 78.8 | 78.3 | 64.4 | 65.5 | 60.9 | 54.8 | 65.3 | 61.4 | 63.0 | 57.7 | 67.0 | 72.7 | 70.5 | 54.7 | 64.0 | 69.8 | 65.5 | 64.7 | 67.7 | 66.3 | 69.5 | 70.9 | 56.9 | 60.3 | 53.6 | 69.0 | 67.2 | 52.3 | 76.0 | 51.8 | 64.8 | 68.2 | 71.8 | 65.5 | 67.5 | 70.4 | 62.4 | 64.6 |
| May 27 | 66.8 | 56.7 | 60.2 | 59.9 | 64.3 | 61.1 | 79.2 | 59.5 | 78.6 | 81.4 | 69.7 | 69.7 | 64.1 | 63.4 | 59.9 | 57.0 | 67.5 | 58.3 | 69.8 | 73.6 | 77.5 | 64.8 | 60.9 | 72.6 | 71.3 | 69.1 | 70.3 | 69.1 | 67.9 | 66.7 | 61.6 | 67.7 | 61.1 | 72.2 | 71.4 | 47.7 | 77.2 | 49.9 | 68.6 | 66.6 | 75.0 | 65.3 | 71.5 | 67.2 | 62.0 | 67.3 |
| May 28 | 72.6 | 62.1 | 65.8 | 59.7 | 64.5 | 55.8 | 76.7 | 57.4 | 67.8 | 77.4 | 66.2 | 69.6 | 69.9 | 64.1 | 64.5 | 61.2 | 70.7 | 65.3 | 64.4 | 55.5 | 70.7 | 61.7 | 65.9 | 77.1 | 71.4 | 71.1 | 71.5 | 62.6 | 68.2 | 68.9 | 57.5 | 66.2 | 62.2 | 65.8 | 57.2 | 61.4 | 71.8 | 57.5 | 68.8 | 68.2 | 69.1 | 63.5 | 60.7 | 67.7 | 61.9 | 61.5 |
| May 29 | 77.4 | 65.8 | 62.5 | 65.1 | 62.3 | 53.0 | 75.5 | 64.3 | 62.6 | 77.1 | 73.5 | 75.3 | 71.5 | 70.7 | 67.3 | 66.8 | 79.5 | 66.7 | 67.8 | 63.1 | 71.4 | 57.6 | 61.3 | 76.5 | 69.4 | 74.4 | 62.0 | 60.6 | 65.1 | 66.8 | 66.7 | 63.0 | 62.3 | 65.1 | 59.0 | 58.8 | 70.1 | 55.8 | 63.0 | 69.5 | 62.0 | 64.4 | 66.6 | 68.5 | 64.8 | 56.6 |

### TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

| YEAR-> | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May 30 | 78.0 | 59.2 | 67.3 | 71.6 | 59.1 | 65.7 | 66.9 | 64.4 | 65.7 | 76.4 | 67.8 | 75.6 | 65.9 | 73.2 | 67.1 | 67.7 | 75.1 | 69.5 | 68.6 | 64.1 | 71.7 | 65.7 | 60.5 | 82.5 | 69.4 | 66.9 | 54.4 | 59.6 | 66.4 | 56.9 | 65.8 | 73.1 | 62.7 | 67.7 | 67.5 | 63.6 | 62.6 | 61.3 | 59.1 | 66.0 | 71.4 | 67.8 | 58.1 | 73.4 | 69.6 | 64.1 |
| May 31 | 73.2 | 59.1 | 64.4 | 71.4 | 66.3 | 58.7 | 71.7 | 66.4 | 58.8 | 69.1 | 64.7 | 72.0 | 66.7 | 66.3 | 61.4 | 64.1 | 63.2 | 59.9 | 66.3 | 56.4 | 73.7 | 68.0 | 56.4 | 74.5 | 67.4 | 58.1 | 52.1 | 63.4 | 71.0 | 63.0 | 57.6 | 68.9 | 60.8 | 64.8 | 58.7 | 66.2 | 70.6 | 64.9 | 53.7 | 69.8 | 64.1 | 65.0 | 64.5 | 74.3 | 69.5 | 65.2 |
| Jun 1 | 75.2 | 55.5 | 54.8 | 80.6 | 66.9 | 67.6 | 67.8 | 70.4 | 58.5 | 77.9 | 71.8 | 65.4 | 63.2 | 60.2 | 70.4 | 65.7 | 69.5 | 64.1 | 66.9 | 62.0 | 73.1 | 55.2 | 54.5 | 67.9 | 75.9 | 61.6 | 61.0 | 63.8 | 62.7 | 63.2 | 62.7 | 75.1 | 63.1 | 65.0 | 62.2 | 67.2 | 67.3 | 60.1 | 60.9 | 75.5 | 63.8 | 64.2 | 66.1 | 75.4 | 62.6 | 66.6 |
| Jun 2 | 72.4 | 58.1 | 59.5 | 77.2 | 67.0 | 70.7 | 65.8 | 70.1 | 61.8 | 72.4 | 67.4 | 58.1 | 67.3 | 58.6 | 73.4 | 73.7 | 72.1 | 69.3 | 64.7 | 64.2 | 70.2 | 58.9 | 63.3 | 64.2 | 71.1 | 70.9 | 62.5 | 70.3 | 57.8 | 57.8 | 65.6 | 70.3 | 68.5 | 55.8 | 59.7 | 65.9 | 73.5 | 62.2 | 61.5 | 67.2 | 63.1 | 64.0 | 68.1 | 72.3 | 58.9 | 57.4 |
| Jun 3 | 72.6 | 64.2 | 58.2 | 74.9 | 73.6 | 61.6 | 71.9 | 77.3 | 64.2 | 76.7 | 62.2 | 53.8 | 69.0 | 65.8 | 76.1 | 76.0 | 70.2 | 69.8 | 64.8 | 70.4 | 68.2 | 60.4 | 72.5 | 67.2 | 62.9 | 73.1 | 62.1 | 67.3 | 49.6 | 68.6 | 62.8 | 71.7 | 68.5 | 58.5 | 58.2 | 72.6 | 66.8 | 60.1 | 66.3 | 67.5 | 65.3 | 64.6 | 67.9 | 78.7 | 60.9 | 52.6 |
| Jun 4 | 72.8 | 61.1 | 64.0 | 73.2 | 73.2 | 67.7 | 66.8 | 77.4 | 64.9 | 72.6 | 69.8 | 62.6 | 70.5 | 62.3 | 72.0 | 70.2 | 61.5 | 67.8 | 61.4 | 64.7 | 66.7 | 64.9 | 64.6 | 75.7 | 66.3 | 69.6 | 66.4 | 69.7 | 52.3 | 68.9 | 60.9 | 68.4 | 62.0 | 58.0 | 58.3 | 73.6 | 74.9 | 60.6 | 71.6 | 66.8 | 58.8 | 64.1 | 68.0 | 69.0 | 62.5 | 64.1 |
| Jun 5 | 71.0 | 59.5 | 57.0 | 71.7 | 68.9 | 61.6 | 68.7 | 69.8 | 64.2 | 67.1 | 64.8 | 62.9 | 59.4 | 67.8 | 71.8 | 67.9 | 61.0 | 68.3 | 62.1 | 69.1 | 61.1 | 62.5 | 57.0 | 72.2 | 71.4 | 68.1 | 62.6 | 63.3 | 52.5 | 61.1 | 60.9 | 65.4 | 67.1 | 54.8 | 58.4 | 65.0 | 65.1 | 61.3 | 73.8 | 71.2 | 56.0 | 71.6 | 74.7 | 77.1 | 60.5 | 67.0 |
| Jun 6 | 70.1 | 65.9 | 65.2 | 76.6 | 66.2 | 54.2 | 69.3 | 73.6 | 67.3 | 69.7 | 70.3 | 69.5 | 67.1 | 68.3 | 61.1 | 59.1 | 65.5 | 62.7 | 57.7 | 68.9 | 63.9 | 72.7 | 68.6 | 68.6 | 64.6 | 64.3 | 61.7 | 72.0 | 55.3 | 62.8 | 64.1 | 70.4 | 64.5 | 60.6 | 54.9 | 64.7 | 57.9 | 65.4 | 74.1 | 72.8 | 55.7 | 76.7 | 72.5 | 71.3 | 62.0 | 66.7 |
| Jun 7 | 79.4 | 72.6 | 70.0 | 78.1 | 63.7 | 58.9 | 55.8 | 70.2 | 67.5 | 66.5 | 69.5 | 72.1 | 66.3 | 64.5 | 67.1 | 64.9 | 59.0 | 68.1 | 68.9 | 64.9 | 65.4 | 77.7 | 68.6 | 70.8 | 68.2 | 69.5 | 59.6 | 71.7 | 68.6 | 61.1 | 61.8 | 68.8 | 63.3 | 63.1 | 64.6 | 67.3 | 55.1 | 64.4 | 71.1 | 66.7 | 67.3 | 70.4 | 75.4 | 67.1 | 64.0 | 73.8 |
| Jun 8 | 78.0 | 66.5 | 68.1 | 81.8 | 70.8 | 70.2 | 56.1 | 63.5 | 64.2 | 58.5 | 66.8 | 75.2 | 60.8 | 70.6 | 67.6 | 70.6 | 62.2 | 66.6 | 73.1 | 62.8 | 66.1 | 78.0 | 72.0 | 64.4 | 68.3 | 62.8 | 60.7 | 68.9 | 63.5 | 67.7 | 60.4 | 67.1 | 69.9 | 68.7 | 72.7 | 73.5 | 60.3 | 68.6 | 67.8 | 74.7 | 69.0 | 73.7 | 73.0 | 68.9 | 68.6 | 74.7 |
| Jun 9 | 70.4 | 67.3 | 69.4 | 80.0 | 76.5 | 69.5 | 61.5 | 71.0 | 63.4 | 63.0 | 66.9 | 75.0 | 66.6 | 75.6 | 69.2 | 68.1 | 59.9 | 64.8 | 73.5 | 59.9 | 60.7 | 77.8 | 82.4 | 62.7 | 61.5 | 63.7 | 58.1 | 67.6 | 67.2 | 76.2 | 60.1 | 69.4 | 72.2 | 70.3 | 75.8 | 71.1 | 59.9 | 64.9 | 62.1 | 68.5 | 70.4 | 70.2 | 70.7 | 68.1 | 68.1 | 79.6 |
| Jun 10 | 65.1 | 67.4 | 74.0 | 82.6 | 72.2 | 73.3 | 62.0 | 69.2 | 64.1 | 67.9 | 69.0 | 63.8 | 67.7 | 73.8 | 74.3 | 63.9 | 67.6 | 65.1 | 67.0 | 67.5 | 54.5 | 74.9 | 78.5 | 64.9 | 62.4 | 71.2 | 62.7 | 68.5 | 74.0 | 77.5 | 57.6 | 73.0 | 63.5 | 72.1 | 68.0 | 75.4 | 68.8 | 63.5 | 71.1 | 73.1 | 65.9 | 72.7 | 68.0 | 59.8 | 70.7 | 71.6 |
| Jun 11 | 68.8 | 66.9 | 70.3 | 73.5 | 68.4 | 69.5 | 62.9 | 71.7 | 62.1 | 64.1 | 71.4 | 65.0 | 55.5 | 78.4 | 74.1 | 71.4 | 67.6 | 62.1 | 67.7 | 72.5 | 60.0 | 69.6 | 73.3 | 73.3 | 60.2 | 68.5 | 63.4 | 70.3 | 64.1 | 70.2 | 51.3 | 73.0 | 64.7 | 74.2 | 64.6 | 71.5 | 67.3 | 68.8 | 69.2 | 68.6 | 68.6 | 69.4 | 66.2 | 57.4 | 69.7 | 66.5 |
| Jun 12 | 72.2 | 74.1 | 72.0 | 67.5 | 61.3 | 70.0 | 68.9 | 66.6 | 67.3 | 57.6 | 69.5 | 66.5 | 57.7 | 80.6 | 68.9 | 71.3 | 69.0 | 65.9 | 74.0 | 67.4 | 54.0 | 71.5 | 75.2 | 65.9 | 63.6 | 69.3 | 66.0 | 66.3 | 60.6 | 74.1 | 55.6 | 76.1 | 67.0 | 78.5 | 63.6 | 71.4 | 62.7 | 67.9 | 62.1 | 65.6 | 63.7 | 68.2 | 68.7 | 61.7 | 67.6 | 72.6 |
| Jun 13 | 69.9 | 69.2 | 71.1 | 69.2 | 70.8 | 66.8 | 68.6 | 72.6 | 61.3 | 59.1 | 68.4 | 71.0 | 63.3 | 80.9 | 80.2 | 64.7 | 65.2 | 65.7 | 72.8 | 68.5 | 53.2 | 67.8 | 75.0 | 73.2 | 66.2 | 77.4 | 62.3 | 67.9 | 59.1 | 78.5 | 66.3 | 75.2 | 62.3 | 74.7 | 66.3 | 65.9 | 66.3 | 70.9 | 64.9 | 69.0 | 72.7 | 68.4 | 58.7 | 66.9 | 73.6 | 68.4 |
| Jun 14 | 72.7 | 70.6 | 70.3 | 70.0 | 70.1 | 60.0 | 63.2 | 73.1 | 75.1 | 58.8 | 69.0 | 75.4 | 64.3 | 83.1 | 74.8 | 73.3 | 75.2 | 73.6 | 72.9 | 71.4 | 63.2 | 72.9 | 80.4 | 68.3 | 68.7 | 75.4 | 67.8 | 63.1 | 58.2 | 78.4 | 68.7 | 71.6 | 64.5 | 71.1 | 64.9 | 60.3 | 69.0 | 70.3 | 67.5 | 65.8 | 66.3 | 66.5 | 66.4 | 66.1 | 82.4 | 69.6 |
| Jun 15 | 78.3 | 67.8 | 68.4 | 61.6 | 70.2 | 66.6 | 61.2 | 70.2 | 72.1 | 72.1 | 70.0 | 79.7 | 65.7 | 81.4 | 68.7 | 71.8 | 74.5 | 71.8 | 76.1 | 69.5 | 68.4 | 68.1 | 72.4 | 74.9 | 62.9 | 67.0 | 72.7 | 64.5 | 54.3 | 75.9 | 75.3 | 74.9 | 64.5 | 75.1 | 71.6 | 65.1 | 66.9 | 68.1 | 65.0 | 71.7 | 63.5 | 68.5 | 67.1 | 66.2 | 78.2 | 76.0 |
| Jun 16 | 79.9 | 66.6 | 66.1 | 57.5 | 73.5 | 68.0 | 66.5 | 73.9 | 77.1 | 66.9 | 68.7 | 78.6 | 66.4 | 78.9 | 67.7 | 69.4 | 79.4 | 79.2 | 68.6 | 74.3 | 72.9 | 64.8 | 69.9 | 77.8 | 71.4 | 66.2 | 72.2 | 65.9 | 66.8 | 79.5 | 72.0 | 74.1 | 63.7 | 75.8 | 74.8 | 68.8 | 69.9 | 72.1 | 62.7 | 68.6 | 59.6 | 66.0 | 76.0 | 63.8 | 79.8 | 79.6 |
| Jun 17 | 79.5 | 67.0 | 64.1 | 61.4 | 73.9 | 70.1 | 66.3 | 76.6 | 78.3 | 62.7 | 71.9 | 75.7 | 69.8 | 77.8 | 62.3 | 68.8 | 77.5 | 73.7 | 70.9 | 78.7 | 73.1 | 66.6 | 65.9 | 70.1 | 66.8 | 63.6 | 69.9 | 75.2 | 69.8 | 69.2 | 72.7 | 74.8 | 66.6 | 72.3 | 72.4 | 74.4 | 69.4 | 64.5 | 72.0 | 61.0 | 62.3 | 65.9 | 74.6 | 63.9 | 69.2 | 79.9 |
| Jun 18 | 76.4 | 63.7 | 73.7 | 67.4 | 71.5 | 76.2 | 77.3 | 64.7 | 79.8 | 57.8 | 73.0 | 81.8 | 71.2 | 78.2 | 68.1 | 66.5 | 75.6 | 72.9 | 74.4 | 78.0 | 70.5 | 67.5 | 72.6 | 77.5 | 64.8 | 67.1 | 65.1 | 70.3 | 69.1 | 74.4 | 75.2 | 75.9 | 64.9 | 66.3 | 70.5 | 70.0 | 68.2 | 68.1 | 72.8 | 60.8 | 61.6 | 67.9 | 69.3 | 64.6 | 73.9 | 72.0 |
| Jun 19 | 78.2 | 65.5 | 79.7 | 65.1 | 74.8 | 69.5 | 73.3 | 64.7 | 80.3 | 64.1 | 76.8 | 81.7 | 71.6 | 78.9 | 67.8 | 66.9 | 76.8 | 72.1 | 70.6 | 76.1 | 68.4 | 65.7 | 67.2 | 73.6 | 66.4 | 64.1 | 71.0 | 72.5 | 68.8 | 67.0 | 75.5 | 75.5 | 63.0 | 62.2 | 67.1 | 70.8 | 60.1 | 70.3 | 70.8 | 66.1 | 66.5 | 66.0 | 70.4 | 74.2 | 79.9 | 66.9 |
| Jun 20 | 76.7 | 58.5 | 78.7 | 64.0 | 76.3 | 72.7 | 76.6 | 60.6 | 79.3 | 72.2 | 77.2 | 81.0 | 76.9 | 72.3 | 66.1 | 68.8 | 70.7 | 81.5 | 67.0 | 69.1 | 64.9 | 65.6 | 69.2 | 68.0 | 68.3 | 73.7 | 66.3 | 74.9 | 68.0 | 67.4 | 71.8 | 73.4 | 60.3 | 64.7 | 63.3 | 72.5 | 58.2 | 78.0 | 74.0 | 71.6 | 68.1 | 59.6 | 71.7 | 75.9 | 73.4 | 74.1 |
| Jun 21 | 75.3 | 61.9 | 75.0 | 69.1 | 77.6 | 72.2 | 75.8 | 61.6 | 70.7 | 72.7 | 74.5 | 81.7 | 74.0 | 63.4 | 67.5 | 73.9 | 69.7 | 72.3 | 70.0 | 66.7 | 69.2 | 65.9 | 67.2 | 70.5 | 74.6 | 65.2 | 72.3 | 74.1 | 71.8 | 67.1 | 73.2 | 75.5 | 71.8 | 65.7 | 62.8 | 75.0 | 64.2 | 77.2 | 69.6 | 69.8 | 61.6 | 59.5 | 70.9 | 70.2 | 79.6 | 74.9 |
| Jun 22 | 82.5 | 69.1 | 73.7 | 73.9 | 68.8 | 73.9 | 76.0 | 68.3 | 72.8 | 65.7 | 72.8 | 76.9 | 77.6 | 73.3 | 61.0 | 78.3 | 68.5 | 73.8 | 72.4 | 70.1 | 70.5 | 62.9 | 67.9 | 71.2 | 76.2 | 70.5 | 63.1 | 75.9 | 65.3 | 72.9 | 76.2 | 79.9 | 69.8 | 67.1 | 65.9 | 73.9 | 68.6 | 71.4 | 68.7 | 69.4 | 74.0 | 60.2 | 66.8 | 70.5 | 70.1 | 73.6 |
| Jun 23 | 77.3 | 76.1 | 77.7 | 69.0 | 66.7 | 69.0 | 75.4 | 73.6 | 74.3 | 67.3 | 72.6 | 76.9 | 72.7 | 72.2 | 61.9 | 78.6 | 69.7 | 69.0 | 70.8 | 71.4 | 69.4 | 65.5 | 58.5 | 63.4 | 72.6 | 76.1 | 77.7 | 71.4 | 67.9 | 76.6 | 73.5 | 80.8 | 69.3 | 72.7 | 66.6 | 70.9 | 62.3 | 62.0 | 68.8 | 70.5 | 72.6 | 70.0 | 66.3 | 63.5 | 72.7 | 73.0 |
| Jun 24 | 69.2 | 69.2 | 79.3 | 74.4 | 64.7 | 66.5 | 67.9 | 74.5 | 64.3 | 72.8 | 75.6 | 69.6 | 75.8 | 72.6 | 60.4 | 80.9 | 72.9 | 68.2 | 71.8 | 71.1 | 68.4 | 70.1 | 68.2 | 72.9 | 69.0 | 70.8 | 75.5 | 75.2 | 69.3 | 80.7 | 74.3 | 79.8 | 70.5 | 78.8 | 70.3 | 69.9 | 65.4 | 66.2 | 64.7 | 70.4 | 71.5 | 71.1 | 63.4 | 75.6 | 73.2 | 74.5 |
| Jun 25 | 68.2 | 69.6 | 74.7 | 73.6 | 74.3 | 64.4 | 63.8 | 74.6 | 64.7 | 72.1 | 75.0 | 71.1 | 70.7 | 73.7 | 61.3 | 78.9 | 74.8 | 68.6 | 63.8 | 69.8 | 71.0 | 66.9 | 66.6 | 71.5 | 76.6 | 68.9 | 71.0 | 72.2 | 67.0 | 79.5 | 83.2 | 70.9 | 67.4 | 76.0 | 75.2 | 73.0 | 66.9 | 73.1 | 68.6 | 68.5 | 79.1 | 70.1 | 64.5 | 72.5 | 76.2 | 73.5 |
| Jun 26 | 65.7 | 79.1 | 70.3 | 67.4 | 70.8 | 66.8 | 72.8 | 70.8 | 70.8 | 70.4 | 78.0 | 76.2 | 71.4 | 71.0 | 59.8 | 73.4 | 71.5 | 66.1 | 71.6 | 63.2 | 66.1 | 71.7 | 70.8 | 73.8 | 74.7 | 76.1 | 66.6 | 72.5 | 68.1 | 75.7 | 84.6 | 77.9 | 66.1 | 73.5 | 71.4 | 69.2 | 69.8 | 75.7 | 67.2 | 74.3 | 72.2 | 68.0 | 68.2 | 70.8 | 68.8 | 69.7 |
| Jun 27 | 61.5 | 67.9 | 74.1 | 67.0 | 69.5 | 63.5 | 71.4 | 77.1 | 65.2 | 78.9 | 76.1 | 72.7 | 73.4 | 68.4 | 67.1 | 67.9 | 77.1 | 63.3 | 70.1 | 66.6 | 59.6 | 73.8 | 68.6 | 77.8 | 70.9 | 80.7 | 67.5 | 74.1 | 76.9 | 75.1 | 78.8 | 77.4 | 71.7 | 79.5 | 68.2 | 67.8 | 66.6 | 74.3 | 72.1 | 68.5 | 75.1 | 72.6 | 73.0 | 71.2 | 73.8 | 72.6 |
| Jun 28 | 64.3 | 76.9 | 67.2 | 77.9 | 70.2 | 70.7 | 63.8 | 72.6 | 67.7 | 69.5 | 75.7 | 71.5 | 71.2 | 73.6 | 73.1 | 70.7 | 79.2 | 74.0 | 67.1 | 65.3 | 56.7 | 71.6 | 69.6 | 74.9 | 68.5 | 76.3 | 67.9 | 74.9 | 75.8 | 78.1 | 76.2 | 77.0 | 65.8 | 79.4 | 70.0 | 73.5 | 62.1 | 80.1 | 72.4 | 76.5 | 73.3 | 72.3 | 69.4 | 78.5 | 65.2 | 70.4 |
| Jun 29 | 59.9 | 72.5 | 69.3 | 80.3 | 73.3 | 77.4 | 68.4 | 70.2 | 76.7 | 75.6 | 78.7 | 71.1 | 69.4 | 73.1 | 71.1 | 69.3 | 78.3 | 68.1 | 73.6 | 64.8 | 61.2 | 72.9 | 69.8 | 78.9 | 66.5 | 74.4 | 68.8 | 63.0 | 67.1 | 84.0 | 81.5 | 73.8 | 67.8 | 78.0 | 74.9 | 72.5 | 65.1 | 78.3 | 69.1 | 77.2 | 75.9 | 72.7 | 75.4 | 76.3 | 64.4 | 74.3 |
| Jun 30 | 69.2 | 66.2 | 77.9 | 82.5 | 76.5 | 69.8 | 77.6 | 70.6 | 82.7 | 74.5 | 74.9 | 74.9 | 83.0 | 71.3 | 81.2 | 79.9 | 76.8 | 70.1 | 79.8 | 76.2 | 74.6 | 66.9 | 69.8 | 85.3 | 76.4 | 68.7 | 79.1 | 75.9 | 75.1 | 75.5 | 79.7 | 77.4 | 76.1 | 76.3 | 75.4 | 72.2 | 69.5 | 79.0 | 75.4 | 69.9 | 81.6 | 75.9 | 88.5 | 78.1 | 73.3 | 70.2 |
| Jul 1 | 72.7 | 73.9 | 84.2 | 80.1 | 79.2 | 75.6 | 81.5 | 73.6 | 76.8 | 82.2 | 82.7 | 75.2 | 84.2 | 76.2 | 81.6 | 73.5 | 79.0 | 84.7 | 83.2 | 80.3 | 73.6 | 76.0 | 71.7 | 90.3 | 74.6 | 78.6 | 74.4 | 79.5 | 77.7 | 80.3 | 78.9 | 80.6 | 81.4 | 80.8 | 84.8 | 80.0 | 78.2 | 73.0 | 74.8 | 75.9 | 83.5 | 78.9 | 81.4 | 71.6 | 78.7 | 74.6 |
| Jul 2 | 74.6 | 79.5 | 81.7 | 80.7 | 80.4 | 76.3 | 80.9 | 77.1 | 77.7 | 78.6 | 81.3 | 76.9 | 81.6 | 79.6 | 79.4 | 79.6 | 81.7 | 84.2 | 78.1 | 80.3 | 69.6 | 77.2 | 72.1 | 92.6 | 74.0 | 78.8 | 75.1 | 80.5 | 81.2 | 76.7 | 81.4 | 83.0 | 80.2 | 78.8 | 87.0 | 76.9 | 77.4 | 81.5 | 75.8 | 76.0 | 87.6 | 72.8 | 85.8 | 71.7 | 79.3 | 77.1 |
| Jul 3 | 77.7 | 80.6 | 82.2 | 81.3 | 76.1 | 75.6 | 83.4 | 81.8 | 80.8 | 77.3 | 82.5 | 77.9 | 84.0 | 82.3 | 84.4 | 79.6 | 85.1 | 79.9 | 79.0 | 88.8 | 70.3 | 81.2 | 75.2 | 94.2 | 77.6 | 77.3 | 80.9 | 76.2 | 79.4 | 76.6 | 70.8 | 81.0 | 79.2 | 79.2 | 82.3 | 78.7 | 74.4 | 79.2 | 81.2 | 75.5 | 89.6 | 80.9 | 75.9 | 70.4 | 82.5 | 81.1 |
| Jul 4 | 84.2 | 80.4 | 84.5 | 81.4 | 78.9 | 73.2 | 85.2 | 85.2 | 82.5 | 76.0 | 83.6 | 81.4 | 75.9 | 78.8 | 84.2 | 81.5 | 81.6 | 76.3 | 78.4 | 84.7 | 73.6 | 80.7 | 76.1 | 85.5 | 78.1 | 78.2 | 83.4 | 78.1 | 81.5 | 75.4 | 73.3 | 82.6 | 77.5 | 75.3 | 80.9 | 79.9 | 77.5 | 80.0 | 81.6 | 84.6 | 86.8 | 77.1 | 79.0 | 80.6 | 86.5 | 84.8 |
| Jul 5 | 78.0 | 76.3 | 81.0 | 72.3 | 71.2 | 76.8 | 79.9 | 80.1 | 81.6 | 76.8 | 88.7 | 79.2 | 79.9 | 83.0 | 85.2 | 87.1 | 87.3 | 75.7 | 78.4 | 79.9 | 74.5 | 79.0 | 77.5 | 88.5 | 79.8 | 79.1 | 80.5 | 82.2 | 77.6 | 72.3 | 77.3 | 80.8 | 76.9 | 77.0 | 79.9 | 81.7 | 77.2 | 81.9 | 83.8 | 84.1 | 88.6 | 79.5 | 78.6 | 75.6 | 83.0 | 82.9 |
| Jul 6 | 77.3 | 77.0 | 81.1 | 75.4 | 72.2 | 78.1 | 79.9 | 78.5 | 84.2 | 84.8 | 87.6 | 82.2 | 77.5 | 77.5 | 80.0 | 80.1 | 83.3 | 74.7 | 75.7 | 71.2 | 74.7 | 81.9 | 79.4 | 87.0 | 82.2 | 74.3 | 79.4 | 81.0 | 77.6 | 79.0 | 74.3 | 80.8 | 78.7 | 75.4 | 80.1 | 78.6 | 79.2 | 80.0 | 86.8 | 85.0 | 91.1 | 83.8 | 76.0 | 84.7 | 72.2 | 85.3 |
| Jul 7 | 77.7 | 78.6 | 83.3 | 75.4 | 76.5 | 77.6 | 73.5 | 77.0 | 80.5 | 78.9 | 91.6 | 81.5 | 75.7 | 75.7 | 76.8 | 84.5 | 81.6 | 75.8 | 68.0 | 82.5 | 75.4 | 79.0 | 77.4 | 87.6 | 83.6 | 76.9 | 84.7 | 80.1 | 79.7 | 83.0 | 84.4 | 77.4 | 77.8 | 76.7 | 80.8 | 71.1 | 83.8 | 80.2 | 80.9 | 84.0 | 86.4 | 82.4 | 75.8 | 80.1 | 75.1 | 84.9 |
| Jul 8 | 77.1 | 74.3 | 82.4 | 77.6 | 81.2 | 76.9 | 72.6 | 75.5 | 83.3 | 79.2 | 87.9 | 87.1 | 75.1 | 75.0 | 85.1 | 85.4 | 80.7 | 79.3 | 68.4 | 83.9 | 74.4 | 82.1 | 80.9 | 79.9 | 82.4 | 80.7 | 84.1 | 83.3 | 77.4 | 83.6 | 84.8 | 74.2 | 82.6 | 76.6 | 77.0 | 69.0 | 80.8 | 81.5 | 89.2 | 88.5 | 84.2 | 84.4 | 83.2 | 79.0 | 73.9 | 82.6 |
| Jul 9 | 78.1 | 71.8 | 83.1 | 79.7 | 83.7 | 72.8 | 74.6 | 75.5 | 85.1 | 82.3 | 90.2 | 82.9 | 73.5 | 79.0 | 87.4 | 84.8 | 74.5 | 79.2 | 77.7 | 78.7 | 76.3 | 85.4 | 79.8 | 77.4 | 84.0 | 80.4 | 83.2 | 76.9 | 74.2 | 72.5 | 83.9 | 82.5 | 80.0 | 76.8 | 78.2 | 67.5 | 84.7 | 84.0 | 80.3 | 86.5 | 82.8 | 79.2 | 78.5 | 80.8 | 78.2 | 82.6 |
| Jul 10 | 71.7 | 75.0 | 77.0 | 80.2 | 74.9 | 84.7 | 78.6 | 75.4 | 84.7 | 84.2 | 89.5 | 85.0 | 75.9 | 78.1 | 85.4 | 80.3 | 80.5 | 81.2 | 75.5 | 75.9 | 76.7 | 83.0 | 82.3 | 74.5 | 80.2 | 77.1 | 84.7 | 76.1 | 85.6 | 83.2 | 80.7 | 80.5 | 84.2 | 72.9 | 82.6 | 74.2 | 78.0 | 78.1 | 85.7 | 86.6 | 74.5 | 82.1 | 76.8 | 83.7 | 77.0 | 75.5 |
| Jul 11 | 71.2 | 77.8 | 82.7 | 78.9 | 75.2 | 83.3 | 77.1 | 76.3 | 82.1 | 86.0 | 87.9 | 79.0 | 73.9 | 82.8 | 83.1 | 80.0 | 80.0 | 81.1 | 70.2 | 81.5 | 79.6 | 81.6 | 78.4 | 77.2 | 76.0 | 80.1 | 87.4 | 78.6 | 81.9 | 83.9 | 86.5 | 79.5 | 85.7 | 81.3 | 82.8 | 78.2 | 82.4 | 74.6 | 85.8 | 77.6 | 74.8 | 75.6 | 80.2 | 84.6 | 73.7 | 73.0 |
| Jul 12 | 81.0 | 77.8 | 80.0 | 81.9 | 82.4 | 82.1 | 77.3 | 78.4 | 84.2 | 82.3 | 89.1 | 83.7 | 78.4 | 83.0 | 85.7 | 80.2 | 77.2 | 75.5 | 72.9 | 84.2 | 80.9 | 85.9 | 78.0 | 77.0 | 72.1 | 82.2 | 83.3 | 78.9 | 83.5 | 85.8 | 81.7 | 75.3 | 83.0 | 78.5 | 85.4 | 74.9 | 80.3 | 76.7 | 87.9 | 83.7 | 77.2 | 74.6 | 88.4 | 79.8 | 78.1 | 72.5 |
| Jul 13 | 77.9 | 79.1 | 79.0 | 83.0 | 77.7 | 77.8 | 80.4 | 78.5 | 83.4 | 81.9 | 85.0 | 82.3 | 72.4 | 80.5 | 80.6 | 77.4 | 76.0 | 76.9 | 73.8 | 84.1 | 79.7 | 78.0 | 77.8 | 77.5 | 74.7 | 79.6 | 78.8 | 80.2 | 83.8 | 79.7 | 82.0 | 84.1 | 81.4 | 79.6 | 82.1 | 75.5 | 77.2 | 74.9 | 79.1 | 81.6 | 76.5 | 75.8 | 85.6 | 79.0 | 76.9 | 77.1 |
| Jul 14 | 83.5 | 76.7 | 77.4 | 72.2 | 74.2 | 84.9 | 79.7 | 77.9 | 81.2 | 76.3 | 80.7 | 87.9 | 82.2 | 78.6 | 85.5 | 87.1 | 83.1 | 76.4 | 77.6 | 78.8 | 76.8 | 81.8 | 80.8 | 73.4 | 69.9 | 80.6 | 80.3 | 82.0 | 81.6 | 81.2 | 73.9 | 80.3 | 78.9 | 73.9 | 78.2 | 75.4 | 79.0 | 74.3 | 79.4 | 87.1 | 79.2 | 79.6 | 84.3 | 81.6 | 77.4 | 77.2 |
| Jul 15 | 78.7 | 77.7 | 82.7 | 79.3 | 78.7 | 84.0 | 82.9 | 82.8 | 76.9 | 72.2 | 82.2 | 86.2 | 83.7 | 76.1 | 84.0 | 85.6 | 85.2 | 72.5 | 83.9 | 78.4 | 77.5 | 80.6 | 79.0 | 74.5 | 82.0 | 76.2 | 82.7 | 81.4 | 78.7 | 79.7 | 80.0 | 80.1 | 73.7 | 75.8 | 80.4 | 77.8 | 83.6 | 74.1 | 77.6 | 83.5 | 79.5 | 81.6 | 84.6 | 77.2 | 79.9 | 71.6 |
| Jul 16 | 83.4 | 75.9 | 80.5 | 75.2 | 76.5 | 80.6 | 81.1 | 85.3 | 76.2 | 78.4 | 78.1 | 85.0 | 78.5 | 73.5 | 82.3 | 88.2 | 84.6 | 71.8 | 86.4 | 76.8 | 75.2 | 80.1 | 82.7 | 75.7 | 79.5 | 78.5 | 85.4 | 83.8 | 85.0 | 80.4 | 80.5 | 78.5 | 71.4 | 74.4 | 78.0 | 75.0 | 85.3 | 77.8 | 74.1 | 82.4 | 75.2 | 79.5 | 87.5 | 78.5 | 75.5 | 76.9 |
| Jul 17 | 82.3 | 77.6 | 78.6 | 79.1 | 80.9 | 76.1 | 81.6 | 83.0 | 71.4 | 84.2 | 78.3 | 80.0 | 80.3 | 74.1 | 83.6 | 85.8 | 77.7 | 73.4 | 86.5 | 74.8 | 77.8 | 84.9 | 83.5 | 79.5 | 83.2 | 75.3 | 84.2 | 78.9 | 86.7 | 85.8 | 78.7 | 81.1 | 74.1 | 75.9 | 71.1 | 78.7 | 80.3 | 78.1 | 80.2 | 84.7 | 76.0 | 80.3 | 85.0 | 79.5 | 73.7 | 80.0 |
| Jul 18 | 86.2 | 80.9 | 82.6 | 77.3 | 82.4 | 72.3 | 79.8 | 85.8 | 75.7 | 85.3 | 86.6 | 86.1 | 83.3 | 74.9 | 81.0 | 80.0 | 78.2 | 74.6 | 85.4 | 70.8 | 77.3 | 83.0 | 79.5 | 86.3 | 84.9 | 74.2 | 88.8 | 76.7 | 85.7 | 85.3 | 81.1 | 81.1 | 73.8 | 77.7 | 72.6 | 77.6 | 80.0 | 80.1 | 73.7 | 84.1 | 76.6 | 81.2 | 88.1 | 78.9 | 77.5 | 82.4 |
| Jul 19 | 86.6 | 79.1 | 83.5 | 72.1 | 81.8 | 81.0 | 74.7 | 89.0 | 72.1 | 85.8 | 88.3 | 92.7 | 78.6 | 78.9 | 81.7 | 75.6 | 79.5 | 76.0 | 88.6 | 76.3 | 79.2 | 82.2 | 81.7 | 80.8 | 83.6 | 80.7 | 84.6 | 81.4 | 82.9 | 82.8 | 80.0 | 84.3 | 75.3 | 77.4 | 77.0 | 79.2 | 82.8 | 82.0 | 73.1 | 87.2 | 75.1 | 80.9 | 79.2 | 75.2 | 80.0 | 83.6 |
| Jul 20 | 82.4 | 83.7 | 80.8 | 77.0 | 81.3 | 81.1 | 82.5 | 87.3 | 71.0 | 82.0 | 86.8 | 89.6 | 85.7 | 79.1 | 83.1 | 79.2 | 80.3 | 82.4 | 83.4 | 79.3 | 86.2 | 74.4 | 72.1 | 84.7 | 81.3 | 78.0 | 77.7 | 76.7 | 79.6 | 78.9 | 80.8 | 88.1 | 77.8 | 76.8 | 82.8 | 75.5 | 87.2 | 86.7 | 80.5 | 83.6 | 72.0 | 83.6 | 73.5 | 72.4 | 78.1 | 86.6 |
| Jul 21 | 82.6 | 77.6 | 84.4 | 76.3 | 82.3 | 82.8 | 82.0 | 80.4 | 67.9 | 79.0 | 86.1 | 85.2 | 86.2 | 82.1 | 82.0 | 80.2 | 84.0 | 80.6 | 83.7 | 80.6 | 89.2 | 78.6 | 77.2 | 85.7 | 84.7 | 80.8 | 80.8 | 76.4 | 86.2 | 78.3 | 80.7 | 80.5 | 78.6 | 79.8 | 83.5 | 85.6 | 85.0 | 86.6 | 79.5 | 81.5 | 70.5 | 88.1 | 83.2 | 74.4 | 80.5 | 86.5 |
| Jul 22 | 82.9 | 83.5 | 82.6 | 78.6 | 83.1 | 78.0 | 83.9 | 80.1 | 70.7 | 75.8 | 80.5 | 84.1 | 83.8 | 80.2 | 85.7 | 82.5 | 79.2 | 80.1 | 84.0 | 79.8 | 84.8 | 78.4 | 78.4 | 82.3 | 85.5 | 75.5 | 84.9 | 82.7 | 75.4 | 73.6 | 76.9 | 83.5 | 84.6 | 79.3 | 79.1 | 79.6 | 82.8 | 81.6 | 83.4 | 75.3 | 76.6 | 86.2 | 84.6 | 79.6 | 82.0 | 82.7 |
| Jul 23 | 81.8 | 83.0 | 80.4 | 82.0 | 79.4 | 84.9 | 83.1 | 76.8 | 78.0 | 73.0 | 81.9 | 85.2 | 81.8 | 83.2 | 85.5 | 83.1 | 80.2 | 76.5 | 84.5 | 77.0 | 84.0 | 75.5 | 78.2 | 86.0 | 82.5 | 78.2 | 83.3 | 79.4 | 77.7 | 83.4 | 82.7 | 83.3 | 77.1 | 81.7 | 84.6 | 77.3 | 81.4 | 81.7 | 80.5 | 75.9 | 81.4 | 84.3 | 83.2 | 85.2 | 84.1 | 78.9 |
| Jul 24 | 82.2 | 85.5 | 77.6 | 80.2 | 76.3 | 88.2 | 81.1 | 79.9 | 82.0 | 81.6 | 82.4 | 81.8 | 73.7 | 84.5 | 77.6 | 83.4 | 79.5 | 78.7 | 82.3 | 79.7 | 80.5 | 75.3 | 76.6 | 86.2 | 84.5 | 82.5 | 80.6 | 79.1 | 84.6 | 86.6 | 80.4 | 84.2 | 80.5 | 80.1 | 83.6 | 78.1 | 85.5 | 80.5 | 80.8 | 80.6 | 82.0 | 80.4 | 85.2 | 86.4 | 79.6 | 79.4 |
| Jul 25 | 85.4 | 85.9 | 83.2 | 89.3 | 68.9 | 87.3 | 81.4 | 77.5 | 75.2 | 80.7 | 79.0 | 85.3 | 77.8 | 88.2 | 82.6 | 77.1 | 79.0 | 76.6 | 77.7 | 79.1 | 80.0 | 78.3 | 76.7 | 84.8 | 81.5 | 81.2 | 87.5 | 83.8 | 83.6 | 84.5 | 80.2 | 83.7 | 84.4 | 76.8 | 85.4 | 75.9 | 81.9 | 80.9 | 79.2 | 81.1 | 85.3 | 79.3 | 85.2 | 83.4 | 79.9 | 77.4 |
| Jul 26 | 81.4 | 86.3 | 80.1 | 86.4 | 72.2 | 82.6 | 79.3 | 78.1 | 66.5 | 79.8 | 76.2 | 74.7 | 85.6 | 88.2 | 78.7 | 73.6 | 77.7 | 78.7 | 79.2 | 71.8 | 73.6 | 78.9 | 80.9 | 80.9 | 83.4 | 75.3 | 87.3 | 85.0 | 84.6 | 77.0 | 81.5 | 86.9 | 83.0 | 75.8 | 85.7 | 75.6 | 77.7 | 80.0 | 76.7 | 83.5 | 88.1 | 75.9 | 85.3 | 76.7 | 79.6 | 79.8 |
| Jul 27 | 80.7 | 80.5 | 83.2 | 83.2 | 78.0 | 86.4 | 85.2 | 79.0 | 68.2 | 79.5 | 76.5 | 76.9 | 79.7 | 87.3 | 75.5 | 70.9 | 75.9 | 76.8 | 79.7 | 79.1 | 77.8 | 81.3 | 76.8 | 74.5 | 85.1 | 79.1 | 82.7 | 82.0 | 79.0 | 80.5 | 74.8 | 90.3 | 83.4 | 75.0 | 81.1 | 73.8 | 77.1 | 80.5 | 78.2 | 80.2 | 88.4 | 74.3 | 81.3 | 72.2 | 77.6 | 79.4 |
| Jul 28 | 76.1 | 78.6 | 78.2 | 79.9 | 73.6 | 86.3 | 81.2 | 77.1 | 72.5 | 74.6 | 80.8 | 84.6 | 79.2 | 87.6 | 75.5 | 74.7 | 77.3 | 77.7 | 74.8 | 80.7 | 80.3 | 84.0 | 77.0 | 67.9 | 73.0 | 76.3 | 83.9 | 85.5 | 83.3 | 77.2 | 78.9 | 90.0 | 74.7 | 74.1 | 75.6 | 80.0 | 75.4 | 84.4 | 80.7 | 80.8 | 80.7 | 67.6 | 82.4 | 80.4 | 75.5 | 81.3 |
| Jul 29 | 77.3 | 79.0 | 76.4 | 83.0 | 70.5 | 80.4 | 78.2 | 77.4 | 76.6 | 71.5 | 84.3 | 80.6 | 86.0 | 85.5 | 78.2 | 75.7 | 81.1 | 73.1 | 77.3 | 78.3 | 77.0 | 83.0 | 84.3 | 71.7 | 77.6 | 80.2 | 79.7 | 83.0 | 79.0 | 79.1 | 73.5 | 85.5 | 76.6 | 72.5 | 70.9 | 75.4 | 81.1 | 77.4 | 83.4 | 82.0 | 77.7 | 75.5 | 76.1 | 79.5 | 78.6 | 86.6 |
| Jul 30 | 82.8 | 79.6 | 73.4 | 79.5 | 79.4 | 77.4 | 80.4 | 80.1 | 75.6 | 70.6 | 81.8 | 74.7 | 81.5 | 86.3 | 78.3 | 76.8 | 79.5 | 76.3 | 79.0 | 81.6 | 80.2 | 80.9 | 86.6 | 77.3 | 79.9 | 83.1 | 85.9 | 77.2 | 80.3 | 77.4 | 76.3 | 85.3 | 78.1 | 66.0 | 79.3 | 77.0 | 84.3 | 84.0 | 85.2 | 74.2 | 73.1 | 76.7 | 79.1 | 72.8 | 76.6 | 82.4 |
| Jul 31 | 78.1 | 80.2 | 75.2 | 79.4 | 81.0 | 81.5 | 81.0 | 80.1 | 75.2 | 78.8 | 78.6 | 75.1 | 72.0 | 76.6 | 70.0 | 73.4 | 79.4 | 76.3 | 79.3 | 75.0 | 77.5 | 81.4 | 82.6 | 83.4 | 78.9 | 79.9 | 86.7 | 82.2 | 81.8 | 82.9 | 81.9 | 89.9 | 71.3 | 75.8 | 78.2 | 79.3 | 82.0 | 82.9 | 79.9 | 84.5 | 76.5 | 78.4 | 87.4 | 70.4 | 77.1 | 81.3 |
| Aug 1 | 77.0 | 83.0 | 73.3 | 72.5 | 79.3 | 79.6 | 82.2 | 81.3 | 76.6 | 82.1 | 78.6 | 71.8 | 73.7 | 82.7 | 70.9 | 81.8 | 80.8 | 74.6 | 77.7 | 82.4 | 75.8 | 77.4 | 70.3 | 81.9 | 84.4 | 85.0 | 84.3 | 81.1 | 82.8 | 86.6 | 84.9 | 89.6 | 76.9 | 79.2 | 75.4 | 80.9 | 79.1 | 77.2 | 83.5 | 81.8 | 70.8 | 85.0 | 89.8 | 73.3 | 76.1 | 83.0 |
| Aug 2 | 78.5 | 80.9 | 72.2 | 74.4 | 83.4 | 85.7 | 80.2 | 77.4 | 79.2 | 82.5 | 76.2 | 72.4 | 76.2 | 78.4 | 74.8 | 75.1 | 75.3 | 77.4 | 76.1 | 80.7 | 85.1 | 77.6 | 70.5 | 86.3 | 77.7 | 85.9 | 77.1 | 85.5 | 85.0 | 79.5 | 82.0 | 88.9 | 79.3 | 73.7 | 77.4 | 79.4 | 83.9 | 78.4 | 83.2 | 84.7 | 76.7 | 86.7 | 89.9 | 75.9 | 79.3 | 79.9 |
| Aug 3 | 76.0 | 80.8 | 71.5 | 79.7 | 86.3 | 78.5 | 84.9 | 78.0 | 83.2 | 84.5 | 79.0 | 80.5 | 78.0 | 79.8 | 79.3 | 74.8 | 71.2 | 78.1 | 73.0 | 81.7 | 80.9 | 78.9 | 73.8 | 82.0 | 72.7 | 75.5 | 86.1 | 78.9 | 84.0 | 76.5 | 83.3 | 85.6 | 83.1 | 76.1 | 80.4 | 77.2 | 82.5 | 77.2 | 72.8 | 74.4 | 74.4 | 85.8 | 88.5 | 84.5 | 82.5 | 74.9 |
| Aug 4 | 75.9 | 83.3 | 72.0 | 74.7 | 81.5 | 75.9 | 78.8 | 79.3 | 89.4 | 85.6 | 77.5 | 81.3 | 75.9 | 75.2 | 75.9 | 83.0 | 74.6 | 78.5 | 78.7 | 80.5 | 74.3 | 79.9 | 76.1 | 82.8 | 79.6 | 80.8 | 84.6 | 78.0 | 83.7 | 84.9 | 83.2 | 83.7 | 85.3 | 75.9 | 78.5 | 80.7 | 79.4 | 83.2 | 77.7 | 71.5 | 76.6 | 85.0 | 84.7 | 75.6 | 84.0 | 71.5 |
| Aug 5 | 72.4 | 80.4 | 71.9 | 76.4 | 86.5 | 74.9 | 82.1 | 83.6 | 79.9 | 78.4 | 74.2 | 77.1 | 79.8 | 77.8 | 74.1 | 82.5 | 77.2 | 72.6 | 70.3 | 78.0 | 72.0 | 83.9 | 80.4 | 82.3 | 79.9 | 86.3 | 83.1 | 79.7 | 79.3 | 79.0 | 80.6 | 79.4 | 79.8 | 81.9 | 78.4 | 86.3 | 79.4 | 83.4 | 82.8 | 81.4 | 79.4 | 84.2 | 87.7 | 75.8 | 84.3 | 70.1 |
| Aug 6 | 72.3 | 71.4 | 78.8 | 76.5 | 85.3 | 74.6 | 79.3 | 83.3 | 84.5 | 83.8 | 83.8 | 70.4 | 77.9 | 77.6 | 80.7 | 81.4 | 76.1 | 68.7 | 67.4 | 75.4 | 84.8 | 77.1 | 78.9 | 79.9 | 76.1 | 89.2 | 79.8 | 77.0 | 76.0 | 80.0 | 80.6 | 77.2 | 75.5 | 84.5 | 78.5 | 83.2 | 80.8 | 76.4 | 83.5 | 82.4 | 78.8 | 83.2 | 83.7 | 80.7 | 78.7 | 72.3 |
| Aug 7 | 74.6 | 76.0 | 83.4 | 73.7 | 86.1 | 73.0 | 73.1 | 85.0 | 78.4 | 87.3 | 73.9 | 74.4 | 74.6 | 67.5 | 80.5 | 79.3 | 71.8 | 63.4 | 70.7 | 72.3 | 84.2 | 83.9 | 81.6 | 84.8 | 76.8 | 88.3 | 78.6 | 79.0 | 85.3 | 80.2 | 80.2 | 74.6 | 78.4 | 85.4 | 79.1 | 81.4 | 74.1 | 73.6 | 85.8 | 86.2 | 81.1 | 79.0 | 75.2 | 81.1 | 78.5 | 74.7 |
| Aug 8 | 78.8 | 71.4 | 82.7 | 73.1 | 90.1 | 71.9 | 69.8 | 84.8 | 76.0 | 86.7 | 78.0 | 70.8 | 79.4 | 66.4 | 75.6 | 83.2 | 76.2 | 68.2 | 73.7 | 71.0 | 83.6 | 86.4 | 82.1 | 83.1 | 77.8 | 86.9 | 80.9 | 76.5 | 82.7 | 82.3 | 79.0 | 80.4 | 75.7 | 83.5 | 77.8 | 81.0 | 71.2 | 71.8 | 88.9 | 78.7 | 79.7 | 80.6 | 82.6 | 73.6 | 76.5 | 72.5 |
| Aug 9 | 78.4 | 75.2 | 86.0 | 70.1 | 85.4 | 77.2 | 73.2 | 84.0 | 84.7 | 87.7 | 79.3 | 69.8 | 82.5 | 66.2 | 81.1 | 75.4 | 80.6 | 72.5 | 73.0 | 70.1 | 86.1 | 80.2 | 82.7 | 85.9 | 80.0 | 79.0 | 75.6 | 77.2 | 84.2 | 81.4 | 77.7 | 78.6 | 84.3 | 84.0 | 81.2 | 85.7 | 64.2 | 75.2 | 84.3 | 75.1 | 78.8 | 71.5 | 79.3 | 80.9 | 81.9 | 78.1 |
| Aug 10 | 80.2 | 76.1 | 75.4 | 68.6 | 79.9 | 79.8 | 74.6 | 80.7 | 79.5 | 89.9 | 80.9 | 74.5 | 88.4 | 73.5 | 83.7 | 71.5 | 79.2 | 71.5 | 71.9 | 73.6 | 77.7 | 76.5 | 86.5 | 88.8 | 76.4 | 81.7 | 75.7 | 77.8 | 82.2 | 80.0 | 78.9 | 83.7 | 83.7 | 81.7 | 83.2 | 82.6 | 67.2 | 79.9 | 77.1 | 76.6 | 75.8 | 73.5 | 76.3 | 76.9 | 79.2 | 75.1 |
| Aug 11 | 80.3 | 75.6 | 77.9 | 70.3 | 76.4 | 81.5 | 79.1 | 73.3 | 81.3 | 84.9 | 77.7 | 70.6 | 91.0 | 70.3 | 84.9 | 66.9 | 81.7 | 76.2 | 77.8 | 72.8 | 76.5 | 86.8 | 75.6 | 88.2 | 73.8 | 74.4 | 75.8 | 75.2 | 84.6 | 75.6 | 75.3 | 88.3 | 81.9 | 83.5 | 82.3 | 86.3 | 76.2 | 74.8 | 76.4 | 73.9 | 76.5 | 71.9 | 64.1 | 67.8 | 82.0 | 72.8 |
| Aug 12 | 79.0 | 73.9 | 72.7 | 73.9 | 81.6 | 75.0 | 81.8 | 82.2 | 73.4 | 84.9 | 75.7 | 71.1 | 82.1 | 73.8 | 86.6 | 70.5 | 86.4 | 75.3 | 75.5 | 69.4 | 78.5 | 87.0 | 69.5 | 92.3 | 74.6 | 69.2 | 81.1 | 73.5 | 79.7 | 82.0 | 80.6 | 85.1 | 75.9 | 78.2 | 82.4 | 90.6 | 72.8 | 72.0 | 76.0 | 73.4 | 71.7 | 73.6 | 69.7 | 63.7 | 79.0 | 68.8 |

## TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET

| YEAR-> | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug 13 | 76.8 | 80.0 | 73.0 | 78.6 | 77.1 | 77.6 | 83.7 | 79.4 | 74.4 | 77.5 | 76.5 | 73.4 | 71.7 | 74.4 | 78.7 | 73.8 | 82.1 | 75.8 | 76.0 | 66.6 | 73.3 | 79.2 | 78.0 | 76.1 | 72.3 | 72.1 | 79.5 | 72.5 | 81.5 | 79.3 | 84.8 | 84.3 | 79.0 | 88.0 | 73.4 | 79.3 | 74.5 | 68.8 | 75.7 | 78.8 | 80.1 | 73.7 | 67.5 | 69.7 | 69.6 | 67.6 |
| Aug 14 | 83.5 | 79.8 | 76.6 | 74.2 | 76.0 | 74.6 | 82.9 | 71.2 | 67.6 | 74.5 | 77.2 | 74.8 | 75.0 | 77.2 | 77.7 | 72.7 | 85.3 | 66.6 | 69.7 | 68.7 | 73.4 | 80.4 | 77.5 | 78.7 | 72.1 | 69.9 | 79.7 | 68.0 | 73.9 | 78.8 | 91.9 | 84.6 | 76.6 | 87.1 | 78.7 | 80.1 | 72.1 | 73.7 | 80.2 | 77.0 | 74.5 | 75.2 | 67.7 | 68.8 | 71.9 | 68.9 |
| Aug 15 | 76.4 | 76.8 | 74.8 | 76.7 | 71.0 | 69.8 | 82.1 | 75.2 | 73.2 | 77.0 | 73.3 | 74.9 | 78.1 | 75.9 | 83.0 | 78.1 | 76.7 | 73.0 | 75.1 | 74.7 | 76.1 | 72.5 | 75.9 | 79.5 | 75.6 | 69.7 | 78.2 | 75.0 | 78.6 | 81.2 | 85.8 | 86.4 | 83.1 | 82.6 | 75.1 | 76.3 | 81.2 | 82.7 | 74.6 | 74.8 | 74.0 | 75.9 | 67.0 | 70.1 | 71.2 | 71.8 |
| Aug 16 | 76.4 | 82.3 | 73.5 | 82.3 | 80.3 | 66.7 | 83.9 | 77.6 | 69.0 | 77.2 | 73.0 | 78.4 | 79.9 | 72.9 | 85.6 | 76.8 | 80.5 | 73.6 | 82.2 | 67.8 | 72.4 | 76.3 | 72.9 | 74.7 | 71.4 | 69.1 | 73.2 | 74.5 | 76.9 | 76.5 | 82.0 | 77.1 | 79.5 | 75.4 | 74.2 | 78.5 | 78.8 | 79.4 | 73.0 | 72.0 | 75.4 | 76.0 | 72.7 | 69.7 | 70.5 | 76.1 |
| Aug 17 | 82.7 | 77.5 | 73.7 | 81.5 | 83.7 | 69.9 | 81.7 | 77.6 | 69.6 | 79.4 | 68.7 | 78.1 | 82.3 | 73.2 | 75.2 | 78.5 | 77.9 | 68.4 | 78.5 | 72.9 | 69.8 | 73.2 | 73.2 | 71.6 | 74.8 | 70.5 | 75.7 | 80.4 | 74.3 | 76.6 | 81.3 | 82.0 | 77.5 | 77.1 | 74.4 | 82.8 | 78.3 | 81.2 | 73.6 | 74.0 | 68.8 | 69.1 | 70.0 | 77.1 | 73.8 | 73.2 |
| Aug 18 | 79.3 | 76.7 | 75.1 | 77.9 | 80.7 | 67.7 | 81.5 | 80.7 | 75.0 | 77.4 | 72.3 | 71.5 | 79.3 | 70.8 | 77.4 | 78.6 | 79.9 | 70.0 | 66.0 | 75.6 | 78.1 | 75.0 | 73.7 | 76.3 | 77.1 | 73.5 | 75.3 | 74.3 | 74.9 | 79.4 | 84.2 | 75.7 | 83.3 | 79.3 | 76.8 | 79.3 | 84.6 | 80.4 | 74.3 | 75.6 | 61.2 | 72.7 | 70.7 | 76.1 | 74.8 | 69.4 |
| Aug 19 | 78.9 | 78.6 | 81.8 | 78.4 | 84.7 | 70.8 | 84.9 | 80.5 | 75.5 | 74.7 | 74.2 | 77.3 | 76.1 | 81.1 | 66.4 | 80.5 | 82.7 | 71.0 | 67.0 | 76.6 | 74.2 | 82.1 | 78.0 | 76.8 | 77.0 | 81.4 | 76.9 | 73.4 | 71.5 | 75.6 | 82.1 | 72.3 | 83.7 | 83.0 | 71.8 | 77.3 | 73.7 | 82.5 | 76.3 | 81.5 | 68.6 | 71.8 | 73.5 | 74.7 | 79.1 | 76.0 |
| Aug 20 | 77.6 | 77.1 | 80.1 | 76.4 | 78.2 | 78.7 | 84.6 | 83.4 | 69.4 | 76.1 | 76.4 | 82.2 | 80.5 | 75.3 | 68.5 | 80.3 | 77.5 | 72.3 | 74.3 | 74.0 | 77.4 | 75.5 | 74.5 | 72.2 | 83.0 | 81.2 | 79.4 | 79.3 | 71.0 | 80.6 | 78.3 | 70.6 | 81.8 | 82.8 | 70.4 | 76.7 | 73.5 | 84.9 | 78.2 | 81.1 | 72.0 | 72.0 | 73.6 | 77.4 | 78.4 | 76.4 |
| Aug 21 | 76.5 | 79.1 | 78.6 | 69.8 | 76.1 | 80.8 | 81.1 | 76.0 | 69.3 | 78.1 | 75.7 | 79.9 | 81.5 | 86.9 | 69.8 | 78.8 | 75.4 | 71.1 | 82.4 | 67.7 | 78.0 | 74.3 | 76.9 | 76.8 | 86.7 | 74.6 | 77.3 | 71.9 | 71.0 | 78.9 | 76.7 | 70.2 | 70.5 | 84.4 | 72.7 | 67.4 | 76.0 | 85.8 | 76.3 | 81.6 | 72.8 | 73.7 | 73.1 | 73.1 | 86.9 | 71.1 |
| Aug 22 | 80.9 | 77.0 | 72.8 | 73.7 | 81.0 | 72.4 | 79.3 | 80.9 | 72.8 | 84.5 | 71.8 | 74.3 | 82.2 | 81.7 | 72.2 | 78.1 | 79.4 | 78.7 | 76.6 | 75.6 | 70.9 | 75.4 | 80.4 | 80.0 | 80.0 | 77.8 | 80.4 | 74.3 | 66.6 | 81.4 | 74.3 | 63.5 | 72.3 | 80.7 | 68.8 | 66.9 | 81.8 | 80.8 | 70.7 | 82.0 | 79.2 | 75.1 | 75.2 | 79.4 | 82.5 | 74.3 |
| Aug 23 | 80.8 | 76.2 | 74.3 | 73.8 | 73.7 | 77.3 | 81.4 | 77.2 | 75.4 | 75.9 | 76.7 | 66.7 | 81.4 | 74.6 | 72.5 | 77.5 | 79.6 | 81.4 | 73.9 | 72.3 | 71.5 | 77.4 | 77.6 | 79.9 | 75.2 | 76.6 | 69.7 | 67.1 | 80.5 | 75.6 | 68.7 | 63.0 | 77.5 | 78.4 | 73.5 | 64.0 | 81.0 | 79.6 | 65.9 | 74.9 | 75.7 | 71.6 | 69.4 | 75.7 | 80.5 | 76.2 |
| Aug 24 | 74.8 | 73.1 | 74.0 | 76.4 | 71.8 | 78.1 | 73.0 | 79.1 | 75.0 | 77.5 | 76.3 | 68.5 | 82.7 | 78.0 | 70.6 | 69.4 | 79.6 | 81.5 | 70.6 | 74.4 | 78.2 | 80.5 | 75.0 | 74.1 | 78.9 | 73.9 | 71.7 | 67.6 | 79.2 | 83.1 | 70.7 | 69.0 | 67.4 | 74.2 | 76.0 | 68.0 | 85.0 | 83.3 | 75.0 | 81.0 | 78.3 | 74.0 | 71.9 | 76.9 | 82.0 | 74.4 |
| Aug 25 | 73.8 | 72.8 | 78.0 | 80.9 | 70.9 | 74.9 | 78.3 | 72.3 | 76.5 | 75.6 | 70.0 | 60.5 | 76.7 | 77.4 | 67.4 | 76.4 | 82.8 | 88.1 | 73.4 | 77.1 | 66.0 | 82.3 | 71.7 | 76.1 | 83.3 | 78.2 | 76.8 | 67.8 | 81.8 | 80.8 | 64.6 | 69.9 | 74.3 | 73.5 | 79.6 | 66.5 | 80.9 | 80.2 | 70.4 | 83.4 | 78.7 | 68.6 | 73.6 | 72.8 | 86.1 | 71.4 |
| Aug 26 | 75.4 | 68.0 | 73.1 | 85.4 | 71.1 | 72.8 | 65.4 | 79.9 | 83.3 | 81.8 | 69.8 | 69.4 | 77.3 | 76.0 | 75.8 | 81.0 | 78.2 | 84.7 | 71.7 | 67.9 | 72.6 | 78.9 | 74.9 | 75.6 | 75.3 | 75.4 | 69.5 | 61.0 | 79.7 | 73.4 | 68.0 | 81.4 | 73.8 | 73.9 | 76.9 | 72.2 | 84.6 | 76.8 | 74.4 | 84.1 | 74.7 | 73.3 | 71.9 | 76.2 | 83.8 | 71.6 |
| Aug 27 | 74.4 | 69.5 | 74.8 | 84.2 | 76.3 | 67.9 | 76.3 | 71.8 | 79.7 | 71.2 | 80.2 | 61.7 | 78.7 | 69.0 | 79.0 | 79.5 | 77.4 | 75.5 | 71.6 | 75.5 | 76.2 | 76.9 | 70.0 | 76.7 | 72.6 | 75.6 | 75.2 | 64.7 | 75.4 | 70.7 | 66.6 | 76.6 | 80.3 | 78.9 | 75.4 | 74.0 | 82.3 | 75.1 | 79.2 | 77.6 | 84.6 | 65.0 | 68.1 | 70.9 | 84.8 | 63.4 |
| Aug 28 | 76.3 | 68.2 | 81.9 | 87.5 | 66.7 | 66.4 | 80.9 | 69.4 | 73.0 | 70.4 | 80.6 | 62.3 | 71.1 | 70.6 | 76.5 | 67.8 | 70.3 | 65.6 | 65.6 | 63.8 | 70.8 | 69.9 | 66.7 | 78.4 | 72.4 | 73.8 | 71.0 | 55.9 | 75.7 | 71.4 | 72.9 | 75.2 | 83.4 | 79.3 | 73.9 | 70.0 | 85.2 | 76.2 | 73.8 | 82.1 | 80.2 | 65.5 | 65.2 | 70.5 | 88.9 | 71.9 |
| Aug 29 | 74.0 | 73.3 | 81.6 | 79.4 | 66.3 | 62.8 | 80.6 | 68.5 | 70.3 | 63.8 | 78.0 | 66.0 | 75.3 | 69.6 | 77.3 | 63.3 | 70.1 | 70.8 | 67.9 | 63.5 | 73.0 | 75.2 | 74.4 | 68.5 | 71.6 | 83.7 | 63.6 | 70.8 | 76.0 | 64.6 | 68.0 | 77.4 | 79.5 | 85.0 | 74.5 | 75.1 | 84.8 | 74.4 | 72.4 | 82.6 | 78.2 | 73.9 | 70.9 | 73.6 | 79.9 | 71.7 |
| Aug 30 | 68.9 | 74.5 | 80.3 | 77.4 | 67.0 | 75.3 | 74.9 | 70.7 | 79.0 | 71.2 | 80.9 | 66.5 | 75.8 | 65.8 | 81.8 | 63.7 | 63.7 | 68.9 | 67.8 | 67.2 | 70.0 | 73.9 | 78.6 | 66.2 | 69.6 | 78.4 | 64.4 | 72.4 | 68.0 | 68.1 | 71.6 | 85.1 | 81.5 | 76.8 | 64.4 | 78.9 | 78.3 | 81.1 | 71.9 | 81.9 | 71.3 | 78.9 | 71.5 | 73.7 | 73.4 | 80.3 |
| Aug 31 | 61.3 | 78.4 | 72.4 | 69.3 | 62.8 | 73.4 | 70.0 | 55.9 | 75.0 | 63.2 | 73.2 | 66.9 | 70.2 | 68.4 | 82.1 | 61.9 | 64.8 | 68.8 | 65.3 | 65.0 | 72.1 | 74.1 | 73.2 | 64.0 | 60.7 | 79.3 | 55.5 | 65.1 | 65.0 | 72.4 | 69.9 | 79.5 | 64.5 | 69.2 | 65.2 | 72.8 | 71.8 | 79.2 | 64.0 | 77.0 | 69.8 | 74.2 | 73.4 | 65.7 | 72.0 | 73.3 |
| Sep 1 | 59.7 | 73.2 | 65.9 | 70.1 | 65.9 | 70.4 | 72.8 | 60.2 | 71.9 | 59.1 | 77.2 | 63.5 | 63.6 | 59.2 | 74.1 | 59.4 | 59.3 | 66.0 | 72.2 | 57.2 | 67.5 | 75.9 | 66.0 | 66.6 | 61.6 | 63.6 | 58.6 | 71.7 | 68.3 | 62.7 | 66.1 | 75.4 | 68.8 | 58.8 | 63.4 | 74.8 | 77.0 | 62.9 | 57.8 | 78.9 | 67.1 | 67.8 | 75.5 | 68.7 | 76.4 | 72.6 |
| Sep 2 | 65.8 | 73.8 | 51.4 | 65.9 | 62.7 | 68.0 | 68.1 | 55.9 | 69.3 | 59.7 | 77.9 | 68.1 | 67.2 | 62.4 | 68.7 | 60.9 | 73.0 | 70.1 | 66.0 | 60.5 | 60.0 | 70.6 | 66.7 | 69.6 | 57.1 | 71.0 | 62.6 | 74.5 | 72.7 | 70.1 | 65.2 | 72.9 | 60.3 | 67.0 | 72.3 | 77.1 | 69.7 | 69.3 | 58.6 | 82.4 | 72.2 | 61.9 | 72.4 | 74.1 | 68.4 | 75.8 |
| Sep 3 | 68.1 | 73.1 | 61.2 | 69.1 | 72.3 | 64.1 | 60.6 | 54.8 | 66.9 | 51.8 | 65.5 | 63.5 | 65.1 | 60.4 | 69.8 | 59.8 | 67.0 | 76.2 | 67.7 | 63.3 | 68.0 | 69.8 | 59.3 | 73.9 | 63.0 | 67.2 | 66.9 | 72.3 | 73.9 | 76.9 | 69.4 | 69.9 | 64.9 | 68.3 | 69.1 | 77.4 | 69.9 | 59.0 | 59.2 | 73.4 | 64.6 | 56.0 | 71.8 | 70.8 | 72.5 | 64.8 |
| Sep 4 | 62.1 | 74.1 | 63.7 | 64.1 | 67.9 | 68.6 | 63.3 | 55.2 | 57.7 | 61.5 | 63.7 | 66.3 | 68.3 | 61.4 | 68.4 | 59.7 | 68.3 | 74.0 | 61.7 | 61.2 | 65.7 | 75.0 | 69.2 | 76.7 | 68.0 | 65.0 | 66.3 | 74.8 | 71.6 | 67.7 | 65.0 | 73.2 | 70.1 | 68.4 | 64.8 | 70.9 | 73.3 | 63.1 | 56.0 | 67.0 | 63.0 | 60.8 | 72.7 | 59.9 | 75.3 | 71.1 |
| Sep 5 | 65.9 | 84.9 | 67.8 | 78.3 | 70.0 | 75.5 | 65.8 | 51.5 | 55.1 | 53.8 | 60.4 | 60.8 | 77.5 | 65.1 | 68.7 | 60.9 | 67.0 | 74.5 | 64.4 | 70.3 | 68.2 | 68.8 | 60.1 | 67.2 | 66.9 | 63.1 | 69.2 | 72.1 | 75.6 | 60.9 | 66.4 | 79.9 | 71.4 | 66.3 | 67.7 | 69.3 | 66.9 | 64.5 | 64.4 | 67.7 | 66.8 | 53.7 | 76.3 | 68.0 | 78.4 | 74.6 |
| Sep 6 | 65.6 | 77.1 | 61.9 | 75.1 | 69.3 | 76.4 | 63.5 | 57.9 | 53.3 | 60.5 | 68.6 | 61.9 | 80.8 | 64.9 | 68.6 | 57.0 | 71.2 | 68.5 | 69.9 | 58.9 | 73.0 | 71.8 | 56.8 | 63.9 | 63.4 | 64.0 | 66.3 | 74.8 | 73.3 | 62.6 | 70.9 | 80.8 | 63.1 | 66.2 | 71.4 | 67.1 | 70.5 | 61.4 | 65.1 | 66.8 | 67.3 | 48.6 | 73.7 | 66.3 | 73.2 | 77.9 |
| Sep 7 | 66.0 | 76.0 | 62.9 | 67.0 | 67.1 | 78.6 | 68.1 | 61.4 | 56.0 | 69.7 | 66.8 | 50.1 | 76.8 | 72.8 | 63.6 | 60.9 | 67.8 | 65.5 | 62.8 | 63.6 | 64.4 | 69.2 | 61.7 | 60.0 | 58.6 | 60.2 | 78.3 | 57.9 | 68.0 | 70.7 | 74.6 | 82.4 | 73.1 | 65.9 | 68.5 | 71.3 | 69.6 | 61.4 | 66.3 | 51.6 | 67.1 | 59.0 | 74.7 | 60.2 | 69.1 | 75.5 |
| Sep 8 | 63.8 | 74.0 | 59.2 | 68.4 | 62.1 | 69.4 | 68.2 | 57.5 | 55.4 | 71.1 | 77.0 | 61.4 | 68.7 | 73.2 | 73.6 | 71.8 | 70.4 | 63.9 | 62.3 | 62.3 | 66.9 | 66.5 | 63.2 | 52.1 | 49.4 | 61.9 | 73.5 | 61.8 | 69.6 | 73.9 | 74.7 | 85.3 | 66.3 | 74.2 | 66.9 | 65.1 | 64.1 | 70.3 | 62.7 | 58.5 | 70.1 | 65.9 | 80.3 | 56.7 | 68.1 | 77.0 |
| Sep 9 | 54.3 | 65.8 | 56.4 | 62.7 | 59.9 | 74.0 | 60.9 | 55.7 | 56.6 | 80.2 | 67.9 | 64.4 | 57.8 | 83.4 | 70.7 | 64.4 | 71.7 | 62.3 | 64.1 | 70.3 | 60.4 | 64.6 | 61.0 | 54.7 | 54.5 | 65.8 | 69.0 | 63.8 | 61.4 | 63.9 | 72.8 | 79.7 | 67.4 | 79.0 | 64.7 | 67.6 | 64.7 | 71.2 | 64.6 | 62.1 | 66.9 | 72.1 | 78.8 | 55.8 | 65.4 | 69.3 |
| Sep 10 | 53.1 | 67.6 | 62.1 | 65.1 | 67.6 | 75.8 | 55.8 | 64.1 | 63.6 | 69.8 | 76.4 | 68.6 | 58.8 | 77.8 | 68.7 | 63.8 | 62.0 | 65.8 | 58.2 | 68.4 | 67.0 | 63.7 | 66.7 | 55.0 | 51.3 | 64.2 | 65.7 | 58.7 | 66.4 | 72.1 | 72.6 | 81.4 | 67.9 | 82.8 | 59.8 | 71.0 | 71.9 | 57.4 | 60.2 | 65.7 | 76.7 | 69.1 | 72.7 | 60.2 | 64.5 | 63.8 |
| Sep 11 | 58.4 | 64.7 | 64.6 | 75.7 | 76.9 | 80.0 | 53.6 | 63.6 | 66.2 | 71.2 | 68.4 | 66.5 | 63.9 | 67.1 | 68.2 | 63.1 | 69.3 | 65.2 | 61.5 | 70.9 | 64.5 | 65.7 | 67.5 | 48.0 | 60.8 | 60.8 | 55.7 | 65.9 | 63.2 | 64.8 | 67.8 | 75.6 | 66.4 | 70.1 | 63.1 | 66.0 | 69.5 | 62.4 | 59.8 | 56.7 | 68.2 | 60.5 | 71.8 | 66.5 | 69.9 | 74.5 |
| Sep 12 | 67.4 | 65.5 | 64.6 | 74.6 | 69.9 | 69.0 | 59.1 | 67.2 | 73.8 | 72.5 | 51.7 | 75.4 | 71.0 | 72.1 | 74.9 | 64.4 | 60.5 | 59.4 | 63.1 | 67.5 | 59.0 | 64.3 | 66.4 | 52.8 | 68.1 | 61.2 | 69.7 | 73.0 | 60.5 | 66.3 | 61.5 | 70.5 | 64.9 | 67.8 | 56.8 | 65.2 | 60.6 | 65.3 | 61.5 | 59.7 | 69.0 | 69.2 | 65.9 | 66.0 | 77.4 | 71.3 |
| Sep 13 | 74.4 | 72.3 | 59.3 | 70.7 | 62.8 | 64.1 | 58.6 | 70.5 | 66.8 | 67.8 | 56.1 | 64.5 | 69.3 | 74.6 | 83.7 | 58.7 | 63.4 | 65.2 | 57.9 | 67.6 | 60.3 | 60.0 | 70.7 | 53.2 | 62.2 | 53.7 | 62.9 | 67.7 | 65.1 | 57.2 | 62.1 | 72.8 | 61.9 | 65.1 | 56.9 | 68.8 | 60.3 | 61.5 | 66.1 | 59.9 | 74.6 | 68.1 | 72.7 | 65.2 | 74.2 | 68.5 |
| Sep 14 | 63.3 | 69.5 | 64.4 | 67.3 | 63.5 | 72.4 | 61.1 | 64.5 | 57.7 | 62.3 | 62.7 | 70.3 | 76.7 | 69.9 | 72.4 | 56.2 | 58.2 | 66.0 | 63.4 | 68.1 | 62.5 | 63.9 | 68.4 | 59.4 | 61.2 | 57.3 | 67.0 | 70.6 | 62.3 | 65.5 | 61.7 | 64.4 | 62.0 | 70.9 | 59.9 | 75.0 | 65.4 | 53.3 | 65.5 | 64.6 | 74.4 | 73.1 | 67.9 | 62.7 | 81.1 | 67.9 |
| Sep 15 | 58.8 | 72.4 | 56.8 | 73.8 | 52.5 | 79.9 | 54.4 | 59.9 | 60.7 | 57.2 | 60.6 | 70.8 | 81.4 | 72.8 | 76.5 | 53.8 | 58.7 | 66.9 | 68.6 | 73.7 | 57.2 | 73.4 | 64.9 | 57.5 | 56.7 | 67.0 | 63.7 | 65.6 | 64.1 | 72.1 | 67.4 | 62.5 | 56.2 | 72.6 | 66.2 | 74.2 | 73.5 | 56.0 | 60.6 | 57.7 | 72.4 | 68.6 | 67.2 | 55.1 | 72.6 | 67.7 |
| Sep 16 | 62.0 | 79.5 | 59.9 | 74.2 | 51.7 | 75.3 | 52.5 | 56.1 | 54.8 | 65.2 | 69.5 | 66.8 | 79.8 | 69.1 | 75.8 | 59.5 | 57.2 | 65.8 | 64.1 | 73.7 | 63.6 | 67.7 | 61.7 | 55.5 | 52.2 | 66.8 | 57.9 | 74.3 | 61.3 | 69.9 | 63.4 | 55.9 | 61.3 | 65.6 | 65.0 | 73.4 | 77.5 | 60.7 | 60.3 | 53.9 | 72.4 | 61.5 | 70.5 | 55.6 | 75.1 | 63.5 |
| Sep 17 | 54.1 | 67.5 | 74.1 | 76.0 | 55.4 | 76.6 | 67.7 | 58.5 | 56.9 | 61.9 | 63.0 | 75.1 | 73.1 | 70.9 | 82.1 | 63.9 | 60.3 | 65.0 | 66.0 | 69.3 | 73.7 | 62.6 | 60.1 | 53.8 | 63.0 | 68.5 | 52.9 | 74.4 | 57.6 | 60.0 | 63.7 | 60.1 | 62.8 | 72.0 | 64.0 | 63.0 | 75.2 | 52.7 | 58.5 | 66.7 | 73.8 | 69.6 | 74.9 | 47.4 | 64.6 | 71.4 |
| Sep 18 | 48.5 | 67.9 | 77.3 | 67.0 | 67.0 | 70.6 | 65.5 | 61.5 | 53.8 | 58.6 | 56.4 | 68.3 | 63.1 | 73.1 | 85.2 | 64.3 | 62.1 | 60.9 | 62.1 | 76.6 | 76.0 | 55.8 | 58.2 | 43.5 | 55.8 | 68.9 | 48.9 | 66.5 | 66.3 | 69.0 | 54.3 | 50.2 | 63.5 | 69.7 | 63.4 | 59.8 | 74.6 | 69.3 | 58.8 | 66.1 | 73.6 | 67.9 | 69.7 | 48.3 | 57.7 | 72.7 |
| Sep 19 | 53.8 | 64.1 | 71.6 | 75.9 | 71.0 | 67.7 | 69.3 | 59.9 | 54.4 | 59.7 | 50.4 | 64.5 | 63.0 | 69.8 | 71.7 | 66.3 | 57.7 | 67.1 | 59.8 | 75.1 | 80.9 | 64.5 | 57.3 | 51.0 | 60.9 | 69.3 | 50.5 | 63.6 | 71.1 | 70.2 | 55.7 | 53.6 | 64.5 | 67.4 | 58.5 | 64.0 | 75.0 | 63.3 | 60.9 | 59.6 | 73.4 | 61.8 | 74.1 | 57.6 | 57.9 | 63.9 |
| Sep 20 | 53.6 | 57.3 | 74.8 | 71.0 | 73.2 | 67.4 | 62.9 | 48.5 | 50.8 | 63.9 | 56.9 | 61.6 | 63.3 | 73.1 | 68.0 | 75.1 | 62.3 | 70.0 | 59.2 | 73.1 | 73.9 | 63.0 | 54.4 | 63.2 | 67.5 | 71.9 | 54.6 | 62.0 | 59.6 | 55.6 | 57.2 | 58.0 | 59.2 | 68.3 | 56.0 | 65.6 | 65.0 | 54.8 | 71.2 | 56.6 | 69.8 | 71.2 | 68.0 | 60.3 | 66.4 | 59.0 |
| Sep 21 | 58.1 | 59.8 | 71.3 | 74.5 | 70.4 | 76.5 | 65.0 | 47.3 | 52.7 | 65.8 | 60.0 | 58.2 | 56.1 | 77.9 | 73.5 | 62.9 | 67.3 | 73.3 | 61.5 | 67.5 | 56.5 | 58.2 | 64.5 | 57.4 | 66.4 | 65.8 | 61.1 | 64.8 | 62.8 | 54.6 | 62.4 | 58.8 | 55.2 | 66.6 | 61.3 | 70.9 | 68.9 | 58.0 | 58.3 | 60.4 | 76.1 | 61.5 | 63.2 | 63.1 | 70.5 | 63.8 |
| Sep 22 | 63.5 | 63.7 | 70.0 | 71.6 | 63.6 | 74.8 | 60.7 | 53.8 | 51.2 | 57.1 | 64.1 | 48.8 | 59.9 | 69.3 | 74.6 | 62.8 | 62.9 | 69.3 | 59.0 | 70.5 | 59.4 | 63.9 | 62.1 | 63.8 | 54.6 | 61.7 | 68.2 | 61.6 | 64.8 | 64.4 | 67.2 | 67.7 | 52.1 | 71.7 | 55.4 | 78.8 | 68.6 | 72.2 | 58.8 | 62.2 | 78.2 | 57.9 | 58.3 | 70.6 | 62.4 | 58.4 |
| Sep 23 | 69.5 | 62.0 | 61.8 | 63.7 | 68.3 | 69.7 | 48.5 | 60.8 | 55.8 | 68.8 | 61.2 | 50.9 | 65.5 | 55.5 | 65.5 | 61.3 | 65.3 | 62.7 | 55.2 | 78.9 | 65.4 | 70.3 | 63.2 | 51.5 | 57.8 | 61.9 | 64.0 | 62.3 | 58.3 | 66.9 | 65.1 | 65.9 | 48.8 | 76.7 | 61.6 | 70.6 | 61.4 | 65.6 | 62.4 | 56.5 | 76.1 | 63.0 | 62.2 | 68.5 | 61.3 | 50.4 |
| Sep 24 | 62.4 | 71.2 | 67.1 | 68.9 | 70.4 | 68.2 | 60.5 | 60.9 | 46.6 | 63.4 | 60.8 | 53.1 | 76.9 | 63.1 | 53.9 | 64.3 | 66.7 | 53.2 | 65.1 | 70.5 | 68.2 | 73.1 | 63.4 | 61.1 | 61.5 | 61.3 | 67.7 | 56.4 | 69.2 | 59.2 | 67.9 | 61.6 | 45.9 | 72.3 | 56.9 | 68.9 | 55.5 | 71.6 | 51.1 | 60.4 | 64.0 | 60.5 | 67.0 | 69.9 | 54.8 | 49.9 |
| Sep 25 | 61.5 | 66.7 | 66.7 | 70.5 | 58.7 | 71.1 | 71.2 | 61.2 | 54.9 | 68.0 | 60.0 | 59.3 | 66.4 | 68.1 | 55.8 | 58.4 | 68.4 | 56.0 | 58.1 | 70.9 | 63.0 | 74.3 | 56.7 | 60.6 | 61.4 | 54.1 | 74.7 | 57.6 | 68.9 | 56.7 | 78.5 | 58.0 | 56.6 | 68.5 | 60.7 | 72.0 | 60.3 | 60.7 | 57.7 | 60.7 | 57.2 | 54.5 | 67.5 | 69.6 | 55.9 | 59.3 |
| Sep 26 | 61.6 | 64.4 | 67.2 | 69.8 | 65.3 | 69.4 | 66.6 | 51.2 | 52.0 | 52.8 | 54.5 | 66.6 | 67.0 | 63.1 | 60.3 | 73.8 | 76.6 | 56.8 | 55.6 | 68.8 | 67.1 | 73.9 | 46.0 | 56.5 | 65.9 | 61.8 | 60.3 | 49.8 | 59.6 | 64.0 | 72.8 | 59.4 | 66.6 | 67.7 | 63.2 | 72.0 | 57.5 | 61.6 | 53.7 | 55.0 | 53.8 | 57.8 | 72.9 | 66.4 | 58.2 | 65.1 |
| Sep 27 | 64.0 | 56.6 | 68.4 | 59.8 | 56.5 | 64.2 | 60.8 | 52.9 | 41.1 | 55.0 | 61.0 | 69.2 | 64.5 | 58.1 | 59.1 | 56.8 | 77.0 | 62.0 | 64.4 | 60.1 | 60.7 | 69.7 | 46.5 | 74.5 | 72.9 | 55.9 | 56.9 | 52.5 | 60.4 | 57.5 | 85.9 | 62.3 | 64.0 | 76.0 | 63.8 | 59.8 | 55.9 | 65.9 | 61.4 | 55.9 | 60.8 | 64.9 | 65.0 | 65.9 | 59.7 | 64.3 |
| Sep 28 | 57.5 | 64.2 | 56.0 | 56.0 | 61.8 | 73.0 | 63.2 | 54.7 | 46.7 | 61.8 | 63.1 | 61.7 | 52.0 | 59.2 | 58.1 | 55.2 | 75.6 | 63.9 | 60.2 | 58.3 | 68.4 | 65.7 | 43.4 | 75.3 | 79.5 | 60.6 | 62.5 | 53.5 | 56.1 | 54.2 | 73.1 | 61.9 | 69.9 | 68.2 | 58.8 | 56.1 | 64.9 | 59.8 | 59.8 | 57.3 | 59.1 | 74.8 | 64.5 | 57.8 | 51.2 | 73.8 |
| Sep 29 | 53.1 | 65.5 | 58.1 | 60.9 | 55.2 | 65.1 | 72.9 | 51.0 | 52.6 | 66.7 | 61.7 | 72.1 | 46.3 | 54.8 | 55.0 | 63.9 | 75.6 | 57.3 | 71.0 | 65.6 | 63.1 | 60.4 | 48.7 | 67.6 | 64.7 | 54.5 | 67.4 | 56.0 | 57.0 | 58.5 | 72.3 | 51.6 | 64.0 | 62.2 | 66.8 | 50.1 | 66.3 | 65.5 | 54.9 | 55.9 | 55.1 | 72.8 | 53.9 | 61.8 | 59.3 | 69.5 |
| Sep 30 | 57.2 | 65.7 | 54.4 | 50.8 | 48.5 | 67.3 | 61.3 | 56.4 | 52.7 | 71.2 | 64.4 | 68.0 | 40.1 | 57.4 | 43.1 | 58.8 | 70.4 | 55.7 | 57.6 | 61.9 | 56.5 | 67.1 | 57.5 | 63.1 | 50.4 | 54.4 | 56.4 | 62.3 | 48.7 | 62.0 | 60.1 | 50.8 | 63.9 | 69.8 | 55.2 | 52.7 | 63.5 | 67.7 | 56.6 | 64.8 | 52.9 | 72.1 | 50.9 | 55.0 | 56.8 | 73.2 |
| Oct 1 | 41.7 | 55.1 | 50.5 | 45.6 | 54.4 | 49.2 | 68.2 | 67.7 | 53.3 | 62.7 | 55.2 | 66.6 | 37.0 | 59.2 | 54.0 | 54.2 | 75.9 | 53.7 | 56.6 | 57.2 | 60.6 | 51.9 | 49.9 | 55.5 | 61.2 | 63.0 | 54.9 | 55.0 | 39.9 | 52.4 | 64.0 | 66.5 | 69.4 | 59.5 | 62.0 | 55.5 | 61.1 | 56.2 | 48.7 | 66.5 | 53.4 | 61.0 | 56.7 | 52.4 | 61.6 | 58.5 |
| Oct 2 | 44.7 | 56.5 | 57.1 | 61.5 | 62.3 | 65.6 | 65.8 | 62.8 | 45.9 | 56.9 | 54.7 | 64.9 | 38.6 | 61.4 | 52.8 | 56.9 | 67.8 | 50.1 | 50.4 | 61.2 | 62.7 | 46.5 | 44.7 | 56.3 | 57.5 | 62.0 | 52.9 | 48.3 | 50.8 | 37.6 | 59.6 | 61.7 | 62.6 | 59.1 | 56.7 | 51.5 | 55.6 | 54.6 | 57.2 | 59.9 | 49.4 | 54.4 | 54.7 | 53.3 | 66.9 | 49.0 |
| Oct 3 | 44.6 | 62.7 | 57.5 | 50.7 | 56.0 | 67.0 | 68.1 | 61.6 | 48.0 | 58.8 | 62.8 | 63.6 | 44.9 | 64.3 | 56.6 | 54.4 | 59.9 | 58.9 | 55.0 | 60.6 | 56.0 | 41.3 | 54.6 | 50.2 | 53.0 | 56.0 | 49.6 | 55.1 | 50.5 | 54.1 | 55.1 | 57.1 | 58.3 | 64.2 | 55.2 | 55.5 | 53.7 | 60.0 | 58.0 | 58.7 | 57.6 | 51.1 | 59.0 | 60.8 | 67.8 | 52.0 |
| Oct 4 | 52.4 | 66.6 | 55.5 | 50.0 | 51.3 | 65.7 | 66.1 | 60.7 | 49.2 | 70.1 | 58.2 | 69.6 | 44.8 | 57.0 | 56.9 | 48.5 | 56.4 | 46.4 | 57.6 | 61.5 | 55.3 | 38.8 | 50.7 | 56.8 | 60.2 | 61.0 | 51.1 | 55.5 | 58.2 | 59.9 | 67.0 | 61.6 | 63.1 | 68.2 | 54.0 | 52.1 | 60.6 | 57.1 | 60.7 | 52.4 | 59.3 | 41.9 | 63.0 | 68.7 | 58.4 | 53.0 |
| Oct 5 | 51.5 | 71.3 | 55.0 | 56.5 | 51.7 | 58.8 | 68.0 | 64.7 | 35.1 | 69.3 | 60.1 | 62.4 | 46.2 | 54.2 | 61.1 | 44.4 | 53.5 | 56.8 | 54.0 | 64.3 | 61.2 | 43.5 | 59.7 | 53.2 | 59.3 | 68.3 | 55.4 | 58.3 | 53.8 | 48.0 | 59.7 | 58.4 | 75.1 | 54.0 | 59.5 | 58.6 | 64.5 | 53.8 | 59.4 | 50.7 | 60.4 | 50.6 | 58.1 | 69.1 | 55.5 | 50.2 |
| Oct 6 | 60.6 | 75.5 | 55.6 | 42.0 | 47.8 | 54.5 | 71.5 | 56.0 | 34.4 | 66.9 | 60.3 | 53.4 | 32.4 | 52.8 | 57.5 | 57.6 | 49.6 | 50.1 | 47.8 | 51.5 | 62.6 | 55.3 | 61.6 | 61.9 | 62.6 | 57.0 | 56.3 | 47.2 | 58.5 | 46.7 | 53.1 | 58.8 | 72.8 | 52.0 | 54.7 | 53.3 | 67.1 | 58.9 | 48.2 | 47.2 | 60.4 | 48.1 | 58.2 | 63.3 | 55.0 | 48.0 |
| Oct 7 | 56.9 | 64.1 | 51.8 | 44.2 | 55.6 | 47.4 | 74.6 | 63.3 | 41.5 | 64.3 | 58.2 | 50.2 | 38.3 | 57.4 | 63.5 | 59.2 | 54.0 | 47.7 | 40.8 | 61.1 | 63.5 | 66.0 | 58.9 | 55.8 | 57.4 | 67.8 | 55.9 | 52.8 | 52.7 | 56.7 | 55.9 | 45.9 | 63.7 | 56.4 | 41.6 | 48.2 | 64.8 | 51.2 | 55.4 | 52.5 | 57.1 | 52.0 | 53.2 | 60.1 | 66.4 | 53.3 |
| Oct 8 | 61.8 | 60.8 | 45.9 | 48.0 | 53.6 | 47.2 | 72.8 | 51.2 | 42.0 | 53.7 | 56.6 | 45.5 | 42.7 | 58.1 | 57.6 | 56.9 | 57.2 | 47.3 | 37.0 | 63.5 | 66.5 | 52.5 | 63.4 | 37.7 | 54.8 | 64.0 | 43.3 | 45.8 | 56.5 | 47.4 | 51.4 | 38.7 | 66.7 | 67.1 | 48.4 | 51.7 | 65.5 | 47.1 | 52.8 | 57.1 | 49.1 | 50.3 | 49.3 | 61.5 | 58.8 | 59.4 |
| Oct 9 | 49.9 | 61.1 | 58.2 | 53.6 | 55.0 | 45.2 | 68.6 | 45.4 | 48.5 | 59.3 | 59.8 | 52.5 | 44.2 | 46.7 | 42.9 | 62.7 | 59.8 | 48.1 | 49.6 | 55.7 | 58.9 | 52.7 | 52.0 | 41.9 | 53.5 | 54.7 | 52.3 | 46.4 | 53.8 | 51.4 | 61.5 | 35.0 | 66.3 | 71.3 | 52.4 | 67.3 | 72.6 | 49.6 | 54.6 | 48.3 | 45.4 | 55.2 | 51.8 | 61.6 | 54.4 | 54.0 |
| Oct 10 | 62.5 | 55.9 | 61.8 | 50.1 | 58.9 | 54.4 | 72.5 | 43.4 | 45.7 | 64.4 | 64.3 | 45.4 | 50.3 | 49.6 | 32.4 | 60.0 | 57.9 | 44.2 | 51.9 | 47.3 | 54.0 | 53.0 | 43.4 | 38.0 | 53.1 | 43.0 | 63.1 | 49.1 | 56.5 | 49.2 | 66.0 | 33.0 | 52.9 | 56.7 | 49.3 | 63.8 | 59.0 | 50.8 | 59.2 | 47.5 | 54.8 | 53.4 | 58.0 | 46.9 | 53.9 | 47.2 |
| Oct 11 | 52.1 | 48.6 | 64.4 | 55.0 | 61.6 | 48.7 | 56.9 | 49.2 | 52.6 | 67.9 | 68.1 | 43.6 | 47.9 | 57.9 | 35.4 | 54.6 | 61.1 | 52.5 | 51.6 | 49.2 | 51.8 | 53.0 | 40.3 | 42.8 | 45.3 | 46.0 | 60.9 | 48.1 | 53.8 | 61.8 | 60.8 | 40.0 | 55.9 | 58.2 | 43.8 | 69.6 | 51.3 | 53.8 | 59.2 | 48.8 | 64.3 | 53.1 | 47.5 | 48.1 | 48.4 | 53.4 |
| Oct 12 | 48.7 | 44.3 | 55.5 | 57.3 | 58.5 | 42.5 | 66.9 | 50.6 | 51.8 | 77.6 | 71.5 | 45.5 | 54.6 | 44.9 | 35.5 | 55.2 | 53.9 | 52.2 | 58.0 | 55.6 | 39.7 | 49.0 | 39.6 | 50.7 | 33.8 | 48.6 | 52.6 | 56.9 | 54.9 | 65.4 | 65.2 | 48.0 | 48.1 | 50.0 | 42.4 | 68.1 | 60.0 | 57.4 | 65.1 | 47.6 | 56.3 | 62.2 | 46.1 | 53.0 | 50.8 | 52.1 |
| Oct 13 | 43.1 | 41.2 | 57.5 | 49.0 | 53.2 | 47.5 | 57.1 | 57.8 | 43.8 | 77.6 | 63.5 | 49.4 | 51.8 | 54.1 | 40.5 | 53.6 | 45.9 | 49.3 | 55.8 | 55.5 | 40.9 | 60.4 | 44.9 | 52.1 | 38.6 | 48.1 | 58.5 | 56.2 | 64.9 | 53.6 | 70.3 | 46.3 | 47.1 | 51.1 | 55.6 | 58.4 | 66.8 | 48.0 | 64.5 | 55.4 | 48.2 | 58.9 | 43.3 | 48.9 | 45.4 | 48.8 |
| Oct 14 | 44.3 | 37.6 | 47.8 | 54.0 | 56.9 | 46.8 | 50.8 | 48.4 | 49.7 | 70.5 | 57.6 | 41.9 | 62.1 | 54.4 | 43.9 | 43.0 | 61.0 | 50.3 | 49.5 | 39.3 | 33.6 | 60.7 | 49.4 | 51.2 | 43.8 | 51.6 | 55.6 | 52.2 | 66.5 | 61.8 | 63.3 | 42.8 | 47.4 | 42.4 | 50.3 | 60.5 | 72.8 | 53.0 | 54.0 | 63.6 | 43.9 | 59.7 | 44.2 | 49.8 | 45.7 | 50.3 |
| Oct 15 | 52.8 | 33.9 | 44.4 | 55.5 | 57.7 | 54.0 | 55.6 | 41.7 | 41.2 | 57.7 | 65.9 | 31.4 | 58.8 | 58.0 | 42.5 | 34.6 | 58.7 | 42.7 | 42.8 | 33.9 | 41.4 | 62.6 | 64.2 | 43.6 | 48.9 | 48.5 | 55.1 | 50.5 | 48.4 | 61.9 | 58.1 | 40.0 | 47.0 | 47.3 | 46.7 | 45.8 | 66.3 | 56.3 | 47.8 | 65.3 | 42.8 | 57.9 | 44.0 | 48.0 | 58.8 | 43.4 |
| Oct 16 | 52.5 | 42.3 | 48.2 | 52.8 | 58.3 | 62.1 | 46.7 | 32.5 | 41.1 | 52.6 | 62.9 | 40.0 | 59.4 | 51.5 | 35.5 | 45.4 | 58.4 | 44.4 | 41.9 | 37.3 | 54.3 | 65.5 | 54.1 | 43.3 | 47.4 | 45.4 | 52.7 | 50.8 | 54.2 | 60.4 | 52.6 | 44.6 | 55.8 | 53.2 | 51.9 | 33.7 | 62.1 | 49.6 | 47.5 | 65.8 | 47.9 | 49.4 | 55.6 | 44.8 | 60.3 | 48.6 |
| Oct 17 | 48.0 | 37.3 | 57.5 | 52.5 | 45.1 | 64.8 | 54.9 | 32.1 | 43.8 | 51.7 | 60.1 | 38.1 | 46.3 | 41.4 | 45.0 | 51.8 | 60.6 | 51.7 | 42.7 | 31.8 | 54.5 | 53.3 | 61.7 | 48.2 | 57.0 | 43.0 | 53.8 | 62.3 | 40.5 | 56.7 | 53.6 | 55.1 | 58.2 | 53.1 | 41.9 | 24.0 | 55.5 | 45.2 | 45.1 | 64.9 | 58.8 | 48.6 | 53.8 | 47.4 | 64.1 | 46.5 |
| Oct 18 | 50.6 | 50.7 | 54.5 | 52.2 | 37.9 | 67.8 | 53.1 | 36.8 | 46.8 | 55.2 | 69.6 | 37.9 | 47.6 | 40.8 | 52.2 | 39.4 | 64.7 | 50.1 | 54.1 | 39.4 | 46.0 | 43.4 | 53.1 | 54.0 | 52.8 | 52.4 | 49.5 | 56.9 | 38.4 | 51.4 | 49.8 | 54.7 | 44.1 | 48.0 | 50.7 | 24.3 | 50.0 | 53.5 | 39.6 | 59.7 | 55.4 | 47.3 | 52.4 | 45.4 | 68.3 | 52.9 |
| Oct 19 | 60.9 | 60.0 | 46.4 | 47.4 | 47.5 | 54.0 | 42.7 | 40.3 | 53.5 | 45.7 | 65.5 | 49.2 | 40.0 | 39.8 | 54.1 | 40.3 | 55.4 | 57.3 | 54.4 | 36.2 | 47.3 | 51.7 | 41.5 | 44.1 | 54.7 | 60.9 | 40.7 | 43.2 | 49.9 | 59.5 | 49.1 | 52.0 | 43.6 | 43.1 | 55.3 | 21.8 | 39.3 | 59.7 | 37.2 | 63.8 | 51.3 | 44.6 | 55.5 | 49.0 | 61.5 | 47.3 |
| Oct 20 | 56.1 | 52.3 | 42.6 | 55.1 | 47.3 | 53.7 | 44.2 | 42.0 | 55.5 | 37.9 | 63.3 | 44.7 | 42.9 | 49.1 | 52.6 | 32.7 | 54.2 | 59.5 | 55.3 | 42.0 | 41.5 | 60.6 | 51.4 | 39.6 | 53.2 | 57.2 | 44.3 | 47.5 | 54.4 | 58.1 | 46.5 | 43.5 | 42.7 | 44.9 | 51.7 | 27.9 | 39.3 | 52.1 | 36.0 | 53.1 | 61.5 | 42.9 | 58.2 | 41.4 | 55.9 | 51.2 |
| Oct 21 | 57.4 | 49.0 | 39.7 | 57.2 | 48.4 | 56.1 | 48.6 | 46.6 | 64.5 | 36.4 | 55.6 | 42.2 | 34.9 | 61.3 | 50.6 | 42.0 | 46.2 | 58.6 | 49.1 | 41.0 | 54.9 | 44.7 | 46.9 | 41.5 | 52.6 | 56.7 | 52.6 | 46.7 | 43.7 | 62.4 | 56.6 | 34.5 | 37.1 | 49.3 | 54.7 | 30.2 | 29.2 | 41.1 | 42.9 | 46.7 | 65.2 | 41.0 | 54.2 | 45.6 | 60.6 | 68.4 |
| Oct 22 | 54.8 | 49.0 | 34.8 | 51.2 | 50.7 | 59.1 | 43.0 | 37.8 | 57.9 | 43.5 | 54.2 | 33.7 | 42.2 | 55.6 | 52.4 | 34.2 | 45.3 | 50.5 | 57.0 | 39.7 | 55.7 | 45.6 | 41.1 | 48.3 | 54.3 | 59.1 | 59.9 | 46.9 | 48.0 | 59.5 | 57.4 | 36.3 | 39.2 | 45.7 | 55.9 | 31.1 | 30.8 | 42.9 | 50.8 | 51.9 | 63.6 | 34.1 | 53.7 | 41.9 | 51.0 | 63.9 |
| Oct 23 | 46.2 | 37.0 | 34.2 | 46.0 | 45.8 | 54.1 | 46.8 | 36.8 | 58.2 | 37.0 | 50.3 | 29.9 | 37.0 | 58.0 | 42.2 | 40.5 | 48.9 | 48.6 | 58.6 | 49.6 | 48.1 | 60.2 | 36.8 | 41.5 | 48.7 | 46.1 | 51.7 | 33.4 | 47.7 | 57.9 | 57.8 | 29.1 | 38.6 | 51.6 | 52.1 | 39.1 | 20.8 | 45.5 | 50.1 | 46.2 | 61.7 | 43.0 | 41.1 | 31.0 | 47.4 | 60.8 |
| Oct 24 | 60.7 | 43.2 | 43.9 | 50.1 | 44.1 | 53.1 | 50.5 | 46.0 | 55.2 | 35.0 | 51.4 | 32.1 | 40.3 | 61.7 | 45.5 | 34.1 | 57.7 | 42.7 | 59.6 | 48.4 | 56.8 | 53.4 | 39.5 | 38.4 | 43.8 | 45.3 | 47.2 | 43.5 | 39.6 | 53.0 | 49.4 | 31.8 | 40.6 | 57.9 | 49.5 | 44.7 | 29.3 | 51.4 | 55.1 | 41.2 | 51.9 | 34.8 | 36.0 | 40.1 | 49.7 | 67.0 |
| Oct 25 | 53.2 | 49.5 | 51.6 | 45.6 | 43.7 | 36.5 | 41.3 | 51.2 | 51.1 | 37.5 | 49.9 | 30.0 | 43.0 | 46.5 | 48.0 | 41.4 | 41.8 | 38.1 | 57.5 | 58.1 | 48.9 | 57.5 | 35.2 | 30.7 | 40.1 | 45.3 | 39.7 | 45.9 | 43.8 | 52.3 | 51.3 | 43.8 | 42.4 | 66.6 | 46.1 | 42.2 | 36.3 | 57.1 | 60.3 | 52.4 | 51.7 | 43.5 | 42.5 | 39.7 | 51.2 | 64.9 |
| Oct 26 | 46.6 | 41.1 | 47.9 | 59.6 | 25.2 | 39.5 | 39.6 | 40.9 | 53.8 | 32.0 | 46.7 | 37.0 | 46.4 | 44.0 | 45.9 | 41.4 | 47.1 | 48.3 | 48.3 | 51.5 | 31.5 | 52.4 | 32.5 | 31.7 | 38.9 | 43.2 | 32.3 | 49.1 | 37.3 | 43.1 | 45.5 | 41.7 | 39.4 | 62.8 | 34.7 | 39.7 | 41.9 | 66.5 | 63.3 | 61.4 | 49.8 | 44.2 | 41.7 | 51.1 | 37.6 | 69.5 |

### *TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET*

| YEAR-> | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 27 | 54.1 | 39.3 | 40.1 | 51.1 | 28.2 | 42.1 | 44.0 | 38.9 | 55.1 | 41.8 | 36.5 | 32.0 | 45.6 | 44.2 | 46.7 |
| Oct 28 | 44.4 | 48.3 | 36.5 | 53.0 | 37.6 | 36.1 | 42.4 | 34.7 | 54.6 | 35.8 | 39.2 | 37.2 | 48.7 | 53.4 | 42.7 |
| Oct 29 | 37.4 | 47.9 | 45.6 | 54.8 | 33.6 | 40.9 | 37.0 | 50.7 | 46.7 | 32.7 | 31.0 | 43.9 | 36.0 | 54.0 | 50.8 |
| Oct 30 | 29.3 | 52.1 | 37.5 | 51.8 | 30.7 | 39.7 | 40.8 | 51.6 | 50.3 | 45.7 | 27.3 | 54.5 | 44.3 | 51.9 | 55.4 |
| Oct 31 | 37.0 | 64.1 | 38.3 | 52.8 | 29.1 | 47.3 | 43.1 | 54.4 | 40.2 | 49.8 | 39.2 | 35.5 | 35.6 | 46.6 | 37.0 |
| Nov 1 | 46.4 | 63.0 | 46.0 | 53.2 | 37.2 | 32.5 | 47.8 | 50.1 | 49.9 | 52.9 | 39.3 | 33.5 | 37.7 | 54.9 | 32.5 |
| Nov 2 | 46.7 | 51.0 | 36.2 | 53.0 | 34.8 | 35.8 | 43.0 | 47.7 | 48.5 | 52.4 | 27.0 | 29.8 | 29.4 | 46.5 | 35.6 |
| Nov 3 | 41.2 | 41.2 | 37.9 | 43.5 | 36.8 | 37.1 | 49.3 | 47.1 | 42.3 | 48.3 | 24.0 | 34.4 | 37.4 | 49.5 | 30.5 |
| Nov 4 | 45.7 | 46.2 | 45.9 | 41.3 | 50.1 | 34.6 | 47.6 | 50.7 | 56.8 | 41.7 | 23.3 | 25.2 | 37.9 | 41.2 | 38.7 |
| Nov 5 | 34.5 | 47.1 | 56.3 | 35.0 | 27.2 | 28.3 | 54.2 | 48.8 | 51.4 | 41.6 | 26.8 | 30.4 | 36.9 | 39.1 | 37.3 |
| Nov 6 | 40.4 | 41.2 | 37.6 | 25.0 | 30.1 | 37.9 | 55.6 | 45.4 | 59.6 | 38.5 | 23.6 | 26.9 | 39.3 | 25.5 | 34.0 |
| Nov 7 | 50.8 | 42.6 | 48.5 | 29.0 | 28.4 | 30.5 | 49.4 | 55.3 | 57.6 | 37.2 | 23.6 | 34.1 | 39.9 | 23.4 | 37.0 |
| Nov 8 | 48.4 | 35.3 | 34.3 | 30.3 | 36.8 | 43.6 | 37.0 | 40.6 | 43.0 | 46.0 | 42.3 | 24.3 | 45.4 | 34.5 | 31.7 |
| Nov 9 | 55.4 | 37.4 | 42.7 | 40.0 | 41.5 | 37.3 | 31.2 | 45.5 | 44.3 | 45.1 | 40.4 | 31.9 | 38.9 | 32.0 | 34.4 |
| Nov 10 | 52.5 | 26.0 | 49.1 | 34.9 | 37.5 | 40.5 | 50.1 | 32.7 | 30.0 | 46.4 | 41.2 | 45.4 | 41.5 | 35.5 | 49.9 |
| Nov 11 | 48.5 | 36.9 | 47.7 | 40.0 | 46.3 | 44.6 | 39.6 | 21.2 | 28.4 | 47.4 | 34.2 | 47.2 | 32.2 | 36.5 | 46.1 |
| Nov 12 | 42.0 | 23.9 | 44.3 | 46.8 | 33.0 | 32.2 | 38.6 | 18.7 | 24.1 | 42.6 | 28.6 | 34.4 | 31.4 | 37.6 | 53.7 |
| Nov 13 | 38.3 | 27.7 | 38.8 | 40.8 | 34.4 | 31.0 | 34.1 | 25.6 | 30.9 | 54.9 | 36.6 | 39.5 | 41.0 | 40.1 | 43.5 |
| Nov 14 | 23.9 | 30.9 | 39.9 | 37.3 | 34.0 | 45.1 | 39.8 | 31.9 | 41.9 | 58.9 | 36.5 | 38.4 | 43.6 | 43.2 | 31.6 |
| Nov 15 | 22.8 | 34.9 | 46.8 | 47.1 | 21.7 | 44.6 | 37.7 | 36.1 | 41.8 | 67.9 | 27.4 | 35.0 | 58.9 | 38.6 | 27.6 |
| Nov 16 | 22.0 | 30.5 | 30.3 | 36.4 | 20.4 | 47.0 | 46.1 | 29.1 | 30.8 | 57.4 | 32.7 | 38.4 | 50.4 | 38.1 | 33.3 |
| Nov 17 | 20.5 | 32.5 | 30.4 | 35.6 | 30.5 | 31.6 | 42.0 | 27.9 | 31.3 | 53.1 | 34.9 | 48.1 | 48.8 | 30.9 | 35.9 |
| Nov 18 | 17.5 | 35.1 | 24.5 | 36.0 | 39.5 | 23.8 | 35.9 | 29.0 | 32.7 | 37.8 | 35.5 | 49.4 | 42.6 | 25.7 | 30.6 |
| Nov 19 | 22.0 | 28.7 | 35.6 | 31.2 | 37.2 | 20.1 | 40.7 | 27.0 | 42.0 | 42.2 | 33.9 | 37.7 | 37.5 | 27.4 | 33.0 |
| Nov 20 | 30.6 | 32.7 | 37.4 | 34.1 | 43.5 | 36.1 | 41.1 | 34.3 | 46.0 | 45.5 | 33.7 | 28.4 | 39.1 | 33.0 | 26.7 |
| Nov 21 | 31.5 | 30.1 | 37.3 | 27.5 | 37.5 | 41.8 | 31.6 | 25.8 | 53.8 | 47.2 | 39.2 | 26.9 | 32.1 | 30.3 | 26.0 |
| Nov 22 | 40.8 | 32.4 | 33.5 | 26.0 | 37.6 | 49.9 | 42.5 | 23.8 | 51.5 | 45.5 | 38.4 | 22.0 | 31.1 | 31.2 | 31.7 |
| Nov 23 | 30.7 | 26.0 | 31.8 | 14.5 | 41.6 | 39.1 | 41.8 | 19.2 | 47.0 | 39.3 | 48.4 | 30.0 | 26.9 | 30.9 | 37.7 |
| Nov 24 | 26.2 | 37.6 | 26.2 | 17.5 | 41.6 | 44.7 | 39.3 | 24.1 | 40.6 | 40.0 | 41.9 | 31.0 | 29.5 | 34.3 | 34.1 |
| Nov 25 | 25.0 | 32.2 | 19.8 | 30.7 | 36.8 | 42.0 | 41.6 | 24.1 | 42.7 | 32.0 | 31.1 | 34.8 | 28.8 | 33.5 | 34.9 |
| Nov 26 | 33.3 | 28.1 | 22.5 | 32.6 | 35.0 | 40.7 | 36.0 | 15.6 | 31.0 | 37.8 | 35.3 | 48.4 | 38.0 | 43.8 | 36.1 |
| Nov 27 | 15.8 | 19.1 | 27.8 | 42.3 | 32.2 | 38.4 | 31.4 | 14.2 | 23.5 | 35.9 | 20.7 | 47.6 | 38.0 | 41.8 | 34.4 |
| Nov 28 | 21.5 | 35.3 | 33.4 | 44.6 | 25.8 | 42.6 | 27.2 | 15.9 | 32.8 | 31.0 | 32.2 | 42.8 | 41.3 | 46.1 | 35.7 |
| Nov 29 | 18.0 | 38.1 | 35.9 | 37.6 | 25.6 | 40.6 | 28.9 | 21.6 | 36.3 | 22.3 | 23.3 | 27.7 | 43.3 | 38.2 | 32.1 |
| Nov 30 | 20.0 | 30.2 | 35.8 | 30.6 | 26.8 | 37.3 | 25.9 | 22.6 | 24.9 | 23.0 | 20.5 | 16.8 | 46.3 | 46.7 | 21.7 |
| Dec 1 | 17.6 | 26.7 | 32.0 | 44.6 | 28.1 | 38.3 | 19.9 | 18.8 | 28.3 | 28.4 | 27.3 | 22.4 | 35.1 | 48.0 | 23.0 |
| Dec 2 | 22.5 | 27.5 | 41.2 | 23.0 | 24.2 | 39.4 | 30.7 | 28.3 | 27.8 | 26.1 | 27.2 | 22.5 | 40.8 | 41.7 | 17.8 |
| Dec 3 | 19.8 | 30.3 | 39.6 | 29.2 | 27.3 | 50.7 | 28.7 | 29.5 | 35.5 | 25.5 | 36.6 | 23.6 | 45.5 | 38.8 | 24.1 |
| Dec 4 | 20.7 | 30.2 | 44.8 | 42.6 | 27.8 | 39.8 | 35.4 | 31.0 | 25.9 | 22.6 | 43.2 | 29.4 | 41.0 | 37.6 | 27.3 |
| Dec 5 | 19.1 | 34.3 | 42.4 | 41.1 | 28.7 | 40.1 | 34.8 | 32.8 | 41.4 | 26.9 | 48.3 | 35.9 | 36.1 | 34.4 | 24.4 |
| Dec 6 | 25.9 | 30.1 | 39.7 | 34.5 | 21.7 | 40.7 | 22.1 | 27.3 | 43.8 | 22.8 | 45.4 | 41.3 | 22.3 | 21.9 | 16.8 |
| Dec 7 | 40.5 | 31.2 | 46.8 | 31.8 | 16.6 | 33.1 | 30.5 | 35.7 | 41.0 | 29.3 | 50.6 | 34.3 | 27.4 | 22.2 | 15.6 |
| Dec 8 | 24.4 | 31.8 | 46.5 | 29.7 | 20.6 | 33.0 | 18.0 | 37.0 | 42.8 | 21.1 | 41.8 | 34.7 | 23.4 | 26.9 | 14.1 |
| Dec 9 | 36.4 | 34.2 | 39.6 | 26.9 | 22.6 | 39.5 | 15.7 | 25.7 | 37.5 | 22.7 | 46.4 | 30.0 | 36.9 | 35.2 | 18.2 |
| Dec 10 | 37.7 | 31.8 | 28.6 | 15.8 | 21.8 | 35.7 | 17.9 | 16.0 | 25.7 | 31.6 | 34.5 | 23.5 | 40.5 | 29.7 | 14.8 |
| Dec 11 | 35.7 | 40.6 | 29.2 | 31.9 | 30.3 | 39.8 | 30.6 | 25.4 | 30.3 | 32.1 | 35.6 | 21.3 | 30.0 | 32.0 | 6.6 |
| Dec 12 | 39.9 | 47.4 | 30.9 | 36.6 | 35.2 | 33.9 | 31.6 | 22.9 | 27.5 | 27.5 | 29.3 | 14.5 | 24.7 | 28.7 | 9.3 |
| Dec 13 | 37.6 | 42.4 | 28.7 | 27.9 | 37.6 | 19.1 | 32.7 | 13.8 | 29.4 | 26.4 | 28.6 | 10.2 | 22.6 | 20.6 | 21.7 |
| Dec 14 | 32.2 | 28.8 | 25.6 | 28.8 | 37.2 | 23.2 | 41.2 | 17.4 | 22.9 | 26.4 | 23.2 | 24.0 | 19.0 | 18.2 | 23.5 |
| Dec 15 | 36.7 | 29.0 | 31.3 | 27.9 | 28.6 | 19.0 | 35.9 | 11.0 | 25.5 | 23.2 | 14.1 | 36.0 | 23.7 | 27.7 | 31.4 |
| Dec 16 | 33.8 | 28.7 | 25.0 | 43.8 | 40.9 | 28.7 | 26.6 | 17.0 | 24.9 | 32.4 | 20.1 | 33.1 | 18.7 | 29.3 | 35.4 |
| Dec 17 | 25.0 | 34.7 | 33.6 | 35.5 | 35.8 | 20.8 | 31.9 | 22.9 | 20.5 | 39.6 | 19.3 | 26.3 | 20.0 | 27.0 | 22.9 |
| Dec 18 | 32.3 | 29.5 | 24.5 | 33.6 | 39.0 | 17.7 | 32.1 | 25.2 | 23.6 | 40.6 | 29.4 | 31.9 | 26.3 | 26.8 | 26.8 |
| Dec 19 | 32.6 | 37.8 | 29.5 | 26.3 | 38.5 | 18.8 | 34.6 | 29.9 | 14.9 | 44.0 | 24.6 | 30.4 | 40.1 | 34.1 | 17.1 |
| Dec 20 | 33.2 | 31.1 | 39.3 | 35.1 | 35.0 | 12.4 | 29.1 | 37.9 | 20.8 | 34.8 | 23.9 | 32.2 | 33.0 | 29.0 | 20.0 |
| Dec 21 | 28.2 | 38.4 | 51.3 | 28.4 | 28.1 | 4.6 | 25.4 | 35.7 | 15.4 | 20.4 | 25.2 | 42.5 | 28.4 | 37.4 | 20.6 |
| Dec 22 | 28.2 | 29.5 | 39.9 | 27.7 | 31.5 | 15.5 | 20.0 | 31.4 | 14.8 | 13.8 | 16.1 | 33.2 | 32.0 | 31.8 | 18.7 |
| Dec 23 | 40.1 | 34.5 | 37.6 | 24.2 | 39.5 | 12.3 | 18.9 | 33.0 | 17.1 | 26.3 | 14.8 | 28.2 | 26.2 | 42.5 | 19.3 |
| Dec 24 | 37.2 | 24.7 | 36.0 | 10.9 | 28.0 | 18.3 | 19.8 | 21.2 | 29.7 | 30.5 | 13.9 | 25.8 | 24.4 | 37.0 | 27.2 |
| Dec 25 | 33.4 | 32.0 | 27.6 | 21.5 | 23.9 | 24.3 | 24.0 | 20.7 | 24.4 | 20.5 | 14.5 | 28.3 | 12.2 | 34.3 | 36.5 |
| Dec 26 | 20.8 | 27.6 | 23.9 | 27.5 | 14.9 | 21.7 | 23.8 | 17.6 | 23.2 | 20.5 | 23.6 | 23.2 | 25.1 | 36.1 | 35.6 |
| Dec 27 | 24.7 | 29.8 | 31.4 | 28.0 | 26.7 | 20.4 | 18.0 | 17.1 | 33.9 | 18.1 | 34.1 | 22.2 | 23.1 | 32.8 | 31.3 |
| Dec 28 | 27.8 | 22.2 | 28.4 | 18.9 | 21.5 | 23.2 | 18.8 | 12.8 | 33.1 | 18.1 | 41.9 | 26.3 | 19.8 | 31.3 | 40.1 |
| Dec 29 | 26.8 | 23.0 | 32.3 | 17.3 | 27.8 | 25.5 | 24.8 | 8.9 | 24.8 | 18.8 | 41.8 | 29.8 | 23.3 | 22.2 | 27.6 |
| Dec 30 | 24.8 | 13.9 | 35.8 | 12.9 | 31.0 | 32.0 | 25.2 | 17.1 | 26.8 | 21.1 | 30.9 | 29.0 | 17.0 | 15.4 | 35.7 |
| Dec 31 | 22.1 | 12.6 | 12.6 | 12.6 | 12.6 | 20.5 | 20.5 | 20.5 | 20.5 | 21.4 | 21.4 | 21.4 | 21.4 | 11.4 | 11.4 |
| Mean | 51.4 | 51.8 | 51.4 | 52.7 | 51.3 | 52.1 | 51.9 | 50.6 | 50.2 | 52.7 | 52.3 | 50.2 | 51.1 | 52.3 | 52.0 |
| Min | 9.4 | 12.6 | 8.2 | 10.9 | 8.9 | 4.6 | 15.7 | 8.9 | 13.1 | 13.8 | 13.9 | 10.2 | 12.2 | 11.4 | 6.6 |
| Max | 86.6 | 86.3 | 86.0 | 89.3 | 90.1 | 88.2 | 85.2 | 89.0 | 89.4 | 89.9 | 91.6 | 92.7 | 91.0 | 88.2 | 87.4 |

| YEAR-> | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 27 | 48.4 | 43.5 | 45.1 | 44.4 | 54.0 | 43.5 | 47.0 | 36.2 | 32.2 | 36.3 | 56.8 | 39.3 | 37.3 | 43.4 | 43.3 | 53.8 |
| Oct 28 | 43.9 | 39.8 | 52.8 | 41.6 | 45.8 | 43.0 | 44.8 | 37.4 | 40.1 | 31.5 | 58.3 | 31.9 | 35.5 | 42.3 | 58.2 | 53.6 |
| Oct 29 | 43.1 | 29.6 | 55.1 | 33.1 | 34.4 | 40.3 | 40.8 | 39.4 | 50.2 | 43.5 | 57.3 | 37.5 | 28.2 | 39.7 | 48.2 | 44.8 |
| Oct 30 | 43.4 | 40.5 | 52.7 | 37.1 | 43.0 | 41.0 | 39.0 | 44.5 | 53.6 | 47.9 | 62.8 | 38.3 | 27.1 | 50.1 | 51.5 | 43.6 |
| Oct 31 | 39.3 | 49.1 | 57.5 | 46.6 | 54.5 | 40.9 | 46.4 | 37.8 | 40.7 | 58.9 | 53.0 | 39.1 | 29.2 | 39.5 | 53.9 | 55.1 |
| Nov 1 | 46.8 | 40.9 | 46.1 | 48.8 | 37.1 | 37.0 | 46.3 | 31.9 | 36.7 | 47.7 | 57.6 | 40.5 | 40.2 | 35.5 | 58.5 | 60.5 |
| Nov 2 | 42.6 | 42.5 | 54.2 | 46.0 | 42.5 | 34.5 | 50.7 | 40.9 | 31.2 | 47.0 | 53.0 | 44.1 | 31.8 | 25.0 | 54.5 | 55.9 |
| Nov 3 | 48.7 | 41.1 | 47.1 | 51.6 | 44.7 | 35.0 | 57.2 | 41.1 | 29.4 | 49.6 | 37.9 | 45.5 | 24.6 | 28.0 | 38.0 | 56.1 |
| Nov 4 | 47.4 | 48.4 | 38.0 | 52.1 | 40.9 | 31.4 | 57.7 | 46.5 | 33.9 | 51.8 | 37.6 | 42.3 | 25.9 | 32.6 | 45.3 | 54.9 |
| Nov 5 | 49.2 | 41.6 | 39.8 | 54.5 | 31.4 | 26.8 | 48.8 | 46.7 | 38.8 | 45.6 | 42.8 | 40.8 | 36.9 | 27.6 | 57.2 | 44.6 |
| Nov 6 | 39.0 | 45.3 | 47.6 | 46.3 | 28.5 | 24.5 | 37.1 | 46.8 | 41.4 | 44.3 | 55.1 | 54.7 | 42.8 | 38.5 | 56.4 | 41.5 |
| Nov 7 | 42.2 | 47.5 | 41.3 | 44.0 | 37.1 | 29.2 | 35.8 | 50.2 | 47.0 | 41.8 | 37.0 | 50.9 | 34.1 | 39.6 | 49.3 | 40.9 |
| Nov 8 | 32.3 | 45.0 | 44.8 | 42.8 | 40.6 | 38.0 | 39.6 | 47.2 | 41.5 | 34.0 | 38.1 | 49.9 | 44.6 | 38.9 | 52.1 | 29.3 |
| Nov 9 | 30.7 | 42.2 | 45.5 | 39.2 | 42.1 | 32.4 | 39.4 | 33.1 | 44.6 | 28.1 | 45.3 | 49.1 | 41.9 | 43.9 | 39.9 | 24.1 |
| Nov 10 | 28.6 | 54.8 | 43.6 | 32.8 | 38.0 | 31.7 | 37.4 | 22.1 | 40.9 | 24.3 | 44.3 | 45.8 | 37.8 | 44.1 | 25.6 | 17.3 |
| Nov 11 | 32.3 | 54.0 | 48.5 | 29.9 | 39.1 | 28.2 | 44.5 | 24.7 | 48.2 | 20.8 | 47.3 | 40.7 | 43.2 | 46.3 | 36.1 | 28.4 |
| Nov 12 | 34.0 | 50.6 | 57.0 | 30.8 | 36.7 | 21.1 | 33.8 | 28.5 | 42.1 | 27.5 | 52.5 | 43.4 | 35.6 | 48.4 | 41.8 | 27.4 |
| Nov 13 | 17.3 | 53.8 | 60.2 | 31.3 | 43.6 | 12.4 | 31.7 | 22.3 | 38.1 | 32.2 | 54.3 | 55.2 | 46.9 | 48.1 | 35.5 | 24.7 |
| Nov 14 | 25.0 | 36.5 | 51.9 | 19.3 | 40.2 | 21.3 | 34.7 | 25.9 | 51.5 | 36.8 | 34.2 | 50.6 | 42.8 | 46.8 | 31.3 | 32.1 |
| Nov 15 | 31.7 | 37.4 | 41.8 | 31.5 | 23.8 | 32.4 | 35.7 | 36.8 | 45.3 | 44.7 | 22.0 | 36.6 | 27.2 | 43.3 | 26.2 | 28.5 |
| Nov 16 | 41.5 | 26.5 | 42.4 | 33.5 | 29.7 | 36.1 | 37.2 | 26.8 | 37.9 | 36.6 | 20.2 | 44.3 | 39.4 | 36.1 | 34.1 | 38.6 |
| Nov 17 | 43.2 | 20.2 | 40.3 | 41.2 | 37.7 | 28.2 | 43.4 | 26.7 | 29.3 | 30.7 | 33.5 | 40.3 | 46.0 | 31.2 | 30.5 | 25.1 |
| Nov 18 | 26.1 | 25.6 | 32.9 | 45.4 | 34.4 | 30.6 | 46.8 | 20.6 | 35.7 | 40.8 | 30.6 | 37.6 | 55.8 | 34.7 | 19.9 | 29.6 |
| Nov 19 | 34.2 | 29.4 | 33.4 | 44.5 | 29.7 | 35.8 | 41.6 | 14.9 | 38.1 | 33.8 | 38.0 | 35.1 | 54.2 | 28.4 | 23.3 | 19.6 |
| Nov 20 | 40.1 | 39.4 | 41.9 | 41.8 | 35.2 | 22.0 | 41.0 | 18.2 | 40.8 | 41.0 | 42.0 | 29.8 | 51.3 | 20.9 | 28.0 | 24.8 |
| Nov 21 | 39.2 | 38.8 | 38.1 | 31.4 | 37.9 | 25.6 | 26.5 | 17.0 | 43.6 | 37.3 | 37.3 | 41.1 | 41.7 | 26.3 | 41.8 | 28.6 |
| Nov 22 | 35.0 | 30.8 | 32.2 | 27.3 | 39.3 | 23.3 | 21.3 | 38.3 | 35.9 | 36.4 | 29.9 | 44.3 | 38.4 | 36.0 | 38.8 | 24.1 |
| Nov 23 | 50.4 | 38.6 | 26.4 | 28.3 | 27.4 | 33.5 | 25.2 | 32.5 | 37.1 | 39.0 | 29.4 | 38.8 | 40.2 | 40.9 | 35.4 | 30.0 |
| Nov 24 | 49.2 | 42.0 | 28.6 | 31.8 | 31.3 | 31.9 | 32.7 | 30.4 | 33.2 | 28.1 | 29.9 | 47.6 | 40.1 | 33.8 | 37.1 | 28.6 |
| Nov 25 | 39.6 | 35.6 | 26.1 | 44.8 | 33.3 | 23.3 | 25.3 | 32.5 | 29.8 | 40.7 | 20.3 | 41.6 | 45.8 | 23.7 | 45.7 | 25.4 |
| Nov 26 | 47.4 | 30.9 | 27.9 | 52.8 | 37.2 | 23.8 | 30.5 | 33.1 | 20.3 | 35.3 | 25.4 | 33.1 | 37.5 | 36.5 | 35.0 | 13.9 |
| Nov 27 | 48.4 | 16.2 | 12.9 | 37.1 | 29.9 | 19.3 | 38.1 | 41.4 | 19.2 | 38.7 | 28.6 | 32.2 | 41.6 | 34.4 | 38.9 | 30.6 |
| Nov 28 | 30.8 | 28.5 | 9.5 | 31.6 | 26.2 | 24.3 | 34.6 | 36.2 | 25.0 | 37.3 | 28.8 | 33.3 | 27.7 | 19.6 | 36.2 | 31.9 |
| Nov 29 | 35.3 | 33.2 | 13.8 | 33.4 | 19.4 | 29.8 | 22.6 | 50.9 | 31.0 | 31.1 | 23.2 | 31.8 | 40.0 | 18.5 | 31.8 | 35.2 |
| Nov 30 | 26.6 | 29.2 | 27.6 | 30.9 | 26.9 | 34.4 | 30.1 | 49.1 | 36.7 | 25.0 | 36.1 | 40.9 | 47.8 | 26.5 | 28.5 | 37.7 |
| Dec 1 | 28.6 | 29.9 | 24.9 | 32.4 | 18.1 | 35.7 | 27.9 | 35.6 | 27.8 | 25.6 | 37.9 | 39.3 | 35.9 | 24.2 | 32.5 | 46.1 |
| Dec 2 | 32.6 | 34.7 | 18.0 | 29.8 | 25.0 | 41.6 | 17.1 | 34.1 | 31.6 | 21.0 | 29.9 | 32.5 | 31.7 | 25.9 | 33.4 | 45.7 |
| Dec 3 | 24.8 | 38.1 | 25.8 | 30.7 | 26.2 | 30.6 | 21.7 | 31.8 | 31.4 | 26.5 | 33.3 | 23.2 | 42.8 | 20.6 | 29.9 | 46.7 |
| Dec 4 | 26.5 | 29.0 | 22.4 | 33.4 | 30.1 | 27.0 | 26.2 | 29.0 | 24.0 | 15.8 | 34.6 | 31.8 | 32.6 | 25.1 | 27.0 | 45.4 |
| Dec 5 | 29.2 | 26.3 | 13.5 | 34.5 | 37.3 | 24.0 | 29.0 | 35.5 | 31.7 | 8.7 | 30.0 | 27.7 | 27.1 | 27.8 | 39.1 | 39.9 |
| Dec 6 | 31.1 | 29.9 | 15.8 | 43.5 | 36.1 | 25.3 | 34.7 | 42.3 | 32.6 | 14.8 | 33.2 | 23.9 | 28.1 | 20.4 | 48.7 | 34.3 |
| Dec 7 | 30.2 | 21.3 | 24.0 | 29.4 | 33.3 | 33.5 | 36.8 | 40.9 | 30.3 | 24.1 | 25.9 | 26.2 | 27.2 | 25.2 | 50.9 | 37.4 |
| Dec 8 | 31.6 | 33.5 | 24.4 | 26.3 | 20.9 | 24.4 | 48.4 | 31.9 | 33.4 | 29.5 | 20.7 | 26.8 | 29.0 | 32.5 | 35.2 | 38.0 |
| Dec 9 | 30.3 | 25.8 | 23.3 | 21.5 | 16.5 | 22.6 | 41.5 | 24.0 | 27.4 | 29.7 | 14.6 | 31.6 | 25.7 | 18.2 | 41.7 | 38.1 |
| Dec 10 | 18.7 | 30.8 | 16.3 | 31.1 | 13.8 | 28.6 | 45.6 | 27.7 | 29.9 | 20.1 | 19.1 | 31.1 | 13.3 | 27.7 | 36.6 | 31.9 |
| Dec 11 | 21.8 | 27.3 | 8.6 | 43.5 | 26.6 | 26.2 | 44.7 | 25.6 | 34.1 | 28.5 | 18.6 | 27.4 | 22.7 | 32.9 | 29.9 | 22.9 |
| Dec 12 | 19.3 | 22.4 | 20.2 | 38.6 | 27.3 | 33.0 | 40.9 | 26.3 | 31.3 | 25.8 | 25.7 | 25.2 | 21.7 | 36.8 | 28.2 | 21.8 |
| Dec 13 | 15.8 | 17.5 | 21.8 | 22.1 | 18.3 | 25.5 | 29.0 | 32.5 | 34.8 | 32.4 | 25.6 | 27.4 | 25.6 | 32.3 | 27.4 | 25.6 |
| Dec 14 | 27.7 | 16.2 | 24.5 | 13.7 | 21.4 | 28.0 | 37.2 | 38.2 | 38.2 | 40.8 | 34.2 | 17.0 | 21.4 | 40.9 | 25.9 | 29.8 |
| Dec 15 | 33.0 | 18.6 | 27.0 | 18.9 | 31.0 | 26.3 | 18.9 | 39.2 | 37.6 | 31.8 | 22.7 | 30.1 | 26.3 | 32.0 | 18.1 | 15.8 |
| Dec 16 | 17.5 | 28.3 | 24.3 | 19.4 | 38.8 | 25.7 | 19.0 | 36.0 | 34.6 | 22.8 | 27.2 | 26.2 | 22.3 | 37.0 | 28.9 | 20.1 |
| Dec 17 | 26.2 | 31.6 | 26.8 | 12.2 | 21.6 | 33.4 | 25.1 | 30.7 | 26.1 | 31.2 | 32.3 | 28.4 | 30.0 | 23.7 | 21.6 | 24.2 |
| Dec 18 | 22.7 | 30.7 | 26.4 | 19.5 | 28.1 | 39.2 | 17.9 | 38.8 | 17.5 | 26.2 | 33.6 | 37.3 | 32.4 | 26.5 | 30.6 | 22.0 |
| Dec 19 | 33.7 | 27.5 | 20.6 | 21.7 | 22.6 | 29.6 | 23.1 | 30.6 | 24.4 | 33.3 | 23.9 | 35.8 | 28.2 | 34.0 | 20.4 | 21.6 |
| Dec 20 | 35.5 | 33.0 | 18.2 | 20.5 | 18.1 | 31.5 | 25.9 | 28.2 | 23.0 | 37.2 | 28.7 | 29.2 | 25.0 | 25.8 | 28.4 | 21.1 |
| Dec 21 | 37.7 | 33.4 | 13.6 | 17.9 | 23.6 | 24.3 | 20.3 | 24.7 | 23.2 | 33.8 | 20.8 | 28.3 | 24.0 | 29.9 | 31.3 | 30.5 |
| Dec 22 | 35.0 | 32.1 | 25.3 | 21.2 | 29.3 | 23.9 | 24.7 | 20.5 | 19.4 | 21.4 | 31.4 | 29.3 | 23.7 | 33.2 | 30.0 | 33.3 |
| Dec 23 | 32.0 | 35.4 | 27.6 | 24.7 | 21.6 | 18.5 | 29.8 | 26.8 | 17.4 | 28.4 | 18.4 | 33.7 | 29.9 | 28.4 | 27.4 | 38.6 |
| Dec 24 | 37.1 | 34.0 | 20.3 | 36.0 | 23.6 | 10.0 | 24.0 | 18.9 | 23.9 | 23.6 | 22.9 | 27.5 | 28.3 | 26.4 | 26.0 | 44.2 |
| Dec 25 | 32.7 | 28.7 | 16.3 | 29.0 | 30.8 | 10.2 | 20.1 | 25.2 | 19.6 | 27.7 | 30.2 | 21.4 | 26.5 | 15.5 | 19.4 | 28.8 |
| Dec 26 | 23.7 | 33.2 | 19.9 | 27.7 | 36.2 | 14.6 | 16.3 | 19.3 | 18.9 | 32.7 | 24.7 | 21.0 | 29.2 | 24.2 | 17.6 | 14.2 |
| Dec 27 | 25.6 | 31.5 | 20.0 | 34.1 | 35.0 | 11.3 | 13.6 | 28.6 | 28.4 | 16.2 | 29.2 | 31.1 | 30.8 | 24.5 | 14.5 | 17.9 |
| Dec 28 | 28.3 | 27.1 | 19.1 | 29.9 | 43.0 | 12.3 | 12.3 | 14.0 | 31.4 | 14.9 | 24.1 | 31.4 | 24.0 | 16.8 | 4.5 | 21.0 |
| Dec 29 | 33.9 | 27.9 | 16.9 | 22.9 | 33.9 | 17.4 | 14.0 | 13.7 | 27.7 | 18.6 | 22.0 | 30.2 | 29.4 | 17.6 | 20.0 | 24.1 |
| Dec 30 | 44.0 | 23.1 | 31.6 | 19.5 | 40.8 | 19.1 | 23.9 | 26.1 | 29.8 | 20.9 | 34.4 | 27.4 | 31.7 | 18.7 | 21.6 | 25.4 |
| Dec 31 | 11.4 | 11.4 | 26.0 | 26.0 | 26.0 | 26.0 | 18.7 | 18.7 | 18.7 | 18.7 | 19.0 | 19.0 | 19.0 | 19.0 | 35.9 | 35.9 |
| Mean | 51.0 | 52.2 | 50.7 | 51.6 | 51.1 | 50.4 | 51.5 | 51.5 | 51.1 | 50.8 | 52.8 | 51.3 | 51.1 | 51.5 | 52.7 | 53.1 |
| Min | 11.4 | 10.9 | 8.6 | 12.2 | 9.0 | 9.0 | 11.5 | 13.7 | 15.2 | 8.7 | 12.2 | 12.1 | 12.5 | 15.5 | 4.5 | 13.9 |
| Max | 88.2 | 87.3 | 88.1 | 88.6 | 88.8 | 89.2 | 87.0 | 86.6 | 94.2 | 86.7 | 89.2 | 88.8 | 85.5 | 86.7 | 86.6 | 91.9 |

| YEAR-> | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 27 | 46.3 | 32.4 | 43.6 | 39.0 | 46.0 | 34.7 | 53.0 | 53.4 | 66.6 | 43.0 | 52.3 | 39.8 | 54.3 | 45.6 | 65.2 |
| Oct 28 | 54.9 | 42.0 | 46.9 | 36.5 | 38.7 | 25.4 | 45.5 | 48.0 | 57.0 | 38.4 | 46.6 | 53.7 | 44.4 | 34.6 | 52.0 |
| Oct 29 | 44.5 | 45.2 | 38.4 | 36.6 | 50.1 | 33.2 | 53.5 | 62.0 | 53.1 | 44.9 | 43.1 | 48.2 | 43.0 | 39.4 | 51.5 |
| Oct 30 | 33.6 | 43.2 | 52.7 | 38.6 | 57.8 | 38.5 | 50.6 | 55.7 | 50.7 | 43.1 | 56.5 | 42.1 | 41.0 | 49.2 | 61.9 |
| Oct 31 | 30.1 | 40.3 | 55.5 | 42.1 | 58.5 | 32.0 | 34.5 | 60.8 | 49.0 | 28.0 | 48.9 | 47.1 | 38.3 | 51.0 | 53.6 |
| Nov 1 | 42.2 | 37.8 | 50.6 | 48.5 | 65.6 | 39.8 | 41.7 | 51.5 | 44.6 | 23.5 | 43.2 | 37.3 | 43.0 | 45.1 | 53.4 |
| Nov 2 | 39.7 | 33.0 | 38.6 | 43.6 | 44.4 | 35.2 | 32.0 | 50.5 | 29.1 | 35.6 | 48.5 | 26.8 | 47.6 | 54.9 | 46.2 |
| Nov 3 | 36.6 | 41.5 | 39.2 | 39.2 | 47.8 | 39.9 | 33.3 | 45.8 | 28.9 | 27.7 | 49.3 | 41.8 | 43.9 | 54.5 | 34.7 |
| Nov 4 | 29.1 | 41.6 | 38.6 | 37.1 | 47.4 | 19.6 | 43.1 | 33.2 | 26.9 | 38.9 | 40.6 | 45.1 | 41.5 | 43.0 | 41.5 |
| Nov 5 | 37.9 | 31.9 | 31.2 | 34.7 | 46.1 | 27.1 | 42.9 | 43.9 | 28.8 | 43.2 | 33.8 | 39.9 | 29.9 | 36.1 | 47.1 |
| Nov 6 | 32.2 | 33.5 | 30.2 | 38.2 | 42.2 | 30.7 | 41.4 | 43.6 | 19.5 | 39.0 | 32.4 | 42.0 | 37.2 | 38.7 | 44.3 |
| Nov 7 | 33.5 | 44.5 | 41.4 | 43.4 | 31.1 | 36.5 | 47.9 | 31.6 | 24.6 | 35.8 | 31.6 | 30.1 | 34.5 | 38.7 | 47.0 |
| Nov 8 | 37.9 | 41.9 | 40.3 | 35.3 | 27.6 | 26.7 | 42.6 | 31.5 | 19.1 | 30.1 | 45.3 | 23.2 | 36.8 | 45.5 | 45.8 |
| Nov 9 | 38.1 | 39.8 | 32.4 | 37.3 | 31.6 | 23.5 | 40.6 | 32.1 | 31.8 | 39.0 | 38.1 | 41.2 | 27.2 | 50.2 | 35.7 |
| Nov 10 | 36.4 | 24.5 | 41.2 | 35.1 | 34.4 | 28.0 | 38.7 | 43.5 | 40.8 | 32.6 | 42.2 | 32.2 | 34.2 | 49.1 | 36.2 |
| Nov 11 | 32.1 | 18.9 | 40.4 | 31.0 | 32.1 | 36.2 | 45.8 | 39.8 | 39.4 | 37.6 | 38.7 | 32.6 | 35.0 | 52.0 | 41.9 |
| Nov 12 | 40.8 | 19.0 | 39.5 | 24.0 | 46.1 | 41.7 | 38.9 | 27.5 | 35.1 | 35.5 | 41.2 | 28.2 | 39.1 | 48.0 | 57.1 |
| Nov 13 | 49.2 | 23.4 | 34.0 | 35.8 | 33.8 | 30.2 | 36.8 | 27.3 | 34.9 | 37.1 | 40.5 | 36.7 | 37.4 | 49.4 | 52.0 |
| Nov 14 | 54.0 | 26.7 | 35.4 | 39.0 | 44.6 | 26.5 | 35.1 | 16.1 | 35.0 | 36.9 | 38.3 | 42.7 | 40.3 | 58.1 | 41.1 |
| Nov 15 | 43.1 | 35.7 | 32.5 | 44.5 | 48.2 | 39.0 | 21.5 | 20.0 | 28.2 | 25.5 | 34.6 | 33.7 | 22.8 | 45.1 | 44.5 |
| Nov 16 | 38.6 | 34.1 | 33.1 | 45.9 | 48.1 | 36.4 | 21.4 | 34.0 | 44.3 | 28.7 | 27.8 | 34.3 | 24.6 | 43.1 | 38.8 |
| Nov 17 | 35.3 | 35.8 | 19.9 | 50.3 | 41.4 | 26.9 | 32.5 | 37.8 | 43.0 | 42.8 | 30.5 | 28.4 | 26.7 | 40.8 | 45.9 |
| Nov 18 | 33.9 | 36.1 | 18.1 | 50.8 | 49.6 | 29.5 | 37.7 | 34.0 | 44.9 | 40.6 | 40.6 | 31.5 | 20.2 | 44.7 | 45.6 |
| Nov 19 | 34.2 | 43.8 | 21.5 | 48.0 | 46.6 | 29.9 | 25.5 | 30.1 | 39.3 | 36.3 | 32.7 | 40.2 | 21.8 | 46.4 | 41.0 |
| Nov 20 | 24.6 | 47.0 | 32.2 | 52.0 | 30.4 | 18.0 | 35.7 | 23.3 | 42.2 | 39.3 | 34.5 | 45.3 | 16.0 | 50.1 | 41.5 |
| Nov 21 | 24.0 | 41.0 | 29.4 | 52.4 | 37.1 | 22.1 | 46.4 | 27.5 | 44.2 | 47.1 | 38.4 | 41.9 | 23.5 | 42.9 | 32.0 |
| Nov 22 | 30.3 | 38.0 | 23.8 | 56.0 | 52.2 | 28.9 | 58.8 | 42.0 | 40.3 | 43.3 | 41.5 | 48.7 | 31.1 | 48.5 | 30.5 |
| Nov 23 | 35.0 | 40.2 | 24.1 | 33.5 | 50.3 | 27.4 | 60.0 | 34.4 | 38.9 | 30.2 | 43.1 | 58.4 | 27.5 | 55.5 | 31.6 |
| Nov 24 | 37.4 | 39.0 | 18.4 | 40.7 | 45.9 | 33.5 | 65.1 | 32.6 | 42.6 | 28.5 | 45.4 | 50.1 | 23.1 | 37.7 | 31.8 |
| Nov 25 | 31.5 | 31.0 | 20.1 | 26.6 | 47.5 | 34.3 | 48.8 | 30.0 | 32.4 | 31.2 | 41.0 | 46.8 | 27.7 | 45.9 | 30.4 |
| Nov 26 | 26.5 | 28.4 | 35.5 | 29.1 | 41.9 | 37.4 | 50.1 | 34.8 | 29.3 | 34.1 | 36.0 | 37.1 | 34.1 | 41.1 | 28.3 |
| Nov 27 | 27.6 | 26.8 | 35.5 | 27.4 | 48.4 | 38.5 | 36.0 | 35.5 | 24.8 | 24.7 | 36.3 | 27.3 | 31.2 | 39.6 | 21.0 |
| Nov 28 | 40.2 | 21.8 | 32.0 | 35.9 | 38.0 | 33.9 | 30.2 | 40.4 | 16.6 | 28.8 | 29.8 | 28.0 | 35.9 | 35.5 | 18.6 |
| Nov 29 | 42.4 | 28.0 | 31.0 | 28.1 | 28.8 | 32.0 | 35.9 | 45.4 | 20.9 | 16.4 | 22.5 | 27.7 | 46.0 | 37.7 | 21.6 |
| Nov 30 | 37.5 | 22.9 | 23.4 | 30.4 | 25.6 | 40.1 | 40.5 | 41.7 | 12.2 | 3.6 | 28.2 | 38.1 | 46.1 | 34.1 | 20.3 |
| Dec 1 | 30.4 | 22.2 | 38.8 | 37.0 | 24.6 | 39.7 | 34.2 | 35.9 | 7.4 | 16.3 | 26.4 | 48.0 | 35.8 | 33.5 | 18.6 |
| Dec 2 | 32.3 | 15.9 | 47.7 | 42.3 | 35.5 | 41.1 | 33.6 | 28.2 | 12.5 | 17.4 | 27.8 | 39.7 | 36.3 | 33.5 | 33.5 |
| Dec 3 | 34.1 | 16.6 | 26.7 | 39.3 | 29.1 | 39.4 | 31.3 | 42.9 | 12.1 | 17.4 | 23.8 | 36.8 | 38.5 | 31.3 | 25.8 |
| Dec 4 | 35.0 | 26.7 | 21.3 | 23.4 | 31.7 | 38.0 | 34.0 | 39.3 | 17.8 | 26.5 | 20.9 | 27.7 | 35.4 | 33.0 | 28.3 |
| Dec 5 | 29.6 | 21.0 | 20.8 | 20.0 | 32.6 | 47.0 | 36.8 | 40.4 | 18.2 | 23.4 | 20.0 | 34.6 | 36.4 | 31.7 | 15.8 |
| Dec 6 | 29.8 | 28.9 | 23.2 | 28.6 | 40.1 | 35.6 | 42.3 | 38.7 | 33.1 | 26.3 | 25.3 | 33.5 | 43.1 | 29.1 | 24.7 |
| Dec 7 | 26.5 | 27.4 | 33.6 | 20.9 | 37.9 | 34.9 | 37.9 | 27.9 | 40.8 | 26.9 | 20.8 | 23.6 | 44.6 | 38.8 | 30.8 |
| Dec 8 | 33.7 | 27.4 | 35.2 | 21.5 | 33.9 | 32.4 | 44.1 | 33.0 | 42.5 | 26.0 | 21.8 | 19.1 | 46.5 | 39.9 | 31.1 |
| Dec 9 | 34.4 | 15.9 | 36.8 | 27.5 | 38.9 | 27.7 | 38.3 | 30.7 | 40.2 | 29.3 | 28.2 | 25.2 | 50.8 | 38.9 | 30.0 |
| Dec 10 | 21.8 | 16.4 | 24.8 | 16.6 | 26.2 | 23.9 | 33.2 | 30.8 | 31.0 | 24.5 | 27.8 | 19.4 | 51.7 | 34.9 | 30.6 |
| Dec 11 | 20.4 | 21.5 | 15.0 | 30.8 | 20.4 | 32.1 | 21.3 | 30.0 | 18.4 | 26.4 | 21.9 | 15.3 | 45.5 | 31.2 | 27.0 |
| Dec 12 | 21.3 | 27.3 | 11.9 | 23.6 | 20.7 | 41.6 | 27.5 | 25.9 | 16.8 | 19.4 | 21.7 | 20.6 | 45.5 | 37.4 | 23.6 |
| Dec 13 | 34.5 | 28.8 | 20.4 | 32.4 | 28.2 | 35.8 | 41.8 | 22.3 | 24.9 | 17.8 | 30.8 | 20.2 | 28.7 | 33.7 | 23.7 |
| Dec 14 | 43.2 | 28.8 | 32.9 | 22.2 | 32.6 | 28.6 | 45.0 | 16.6 | 23.5 | 20.3 | 33.6 | 22.8 | 29.1 | 24.9 | 26.2 |
| Dec 15 | 38.0 | 32.5 | 33.2 | 24.4 | 36.2 | 26.2 | 29.9 | 23.8 | 29.7 | 27.7 | 33.5 | 19.6 | 23.9 | 16.3 | 21.1 |
| Dec 16 | 26.9 | 27.8 | 33.4 | 11.0 | 36.4 | 25.7 | 34.5 | 21.4 | 30.9 | 17.1 | 29.7 | 38.8 | 20.2 | 24.0 | 16.6 |
| Dec 17 | 33.0 | 21.6 | 28.4 | 24.6 | 21.0 | 26.7 | 41.6 | 18.9 | 26.6 | 20.8 | 41.1 | 46.3 | 26.8 | 28.4 | 19.1 |
| Dec 18 | 19.9 | 31.9 | 22.0 | 28.8 | 22.2 | 16.8 | 33.4 | 28.8 | 22.7 | 21.5 | 33.9 | 36.4 | 24.8 | 27.6 | 26.9 |
| Dec 19 | 27.1 | 34.3 | 26.0 | 21.6 | 25.3 | 20.5 | 26.7 | 22.6 | 21.0 | 31.1 | 22.3 | 37.1 | 17.4 | 43.5 | 19.4 |
| Dec 20 | 30.6 | 37.7 | 25.7 | 21.2 | 26.7 | 14.4 | 37.3 | 25.3 | 15.4 | 31.8 | 21.4 | 28.3 | 24.5 | 29.7 | 30.7 |
| Dec 21 | 26.4 | 32.9 | 27.0 | 30.6 | 37.6 | 12.5 | 31.2 | 24.5 | 20.3 | 38.8 | 30.2 | 38.4 | 20.2 | 21.4 | 18.6 |
| Dec 22 | 23.3 | 39.1 | 23.3 | 23.1 | 34.1 | 27.7 | 26.3 | 33.4 | 17.0 | 34.3 | 25.3 | 27.0 | 31.0 | 12.2 | 18.6 |
| Dec 23 | 16.3 | 45.3 | 21.3 | 13.7 | 24.6 | 39.1 | 31.9 | 39.9 | 20.8 | 32.8 | 20.7 | 33.4 | 26.9 | 21.6 | 17.7 |
| Dec 24 | 30.3 | 40.2 | 24.4 | 6.7 | 21.0 | 30.6 | 23.8 | 34.7 | 26.7 | 39.1 | 22.8 | 34.4 | 29.7 | 30.0 | 25.4 |
| Dec 25 | 17.3 | 37.4 | 18.7 | 14.3 | 12.6 | 23.9 | 27.5 | 21.1 | 33.3 | 21.6 | 30.5 | 40.4 | 29.0 | 30.4 | 17.0 |
| Dec 26 | 15.8 | 27.2 | 19.4 | 7.9 | 18.9 | 21.1 | 34.7 | 19.8 | 30.3 | 26.6 | 26.4 | 36.7 | 23.6 | 41.0 | 23.8 |
| Dec 27 | 25.1 | 21.7 | 16.6 | 5.6 | 15.7 | 25.5 | 37.5 | 18.6 | 33.7 | 15.4 | 23.7 | 32.6 | 23.5 | 38.6 | 21.7 |
| Dec 28 | 22.0 | 28.5 | 18.4 | 7.0 | 17.4 | 31.6 | 36.3 | 28.0 | 25.5 | 10.7 | 21.1 | 30.1 | 22.4 | 39.2 | 24.5 |
| Dec 29 | 30.5 | 37.5 | 12.2 | 6.5 | 24.1 | 38.5 | 20.5 | 29.4 | 19.7 | 6.7 | 14.7 | 35.3 | 13.4 | 25.2 | 28.5 |
| Dec 30 | 30.9 | 33.9 | 6.8 | 19.7 | 18.2 | 40.1 | 18.5 | 23.7 | 21.0 | 9.5 | 14.8 | 32.2 | 17.4 | 19.0 | 33.5 |
| Dec 31 | 35.9 | 35.9 | 15.1 | 15.1 | 15.1 | 15.1 | 19.8 | 19.8 | 19.8 | 19.8 | 24.7 | 24.7 | 24.7 | 24.7 | 35.0 |
| Mean | 52.6 | 51.5 | 51.7 | 51.2 | 51.3 | 51.0 | 53.2 | 50.6 | 51.4 | 51.2 | 51.3 | 53.2 | 52.5 | 52.9 | 52.1 |
| Min | 15.2 | 15.9 | 6.8 | 5.6 | 8.2 | 12.5 | 15.7 | 14.0 | 7.4 | 3.6 | 14.1 | 15.3 | 13.4 | 12.2 | 12.1 |
| Max | 90.3 | 85.7 | 88.0 | 87.0 | 90.6 | 87.2 | 86.7 | 89.2 | 88.5 | 91.1 | 88.1 | 89.9 | 86.4 | 88.9 | 86.6 |

***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | $T_{avg}$ | $T_{min}$ | $T_{max}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1 | 28.5 | 20.6 | 33.8 | 17.1 | 29.7 | 47.3 | 35.0 | 33.1 | 30.363 | 14.5 | 50.3 |
| Jan 2 | 19.3 | 9.8 | 32.5 | 25.1 | 23.2 | 49.2 | 38.0 | 27.2 | 29.858 | 9.8 | 49.2 |
| Jan 3 | 11.6 | 24.0 | 22.9 | 31.3 | 31.4 | 39.0 | 33.2 | 21.8 | 30.382 | 11.6 | 52.1 |
| Jan 4 | 21.2 | 24.8 | 14.3 | 26.3 | 28.5 | 39.9 | 43.2 | 23.1 | 30.377 | 11.6 | 45.8 |
| Jan 5 | 34.2 | 34.9 | 10.7 | 35.5 | 30.7 | 36.8 | 48.0 | 18.9 | 29.887 | 10.7 | 50.5 |
| Jan 6 | 28.4 | 26.4 | 7.8 | 37.1 | 37.2 | 34.6 | 53.4 | 22.2 | 30.124 | 7.8 | 53.4 |
| Jan 7 | 26.0 | 36.2 | 21.1 | 31.3 | 31.3 | 38.1 | 49.1 | 22.5 | 28.680 | 7.2 | 49.1 |
| Jan 8 | 34.5 | 30.4 | 28.4 | 33.3 | 30.5 | 27.7 | 51.8 | 17.5 | 28.568 | 14.4 | 51.8 |
| Jan 9 | 44.6 | 28.0 | 36.4 | 25.0 | 28.5 | 34.7 | 46.9 | 22.2 | 28.606 | 13.6 | 46.9 |
| Jan 10 | 31.1 | 28.5 | 31.9 | 30.2 | 31.0 | 29.5 | 44.9 | 23.3 | 28.661 | 8.2 | 46.3 |
| Jan 11 | 25.8 | 24.7 | 40.2 | 30.0 | 33.3 | 26.3 | 39.7 | 12.9 | 28.847 | 8.8 | 49.3 |
| Jan 12 | 28.0 | 25.1 | 34.9 | 29.6 | 29.0 | 21.3 | 32.0 | 19.0 | 29.341 | 13.8 | 44.9 |
| Jan 13 | 31.7 | 23.2 | 19.6 | 31.4 | 30.6 | 25.7 | 27.7 | 9.6 | 28.209 | 9.6 | 46.8 |
| Jan 14 | 25.6 | 25.7 | 22.1 | 27.5 | 26.3 | 31.7 | 32.7 | 14.3 | 28.752 | 11.4 | 45.5 |
| Jan 15 | 32.0 | 29.1 | 26.0 | 30.4 | 33.8 | 37.1 | 30.4 | 12.5 | 29.156 | 12.5 | 44.5 |
| Jan 16 | 27.4 | 30.0 | 33.8 | 24.0 | 27.5 | 25.7 | 39.9 | 14.6 | 28.682 | 10.4 | 44.9 |
| Jan 17 | 33.5 | 35.5 | 29.9 | 21.5 | 24.6 | 23.7 | 32.2 | 11.6 | 29.454 | 11.6 | 51.6 |
| Jan 18 | 34.4 | 36.4 | 17.0 | 18.6 | 27.8 | 29.2 | 38.3 | 16.8 | 29.095 | 9.1 | 46.7 |
| Jan 19 | 33.0 | 28.6 | 26.9 | 13.3 | 18.3 | 28.1 | 38.5 | 21.7 | 28.150 | 13.3 | 46.7 |
| Jan 20 | 37.8 | 35.6 | 29.4 | 26.0 | 18.3 | 30.4 | 46.2 | 20.9 | 28.922 | 10.2 | 46.2 |
| Jan 21 | 35.8 | 43.8 | 28.5 | 26.0 | 23.2 | 33.7 | 44.2 | 13.6 | 28.413 | 8.9 | 51.5 |
| Jan 22 | 45.6 | 43.1 | 36.6 | 25.4 | 27.4 | 37.9 | 39.4 | 19.3 | 29.888 | 10.1 | 45.6 |
| Jan 23 | 30.3 | 40.3 | 34.1 | 24.9 | 25.3 | 29.6 | 26.0 | 14.7 | 29.852 | 14.7 | 47.9 |
| Jan 24 | 28.5 | 33.0 | 27.0 | 27.5 | 28.3 | 34.4 | 17.8 | 25.7 | 29.103 | 10.7 | 47.4 |
| Jan 25 | 34.1 | 33.0 | 30.7 | 23.6 | 31.6 | 21.7 | 23.1 | 33.2 | 29.491 | 9.6 | 49.9 |
| Jan 26 | 42.3 | 26.0 | 27.3 | 18.8 | 34.6 | 23.7 | 20.6 | 31.6 | 29.589 | 12.1 | 47.5 |
| Jan 27 | 39.0 | 17.9 | 34.3 | 32.1 | 30.5 | 29.6 | 8.3 | 24.0 | 29.090 | 8.3 | 46.8 |
| Jan 28 | 43.6 | 25.8 | 44.8 | 25.4 | 27.5 | 29.8 | 11.8 | 28.7 | 29.153 | 9.7 | 54.2 |
| Jan 29 | 34.9 | 29.5 | 44.4 | 16.1 | 25.0 | 22.6 | 13.1 | 17.2 | 29.027 | 7.9 | 45.7 |
| Jan 30 | 31.2 | 21.3 | 34.3 | 22.2 | 23.7 | 33.0 | 7.6 | 17.9 | 27.567 | 7.6 | 50.5 |
| Jan 31 | 34.7 | 21.3 | 41.9 | 29.2 | 32.0 | 34.8 | 7.9 | 20.1 | 28.542 | 7.9 | 54.6 |
| Feb 1 | 33.0 | 35.1 | 35.5 | 17.5 | 34.0 | 34.3 | 21.3 | 30.6 | 29.391 | 13.4 | 46.1 |
| Feb 2 | 32.4 | 27.4 | 32.2 | 19.3 | 36.2 | 26.8 | 22.8 | 31.3 | 29.142 | 14.5 | 45 |
| Feb 3 | 29.5 | 15.0 | 39.9 | 12.4 | 47.4 | 28.4 | 14.1 | 32.6 | 29.767 | 12.4 | 47.6 |
| Feb 4 | 35.2 | 23.2 | 43.4 | 26.3 | 40.1 | 33.6 | 25.0 | 21.1 | 30.224 | 7.1 | 44.7 |
| Feb 5 | 28.8 | 35.0 | 39.2 | 30.3 | 33.3 | 18.2 | 26.7 | 28.2 | 30.043 | 12.2 | 44.3 |
| Feb 6 | 40.0 | 40.4 | 25.3 | 29.2 | 40.0 | 22.0 | 20.0 | 41.0 | 30.795 | 9.0 | 46.3 |
| Feb 7 | 30.7 | 38.6 | 21.3 | 18.0 | 31.1 | 22.8 | 28.6 | 28.6 | 30.340 | 12.8 | 53.9 |
| Feb 8 | 25.9 | 29.8 | 23.7 | 22.2 | 31.0 | 27.9 | 34.8 | 27.8 | 30.302 | 12.1 | 49.9 |
| Feb 9 | 19.0 | 25.6 | 19.0 | 29.9 | 29.8 | 22.6 | 35.9 | 29.1 | 29.785 | 13.8 | 49.6 |
| Feb 10 | 14.9 | 31.4 | 26.1 | 37.7 | 30.2 | 19.8 | 31.8 | 24.4 | 30.954 | 14.9 | 51.4 |
| Feb 11 | 14.9 | 39.0 | 32.1 | 32.3 | 39.9 | 29.9 | 39.9 | 23.5 | 32.122 | 11.2 | 58 |
| Feb 12 | 15.1 | 38.4 | 29.7 | 28.7 | 30.7 | 28.2 | 43.1 | 28.4 | 31.644 | 15.1 | 61 |
| Feb 13 | 16.9 | 40.6 | 37.8 | 31.4 | 32.1 | 41.6 | 47.4 | 28.5 | 32.311 | 12.3 | 55.3 |
| Feb 14 | 21.6 | 39.9 | 42.3 | 36.2 | 32.5 | 45.7 | 40.9 | 31.5 | 32.803 | 16.0 | 55.3 |
| Feb 15 | 25.2 | 49.6 | 45.6 | 25.9 | 27.0 | 38.4 | 44.3 | 29.2 | 32.733 | 11.5 | 54.7 |
| Feb 16 | 31.5 | 32.2 | 31.8 | 18.7 | 42.9 | 36.6 | 49.4 | 41.0 | 32.757 | 9.0 | 49.4 |
| Feb 17 | 27.9 | 40.3 | 49.3 | 38.0 | 39.2 | 32.8 | 42.2 | 39.2 | 33.181 | 15.3 | 51.5 |
| Feb 18 | 33.3 | 37.0 | 47.2 | 21.2 | 46.1 | 35.4 | 36.7 | 26.0 | 33.419 | 19.1 | 53.9 |
| Feb 19 | 32.1 | 37.6 | 46.2 | 24.9 | 42.3 | 37.4 | 33.5 | 27.0 | 32.822 | 14.0 | 55.4 |
| Feb 20 | 37.2 | 44.4 | 41.6 | 27.7 | 30.5 | 41.6 | 41.3 | 31.5 | 33.007 | 16.2 | 47.2 |
| Feb 21 | 36.9 | 29.8 | 24.8 | 25.8 | 37.7 | 31.8 | 42.8 | 39.8 | 32.153 | 17.8 | 48.4 |
| Feb 22 | 36.7 | 30.3 | 25.4 | 29.8 | 27.6 | 32.4 | 41.7 | 45.2 | 33.054 | 13.9 | 52.9 |
| Feb 23 | 34.0 | 40.6 | 33.1 | 19.3 | 20.6 | 44.3 | 37.8 | 45.5 | 33.237 | 7.1 | 53.8 |
| Feb 24 | 23.0 | 31.0 | 36.3 | 20.3 | 22.9 | 39.7 | 35.4 | 48.7 | 33.971 | 14.5 | 54.4 |
| Feb 25 | 35.0 | 31.7 | 39.9 | 17.3 | 28.8 | 45.6 | 32.5 | 39.6 | 33.887 | 12.2 | 51.1 |
| Feb 26 | 42.2 | 36.1 | 37.7 | 25.1 | 32.5 | 43.0 | 35.3 | 37.9 | 35.929 | 12.0 | 53 |
| Feb 27 | 35.0 | 25.5 | 52.7 | 37.8 | 37.4 | 48.1 | 37.4 | 27.3 | 36.100 | 19.9 | 61.3 |
| Feb 28 | 33.3 | 39.4 | 50.0 | 40.9 | 34.2 | 51.7 | 36.0 | 39.1 | 36.932 | 20.0 | 56.2 |
| Feb 29 | 38.8 | 49.3 | 45.1 | 36.8 | 32.0 | 48.6 | 38.5 | 37.9 | 38.475 | 16.3 | 56.5 |
| Mar 1 | 36.3 | 39.3 | 49.0 | 46.2 | 31.9 | 44.4 | 38.9 | 37.4 | 37.892 | 19.8 | 57 |
| Mar 2 | 35.0 | 32.0 | 42.9 | 44.5 | 32.3 | 40.5 | 37.7 | 44.0 | 38.538 | 20.2 | 59.1 |
| Mar 3 | 39.8 | 33.8 | 35.9 | 30.6 | 44.1 | 38.0 | 46.5 | 51.8 | 39.042 | 16.2 | 59 |
| Mar 4 | 43.3 | 31.5 | 55.6 | 40.0 | 48.0 | 34.7 | 28.0 | 37.8 | 38.573 | 21.1 | 59.4 |
| Mar 5 | 38.4 | 34.2 | 55.8 | 43.1 | 46.0 | 43.4 | 32.5 | 42.3 | 38.378 | 23.8 | 57.6 |
| Mar 6 | 31.8 | 30.3 | 46.0 | 46.1 | 37.1 | 41.9 | 40.8 | 48.7 | 39.182 | 22.1 | 58.4 |
| Mar 7 | 35.0 | 32.0 | 40.2 | 41.0 | 29.9 | 35.9 | 32.4 | 42.0 | 38.982 | 14.8 | 59 |
| Mar 8 | 35.6 | 38.9 | 32.3 | 31.9 | 36.1 | 30.8 | 29.1 | 48.5 | 38.735 | 14.9 | 59.2 |
| Mar 9 | 47.5 | 50.2 | 31.7 | 44.0 | 26.3 | 31.6 | 31.6 | 56.7 | 38.371 | 17.4 | 63 |
| Mar 10 | 41.9 | 48.3 | 39.7 | 43.0 | 24.0 | 38.5 | 31.8 | 57.6 | 38.455 | 20.5 | 66 |
| Mar 11 | 39.1 | 55.3 | 33.2 | 32.5 | 29.3 | 52.2 | 42.8 | 53.6 | 38.960 | 18.0 | 68.6 |
| Mar 12 | 38.8 | 43.4 | 41.0 | 33.4 | 31.9 | 38.2 | 45.1 | 46.8 | 39.452 | 10.2 | 59.3 |
| Mar 13 | 33.8 | 54.2 | 36.4 | 33.6 | 40.3 | 37.5 | 42.8 | 33.9 | 40.519 | 18.0 | 61 |
| Mar 14 | 19.2 | 43.4 | 47.3 | 45.5 | 41.4 | 28.6 | 45.0 | 39.6 | 40.678 | 19.2 | 57.6 |
| Mar 15 | 21.2 | 51.2 | 44.3 | 40.1 | 38.4 | 30.3 | 41.0 | 44.8 | 40.255 | 18.3 | 61.5 |

***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | $T_{avg}$ | $T_{min}$ | $T_{max}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar 16 | 31.1 | 30.3 | 42.4 | 42.7 | 46.9 | 34.6 | 37.1 | 43.9 | 41.355 | 23.5 | 64.3 |
| Mar 17 | 32.9 | 41.5 | 38.2 | 43.1 | 53.5 | 35.2 | 52.4 | 46.0 | 42.318 | 23.8 | 59 |
| Mar 18 | 41.6 | 37.6 | 49.4 | 43.8 | 49.7 | 33.4 | 41.6 | 40.8 | 43.136 | 25.0 | 69.6 |
| Mar 19 | 52.7 | 40.9 | 55.0 | 53.8 | 47.4 | 40.6 | 42.1 | 39.8 | 44.623 | 21.6 | 68.9 |
| Mar 20 | 49.0 | 38.7 | 46.9 | 59.6 | 46.8 | 53.0 | 47.8 | 46.0 | 43.371 | 26.4 | 66.6 |
| Mar 21 | 51.4 | 35.2 | 44.3 | 55.9 | 35.9 | 39.2 | 45.8 | 52.5 | 43.105 | 21.9 | 63.7 |
| Mar 22 | 49.9 | 33.0 | 43.0 | 49.5 | 53.4 | 37.7 | 47.6 | 46.9 | 44.157 | 28.8 | 65.7 |
| Mar 23 | 44.6 | 37.3 | 39.7 | 43.9 | 59.3 | 44.1 | 38.9 | 51.6 | 44.889 | 28.6 | 59.9 |
| Mar 24 | 51.6 | 45.1 | 40.0 | 48.9 | 60.5 | 60.8 | 43.8 | 49.3 | 45.218 | 26.4 | 62.8 |
| Mar 25 | 47.8 | 43.5 | 40.6 | 43.8 | 64.9 | 49.1 | 50.0 | 56.4 | 45.890 | 22.9 | 68.6 |
| Mar 26 | 51.4 | 54.0 | 43.6 | 51.4 | 50.0 | 44.2 | 44.8 | 51.2 | 46.060 | 21.8 | 66.9 |
| Mar 27 | 39.5 | 59.7 | 35.7 | 59.9 | 51.6 | 45.5 | 54.0 | 54.6 | 45.809 | 31.6 | 68.4 |
| Mar 28 | 54.4 | 59.5 | 46.5 | 44.8 | 51.7 | 46.7 | 52.2 | 42.8 | 46.327 | 27.1 | 71.4 |
| Mar 29 | 54.4 | 56.5 | 43.6 | 59.2 | 46.8 | 38.4 | 40.7 | 32.5 | 47.022 | 29.5 | 70.6 |
| Mar 30 | 54.6 | 54.4 | 60.8 | 47.6 | 49.1 | 40.9 | 39.3 | 42.1 | 47.014 | 27.3 | 69.2 |
| Mar 31 | 50.7 | 57.2 | 56.7 | 44.4 | 57.9 | 32.6 | 41.7 | 37.7 | 44.955 | 24.2 | 66.8 |
| Apr 1 | 50.8 | 45.6 | 47.7 | 47.0 | 56.4 | 33.7 | 46.5 | 27.3 | 43.848 | 26.1 | 61.3 |
| Apr 2 | 59.0 | 60.6 | 48.3 | 45.8 | 67.0 | 34.4 | 51.0 | 32.5 | 45.680 | 24.0 | 67.3 |
| Apr 3 | 49.2 | 44.3 | 51.5 | 45.2 | 46.4 | 44.4 | 58.5 | 33.6 | 45.677 | 25.4 | 67.8 |
| Apr 4 | 40.5 | 33.2 | 55.0 | 40.2 | 58.2 | 39.8 | 50.3 | 37.6 | 45.953 | 25.9 | 65 |
| Apr 5 | 42.9 | 40.3 | 60.0 | 38.4 | 44.1 | 46.4 | 33.2 | 48.8 | 46.111 | 28.3 | 70.8 |
| Apr 6 | 34.1 | 36.5 | 56.5 | 36.2 | 46.8 | 43.9 | 36.2 | 41.2 | 46.366 | 28.4 | 68.7 |
| Apr 7 | 36.7 | 42.4 | 41.4 | 44.1 | 49.1 | 36.2 | 29.5 | 49.8 | 45.732 | 27.3 | 64.7 |
| Apr 8 | 39.6 | 44.6 | 56.9 | 41.7 | 46.8 | 45.6 | 37.6 | 53.1 | 46.204 | 26.1 | 64.6 |
| Apr 9 | 44.1 | 48.3 | 50.0 | 41.6 | 51.4 | 41.6 | 42.5 | 39.5 | 47.139 | 24.9 | 65.4 |
| Apr 10 | 40.1 | 52.6 | 54.2 | 42.4 | 46.7 | 41.5 | 41.9 | 48.6 | 48.038 | 31.9 | 66 |
| Apr 11 | 34.9 | 46.0 | 54.1 | 41.7 | 67.9 | 51.2 | 41.1 | 51.5 | 48.257 | 28.1 | 68.9 |
| Apr 12 | 38.8 | 42.9 | 48.4 | 31.2 | 69.0 | 50.3 | 49.8 | 53.2 | 48.512 | 29.5 | 69 |
| Apr 13 | 39.9 | 42.3 | 56.3 | 26.3 | 68.8 | 48.7 | 56.4 | 56.8 | 49.170 | 24.9 | 77.2 |
| Apr 14 | 48.0 | 41.0 | 56.5 | 37.4 | 68.6 | 53.6 | 52.2 | 47.9 | 50.631 | 31.7 | 82.1 |
| Apr 15 | 52.8 | 40.0 | 49.7 | 38.3 | 61.4 | 50.7 | 40.5 | 49.6 | 51.575 | 34.8 | 74.3 |
| Apr 16 | 48.7 | 39.1 | 45.9 | 41.5 | 61.3 | 62.6 | 42.3 | 53.4 | 51.466 | 35.4 | 80.4 |
| Apr 17 | 46.3 | 55.2 | 48.5 | 49.0 | 51.0 | 52.4 | 38.4 | 42.6 | 51.361 | 35.9 | 79.8 |
| Apr 18 | 48.6 | 54.8 | 46.7 | 45.0 | 60.8 | 47.3 | 42.2 | 39.9 | 51.961 | 31.1 | 79.9 |
| Apr 19 | 49.7 | 54.3 | 49.5 | 46.7 | 61.2 | 49.3 | 51.3 | 46.1 | 52.068 | 32.2 | 72.1 |
| Apr 20 | 53.0 | 49.7 | 57.9 | 46.6 | 59.6 | 50.2 | 41.6 | 53.2 | 53.119 | 32.6 | 70.6 |
| Apr 21 | 56.0 | 45.9 | 46.6 | 38.0 | 63.3 | 54.8 | 34.6 | 53.5 | 52.947 | 34.6 | 71.7 |
| Apr 22 | 45.6 | 46.5 | 52.1 | 45.7 | 64.7 | 53.1 | 48.6 | 42.2 | 52.438 | 32.7 | 68.4 |
| Apr 23 | 48.4 | 43.3 | 50.3 | 52.3 | 68.1 | 62.7 | 55.3 | 34.0 | 53.099 | 34.0 | 73.2 |
| Apr 24 | 45.8 | 41.4 | 50.1 | 46.9 | 62.9 | 57.1 | 58.1 | 31.2 | 52.216 | 31.2 | 70.9 |
| Apr 25 | 52.3 | 46.2 | 52.2 | 37.7 | 55.1 | 54.1 | 55.3 | 42.9 | 52.759 | 33.7 | 73.1 |
| Apr 26 | 52.1 | 46.7 | 50.0 | 49.6 | 49.8 | 56.3 | 54.1 | 52.9 | 53.659 | 35.5 | 81.4 |
| Apr 27 | 52.0 | 47.4 | 56.0 | 52.3 | 48.2 | 41.8 | 50.8 | 50.8 | 53.856 | 37.7 | 75.5 |
| Apr 28 | 59.4 | 45.5 | 58.2 | 60.6 | 60.2 | 49.0 | 42.1 | 46.6 | 53.526 | 31.2 | 73.8 |
| Apr 29 | 55.1 | 49.8 | 58.7 | 55.4 | 57.6 | 61.9 | 50.2 | 56.8 | 55.184 | 38.0 | 72.4 |
| Apr 30 | 47.8 | 46.9 | 60.7 | 51.5 | 65.8 | 61.6 | 46.1 | 59.9 | 54.321 | 39.2 | 71.2 |
| May 1 | 40.0 | 48.8 | 61.6 | 60.7 | 69.6 | 59.1 | 43.6 | 55.7 | 54.849 | 36.7 | 69.6 |
| May 2 | 27.2 | 52.5 | 52.6 | 59.7 | 65.3 | 49.3 | 53.7 | 58.8 | 55.174 | 27.2 | 73.3 |
| May 3 | 45.8 | 48.1 | 55.8 | 65.2 | 60.1 | 43.1 | 61.3 | 51.2 | 55.282 | 39.0 | 70.8 |
| May 4 | 47.4 | 67.3 | 53.2 | 60.4 | 57.4 | 47.6 | 66.0 | 63.4 | 56.183 | 36.9 | 75.4 |
| May 5 | 49.0 | 63.6 | 60.5 | 73.9 | 55.6 | 58.6 | 55.7 | 59.3 | 56.557 | 37.7 | 73.9 |
| May 6 | 49.4 | 50.6 | 62.6 | 67.1 | 59.2 | 58.7 | 47.6 | 63.0 | 57.191 | 43.2 | 81.9 |
| May 7 | 55.6 | 68.9 | 48.7 | 63.2 | 62.8 | 58.2 | 46.7 | 60.9 | 58.230 | 39.2 | 80.6 |
| May 8 | 47.6 | 62.0 | 52.7 | 58.6 | 58.2 | 43.9 | 55.7 | 68.9 | 57.538 | 36.4 | 79.6 |
| May 9 | 46.9 | 50.5 | 57.6 | 59.2 | 53.1 | 46.9 | 53.5 | 55.0 | 58.169 | 41.6 | 78.8 |
| May 10 | 49.9 | 50.7 | 62.9 | 54.9 | 51.6 | 65.1 | 59.4 | 46.8 | 57.938 | 40.0 | 80 |
| May 11 | 34.8 | 47.8 | 60.4 | 57.3 | 55.3 | 67.7 | 61.1 | 47.9 | 58.130 | 34.8 | 80.4 |
| May 12 | 41.7 | 40.1 | 63.9 | 58.4 | 53.4 | 59.1 | 48.7 | 52.7 | 58.302 | 40.1 | 77.4 |
| May 13 | 51.2 | 53.5 | 56.2 | 60.9 | 51.6 | 69.4 | 50.8 | 52.3 | 59.618 | 38.8 | 80.2 |
| May 14 | 55.7 | 56.0 | 51.1 | 49.9 | 51.7 | 68.8 | 52.4 | 58.4 | 59.065 | 38.5 | 72.8 |
| May 15 | 51.5 | 58.7 | 49.1 | 51.9 | 56.2 | 68.6 | 67.2 | 61.6 | 60.136 | 41.4 | 81.7 |
| May 16 | 58.2 | 62.9 | 56.4 | 56.1 | 57.5 | 62.6 | 57.0 | 54.0 | 59.663 | 40.8 | 77.9 |
| May 17 | 60.8 | 59.5 | 54.9 | 63.4 | 59.1 | 60.2 | 59.5 | 66.4 | 60.384 | 45.6 | 75.8 |
| May 18 | 63.5 | 56.3 | 60.1 | 70.7 | 48.7 | 66.6 | 60.4 | 59.8 | 61.543 | 48.1 | 78.4 |
| May 19 | 59.3 | 55.3 | 56.7 | 72.8 | 51.0 | 58.5 | 58.4 | 59.0 | 61.380 | 46.6 | 74.9 |
| May 20 | 67.3 | 61.5 | 48.8 | 66.7 | 60.7 | 70.2 | 62.9 | 62.3 | 61.683 | 46.8 | 79.6 |
| May 21 | 71.6 | 61.2 | 51.5 | 65.8 | 60.4 | 61.7 | 60.1 | 61.5 | 62.508 | 48.4 | 76.7 |
| May 22 | 68.6 | 56.8 | 52.3 | 58.9 | 67.2 | 58.9 | 71.5 | 65.7 | 63.206 | 45.8 | 80.6 |
| May 23 | 63.2 | 60.3 | 60.7 | 56.8 | 72.0 | 62.9 | 59.7 | 66.8 | 62.983 | 50.5 | 82.8 |
| May 24 | 74.4 | 65.1 | 61.8 | 58.1 | 66.6 | 59.2 | 54.8 | 65.8 | 63.365 | 49.3 | 79.4 |
| May 25 | 72.4 | 64.3 | 63.2 | 62.7 | 64.5 | 64.6 | 56.4 | 60.5 | 63.806 | 47.4 | 81 |
| May 26 | 70.4 | 66.5 | 66.2 | 61.2 | 62.3 | 62.8 | 64.4 | 64.4 | 64.130 | 50.0 | 78.8 |
| May 27 | 64.6 | 64.4 | 74.9 | 68.4 | 67.9 | 64.2 | 63.7 | 56.0 | 65.280 | 47.6 | 81.4 |
| May 28 | 51.3 | 69.8 | 69.4 | 67.5 | 58.2 | 69.6 | 66.5 | 54.8 | 64.978 | 47.8 | 80.2 |
| May 29 | 57.9 | 60.7 | 69.2 | 60.6 | 62.6 | 68.4 | 70.3 | 56.9 | 65.858 | 50.3 | 80.4 |

***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | $T_{avg}$ | $T_{min}$ | $T_{max}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| May 30 | 60.4 | 63.3 | 70.3 | 60.5 | 59.3 | 60.4 | 84.6 | 56.7 | 66.403 | 52.9 | 84.6 |
| May 31 | 59.6 | 71.1 | 65.6 | 65.3 | 64.3 | 63.1 | 74.9 | 60.9 | 65.735 | 52.1 | 76.2 |
| Jun 1 | 61.0 | 75.3 | 64.8 | 62.5 | 64.1 | 65.6 | 71.7 | 64.9 | 66.554 | 51.0 | 83.2 |
| Jun 2 | 71.6 | 77.4 | 57.6 | 61.6 | 60.4 | 65.2 | 82.3 | 58.8 | 66.560 | 49.5 | 82.3 |
| Jun 3 | 76.4 | 79.5 | 55.0 | 65.6 | 61.3 | 63.8 | 82.8 | 63.1 | 66.961 | 49.6 | 82.8 |
| Jun 4 | 74.3 | 81.3 | 51.6 | 65.9 | 70.7 | 66.1 | 73.4 | 66.4 | 67.479 | 51.6 | 81.3 |
| Jun 5 | 74.8 | 80.6 | 58.7 | 63.7 | 69.7 | 66.0 | 78.7 | 69.6 | 66.976 | 52.5 | 80.6 |
| Jun 6 | 75.4 | 79.9 | 57.6 | 60.1 | 71.7 | 77.5 | 75.4 | 73.9 | 67.900 | 54.2 | 81.3 |
| Jun 7 | 62.6 | 73.4 | 58.8 | 53.9 | 70.9 | 75.0 | 77.0 | 70.2 | 67.668 | 53.9 | 80.6 |
| Jun 8 | 70.7 | 71.4 | 65.4 | 50.7 | 71.8 | 69.3 | 71.6 | 69.6 | 68.173 | 50.7 | 81.8 |
| Jun 9 | 68.6 | 71.1 | 67.5 | 53.9 | 64.7 | 64.5 | 68.0 | 72.6 | 68.409 | 53.9 | 82.4 |
| Jun 10 | 68.6 | 66.6 | 59.1 | 59.0 | 60.1 | 66.6 | 73.7 | 74.3 | 68.631 | 54.5 | 82.6 |
| Jun 11 | 69.8 | 68.3 | 69.7 | 64.3 | 61.0 | 71.2 | 67.5 | 67.0 | 68.210 | 51.3 | 81.4 |
| Jun 12 | 70.1 | 65.6 | 67.8 | 72.7 | 65.7 | 66.2 | 73.0 | 63.8 | 68.355 | 49.9 | 80.6 |
| Jun 13 | 70.6 | 67.5 | 71.5 | 71.2 | 67.9 | 72.8 | 66.4 | 70.7 | 68.694 | 53.2 | 80.9 |
| Jun 14 | 66.4 | 72.9 | 68.7 | 64.0 | 71.8 | 77.2 | 70.0 | 69.9 | 69.813 | 58.2 | 83.1 |
| Jun 15 | 73.6 | 71.0 | 73.9 | 69.5 | 76.4 | 74.5 | 70.8 | 76.5 | 69.929 | 54.3 | 81.4 |
| Jun 16 | 76.2 | 76.0 | 69.4 | 68.2 | 71.5 | 70.3 | 72.2 | 77.1 | 70.310 | 57.5 | 79.9 |
| Jun 17 | 79.8 | 69.7 | 75.6 | 73.6 | 70.2 | 70.7 | 69.6 | 71.7 | 70.850 | 55.5 | 80.8 |
| Jun 18 | 79.3 | 75.6 | 72.9 | 71.9 | 72.1 | 71.2 | 71.9 | 76.2 | 71.280 | 57.2 | 84.5 |
| Jun 19 | 72.3 | 73.8 | 66.6 | 66.0 | 66.0 | 73.6 | 78.1 | 69.3 | 71.003 | 58.2 | 83 |
| Jun 20 | 68.4 | 73.1 | 66.8 | 70.0 | 66.2 | 69.4 | 66.4 | 66.2 | 70.413 | 56.7 | 81.6 |
| Jun 21 | 63.9 | 67.8 | 68.8 | 66.5 | 67.7 | 61.0 | 66.8 | 70.2 | 70.512 | 55.5 | 84.6 |
| Jun 22 | 64.6 | 69.0 | 70.7 | 75.5 | 68.2 | 59.8 | 68.6 | 67.3 | 71.103 | 57.2 | 84.2 |
| Jun 23 | 68.7 | 76.7 | 69.5 | 71.0 | 66.7 | 65.6 | 70.4 | 73.5 | 70.964 | 57.1 | 80.9 |
| Jun 24 | 78.0 | 74.0 | 72.1 | 74.2 | 70.0 | 69.9 | 72.2 | 69.9 | 71.347 | 56.8 | 82.3 |
| Jun 25 | 74.2 | 72.9 | 64.2 | 66.5 | 63.6 | 73.8 | 74.4 | 75.4 | 71.603 | 60.2 | 83.2 |
| Jun 26 | 69.2 | 69.5 | 66.4 | 71.7 | 66.9 | 71.5 | 76.7 | 74.4 | 71.793 | 59.8 | 84.6 |
| Jun 27 | 68.0 | 72.2 | 70.3 | 70.0 | 69.2 | 71.1 | 73.7 | 73.7 | 72.156 | 59.6 | 80.7 |
| Jun 28 | 71.2 | 76.1 | 66.2 | 70.8 | 70.0 | 67.8 | 75.8 | 75.5 | 72.299 | 56.7 | 80.2 |
| Jun 29 | 70.6 | 78.6 | 68.2 | 70.6 | 72.4 | 71.9 | 77.1 | 74.3 | 72.912 | 59.9 | 84 |
| Jun 30 | 66.1 | 77.2 | 70.4 | 74.7 | 72.9 | 68.8 | 82.9 | 75.3 | 76.799 | 66.1 | 88.7 |
| Jul 1 | 68.5 | 90.2 | 72.8 | 77.4 | 75.8 | 76.6 | 80.9 | 81.3 | 79.351 | 68.5 | 95.1 |
| Jul 2 | 72.3 | 82.0 | 72.0 | 76.1 | 70.3 | 73.0 | 86.4 | 79.4 | 79.421 | 67.1 | 92.6 |
| Jul 3 | 80.8 | 79.5 | 73.1 | 77.0 | 69.0 | 72.7 | 80.9 | 77.1 | 79.333 | 65.9 | 94.2 |
| Jul 4 | 78.7 | 79.6 | 74.5 | 80.8 | 67.1 | 76.5 | 78.1 | 80.8 | 79.886 | 66.9 | 87 |
| Jul 5 | 82.6 | 84.2 | 72.3 | 83.1 | 70.3 | 82.2 | 79.6 | 83.2 | 80.014 | 70.3 | 90 |
| Jul 6 | 83.4 | 86.6 | 78.6 | 88.8 | 74.7 | 84.1 | 79.0 | 81.0 | 80.047 | 71.2 | 91.1 |
| Jul 7 | 86.5 | 84.1 | 74.7 | 86.3 | 76.8 | 82.3 | 80.2 | 78.8 | 79.956 | 68.0 | 91.6 |
| Jul 8 | 81.2 | 79.6 | 82.3 | 82.9 | 78.8 | 80.3 | 80.2 | 73.2 | 79.908 | 68.4 | 89.2 |
| Jul 9 | 80.0 | 85.3 | 84.4 | 84.0 | 78.4 | 81.0 | 83.2 | 76.0 | 79.809 | 64.5 | 90.2 |
| Jul 10 | 78.5 | 80.7 | 84.2 | 83.3 | 82.5 | 81.0 | 83.0 | 74.9 | 79.786 | 70.4 | 91.1 |
| Jul 11 | 78.6 | 78.4 | 81.2 | 78.6 | 81.7 | 78.5 | 83.4 | 79.5 | 79.961 | 70.2 | 87.9 |
| Jul 12 | 79.7 | 76.8 | 80.4 | 78.1 | 87.5 | 78.3 | 83.7 | 77.0 | 80.578 | 72.1 | 90.1 |
| Jul 13 | 85.4 | 79.4 | 84.0 | 75.3 | 85.9 | 81.2 | 83.2 | 79.9 | 80.659 | 72.4 | 89.3 |
| Jul 14 | 85.0 | 73.5 | 75.3 | 75.8 | 79.4 | 81.9 | 78.7 | 82.0 | 80.269 | 69.9 | 90.4 |
| Jul 15 | 79.8 | 69.5 | 78.0 | 73.5 | 76.0 | 80.0 | 77.3 | 78.9 | 79.874 | 69.5 | 88.1 |
| Jul 16 | 79.2 | 78.6 | 79.9 | 83.9 | 76.7 | 78.5 | 74.1 | 81.2 | 79.405 | 71.4 | 88.2 |
| Jul 17 | 82.4 | 79.9 | 80.6 | 83.0 | 76.2 | 78.5 | 78.5 | 77.4 | 79.795 | 71.1 | 88.2 |
| Jul 18 | 82.0 | 81.5 | 78.4 | 77.8 | 78.8 | 77.4 | 79.2 | 82.1 | 80.497 | 70.8 | 89.9 |
| Jul 19 | 79.1 | 79.4 | 83.6 | 83.0 | 83.0 | 80.3 | 80.9 | 81.6 | 80.576 | 70.8 | 92.7 |
| Jul 20 | 83.5 | 73.9 | 76.4 | 82.7 | 84.9 | 82.7 | 83.9 | 84.6 | 80.683 | 71.0 | 89.6 |
| Jul 21 | 86.7 | 75.7 | 76.9 | 79.6 | 84.4 | 78.7 | 86.9 | 88.4 | 80.942 | 67.9 | 89.2 |
| Jul 22 | 87.6 | 77.7 | 78.0 | 74.0 | 85.5 | 84.4 | 78.2 | 85.7 | 80.526 | 70.6 | 87.9 |
| Jul 23 | 84.1 | 84.4 | 81.2 | 74.2 | 86.1 | 73.5 | 80.0 | 81.0 | 80.509 | 71.0 | 89.2 |
| Jul 24 | 81.1 | 84.3 | 77.1 | 79.0 | 83.0 | 76.6 | 75.5 | 78.2 | 80.260 | 70.4 | 88.5 |
| Jul 25 | 79.0 | 85.8 | 80.3 | 85.9 | 87.6 | 73.5 | 76.7 | 75.7 | 80.458 | 68.9 | 91 |
| Jul 26 | 84.2 | 90.4 | 77.0 | 85.9 | 90.4 | 70.5 | 72.6 | 78.3 | 79.710 | 66.5 | 90.4 |
| Jul 27 | 85.1 | 87.4 | 78.0 | 83.8 | 82.9 | 74.9 | 67.4 | 77.1 | 79.127 | 66.2 | 92.4 |
| Jul 28 | 81.9 | 83.5 | 77.9 | 82.8 | 82.2 | 74.1 | 74.7 | 71.4 | 78.736 | 66.1 | 90 |
| Jul 29 | 82.1 | 82.4 | 78.1 | 81.7 | 81.3 | 77.2 | 73.4 | 66.8 | 78.920 | 66.8 | 90.6 |
| Jul 30 | 82.9 | 87.4 | 79.8 | 85.1 | 84.4 | 82.5 | 75.0 | 66.0 | 79.557 | 66.0 | 91.2 |
| Jul 31 | 76.4 | 84.8 | 83.0 | 77.8 | 85.6 | 76.8 | 73.7 | 74.2 | 79.542 | 70.0 | 89.9 |
| Aug 1 | 83.4 | 84.5 | 80.4 | 81.1 | 86.8 | 85.0 | 77.2 | 77.0 | 79.894 | 69.3 | 89.8 |
| Aug 2 | 75.6 | 87.4 | 83.1 | 85.5 | 82.6 | 81.7 | 82.8 | 77.7 | 79.471 | 69.7 | 89.9 |
| Aug 3 | 75.9 | 80.3 | 81.8 | 85.0 | 77.1 | 77.3 | 82.8 | 74.6 | 79.288 | 70.6 | 89 |
| Aug 4 | 76.8 | 83.4 | 78.9 | 82.3 | 82.3 | 83.6 | 90.9 | 82.7 | 79.687 | 64.5 | 91.5 |
| Aug 5 | 80.3 | 82.5 | 78.1 | 83.3 | 81.3 | 84.0 | 90.0 | 79.8 | 79.212 | 64.2 | 90 |
| Aug 6 | 78.8 | 83.0 | 74.4 | 83.0 | 84.9 | 84.6 | 87.3 | 81.2 | 78.705 | 67.1 | 90.6 |
| Aug 7 | 76.7 | 82.1 | 77.7 | 77.5 | 83.5 | 74.4 | 86.2 | 76.2 | 78.427 | 63.4 | 88.3 |
| Aug 8 | 76.6 | 79.8 | 77.6 | 79.6 | 78.0 | 77.2 | 87.8 | 77.5 | 78.242 | 65.9 | 90.1 |
| Aug 9 | 77.8 | 84.2 | 75.7 | 77.5 | 78.8 | 77.8 | 84.6 | 81.1 | 78.414 | 64.2 | 87.7 |
| Aug 10 | 78.8 | 81.4 | 77.6 | 79.7 | 75.8 | 80.6 | 83.0 | 85.9 | 77.932 | 67.2 | 89.9 |
| Aug 11 | 75.4 | 77.4 | 81.0 | 74.1 | 75.1 | 82.8 | 82.7 | 91.4 | 77.545 | 64.1 | 91.4 |
| Aug 12 | 76.7 | 78.2 | 76.0 | 82.5 | 74.8 | 75.5 | 84.4 | 84.9 | 76.886 | 63.7 | 92.3 |

***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | $T_{avg}$ | $T_{min}$ | $T_{max}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aug 13 | 78.5 | 71.3 | 79.2 | 80.1 | 75.2 | 71.4 | 82.8 | 79.1 | 76.470 | 66.6 | 88 |
| Aug 14 | 81.8 | 75.4 | 77.5 | 82.3 | 83.4 | 75.2 | 80.4 | 81.4 | 76.451 | 63.5 | 91.9 |
| Aug 15 | 83.1 | 79.3 | 80.6 | 82.8 | 82.3 | 77.2 | 87.8 | 75.6 | 76.766 | 64.9 | 91.4 |
| Aug 16 | 81.0 | 85.2 | 75.2 | 84.3 | 73.5 | 78.6 | 75.2 | 72.4 | 76.300 | 65.1 | 90.8 |
| Aug 17 | 73.5 | 82.2 | 69.9 | 78.0 | 74.1 | 79.3 | 75.5 | 77.0 | 76.030 | 65.1 | 89.3 |
| Aug 18 | 79.1 | 77.6 | 70.3 | 80.1 | 74.1 | 74.1 | 83.3 | 83.1 | 76.087 | 61.2 | 88.1 |
| Aug 19 | 72.2 | 78.3 | 76.3 | 79.2 | 73.3 | 75.6 | 75.1 | 79.7 | 76.356 | 63.8 | 85.6 |
| Aug 20 | 79.1 | 82.4 | 74.2 | 80.0 | 68.1 | 72.3 | 71.6 | 80.3 | 76.515 | 60.7 | 86.4 |
| Aug 21 | 79.5 | 81.0 | 74.0 | 77.7 | 77.3 | 76.4 | 75.6 | 74.6 | 76.239 | 64.0 | 88.3 |
| Aug 22 | 80.9 | 78.6 | 69.6 | 78.7 | 83.4 | 73.9 | 75.4 | 73.5 | 76.273 | 63.5 | 84.6 |
| Aug 23 | 85.7 | 76.4 | 70.8 | 71.6 | 83.8 | 74.3 | 77.7 | 77.3 | 75.546 | 63.0 | 88 |
| Aug 24 | 84.2 | 72.7 | 66.8 | 75.5 | 86.4 | 76.6 | 81.7 | 76.2 | 75.547 | 64.7 | 86.4 |
| Aug 25 | 71.6 | 77.2 | 66.1 | 70.7 | 81.2 | 79.5 | 75.8 | 78.9 | 74.895 | 60.5 | 88.1 |
| Aug 26 | 76.8 | 77.5 | 68.9 | 71.9 | 75.4 | 79.0 | 80.1 | 78.7 | 74.620 | 61.0 | 85.4 |
| Aug 27 | 73.9 | 73.5 | 67.9 | 70.8 | 83.8 | 76.8 | 78.5 | 73.9 | 74.268 | 61.6 | 84.8 |
| Aug 28 | 72.7 | 73.1 | 68.1 | 74.0 | 81.7 | 79.1 | 76.1 | 69.3 | 73.285 | 55.9 | 88.9 |
| Aug 29 | 72.4 | 78.1 | 72.8 | 74.9 | 72.6 | 79.3 | 71.5 | 68.6 | 73.039 | 56.7 | 86.6 |
| Aug 30 | 67.9 | 78.3 | 72.0 | 77.2 | 71.3 | 71.0 | 75.1 | 74.8 | 72.990 | 58.4 | 85.8 |
| Aug 31 | 58.5 | 73.4 | 74.0 | 73.3 | 59.8 | 70.2 | 74.1 | 66.9 | 69.384 | 53.2 | 83.3 |
| Sep 1 | 57.6 | 66.1 | 73.4 | 69.7 | 59.9 | 66.4 | 66.2 | 62.5 | 68.035 | 56.0 | 84.1 |
| Sep 2 | 61.3 | 62.3 | 73.9 | 70.5 | 63.8 | 64.5 | 65.6 | 58.5 | 68.123 | 51.4 | 84.1 |
| Sep 3 | 71.6 | 58.6 | 77.9 | 70.5 | 62.2 | 64.7 | 61.5 | 62.9 | 67.781 | 51.8 | 82.5 |
| Sep 4 | 70.0 | 55.2 | 76.5 | 70.2 | 73.2 | 60.2 | 66.1 | 64.7 | 67.633 | 54.2 | 85.7 |
| Sep 5 | 72.2 | 65.5 | 72.4 | 68.2 | 75.0 | 62.3 | 63.1 | 70.8 | 67.805 | 51.5 | 84.9 |
| Sep 6 | 64.6 | 58.6 | 71.9 | 75.4 | 80.4 | 62.0 | 69.1 | 75.6 | 67.891 | 47.8 | 83.7 |
| Sep 7 | 65.4 | 67.9 | 65.8 | 72.9 | 78.4 | 60.4 | 74.5 | 69.6 | 67.084 | 50.1 | 82.4 |
| Sep 8 | 70.3 | 66.6 | 59.9 | 68.0 | 66.5 | 53.0 | 64.7 | 70.4 | 66.392 | 49.4 | 85.3 |
| Sep 9 | 66.4 | 58.8 | 60.1 | 67.0 | 65.3 | 50.8 | 61.5 | 61.0 | 65.869 | 49.4 | 83.4 |
| Sep 10 | 68.4 | 70.7 | 68.0 | 74.8 | 62.8 | 53.6 | 68.6 | 67.2 | 66.005 | 50.2 | 82.8 |
| Sep 11 | 66.1 | 67.3 | 64.6 | 71.4 | 61.3 | 60.0 | 70.6 | 63.8 | 66.164 | 48.0 | 80 |
| Sep 12 | 66.0 | 63.5 | 65.1 | 69.2 | 63.4 | 67.9 | 68.9 | 64.6 | 66.171 | 50.0 | 81.2 |
| Sep 13 | 72.6 | 51.4 | 74.2 | 78.6 | 60.4 | 57.7 | 73.5 | 65.6 | 65.454 | 51.4 | 83.7 |
| Sep 14 | 77.0 | 44.1 | 68.1 | 66.0 | 64.4 | 60.7 | 69.0 | 63.6 | 65.006 | 44.1 | 81.1 |
| Sep 15 | 63.4 | 43.2 | 64.8 | 67.8 | 70.7 | 67.9 | 64.2 | 64.2 | 65.704 | 43.2 | 81.4 |
| Sep 16 | 67.8 | 56.3 | 64.0 | 66.4 | 74.0 | 71.3 | 65.4 | 68.7 | 65.623 | 51.7 | 79.8 |
| Sep 17 | 62.7 | 71.2 | 62.9 | 76.7 | 69.5 | 68.9 | 59.9 | 67.5 | 65.849 | 47.4 | 82.1 |
| Sep 18 | 56.5 | 64.1 | 53.7 | 65.9 | 69.8 | 73.3 | 58.1 | 75.7 | 64.064 | 43.5 | 85.2 |
| Sep 19 | 54.2 | 52.3 | 62.4 | 66.5 | 66.7 | 71.4 | 59.4 | 71.7 | 63.534 | 48.6 | 80.9 |
| Sep 20 | 54.7 | 51.0 | 67.9 | 60.5 | 66.1 | 64.6 | 71.1 | 68.5 | 63.046 | 48.1 | 75.9 |
| Sep 21 | 51.0 | 56.6 | 63.2 | 60.2 | 63.4 | 65.8 | 68.4 | 65.6 | 62.893 | 47.3 | 77.9 |
| Sep 22 | 59.2 | 53.6 | 61.0 | 65.5 | 64.0 | 63.4 | 61.8 | 78.7 | 62.816 | 46.8 | 78.8 |
| Sep 23 | 64.3 | 57.2 | 59.3 | 54.2 | 68.8 | 59.0 | 61.9 | 72.5 | 61.962 | 48.2 | 78.9 |
| Sep 24 | 62.0 | 56.9 | 62.7 | 57.9 | 72.9 | 52.1 | 59.9 | 73.2 | 62.036 | 45.9 | 76.9 |
| Sep 25 | 68.0 | 51.4 | 62.8 | 68.1 | 63.6 | 52.3 | 66.4 | 78.4 | 62.245 | 49.2 | 78.5 |
| Sep 26 | 57.5 | 54.4 | 71.5 | 66.8 | 62.5 | 54.0 | 72.4 | 80.9 | 62.630 | 46.0 | 81.2 |
| Sep 27 | 49.7 | 50.6 | 69.6 | 67.9 | 55.1 | 50.6 | 71.0 | 66.4 | 61.182 | 41.1 | 85.9 |
| Sep 28 | 52.4 | 60.4 | 69.8 | 61.1 | 52.4 | 47.4 | 68.4 | 63.8 | 60.715 | 39.4 | 79.5 |
| Sep 29 | 60.9 | 54.5 | 73.0 | 56.0 | 58.3 | 37.2 | 65.0 | 58.8 | 59.524 | 37.2 | 75.6 |
| Sep 30 | 50.5 | 53.8 | 63.7 | 54.8 | 51.1 | 42.4 | 55.6 | 54.4 | 57.201 | 40.1 | 80 |
| Oct 1 | 44.7 | 66.2 | 69.1 | 62.4 | 50.4 | 47.6 | 56.8 | 51.5 | 55.844 | 37.0 | 75.9 |
| Oct 2 | 44.0 | 71.3 | 59.1 | 51.8 | 53.7 | 48.5 | 49.8 | 52.2 | 54.587 | 33.4 | 75.4 |
| Oct 3 | 56.4 | 59.8 | 60.2 | 40.1 | 60.3 | 51.4 | 61.2 | 51.5 | 54.720 | 39.8 | 72.9 |
| Oct 4 | 65.9 | 71.6 | 59.7 | 43.0 | 62.6 | 49.6 | 62.6 | 51.2 | 55.459 | 33.2 | 71.6 |
| Oct 5 | 55.4 | 66.1 | 53.3 | 39.9 | 63.1 | 47.5 | 53.3 | 52.8 | 54.959 | 34.9 | 75.1 |
| Oct 6 | 51.6 | 65.5 | 55.0 | 46.3 | 76.3 | 52.4 | 48.8 | 45.1 | 53.383 | 32.4 | 76.3 |
| Oct 7 | 55.9 | 70.0 | 61.6 | 54.6 | 58.8 | 48.7 | 64.0 | 53.9 | 53.973 | 33.6 | 74.6 |
| Oct 8 | 48.8 | 72.8 | 55.8 | 55.4 | 55.1 | 54.2 | 58.9 | 57.9 | 53.597 | 36.5 | 72.8 |
| Oct 9 | 51.0 | 66.6 | 52.7 | 55.4 | 49.9 | 56.7 | 46.5 | 48.4 | 53.204 | 35.0 | 72.6 |
| Oct 10 | 58.8 | 65.0 | 54.9 | 57.8 | 52.8 | 50.7 | 50.9 | 39.3 | 52.368 | 31.2 | 72.5 |
| Oct 11 | 64.4 | 59.0 | 52.1 | 52.1 | 55.8 | 49.2 | 55.1 | 40.6 | 51.714 | 31.4 | 69.6 |
| Oct 12 | 53.7 | 57.1 | 61.1 | 50.2 | 53.8 | 44.3 | 55.5 | 53.9 | 52.110 | 27.7 | 77.6 |
| Oct 13 | 59.7 | 59.7 | 56.4 | 61.4 | 46.7 | 45.2 | 46.1 | 53.6 | 52.291 | 33.9 | 77.6 |
| Oct 14 | 59.4 | 52.0 | 43.1 | 50.5 | 56.3 | 50.8 | 40.5 | 60.8 | 51.923 | 32.8 | 72.8 |
| Oct 15 | 57.0 | 53.1 | 53.3 | 57.1 | 55.1 | 50.2 | 49.8 | 57.8 | 50.652 | 31.4 | 67.3 |
| Oct 16 | 48.3 | 48.5 | 64.2 | 58.1 | 49.1 | 49.8 | 59.2 | 44.2 | 50.793 | 32.5 | 65.8 |
| Oct 17 | 45.2 | 45.8 | 60.7 | 59.8 | 58.4 | 49.9 | 60.7 | 50.2 | 50.279 | 24.0 | 67.2 |
| Oct 18 | 56.8 | 46.2 | 45.9 | 61.3 | 57.4 | 50.8 | 58.1 | 50.8 | 49.801 | 24.3 | 69.6 |
| Oct 19 | 64.4 | 36.7 | 42.0 | 58.9 | 58.9 | 38.3 | 62.6 | 52.3 | 49.024 | 21.8 | 77.7 |
| Oct 20 | 56.3 | 41.1 | 38.9 | 43.9 | 55.6 | 41.5 | 42.1 | 54.0 | 47.273 | 24.5 | 73.5 |
| Oct 21 | 46.8 | 33.9 | 44.9 | 48.7 | 56.8 | 45.3 | 45.1 | 53.5 | 47.397 | 23.3 | 73 |
| Oct 22 | 46.2 | 42.9 | 35.7 | 49.6 | 54.2 | 38.0 | 45.2 | 43.9 | 46.454 | 19.0 | 75.2 |
| Oct 23 | 50.1 | 49.7 | 47.6 | 52.1 | 48.9 | 46.7 | 44.7 | 54.0 | 45.695 | 20.8 | 61.7 |
| Oct 24 | 42.5 | 50.7 | 52.4 | 48.4 | 54.4 | 51.5 | 42.8 | 59.0 | 46.303 | 29.3 | 67 |
| Oct 25 | 42.3 | 48.6 | 46.2 | 45.5 | 46.5 | 45.9 | 36.4 | 54.5 | 46.157 | 23.0 | 69.8 |
| Oct 26 | 43.3 | 52.1 | 38.0 | 51.3 | 57.1 | 34.7 | 35.1 | 63.0 | 45.012 | 25.2 | 74.7 |

***TABLE 5. SUMMARY AND EVALUATION OF DAILY TEMPERATURE DATA IN HELP MODEL 100-YEAR SYNTHETIC WEATHER DATA SET***

| YEAR-> | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | $T_{avg}$ | $T_{min}$ | $T_{max}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct 27 | 53.8 | 55.8 | 49.9 | 51.8 | 54.2 | 37.6 | 36.3 | 48.8 | 45.034 | 27.1 | 66.6 |
| Oct 28 | 58.2 | 50.4 | 50.7 | 57.0 | 51.2 | 42.5 | 43.5 | 57.4 | 44.906 | 24.8 | 62.9 |
| Oct 29 | 61.6 | 62.6 | 49.7 | 52.6 | 56.8 | 38.9 | 48.4 | 62.8 | 45.039 | 28.1 | 62.8 |
| Oct 30 | 67.5 | 58.1 | 50.2 | 58.8 | 43.9 | 42.5 | 52.0 | 50.8 | 45.665 | 27.1 | 67.7 |
| Oct 31 | 56.9 | 52.2 | 51.7 | 56.2 | 23.8 | 48.9 | 36.6 | 58.1 | 44.230 | 23.8 | 64.1 |
| Nov 1 | 56.3 | 49.2 | 35.0 | 59.0 | 20.6 | 36.3 | 42.8 | 60.1 | 43.463 | 20.6 | 65.6 |
| Nov 2 | 62.1 | 46.0 | 34.4 | 67.6 | 28.1 | 35.9 | 44.5 | 54.8 | 41.767 | 24.6 | 67.6 |
| Nov 3 | 54.9 | 44.5 | 44.6 | 58.7 | 23.9 | 29.5 | 39.1 | 46.0 | 41.388 | 17.3 | 65.9 |
| Nov 4 | 48.2 | 48.7 | 51.8 | 57.4 | 40.9 | 36.8 | 38.8 | 58.7 | 41.680 | 12.9 | 62.6 |
| Nov 5 | 32.6 | 53.8 | 43.8 | 62.8 | 37.9 | 47.6 | 33.7 | 49.3 | 40.342 | 16.6 | 62.8 |
| Nov 6 | 28.1 | 57.3 | 37.4 | 57.8 | 39.6 | 37.4 | 36.7 | 42.2 | 40.308 | 19.5 | 62.2 |
| Nov 7 | 30.5 | 57.6 | 43.4 | 49.1 | 48.3 | 46.5 | 41.6 | 29.8 | 40.709 | 23.4 | 57.6 |
| Nov 8 | 45.0 | 54.8 | 45.1 | 36.0 | 44.3 | 48.0 | 39.8 | 30.4 | 39.278 | 19.1 | 64.3 |
| Nov 9 | 38.0 | 40.5 | 50.7 | 30.5 | 42.2 | 53.4 | 38.1 | 35.1 | 39.300 | 17.1 | 61.3 |
| Nov 10 | 28.6 | 45.9 | 40.8 | 23.7 | 51.2 | 55.9 | 41.5 | 45.2 | 38.686 | 17.3 | 58.9 |
| Nov 11 | 34.9 | 34.3 | 49.4 | 17.9 | 47.1 | 43.0 | 53.9 | 37.5 | 38.196 | 17.9 | 56.2 |
| Nov 12 | 27.9 | 40.8 | 42.9 | 18.1 | 55.2 | 40.9 | 58.5 | 28.0 | 38.009 | 18.1 | 58.5 |
| Nov 13 | 28.0 | 40.7 | 36.2 | 19.1 | 44.8 | 38.0 | 42.6 | 33.9 | 37.771 | 12.4 | 60.2 |
| Nov 14 | 45.4 | 44.7 | 30.7 | 30.4 | 56.1 | 40.8 | 37.1 | 26.0 | 38.263 | 16.1 | 58.9 |
| Nov 15 | 43.4 | 53.7 | 22.6 | 32.6 | 50.7 | 41.9 | 47.6 | 29.6 | 36.333 | 18.5 | 67.9 |
| Nov 16 | 46.2 | 44.6 | 31.4 | 25.7 | 58.4 | 40.3 | 44.2 | 26.2 | 36.075 | 17.7 | 66 |
| Nov 17 | 37.5 | 39.6 | 28.5 | 33.3 | 51.9 | 33.1 | 39.2 | 24.4 | 35.740 | 18.3 | 63.5 |
| Nov 18 | 32.7 | 55.8 | 32.4 | 38.9 | 41.8 | 29.0 | 42.5 | 27.8 | 35.395 | 17.5 | 56.3 |
| Nov 19 | 33.9 | 44.5 | 39.7 | 40.8 | 52.2 | 46.5 | 40.5 | 31.8 | 35.486 | 14.9 | 62.7 |
| Nov 20 | 40.3 | 37.6 | 32.9 | 43.4 | 35.6 | 43.4 | 53.2 | 27.3 | 36.360 | 16.0 | 54 |
| Nov 21 | 35.7 | 38.6 | 28.1 | 44.0 | 41.4 | 38.9 | 44.4 | 27.7 | 36.425 | 14.6 | 53.8 |
| Nov 22 | 40.3 | 40.6 | 31.7 | 45.0 | 45.0 | 53.2 | 39.8 | 29.1 | 36.598 | 12.6 | 58.8 |
| Nov 23 | 37.7 | 40.6 | 37.3 | 47.1 | 29.2 | 57.8 | 34.7 | 30.1 | 36.087 | 14.5 | 60 |
| Nov 24 | 37.1 | 44.0 | 29.9 | 47.4 | 26.1 | 36.7 | 30.2 | 25.2 | 35.597 | 11.9 | 65.1 |
| Nov 25 | 31.3 | 39.0 | 34.8 | 32.9 | 29.0 | 46.5 | 27.8 | 23.2 | 34.131 | 12.9 | 53.2 |
| Nov 26 | 32.3 | 39.9 | 41.3 | 27.8 | 37.3 | 39.7 | 26.3 | 20.7 | 33.648 | 13.9 | 53.4 |
| Nov 27 | 39.1 | 41.7 | 39.5 | 32.1 | 27.5 | 40.2 | 27.3 | 17.9 | 32.689 | 7.4 | 51.6 |
| Nov 28 | 24.6 | 38.1 | 35.9 | 36.7 | 28.9 | 41.7 | 29.6 | 22.9 | 31.890 | 9.5 | 51.9 |
| Nov 29 | 23.5 | 40.2 | 38.0 | 34.4 | 25.9 | 41.9 | 35.1 | 24.4 | 31.391 | 13.8 | 54.4 |
| Nov 30 | 11.7 | 43.1 | 43.6 | 29.4 | 34.2 | 41.6 | 24.7 | 25.1 | 31.422 | 3.6 | 50.3 |
| Dec 1 | 15.3 | 40.3 | 40.9 | 29.3 | 33.1 | 34.5 | 25.7 | 23.9 | 30.498 | 7.4 | 49.4 |
| Dec 2 | 14.8 | 39.4 | 28.0 | 26.9 | 46.9 | 19.9 | 12.3 | 26.4 | 30.225 | 12.3 | 53.6 |
| Dec 3 | 20.5 | 41.3 | 17.7 | 27.0 | 33.5 | 23.9 | 14.9 | 24.2 | 29.905 | 12.1 | 55.2 |
| Dec 4 | 18.5 | 40.0 | 24.5 | 24.7 | 30.1 | 19.9 | 19.8 | 27.0 | 29.437 | 9.3 | 51.6 |
| Dec 5 | 32.6 | 32.4 | 18.7 | 28.7 | 35.5 | 16.9 | 21.2 | 19.8 | 29.324 | 7.1 | 49.7 |
| Dec 6 | 27.0 | 36.7 | 18.4 | 22.4 | 36.4 | 14.6 | 21.9 | 20.1 | 29.344 | 7.8 | 50.2 |
| Dec 7 | 26.6 | 38.3 | 15.1 | 22.9 | 25.8 | 18.9 | 24.0 | 17.1 | 29.588 | 12.5 | 50.9 |
| Dec 8 | 29.1 | 32.9 | 20.3 | 21.9 | 22.5 | 17.6 | 23.5 | 24.7 | 29.272 | 11.9 | 48.4 |
| Dec 9 | 21.2 | 36.9 | 27.8 | 24.6 | 28.0 | 17.7 | 34.7 | 35.0 | 28.846 | 10.7 | 50.8 |
| Dec 10 | 28.4 | 36.7 | 33.2 | 34.4 | 22.9 | 20.6 | 40.3 | 37.6 | 27.155 | 12.9 | 51.7 |
| Dec 11 | 31.9 | 33.9 | 26.7 | 28.4 | 23.5 | 19.8 | 37.2 | 27.1 | 27.192 | 6.6 | 45.8 |
| Dec 12 | 34.4 | 28.2 | 25.6 | 26.0 | 30.6 | 26.2 | 24.4 | 23.4 | 27.095 | 9.3 | 47.4 |
| Dec 13 | 30.2 | 38.3 | 26.5 | 26.8 | 24.4 | 25.1 | 15.9 | 23.1 | 26.533 | 7.8 | 43.2 |
| Dec 14 | 30.5 | 30.1 | 28.3 | 20.7 | 22.2 | 17.1 | 8.5 | 32.9 | 27.642 | 8.5 | 47.4 |
| Dec 15 | 29.9 | 33.3 | 19.2 | 16.9 | 22.0 | 26.4 | 12.9 | 25.4 | 27.271 | 11.0 | 48 |
| Dec 16 | 21.4 | 36.3 | 23.1 | 19.9 | 24.7 | 21.5 | 20.3 | 30.6 | 27.068 | 8.1 | 44.9 |
| Dec 17 | 19.4 | 31.4 | 28.7 | 31.3 | 17.8 | 19.5 | 18.1 | 22.1 | 26.288 | 8.5 | 48.4 |
| Dec 18 | 32.1 | 34.5 | 31.6 | 41.1 | 17.0 | 28.7 | 17.5 | 21.7 | 26.759 | 12.0 | 47.5 |
| Dec 19 | 29.3 | 29.6 | 36.3 | 44.1 | 26.3 | 29.7 | 19.5 | 36.1 | 27.359 | 2.5 | 45.1 |
| Dec 20 | 24.9 | 33.3 | 38.0 | 37.5 | 21.6 | 32.2 | 15.7 | 30.3 | 28.049 | 7.1 | 46 |
| Dec 21 | 21.2 | 24.4 | 29.7 | 25.4 | 28.2 | 32.1 | 15.3 | 38.3 | 27.016 | 4.6 | 51.3 |
| Dec 22 | 22.9 | 29.8 | 26.5 | 33.9 | 28.5 | 27.7 | 19.2 | 30.1 | 27.268 | 12.2 | 41.8 |
| Dec 23 | 31.3 | 32.1 | 37.3 | 21.3 | 14.4 | 21.0 | 30.0 | 39.1 | 27.283 | 11.5 | 45.3 |
| Dec 24 | 22.7 | 25.7 | 38.2 | 25.5 | 27.5 | 15.5 | 30.0 | 23.7 | 26.316 | 4.8 | 44.2 |
| Dec 25 | 24.7 | 16.9 | 33.1 | 14.8 | 33.4 | 14.0 | 44.5 | 25.2 | 25.454 | 10.2 | 44.5 |
| Dec 26 | 32.3 | 24.5 | 35.2 | 25.4 | 33.8 | 14.7 | 38.8 | 29.6 | 25.339 | 4.2 | 41 |
| Dec 27 | 28.9 | 17.9 | 27.5 | 32.0 | 33.0 | 18.8 | 30.4 | 32.1 | 25.247 | 5.6 | 47.8 |
| Dec 28 | 25.4 | 26.1 | 27.5 | 30.7 | 42.4 | 20.0 | 26.6 | 32.7 | 24.658 | 4.5 | 43.2 |
| Dec 29 | 20.4 | 29.2 | 20.7 | 31.0 | 48.2 | 18.2 | 24.7 | 37.8 | 24.531 | 6.5 | 48.2 |
| Dec 30 | 16.7 | 24.3 | 17.3 | 38.0 | 45.7 | 23.1 | 22.1 | 29.0 | 25.281 | 6.8 | 45.7 |
| Dec 31 | 35.0 | 35.0 | 35.0 | 28.2 | 28.2 | 28.2 | 28.2 | 28.8 | 23.390 | 11.4 | 35.9 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mean | 51.3 | 53.1 | 52.1 | 51.5 | 53.3 | 51.1 | 52.3 | 51.1 |
| Min | 11.6 | 9.8 | 7.8 | 12.4 | 14.4 | 14.0 | 7.6 | 9.6 |
| Max | 87.6 | 90.4 | 84.4 | 88.8 | 90.4 | 85.0 | 90.9 | 91.4 |

| | |
|---|---|
| Average daily temp: | 51.69 |
| Min daily temperature: | 2.50 |
| Max daily temperature: | 95.1 |

## *Table 16. Site-Wide Hydraulic Conductivity Values*

| Well/Test | Cell | Total Depth (ft) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Well Hydraulic Conductivity (cm/sec) | Log Hydraulic Conductivity (log[cm/sec]) | Well Hydraulic Conductivity (log[cm/sec]) |
|---|---|---|---|---|---|---|---|
| PZ-1#1 | | 30.4 | 3.49 | 1.23E-03 | | -2.91 | |
| PZ-1#2 | | 30.4 | 3.56 | 1.26E-03 | 1.24E-03 | -2.901 | -2.905 |
| DH-31B1 | MW | 34.18 | 2.359 | 8.32E-04 | | -3.08 | |
| DH-31B2 | MW | 34.18 | 2.661 | 9.39E-04 | | -3.027 | |
| DH-31B3 | MW | 34.18 | 2.428 | 8.56E-04 | 8.76E-04 | -3.067 | -3.058 |
| DH-32A1 | LARW | 33.26 | 0.03 | 1.08E-05 | | -4.968 | |
| DH-32A2 | LARW | 33.26 | 0.033 | 1.17E-05 | 1.12E-05 | -4.931 | -4.949 |
| DH-33A1 | MW | 33.83 | 0.006 | 2.23E-06 | 2.23E-06 | -5.652 | -5.652 |
| DH-59A1 | 11.e(2) | | 0.186 | 6.55E-05 | | -4.184 | |
| DH-59A2 | 11.e(2) | | 0.688 | 2.43E-04 | | -3.615 | |
| DH-59A3 | 11.e(2) | | 0.861 | 3.04E-04 | 2.04E-04 | -3.517 | -3.772 |
| DH-62A1 | 11.e(2) | | 2.938 | 1.04E-03 | | -2.985 | |
| DH-62A3 | 11.e(2) | | 2.938 | 1.04E-03 | | -2.985 | |
| DH-62B2 | 11.e(2) | | 2.868 | 1.01E-03 | 1.03E-03 | -2.995 | -2.988 |
| GW-16R-A1 | LARW | 36.94 | 1.754 | 6.19E-04 | | -3.208 | |
| GW-16R-B1 | LARW | 36.94 | 1.979 | 6.98E-04 | | -3.156 | |
| GW-16R-B2 | LARW | 36.94 | 1.028 | 3.63E-04 | 5.60E-04 | -3.44 | -3.268 |
| GW-17AA1 | VITRO | 34.61 | 2.074 | 7.32E-04 | | -3.136 | |
| GW-17AB1 | VITRO | 34.61 | 2.497 | 8.81E-04 | | -3.055 | |
| GW-17AB2 | VITRO | 34.61 | 2.393 | 8.44E-04 | 8.19E-04 | -3.074 | -3.088 |
| GW-19AA1 | 11.e(2) | 29.44 | 0.221 | 7.80E-05 | | -4.108 | |
| GW-19AB1 | 11.e(2) | 29.44 | 0.178 | 6.28E-05 | | -4.202 | |
| GW-19AB2 | 11.e(2) | 29.44 | 0.253 | 8.93E-05 | 7.67E-05 | -4.049 | -4.12 |
| GW-20-A1 | LARW | 36.05 | 5.011 | 1.77E-03 | | -2.753 | |
| GW-20-A2 | LARW | 36.05 | 5.495 | 1.94E-03 | | -2.713 | |
| GW-20-A3 | LARW | 36.05 | 6.661 | 2.35E-03 | 2.02E-03 | -2.629 | -2.698 |
| GW-21A1 | VITRO | 44.26 | 5.149 | 1.82E-03 | | -2.741 | |
| GW-21A2 | VITRO | 44.26 | 4.251 | 1.50E-03 | | -2.824 | |
| GW-21A3 | VITRO | 44.26 | 5.365 | 1.89E-03 | 1.74E-03 | -2.723 | -2.763 |
| GW-22-A1 | LARW | 33.3 | 2.445 | 8.63E-04 | | -3.064 | |
| GW-22-A2 | LARW | 33.3 | 2.203 | 7.77E-04 | | -3.109 | |
| GW-22-A3 | LARW | 33.3 | 2.108 | 7.44E-04 | 7.95E-04 | -3.129 | -3.101 |
| GW-23-A3 | LARW | 33.28 | 1.469 | 5.18E-04 | | -3.286 | |
| GW-23-B1 | LARW | 33.28 | 1.693 | 5.97E-04 | 5.58E-04 | -3.224 | -3.255 |
| GW-24-A1 | LARW | 33.18 | 0.605 | 2.13E-04 | | -3.671 | |
| GW-24-B1 | LARW | 33.18 | 0.775 | 2.73E-04 | | -3.563 | |
| GW-24-B2 | LARW | 33.18 | 0.719 | 2.54E-04 | 2.47E-04 | -3.596 | -3.61 |
| GW-25-B1 | 11.e(2) | 35 | 2.316 | 8.17E-04 | | -3.088 | |
| GW-25-B2 | 11.e(2) | 35 | 3.326 | 1.17E-03 | | -2.931 | |
| GW-25-B3 | 11.e(2) | 35 | 3.568 | 1.26E-03 | | -2.9 | |
| GW-25-B4 | 11.e(2) | 35 | 2.557 | 9.02E-04 | | -3.045 | |
| GW-25-B5 | 11.e(2) | 35 | 3.154 | 1.11E-03 | 1.05E-03 | -2.954 | -2.983 |
| GW-26-A1 | 11.e(2) | 31 | 0.95 | 3.35E-04 | | -3.475 | |
| GW-26-A2 | 11.e(2) | 31 | 0.924 | 3.26E-04 | 3.31E-04 | -3.487 | -3.481 |
| GW-27A1 | 11.e(2) | 32 | 0.125 | 4.42E-05 | | -4.355 | |
| GW-27B1 | 11.e(2) | 32 | 0.074 | 2.60E-05 | | -4.585 | |
| GW-27B2 | 11.e(2) | 32 | 0.098 | 3.44E-05 | 3.49E-05 | -4.463 | -4.467 |
| GW-28A1 | 11.e(2) | 31.41 | 0.684 | 2.41E-04 | | -3.617 | |
| GW-28B1 | 11.e(2) | 31.41 | 0.569 | 2.01E-04 | | -3.697 | |
| GW-28B2 | 11.e(2) | 31.41 | 0.431 | 1.52E-04 | 1.98E-04 | -3.818 | -3.711 |
| GW-29A1 | LARW | | 2.436 | 8.60E-04 | | -3.066 | |
| GW-29A2 | LARW | | 0.582 | 2.05E-04 | | -3.687 | |
| GW-29A3 | LARW | | 1.331 | 4.69E-04 | 5.11E-04 | -3.328 | -3.361 |

## *Table 16. Site-Wide Hydraulic Conductivity Values*

| Well/Test | Cell | Total Depth (ft) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Well Hydraulic Conductivity (cm/sec) | Log Hydraulic Conductivity (log[cm/sec]) | Well Hydraulic Conductivity (log[cm/sec]) |
|---|---|---|---|---|---|---|---|
| GW-36A1 | 11.e(2) | 31.64 | 1.875 | 6.61E-04 | | -3.18 | |
| GW-36A2 | 11.e(2) | 31.64 | 1.728 | 6.10E-04 | | -3.215 | |
| GW-36A3 | 11.e(2) | 31.64 | 1.84 | 6.49E-04 | 6.40E-04 | -3.188 | -3.194 |
| GW-37A1 | 11.e(2) | 31.74 | 0.976 | 3.44E-04 | | -3.463 | |
| GW-37B1 | 11.e(2) | 31.74 | 1.02 | 3.60E-04 | | -3.444 | |
| GW-37B2 | 11.e(2) | 31.74 | 1.071 | 3.78E-04 | 3.61E-04 | -3.423 | -3.443 |
| GW-38A1 | 11.e(2) | 32.14 | 1.788 | 6.31E-04 | | -3.2 | |
| GW-38B1 | 11.e(2) | 32.14 | 1.572 | 5.55E-04 | | -3.256 | |
| GW-38B2 | 11.e(2) | 32.14 | 1.572 | 5.55E-04 | 5.80E-04 | -3.256 | -3.237 |
| GW-41A1 | MW | 37.48 | 1.391 | 4.91E-04 | | -3.309 | |
| GW-41B1 | MW | 37.48 | 2.048 | 7.22E-04 | | -3.141 | |
| GW-41B2 | MW | 37.48 | 1.979 | 6.98E-04 | 6.37E-04 | -3.156 | -3.202 |
| GW-42A1 | MW | 37.06 | 2.195 | 7.74E-04 | | -3.111 | |
| GW-42B1 | MW | 37.06 | 2.713 | 9.57E-04 | | -3.019 | |
| GW-42B2 | MW | 37.06 | 2.246 | 7.92E-04 | 8.41E-04 | -3.101 | -3.077 |
| GW-43A1 | MW | 37.68 | 2.056 | 7.25E-04 | | -3.139 | |
| GW-43B2 | MW | 37.68 | 3.231 | 1.14E-03 | | -2.943 | |
| GW-43B3 | MW | | 2.843 | 1.00E-03 | 9.56E-04 | -2.999 | -3.027 |
| GW-44A1 | MW | 36.82 | 1.4 | 4.94E-04 | | -3.306 | |
| GW-44B1 | MW | 36.82 | 2.359 | 8.32E-04 | | -3.08 | |
| GW-44B2 | MW | 36.82 | 2.229 | 7.86E-04 | 7.04E-04 | -3.104 | -3.164 |
| GW-45A1 | MW | 36.85 | 0.459 | 1.62E-04 | | -3.791 | |
| GW-45B1 | MW | 36.85 | 0.682 | 2.40E-04 | | -3.619 | |
| GW-45B2 | MW | 36.85 | 0.687 | 2.42E-04 | 2.15E-04 | -3.616 | -3.675 |
| GW-46A1 | MW | 37.31 | 0.296 | 1.05E-04 | | -3.981 | |
| GW-46B1 | MW | 37.31 | 0.3 | 1.06E-04 | | -3.976 | |
| GW-46B2 | MW | 37.31 | 0.33 | 1.16E-04 | 1.09E-04 | -3.934 | -3.963 |
| GW-56R-A1 | LARW | 36.5 | 6.843 | 2.41E-03 | | -2.617 | |
| GW-56R-A2 | LARW | 36.5 | 2.635 | 9.30E-04 | | -3.032 | |
| GW-56R-A3 | LARW | 36.5 | 4.225 | 1.49E-03 | | -2.827 | |
| GW-56R-A4 | LARW | 36.5 | 7.422 | 2.62E-03 | 1.86E-03 | -2.582 | -2.764 |
| GW-57A1 | 11.e(2) | 32.13 | 0.461 | 1.63E-04 | | -3.788 | |
| GW-57B1 | 11.e(2) | 32.13 | 0.334 | 1.18E-04 | | -3.928 | |
| GW-57B2 | 11.e(2) | 32.13 | 0.527 | 1.86E-04 | 1.56E-04 | -3.731 | -3.816 |
| GW-58A1 | 11.e(2) | 31.77 | 1.59 | 5.61E-04 | | -3.251 | |
| GW-58B1 | 11.e(2) | 31.77 | 1.322 | 4.66E-04 | | -3.331 | |
| GW-58B2 | 11.e(2) | 31.77 | 0.95 | 3.35E-04 | 4.54E-04 | -3.475 | -3.352 |
| GW-60-A1 | 11.e(2) | 29.44 | 5.694 | 2.01E-03 | | -2.697 | |
| GW-60-A3 | 11.e(2) | 29.44 | 13.565 | 4.79E-03 | 3.40E-03 | -2.32 | -2.509 |
| GW-63-A1 | 11.e(2) | | 2.532 | 8.93E-04 | | -3.049 | |
| GW-63-A2 | 11.e(2) | 31.1 | 2.462 | 8.69E-04 | | -3.061 | |
| GW-63-A3 | 11.e(2) | 31.1 | 1.279 | 4.51E-04 | 7.38E-04 | -3.346 | -3.152 |
| GW-64-B1 | LARW | 36.61 | 2.048 | 7.22E-04 | | -3.141 | |
| GW-64-B2 | LARW | 36.61 | 1.875 | 6.61E-04 | | -3.18 | |
| GW-64-B4 | LARW | | 1.97 | 6.95E-04 | 6.93E-04 | -3.158 | -3.16 |
| GW-66A1 | MW | 37.36 | 0.218 | 7.68E-05 | | -4.115 | |
| GW-66B1 | MW | 37.36 | 0.148 | 5.21E-05 | | -4.283 | |
| GW-66B2 | MW | 37.36 | 0.29 | 1.02E-04 | 7.71E-05 | -3.99 | -4.129 |
| GW-66R #1 | MW Pond | 43.28 | 0.54 | 1.91E-04 | | -3.720 | |
| GW-66R #2 | MW Pond | 43.28 | 0.62 | 2.19E-04 | | -3.660 | |
| GW-66R #3 | MW Pond | 43.28 | 0.69 | 2.43E-04 | 2.18E-04 | -3.614 | -3.665 |
| GW-67A1 | MW | 39.63 | 0.976 | 3.44E-04 | | -3.463 | |
| GW-67B1 | MW | 39.63 | 1.192 | 4.21E-04 | | -3.376 | |

## *Table 16. Site-Wide Hydraulic Conductivity Values*

| Well/Test | Cell | Total Depth (ft) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Well Hydraulic Conductivity (cm/sec) | Log Hydraulic Conductivity (log[cm/sec]) | Well Hydraulic Conductivity (log[cm/sec]) |
|---|---|---|---|---|---|---|---|
| GW-67B2 | MW | 39.63 | 1.166 | 4.11E-04 | | -3.386 | |
| GW-67 #1 | MW | 40.83 | 1.98 | 6.99E-04 | | -3.156 | |
| GW-67 #2 | MW | 40.83 | 1.97 | 6.95E-04 | 5.14E-04 | -3.158 | -3.308 |
| GW-67R#1 | MW | 39.3 | 5.32 | 1.88E-03 | | -2.727 | |
| GW-67R#2 | MW | 39.3 | 5.25 | 1.85E-03 | 1.86E-03 | -2.732 | -2.729 |
| GW-68A1 | MW | 42.09 | 0.327 | 1.16E-04 | | -3.937 | |
| GW-68B1 | MW | 42.09 | 0.27 | 9.54E-05 | | -4.02 | |
| GW-68B2 | MW | 42.09 | 0.26 | 9.17E-05 | | -4.037 | |
| GW-68 #1 | MW | 43.96 | 0.94 | 3.32E-04 | | -3.479 | |
| GW-68 #2 | MW | 43.96 | 0.93 | 3.28E-04 | 1.92E-04 | -3.484 | -3.792 |
| GW-68R#1 | MW | 39.15 | 8.24 | 2.91E-03 | | -2.537 | |
| GW-68R#2 | MW | 39.15 | 8.44 | 2.98E-03 | 2.94E-03 | -2.526 | -2.531 |
| GW-69B1 | MW | 40.68 | 0.124 | 4.39E-05 | | -4.358 | |
| GW-69A1 | MW | 40.68 | 0.131 | 4.63E-05 | | -4.334 | |
| GW-69 #1 | MW | 42.35 | 2.82 | 9.95E-04 | | -3.002 | |
| GW-69 #2 | MW | 42.35 | 2.12 | 7.48E-04 | 4.58E-04 | -3.126 | -3.705 |
| GW-69R#1 | MW | 39.4 | 4.25 | 1.50E-03 | | -2.824 | |
| GW-69R#2 | MW | 39.4 | 3.32 | 1.17E-03 | 1.34E-03 | -2.931 | -2.878 |
| GW-70A1 | MW | 42.36 | 0.463 | 1.63E-04 | | -3.787 | |
| GW-70B1 | MW | 42.36 | 0.606 | 2.14E-04 | | -3.67 | |
| GW-70B2 | MW | 42.36 | 0.48 | 1.69E-04 | | -3.772 | |
| GW-70 #1 | MW | 42.45 | 7.98 | 2.82E-03 | | -2.55 | |
| GW-70 #2 | MW | 42.45 | 7.79 | 2.75E-03 | 1.22E-03 | -2.561 | -3.268 |
| GW-71A1 | MW | 42.4 | 4.355 | 1.54E-03 | | -2.814 | |
| GW-71B1 | MW | 42.4 | 2.402 | 8.47E-04 | | -3.072 | |
| GW-71B2 | MW | 42.4 | 2.203 | 7.77E-04 | | -3.109 | |
| GW-71 #1 | MW | 43.97 | 8.89 | 3.14E-03 | | -2.504 | |
| GW-71 #2 | MW | 43.97 | 8.86 | 3.13E-03 | 1.88E-03 | -2.505 | -2.801 |
| GW-75A1 | LARW | | 0.026 | 9.33E-06 | | -5.03 | |
| GW-75A2 | LARW | | 0.066 | 2.33E-05 | 1.63E-05 | -4.633 | -4.832 |
| GW-76A1 | LARW | | 0.046 | 1.61E-05 | | -4.794 | |
| GW-76A2 | LARW | | 0.282 | 9.94E-05 | 5.77E-05 | -4.003 | -4.398 |
| GW-77 #1 | LARW | 40 | 2.56 | 9.03E-04 | | -3.044 | |
| GW-77 #2 | LARW | 40 | 2.5 | 8.82E-04 | 8.93E-04 | -3.055 | -3.049 |
| GW-78 #1 | | 40 | 5.08 | 1.79E-03 | | -2.747 | |
| GW-78 #2 | | 40 | 4.15 | 1.46E-03 | 1.63E-03 | -2.834 | -2.791 |
| GW-79 #1 | MW | 36.5 | 4.5 | 1.59E-03 | | -2.799 | |
| GW-79 #2 | MW | 36.5 | 4.12 | 1.45E-03 | 1.52E-03 | -2.838 | -2.818 |
| GW-80 #1 | MW | 36.18 | 4.91 | 1.73E-03 | | -2.761 | |
| GW-80 #2 | MW | 36.18 | 5.01 | 1.77E-03 | 1.75E-03 | -2.753 | -2.757 |
| GW-81 #1 | WLARW | 36.71 | 1.49 | 5.26E-04 | | -3.279 | |
| GW-81 #2 | WLARW | 36.71 | 1.47 | 5.19E-04 | 5.22E-04 | -3.285 | -3.282 |
| GW-82 #1 | WLARW | 36.44 | 1.82 | 6.42E-04 | | -3.192 | |
| GW-82 #2 | WLARW | 36.44 | 1.45 | 5.12E-04 | 5.77E-04 | -3.291 | -3.242 |
| GW-83 #1 | WLARW | 36.45 | 8.54 | 3.01E-03 | | -2.521 | |
| GW-83 #2 | WLARW | 36.45 | 8.76 | 3.09E-03 | 3.05E-03 | -2.51 | -2.516 |
| GW-84 #1 | WLARW | 36.76 | 10.95 | 3.86E-03 | | -2.413 | |
| GW-84 #2 | WLARW | 36.76 | 10.3 | 3.63E-03 | 3.75E-03 | -2.44 | -2.426 |
| GW-85 #1 | WLARW | 37.34 | 11.14 | 3.93E-03 | | -2.406 | |
| GW-85 #2 | WLARW | 37.34 | 11.18 | 3.94E-03 | 3.94E-03 | -2.404 | -2.405 |
| GW-86 #1 | WLARW | 41.4 | 4.8 | 1.69E-03 | | -2.771 | |
| GW-86 #2 | WLARW | 41.4 | 4.57 | 1.61E-03 | 1.65E-03 | -2.793 | -2.782 |
| GW-88 #1 | WLARW | 36.78 | 2.66 | 9.38E-04 | | -3.028 | |

## *Table 16. Site-Wide Hydraulic Conductivity Values*

| Well/Test | Cell | Total Depth (ft) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Well Hydraulic Conductivity (cm/sec) | Log Hydraulic Conductivity (log[cm/sec]) | Well Hydraulic Conductivity (log[cm/sec]) |
|---|---|---|---|---|---|---|---|
| GW-88 #2 | WLARW | 36.78 | 2.92 | 1.03E-03 | 9.84E-04 | -2.987 | -3.007 |
| GW-89 #1 | WLARW | 37.02 | 1.67 | 5.89E-04 | | -3.23 | |
| GW-89 #2 | WLARW | 37.02 | 1.88 | 6.63E-04 | 6.26E-04 | -3.178 | -3.204 |
| GW-90 #1 | WLARW | 36.84 | 8.86 | 3.13E-03 | | -2.505 | |
| GW-90 #2 | WLARW | 36.84 | 7.78 | 2.74E-03 | 2.94E-03 | -2.562 | -2.533 |
| GW-91 #1 | WLARW | 36.92 | 5.73 | 2.02E-03 | | -2.694 | |
| GW-91 #2 | WLARW | 36.92 | 5.48 | 1.93E-03 | 1.98E-03 | -2.714 | -2.704 |
| GW-92 #1 | WLARW | 36.93 | 2.45 | 8.64E-04 | | -3.063 | |
| GW-92 #2 | WLARW | 36.93 | 2.47 | 8.71E-04 | 8.68E-04 | -3.06 | -3.062 |
| GW-93 #1 | WLARW | 37.49 | 17.04 | 6.01E-03 | | -2.221 | |
| GW-93 #2 | WLARW | 37.49 | 16.72 | 5.90E-03 | 5.96E-03 | -2.229 | -2.225 |
| GW-94 #1 | WLARW | 36.91 | 12.73 | 4.49E-03 | | -2.348 | |
| GW-94 #2 | WLARW | 36.91 | 13.71 | 4.84E-03 | 4.66E-03 | -2.315 | -2.332 |
| GW-95 #1 | WLARW | 31.99 | 1.04 | 3.67E-04 | | -3.435 | |
| GW-95 #2 | WLARW | 31.99 | 1.01 | 3.56E-04 | 3.62E-04 | -3.448 | -3.442 |
| GW-99 #1 | WLARW | 31.8 | 0.85 | 3.00E-04 | | -3.523 | |
| GW-99 #2 | WLARW | 31.8 | 0.82 | 2.89E-04 | 2.95E-04 | -3.539 | -3.531 |
| GW-100 #1 | WLARW | 32.95 | 1.78 | 6.28E-04 | | -3.202 | |
| GW-100 #2 | WLARW | 32.95 | 1.87 | 6.60E-04 | 6.44E-04 | -3.181 | -3.191 |
| GW-101 #1 | WLARW | 36.53 | 2.36 | 8.33E-04 | | -3.08 | |
| GW-101 #2 | WLARW | 36.53 | 1.91 | 6.74E-04 | 7.53E-04 | -3.171 | -3.126 |
| GW-102 #1 | WLARW | 36.8 | 2.37 | 8.36E-04 | | -3.078 | |
| GW-102 #2 | WLARW | 36.8 | 2.46 | 8.68E-04 | 8.52E-04 | -3.062 | -3.07 |
| GW-103 | LARW | 41.32 | 11.45 | 4.04E-03 | | -2.394 | |
| GW-103 | LARW | 41.32 | 11.67 | 4.12E-03 | | -2.386 | |
| GW-103 | LARW | 41.32 | 17.83 | 6.29E-03 | | -2.201 | |
| GW-103 | LARW | 41.32 | 8.85 | 3.12E-03 | 4.39E-03 | -2.505 | -2.372 |
| GW-104 | LARW | 40.28 | 7.17 | 2.53E-03 | | -2.597 | |
| GW-104 | LARW | 40.28 | 10.39 | 3.66E-03 | | -2.436 | |
| GW-104 | LARW | 40.28 | 8.89 | 3.14E-03 | 3.11E-03 | -2.503 | -2.512 |
| GW-105 | LARW | 38.58 | 15.72 | 5.55E-03 | | -2.256 | |
| GW-105 | LARW | 38.58 | 15.18 | 5.35E-03 | | -2.271 | |
| GW-105 | LARW | 38.58 | 15.8 | 5.57E-03 | 5.49E-03 | -2.254 | -2.26 |
| I-1-30A1 | MW | 37.72 | 2.203 | 7.77E-04 | | -3.109 | |
| I-1-30A2 | MW | 37.72 | 2.402 | 8.47E-04 | | -3.072 | |
| I-1-30A3 | MW | 37.72 | 2.359 | 8.32E-04 | 8.19E-04 | -3.08 | -3.087 |
| I-2-30A2 | LARW | 40.22 | 0.494 | 1.74E-04 | 1.74E-04 | -3.759 | -3.759 |
| I-3-30A1 | MW | 37.12 | 1.097 | 3.87E-04 | | -3.412 | |
| I-3-30B1 | MW | 37.12 | 0.633 | 2.23E-04 | | -3.651 | |
| I-3-30B2 | MW | 37.12 | 0.67 | 2.36E-04 | 2.82E-04 | -3.627 | -3.563 |
| GW-106 | A,B&C | | 1.75 | 6.19E-04 | | -3.208 | |
| GW-106 | A,B&C | | 1.68 | 5.94E-04 | 6.07E-04 | -3.226 | -3.217 |
| GW-107 | A,B&C | | 1.41 | 4.96E-04 | | -3.305 | |
| GW-107 | A,B&C | | 1.54 | 5.45E-04 | 5.21E-04 | -3.264 | -3.284 |
| GW-108 | A,B&C | | 1.82 | 6.41E-04 | | -3.193 | |
| GW-108 | A,B&C | | 1.74 | 6.13E-04 | 6.27E-04 | -3.213 | -3.203 |
| GW-109 | A,B&C | | 1.84 | 6.50E-04 | | -3.187 | |
| GW-109 | A,B&C | | 1.71 | 6.04E-04 | 6.27E-04 | -3.219 | -3.203 |
| GW-110 | A,B&C | | 2.27 | 8.00E-04 | | -3.097 | |
| GW-110 | A,B&C | | 2.1 | 7.41E-04 | 7.71E-04 | -3.13 | -3.114 |
| GW-111 | A,B&C | | 5.39 | 1.90E-03 | | -2.721 | |
| GW-111 | A,B&C | | 4.39 | 1.55E-03 | 1.73E-03 | -2.81 | -2.765 |
| GW-112 | A,B&C | | 5.95 | 2.10E-03 | | -2.678 | |

## *Table 16. Site-Wide Hydraulic Conductivity Values*

| Well/Test | Cell | Total Depth (ft) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Well Hydraulic Conductivity (cm/sec) | Log Hydraulic Conductivity (log[cm/sec]) | Well Hydraulic Conductivity (log[cm/sec]) |
|---|---|---|---|---|---|---|---|
| GW-112 | A,B&C | | 6.49 | 2.29E-03 | 2.20E-03 | -2.64 | -2.659 |
| GW-113 | A,B&C | | 3.12 | 1.10E-03 | | -2.959 | |
| GW-113 | A,B&C | | 2.69 | 9.50E-04 | 1.03E-03 | -3.022 | -2.99 |
| GW-114 | A,B&C | | 3.03 | 1.07E-03 | | -2.971 | |
| GW-114 | A,B&C | | 3.37 | 1.19E-03 | 1.13E-03 | -2.924 | -2.948 |
| GW-115 | A,B&C | | 3.94 | 1.39E-03 | | -2.857 | |
| GW-115 | A,B&C | | 4.11 | 1.45E-03 | 1.42E-03 | -2.839 | -2.848 |
| GW-116 | A,B&C | | 6.72 | 2.37E-03 | | -2.625 | |
| GW-116 | A,B&C | | 7.06 | 2.49E-03 | 2.43E-03 | -2.604 | -2.615 |
| GW-117 | A,B&C | | 5.75 | 2.03E-03 | | -2.693 | |
| GW-117 | A,B&C | | 6.32 | 2.23E-03 | 2.13E-03 | -2.652 | -2.672 |
| GW-118 | MW | 46.6 | 6.98 | 2.46E-03 | | -2.608 | |
| GW-118 | MW | 46.6 | 6.7 | 2.36E-03 | 2.41E-03 | -2.627 | -2.618 |
| GW-119 | MW | 46.6 | 0.78 | 2.73E-04 | | -3.563 | |
| GW-119 | MW | 46.6 | 3.04 | 1.07E-03 | 6.72E-04 | -2.97 | -3.267 |
| GW-120 | MW | 46.5 | 5.76 | 2.03E-03 | | -2.692 | |
| GW-120 | MW | 46.5 | 6.88 | 2.43E-03 | 2.23E-03 | -2.615 | -2.654 |
| GW-121 | MW | 46.22 | 0.34 | 1.21E-04 | | -3.919 | |
| GW-121 | MW | 46.22 | 0.34 | 1.18E-04 | 1.20E-04 | -3.927 | -3.923 |
| GW-122 | MW | 44.53 | 2.21 | 7.79E-04 | | -3.108 | |
| GW-122 | MW | 44.53 | 2.35 | 8.28E-04 | 8.04E-04 | -3.082 | -3.095 |
| GW-123 | MW | 51.4 | 5.45 | 1.92E-03 | | -2.716 | |
| GW-123 | MW | 51.4 | 1.82 | 6.43E-04 | 1.28E-03 | -3.192 | -2.954 |
| GW-123R | MW | 42.5 | 1.23 | 4.34E-04 | | -3.363 | |
| GW-123R | MW | 42.5 | 1.076 | 3.80E-04 | | -3.421 | |
| GW-123R | MW | 42.5 | 1.033 | 3.65E-04 | 3.93E-04 | -3.438 | -3.407 |
| GW-124 | MW | 42.44 | 0.8 | 2.84E-04 | | -3.547 | |
| GW-124 | MW | 42.44 | 0.72 | 2.55E-04 | 2.69E-04 | -3.594 | -3.571 |
| GW-125 | B&C | 38.5 | 8.67 | 3.06E-03 | | -2.514 | |
| GW-125 | B&C | 38.5 | 9.608 | 3.39E-03 | | -2.47 | |
| GW-125 | B&C | 38.5 | 8.689 | 3.07E-03 | 3.17E-03 | -2.514 | -2.499 |
| GW-126 | 11e.(2) | 36 | 0.938 | 3.31E-04 | | -3.48 | |
| GW-126 | 11e.(2) | 36 | 0.998 | 3.52E-04 | 3.42E-04 | -3.453 | -2.886 |
| GW-127 | 11e.(2) | 36 | 1.832 | 6.46E-04 | | -3.19 | |
| GW-127 | 11e.(2) | 36 | 1.637 | 5.78E-04 | 6.12E-04 | -3.238 | -3.175 |
| GW-128 #2 | LARW | 43.3 | 4.16 | 1.47E-03 | | -2.833 | |
| GW-128 #3 | LARW | 43.3 | 4.16 | 1.47E-03 | | -2.833 | |
| GW-128 #4 | LARW | 43.3 | 4.16 | 1.47E-03 | 1.47E-03 | -2.833 | -2.833 |
| GW-129 | Pond | 44 | 1.44 | 5.08E-04 | | -3.294 | |
| GW-129 | Pond | 44 | 1.59 | 5.61E-04 | 5.35E-04 | -3.251 | -3.273 |
| GW-130 | MW | 39.6 | 0.7 | 2.47E-04 | | -3.607 | |
| GW-130 | MW | 39.6 | 0.71 | 2.50E-04 | 2.49E-04 | -3.601 | -3.604 |
| GW-131 | MW | 39.9 | 0.85 | 3.00E-04 | | -3.523 | |
| GW-131 | MW | 39.9 | 0.86 | 3.03E-04 | 3.02E-04 | -3.518 | -3.521 |
| GW-132 | MW | 40.0 | 1.41 | 4.97E-04 | | -3.303 | |
| GW-132 | MW | 40.0 | 1.48 | 5.22E-04 | 5.10E-04 | -3.282 | -3.293 |
| GW-133 | MW | 40.0 | 0.69 | 2.43E-04 | | -3.614 | |
| GW-133 | MW | 40.0 | 0.63 | 2.22E-04 | 2.33E-04 | -3.653 | -3.633 |
| GW-134 | MW | 42.2 | 6.59 | 2.32E-03 | | -2.634 | |
| GW-134 | MW | 42.2 | 6.54 | 2.31E-03 | 2.32E-03 | -2.637 | -2.635 |
| GW-135 | MW | 42.0 | 0.17 | 6.00E-05 | | -4.222 | |
| GW-135 | MW | 42.0 | 0.18 | 6.35E-05 | 6.17E-05 | -4.197 | -4.210 |
| GW-136 | MW | 42.0 | 0.65 | 2.29E-04 | | -3.640 | |

## *Table 16. Site-Wide Hydraulic Conductivity Values*

| Well/Test | Cell | Total Depth (ft) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Well Hydraulic Conductivity (cm/sec) | Log Hydraulic Conductivity (log[cm/sec]) | Well Hydraulic Conductivity (log[cm/sec]) |
|---|---|---|---|---|---|---|---|
| GW-136 | MW | 42.0 | 0.64 | 2.26E-04 | 2.28E-04 | -3.646 | -3.643 |
| GW-137 | Class A North | 36.0 | 4.82 | 1.70E-03 | | -2.769 | |
| GW-137 | Class A North | 36.0 | 6.86 | 2.42E-03 | 2.06E-03 | -2.616 | -2.693 |
| GW-138 | Class A North | 40.0 | 6.49 | 2.29E-03 | | -2.640 | |
| GW-138 | Class A North | 40.0 | 6.26 | 2.21E-03 | 2.25E-03 | -2.656 | -2.648 |
| GW-139 | Class A North | 39.2 | 3.97 | 1.40E-03 | | -2.854 | |
| GW-139 | Class A North | 39.2 | 4.01 | 1.41E-03 | 1.41E-03 | -2.849 | -2.852 |
| GW-139D | Class A North | 96.0 | 3.66 | 1.29E-03 | | -2.889 | |
| GW-139D | Class A North | 96.0 | 3.88 | 1.37E-03 | 1.33E-03 | -2.864 | -2.876 |
| GW-140 | Class A North | 39.9 | 2.29 | 8.08E-04 | | -3.093 | |
| GW-140 | Class A North | 39.9 | 2.29 | 8.08E-04 | 8.08E-04 | -3.093 | -3.093 |
| GW-141 | Class A North | 36.0 | 1.81 | 6.39E-04 | | -3.195 | |
| GW-141 | Class A North | 36.0 | 1.84 | 6.49E-04 | 6.44E-04 | -3.188 | -3.191 |
| EW-901 | NA | 32.0 | 1.66 | 5.86E-04 | | -3.232 | |
| EW-901 | NA | 32.0 | 1.49 | 5.26E-04 | 5.56E-04 | -3.279 | -3.256 |
| GW-38R | 11e.(2) | 37.33 | 0.28 | 1.00E-04 | | -3.999 | |
| GW-38R | 11e.(2) | 37.33 | 0.29 | 1.04E-04 | 1.02E-04 | -3.983 | -3.991 |
| P3-95 NEC | Pond | 41.92 | 0.98 | 3.46E-04 | | -3.461 | |
| P3-95 NEC | Pond | 41.92 | 0.81 | 2.87E-04 | | -3.542 | |
| P3-95 NEC | Pond | 41.92 | 0.85 | 3.01E-04 | 3.11E-04 | -3.522 | -3.508 |
| P3-95 SWC | Pond | 39.3 | 0.13 | 4.53E-05 | | -4.344 | |
| P3-95 SWC | Pond | 39.3 | 0.1 | 3.48E-05 | 4.01E-05 | -4.458 | -4.401 |
| P3-97 NECR | Pond | 32.22 | 0.26 | 9.17E-05 | 5.26E-04 | -4.038 | -3.279 |
| P3-97 NEC | Pond | 36.96 | 0.73 | 2.58E-04 | | -3.589 | |
| P3-97 NEC | Pond | 36.96 | 0.32 | 1.13E-04 | 1.86E-04 | -3.945 | -3.767 |

| | | | |
|---|---|---|---|
| | | Mean log[K] | -3.210 |
| Mean K (cm/s) | 1.13E-03 | Geo Mean K: | 6.16E-04 |

| | |
|---|---|
| Site-wide mean K | 1.13E-03 |
| Site-wide Geometric Mean K | 6.16E-04 |
| 90% UCL eometric Mean K | 7.53E-04 |
| 90% LCL eometric Mean K | 5.04E-04 |

## *TABLE 27. SORPTION COEFFICIENT ($K_d$) VALUES FOR RADIONUCLIDES AND METALS*

| NUCLIDE | Kd (L/kg) | RATIONALE |
|---|---|---|
| Ac-225 | 4.5 | Sheppard, M.I. and Thibault, D.H. 1990 gave a calculated Kd value = 450 L/kg, which was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. In the model, the Kd value was conservatively set two orders of magnitude lower than calculated value by Sheppard and Thibault.<br>Lowest value from McKinley, I.G., et al. 1991, in surficial sediments is 250 L/kg. |
| Ag-105<br>Ag-108m<br>Ag-110m<br>Ag-111<br>Ag | 2.7 | Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 12 reported values in sand was 2.7 to 1,000 L/kg, with a mean value of 90 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Recommended value is 100 L/kg.<br>Site-specific in-situ Kd value of 218 L/kg (+/- 0.5) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 0.579 L/kg, with a range of 0 to 6.72 L/kg. |
| Al-26 | 15 | Default Kd estimated to be 1500 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Am-241<br>Am-242<br>Am-242m<br>Am-243 | 1 | Lowest Kd value from "Estimation of Geochemical Parameters for Assessing Subsurface Transport at the Savannah River Plant," by B.B. Looney, M.W. Grant, and C.M. King, DuPont DPST-85-904, March 1987, Table 1, is 1 L/kg. Recommended value is 100 L/kg.<br>Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 100 to 100,000 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 8.2 L/kg. The range of 29 reported values in sand was 8.2 to 300,000 L/kg, with a mean value of 1,900 L/kg. |
| As-73<br>As-74<br>As | 1 | Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Reported range is 1-10. Recommended value is 3.16 L/kg.<br>Site-specific in-situ Kd value of 103 L/kg (+/- 1.6) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 4.5 L/kg, with a range of 3.66 to 45.6 L/kg. |
| Au-195<br>Au-198<br>Au-199 | 0.25 | Default Kd estimated to be 25 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Ba-133<br>Ba-140<br>Ba | 10 | Literature range of Ba Kd values in Bingham (1993) report is 10 - 1,000,000 L/kg, and 10 L/kg value was by DRC in previous modeling. The contaminant transport modeling code "TERRA" developed by ORNL (Baes et al., 1984) uses a default Kd value of 60 L/kg.<br>Site-specific in-situ Kd value of 9,224 L/kg (+/- 77) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 14.2 L/kg, with a range of 9 to 22.2 L/kg. |
| Be-7<br>Be | 2.5 | Sheppard, M.I. and Thibault, D.H. (1990) calculated Kd value = 250 L/kg, which was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. In the model, the Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard and Thibault.<br>The CR values used were taken from Baes et al. (1984)<br>Site-specific in-situ Kd value of 121 L/kg (+/- 0.15) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 27.9 L/kg, with a range of >27.9 to >2,862 L/kg. |
| Bk-249<br>Bk-250 | 0.001 | Kd unknown, therefore conservatively assigned a value of 0.001 L/kg.<br>Berkelium is a member of the actinide rare earth series. All rare earth elements have similar physical and chemical properties. ("General Chemistry" by Nebergall, et al., 1976.)<br>Kd values are available for Np, Am and Cm, which are also actinide rare earth elements. Consequently, it is reasonable to assign the lowest Kd value from these three elements (Am) to berkelium, Kd = 1 L/kg. |
| Bi-205<br>Bi-206<br>Bi-207<br>Bi-210m | 1 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 100 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| C-14 | 8.52 | Kd value from site-specific measurements. See the Response to Interrogatories (ABC 1997) which includes a re-evaluation of the Bingham (1995) Kd values. (Summary of Results, Radionuclide Kd Tests, Bingham Environmental, Inc. August 3, 1995).<br>The lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 1.7 L/kg. The range of 3 reported values in sand was 1.7 to 7.1 L/kg, with a mean value of 5 L/kg. |
| Ca-45<br>Ca-47 | 0.05 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 50 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| Cd-109<br>Cd-113m<br>Cd | 1 | Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 1 L/kg. Recommended value is 6.3 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 2.7 L/kg. The range of 14 reported values in sand was 2.7 to 625 L/kg, with the mean value at 80 L/kg.<br>Site-specific laboratory batch Kd of 2.39 determined by MFG (2000), with a range of 0.703 to 4.0 L/kg. |
| Ce-139<br>Ce-141<br>Ce-143<br>Ce-144 | 1 | Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 1000 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 40 L/kg. The range of 12 reported values in sand was 40 to 3,968 L/kg, with a mean value of 500 L/kg. |
| Cf<br>Cf-248<br>Cf-249<br>Cf-250<br>Cf-251<br>Cf-252 | 2 | Kd value of 2.0 is two orders of magnitude lower than the default Kd value of 200 L/kg used in the RESRAD code (EAD, 2001; Yu et al., 1993, 2000). The RESRAD code was developed at Argonne National Laboratory and is authorized for use at DOE Sites, under DOE Order 5400.5. Kd value of 2.0 approved by DRC (DRC, Sept 2001).<br>In NUREG/CR-5512, Vol. 1, a Cf Kd value of 510 is used (Kennedy and Strenge, 1992). A letter report prepared by Sandia National Laboratory for the NRC reviewed the parameter data for NUREG/CR-5512 and suggested a Kd value of 158 for Cf (Beyeler, et al., 1998).<br>Californium is a member of the actinide rare earth series. All rare earth elements have similar physical and chemical properties. ("General Chemistry" by Nebergall, Schmidt, and Holtzclaw, D.C. Health and Company, 1976, p. 905). Kd values are available for Np, Am and Cm, which are also actinide rare earth elements. |

## *TABLE 27. SORPTION COEFFICIENT ($K_d$) VALUES FOR RADIONUCLIDES AND METALS*

| NUCLIDE | Kd (L/kg) | RATIONALE |
|---|---|---|
| Cl-36 | 0.0025 | Default Kd estimated to be 0.25 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). Kd value in model is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Cm-241<br>Cm-242<br>Cm-243<br>Cm-244<br>Cm-245<br>Cm-246<br>Cm-247<br>Cm-248 | 93.3 | Lowest Kd value found in Baes, C.F. and Sharp, R.D. (1983) is 93.3. The range of the 31 reported values was 93.3 to 51,900 L/kg in agricultural soils and clays.<br>The lowest Kd value found in Looney, et al., March, 1987, Table 1 is 100 L/kg. Recommended value is 3162 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 780 L/kg. The range of 2 reported values in sand was 780 to 22,970 L/kg, with a mean value of 4,000 L/kg. |
| Co-56<br>Co-57<br>Co-58<br>Co-60 | 370 | Site-specific Kd, reported by Bingham, 1996. Consistent with range of values in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1. The range of 33 reported values in sand was 0.07 to 9,000 L/kg, with a mean value of 60 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 0.1 L/kg. Recommended value is 1 L/kg. |
| Cr<br>Cr-51 | 1 | Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 39.8 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 1.7 L/kg . The range of 15 reported values in sand was 1.7 to 1,729 L/kg, with a mean value of 70 L/kg.<br>Site-specific in-situ Kd value of 459 L/kg (+/- 3.0) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 6.23 L/kg, with a range of 5.69 to 758 L/kg. |
| Cs-134<br>Cs-135<br>Cs-136<br>Cs-137 | 133 | Site-specific Kd, reported by Bingham, 1996. Consistent with range of values in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (Range of 81 reported values in sand was 0.2 to 10,000 L/kg, with a mean value of 280 L/kg.)<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Recommended value is 501.1 L/kg. |
| Cu<br>Cu-67 | 1 | Lowest Kd value found in Looney, et al., March, 1987, Table 1 is 1 L/kg. Recommended value is 25.11 L/kg.<br>Site-specific laboratory batch Kd of 8.58 determined by MFG (2000), with a range of 0 to >2,365 L/kg. |
| Dy-166 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Es-253<br>Es-254 | 0.001 | Kd unknown, therefore conservatively assigned a value of 0.001 L/kg. |
| Eu-152<br>Eu-154<br>Eu-155<br>Eu-156 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Fe-52<br>Fe-55<br>Fe-59<br>Fe-60 | 1.4 | Lowest Kd value found in Baes, C.F. and Sharp, R.D. (1983) is 1.4. The range of the 30 reported values was 1.4 to 1,000 L/kg in agricultural soils and clays.<br>Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values) is 5 L/kg. The range of 16 reported values in sand was 5 to 6,000 L/kg, with a mean value of 280 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg. |
| Fm-252 | 0.001 | Kd unknown, therefore conservatively assigned a value of 0.001 L/kg. |
| Ga-67 | 15 | Default Kd estimated to be 1500 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Gd-148<br>Gd-153 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Ge-68 | 0.25 | Default Kd estimated to be 25 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| H-3 | 0.04 | Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). |
| Hf-172<br>Hf-175<br>Hf-181 | 4.5 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 450 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| Hg<br>Hg-194<br>Hg-203 | 10 | Kd value of 10.0 was from DRC, taken from Bingham Environmental value for stable mercury. (May, 1993 Report, Table 4-2 and August, 1993 Report, Table 3-4.<br>Lowest Kd value found in Buchter et al., 1989, Table 3, for a sandy loam soil is 19.6 L/kg. The range of 11 reported values in various soil types was 19.6 to 299.2 L/kg.<br>Kd values in interbed sediment range from 80.8 to 998 L/kg (Del Debbio, J.A., 1991).<br>Site-specific laboratory batch Kd of 387 determined by MFG (2000), with a range of 0.586 to >388 L/kg. |
| Ho-166m | 2.5 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 250 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. |
| I-125<br>I-126<br>I-129<br>I-131<br>I-133 | 0.12 | Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Inc. August 3, 1995) was 0.7 L/Kg. Re-evaluated in Response to Interrogatories (ABC 1997), with a recommended value of 0.46. Lowest slope of curve is 0.12 L/kg.<br>The lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 0.04 L/kg. The range of 22 reported values in sand was 0.04 to 81 L/kg, with a mean value of 1.0 L/kg. |

## *TABLE 27. SORPTION COEFFICIENT ($K_d$) VALUES FOR RADIONUCLIDES AND METALS*

| NUCLIDE | Kd (L/kg) | RATIONALE |
|---|---|---|
| In-111<br>In-113m<br>In-114<br>In-114m | 15 | Default Kd estimated to be 1500 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Ir-192 | 1.5 | Default Kd estimated to be 150 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| K-40 | 0.15 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 15 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984).<br>The lowest published Kd value for potassium is 2.0, found in Dragun (1988) |
| Kr-85 | 0.001 | Kd unknown, therefore conservatively assigned a value of 0.001 L/kg. |
| La-140 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Mn-52<br>Mn-52m<br>Mn-54 | 6.4 | Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 54 reported values was 6.4 to 5,000 L/kg, with a mean value of 50 L/kg. |
| Mo<br>Mo-99 | 1.0 | Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 1.0 L/kg. The range of 15 reported values in sand was 1.0 to 32 L/kg, with a geometric mean value of 10 L/kg.<br>Kd conservatively set one order of magnitude lower than site-specific in-situ Kd value of 6.5 L/kg (+/- 0.51) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 0 L/kg, with a range of 0 to 0.260 L/kg. |
| Na-22 | 1 | Default Kd estimated to be 100 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Nb-93m<br><br>Nb-94 | 1.6 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 160 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd.<br>The CR values used were taken from Baes et al. (1984) |
| Nd-144<br>Nd-147 | 6.5 | Kd assigned a conservatively low value of 6.5 L/kg. The contaminant transport modeling code "TERRA" developed by ORNL uses a default value of 650 L/kg (Baes et al. 1984). |
| Ni-59<br>Ni-63<br><br>Ni-63 | 10 | Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 10 L/kg. Recommended value is 100 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 60 L/kg. The range of 11 reported values was 60 to 3,600 L/kg, with a mean value of 400 L/kg.<br>Site-specific in-situ Kd value of 170 L/kg (+/- 2.7) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 18.6 L/kg, with a range of >7.96 to 60.9 L/kg. |
| Np-235<br>Np-237 | 3 | Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Inc. August 3, 1995) was 400. Re-evaluation of the data (ABC 1997 Response to Interrogatories) calculated a Kd of 425.<br>DRC recommended using the literature value. Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kds), is 0.5 L/kg, but applies to pH 2.0 solutions. Lowest value for pH>4.0 is greater than 3 L/kg. For pH = 7, Kd is over 20. |
| Os-191<br>Os-191m<br>Os-194 | 4.5 | Default Kd estimated to be 450 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Pa-231<br>Pa-233<br>Pa-234<br>Pa-234m | 5.5 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 550 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| P-32<br>P-33 | 0.035 | Default Kd estimated to be 3.5 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Pb-203<br>Pb-210 | 19 | Note: Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 19 L/kg. The range of 3 reported values in sand was 19 to 1,405 L/kg, with a mean value of 150 L/kg. Geometric mean Kd is 270 L/kg.<br>Default Kd estimated to be 900 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984).<br>Site-specific in-situ Kd value of 686 L/kg (+/- 1.4) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 10.6 L/kg, with a range of >10.6 to >3,194 L/kg. |
| Pd-103 | 0.55 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 55 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| Pm-143<br>Pm-147 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Po-208<br>Po-210 | 9 | Note: Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 9 L/kg. The range of 36 reported values in sand was 9 to 7,020 L/kg, with a mean value of 150 L/kg. |

## *TABLE 27. SORPTION COEFFICIENT ($K_d$) VALUES FOR RADIONUCLIDES AND METALS*

| NUCLIDE | Kd (L/kg) | RATIONALE |
|---|---|---|
| Pu-236<br>Pu-238<br>Pu-239<br>Pu-240<br>Pu-241<br>Pu-242<br>Pu-243<br>Pu-244 | 10 | Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 27 L/kg. The range of 39 reported values in sand was 27 to 36,000 L/kg, with a mean value of 550 L/kg. |
| Pt-193 | 0.9 | Kd assigned a conservatively low value of 0.9 L/kg. The contaminant transport modeling code "TERRA" developed by ORNL uses a default value of 90 L/kg (Baes et al. 1984). |
| Ra-225<br>Ra-226<br>Ra-228 | 10 | Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 57 L/kg. The range of 3 reported values in sand was 57 to 21,000 L/kg, with a mean value of 500 L/kg. |
| Re-183<br>Re-184<br>Re-184m<br>Re-186<br>Re-187<br>Re-188 | 0.075 | Default Kd estimated to be 7.5 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Rb-82<br>Rb-83<br>Rb-84<br>Rb-86 | 0.55 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 55 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd.<br>The CR values used were taken from Baes et al. (1984) |
| Rh-103m | 0.001 | Kd not reported in literature. Therefore assigned a value of 0.001 L/kg. |
| Ru-103<br>Ru-106 | 5 | Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 7 reported values in sand was 5 to 490 L/kg, with a mean value of 55 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 100 L/kg. Recommended value is 158 L/kg. |
| S-35 | 0.075 | Default Kd estimated to be 7.5 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Sb-122<br>Sb-124<br>Sb-125<br>Sb-126<br>Sb-126m | 100 | Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 3162 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 45 L/kg, from one reported observation in sand. |
| Sc-44<br>Sc-46<br>Sc-47 | 10 | Default Kd estimated to be 1000 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Se-75<br>Se-79 | 1 | Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 1 L/kg. Recommended value is 2.5 L/kg.<br>Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 1 to 50 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 36 L.kg. The range of 3 reported values in sand was 36 to 70 L/kg, with a mean value of 55 L/kg.<br>Lowest Kd value found for Se (IV) in Baes, C.F. and Sharp, R.D. (1983) is 1.2. The range of the 19 reported values was 1.2 to 8.6 L/kg.<br>Site-specific in-situ Kd value of 62 L/kg (+/- 0.4) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 29.3 L/kg, with a range of 13.0 to >405 L/kg. |
| Si-32 | 0.35 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 35 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. |
| Sm-145 Sm-151 Sm-153 | 2.45 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 245 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| Sn-113<br>Sn-117m<br>Sn-119m<br>Sn-121<br>Sn-121m<br>Sn-126 | 50 | Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 50 to 700 L/kg.<br>Sheppard, M.I. and Thibault, D.H. (1990) calculated Kd value = 130 L/kg; calculated using the soil-to-plant ratio (CR), which is strongly correlated with Kd.<br>The CR values used were taken from Baes et al. (1984)<br>Recommended Kd value found in Looney, et al., March, 1987, Table 1, is 100 L/kg. |
| Sr-82<br>Sr-85<br>Sr-89<br>Sr-90 | 0.05 | Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values). The range of 81 reported values in sand was 0.05 to 190 L/kg, with a mean value of 15 L/kg.<br>Average Kd in near-neutral pH, saline brines is 0.66 L/kg, based on data from NTIS (1981) and Serne, et al. (1977).<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 1 L/kg. Recommended value is 2.5 L/kg. |
| Ta-182 | 2.2 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 220 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |
| Te-123m<br>Te-125m<br>Te-129<br>Te-129m | 1.25 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 125 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. The CR values used were taken from Baes et al. (1984). |

## *TABLE 27. SORPTION COEFFICIENT ($K_d$) VALUES FOR RADIONUCLIDES AND METALS*

| NUCLIDE | Kd (L/kg) | RATIONALE |
|---|---|---|
| Tb-157<br>Tb-158<br>Tb-160 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Tc-95<br>Tc-95m<br>Tc-99<br>Tc-99m | 0.11 | Site-specific Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Inc. August 3, 1995) was 0.07 L/kg. Re-evaluated in Response to Interrogatories (ABC 1997), result 0.11 L/kg .<br>The lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 0.01 L/kg. The range of 19 reported values in sand was 0.01 to 16 L/kg, with a mean value of 0.1 L/kg. |
| Th-229<br>Th-230<br>Th-231<br>Th-232 | 10 | Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 80 to 60,000 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1. Recommended value is 100 L/kg.<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 207 L/kg. The range of 10 reported values in sand was 207 to 150,000 L/kg, with a mean value of 3,200 L/kg. |
| Ti-44 | 10 | Default Kd estimated to be 1000 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Tl-201<br>Tl-202<br>Tl-204 | 0.15 | Based on similarities between ionic radii and valance, thallium Kd estimated using lowest published potassium value of 2.0 found in Dragun, 1988 (Whetstone Associates, 2000).<br>The 'Kd value for potassium was conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 15 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd. Due to similarities in ionic structure, thallium Kd values would be similar to potassium. |
| Tm-170 Tm-171 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| U-232<br>U-233<br>U-234<br>U-235<br>U-236<br>U-238<br>U-238 | 6 | Site-specific Kd value from Summary of Results, Radionuclide Kd Tests (Bingham Environmental, Aug 3, 1995).<br>Lowest Kd value found in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values), is 0.03 L/kg. The range of 24 reported values in sand was 0.03 to 2,200 L/kg, with a mean value of 35 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is 0.1 L/kg. Recommended value is 39.8 L/kg. |
| V-48 | 10 | Default Kd estimated to be 1000 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| W-181<br>W-185<br>W-188 | 1.5 | Default Kd estimated to be 150 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Xe-127<br>Xe-133<br>Xe-131m<br>Xe-133m | 0.001 | Kd unknown, therefore conservatively assigned a value of 0.001 L/kg. |
| Y-88<br>Y-91 | 1.7 | Kd value conservatively set two orders of magnitude lower than calculated value by Sheppard, M.I. and Thibault, D.H. 1990. Calculated Kd value = 170 L/kg, was determined using the soil-to-plant ratio (CR), which is strongly correlated with Kd.<br>The CR values used were taken from Baes et al. (1984) |
| Yb-169 | 6.5 | Default Kd estimated to be 650 L/kg for contaminant transport modeling code "TERRA" developed by ORNL (Baes et al. 1984). In the model, the Kd value is conservatively set two orders of magnitude lower than the default value used by TERRA. |
| Zn<br>Zn-65 | 368 | Site-specific in-situ Kd value of 374 L/kg (+/- 4.1) determined by Enchemica (2002). MFG (2000) determined site-specific batch Kd of 116 L/kg, with a range of >116 to >1,648 L/kg. Site specific value of 368 L/kg approved by DRC (DRC, Feb 2003).<br>Lowest Kd value in Sheppard, M.I. and Thibault, D.H., 1990, Table A-1 (sand soil Kd values) is 0.1 L/kg. The range of 22 reported values in sand was 0.1 to 8,000 L/kg, with a mean value of 200 L/kg.<br>Lowest Kd value found in Looney, et al., March, 1987, Table 1, is also 0.1 L/kg. Recommended value is 15.8 L/kg. |
| Zr-88<br>Zr-93<br>Zr-95 | 10 | Lowest Kd value for soil/surface sediments found in McKinley, I.G. and Scholtis, A., 1993, Table 4. Kd values for soil/surface sediments ranged from 10 to 8,300 L/kg.<br>Sheppard, M.I. and Thibault, D.H. (1990) calculated a Kd value of 600 L/kg. Calculation was based on the soil-to-plant ratio (CR), which is strongly correlated with Kd. |

*TABLE 34.*
*PEAK RADIONUCLIDE CONCENTRATIONS AT THE WATER TABLE,*
*VERTICAL PATHRAE RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE | PEAK CONCENTRATION ($Ci/m^3$) | PEAK CONCENTRATION (pCi/L) | PEAK YEAR |
|---|---|---|---|
| Ac-227 | 0 | | > 10,000 |
| Ag-108m | 0 | | > 10,000 |
| Al-26 | 0 | | > 10,000 |
| Am-241 | 7.84E-08 | 7.84E+01 | 5,699 |
| Am-242m | 2.07E-14 | 2.07E-05 | 3,829 |
| Am-243 | 2.17E-03 | 2.17E+06 | 8,199 |
| Ba-133 | 0 | | > 10,000 |
| Be-10 | 0 | | > 10,000 |
| Bi-207 | 0 | | --- |
| Bi-210m | 2.69E+02 | 2.69E+11 | 8,443 |
| Bk-247 | 4.23E-08 | 4.23E+01 | 474 |
| C-14 | 0 | | > 10,000 |
| Ca-41 | 1.61E-01 | 1.61E+08 | 868 |
| Cd-113 | 2.05E-07 | 2.05E+02 | 8,443 |
| Cd-113m | 0 | | --- |
| Cf-249 | 0 | | > 10,000 |
| Cf-250 | 0 | | > 10,000 |
| Cf-251 | 0 | | > 10,000 |
| Cf-252 | 0 | | > 10,000 |
| Cl-36 | 1.28E-04 | 1.28E+05 | 490 |
| Cm-243 | 0 | | > 10,000 |
| Cm-244 | 0 | | > 10,000 |
| Cm-245 | 0 | | > 10,000 |
| Cm-246 | 0 | | > 10,000 |
| Cm-247 | 0 | | > 10,000 |
| Cm-248 | 0 | | > 10,000 |
| Co-60 | 0 | | > 10,000 |
| Cs-135 | 0 | | > 10,000 |
| Cs-137 | 0 | | > 10,000 |
| Eu-152 | 0 | | > 10,000 |
| Eu-154 | 0 | | > 10,000 |
| Eu-155 | 0 | | > 10,000 |
| Fe-55 | 0 | | > 10,000 |
| Fe-60 | 0 | | > 10,000 |
| Gd-148 | 0 | | > 10,000 |
| H-3 | 8.61E-11 | 8.61E-02 | 357 |
| Hg-194 | 0 | | > 10,000 |
| Ho-166m | 0 | | > 10,000 |
| I-129 | 1.41E-02 | 1.41E+07 | 1,426 |
| Ks-20 | 0 | | --- |
| Ks-21 | 0 | | --- |
| Ks-22 | 0 | | --- |
| Ks-23 | 0 | | --- |
| Ks-24 | 0 | | > 10,000 |
| Ks-25 | 0 | | > 10,000 |
| Ks-26 | 0 | | --- |
| Mn-53 | 0 | | > 10,000 |
| Na-22 | 0 | | --- |
| Nb-91 | 0 | | > 10,000 |
| Nb-92 | 0 | | > 10,000 |
| Nb-93m | 0 | | > 10,000 |
| Nb-94 | 0 | | > 10,000 |
| Ni-59 | 0 | | > 10,000 |
| Ni-63 | 0 | | > 10,000 |
| Np-237 | 0 | | > 10,000 |
| Os-194 | 0 | | > 10,000 |
| Pa-231 | 0 | | > 10,000 |
| Pb-202 | 0 | | --- |
| Pb-210 | 0 | | > 10,000 |
| Pd-107 | 4.22E+02 | 4.22E+11 | 4,856 |
| Pm-145 | 0 | | > 10,000 |
| Pm-147 | 0 | | > 10,000 |
| Po-208 | 0 | | > 10,000 |
| Po-209 | 0 | | > 10,000 |
| Pt-193 | 0 | | --- |
| Pu-236 | 0 | | > 10,000 |
| Pu-238 | 0 | | > 10,000 |
| Pu-239 | 0 | | > 10,000 |
| Pu-240 | 0 | | > 10,000 |
| Pu-241 | 0 | | > 10,000 |
| Pu-242 | 0 | | > 10,000 |
| Pu-244 | 0 | | > 10,000 |
| Ra-226 | 0 | | > 10,000 |
| Ra-228 | 0 | | > 10,000 |
| Re-187 | 1.42E-01 | 1.42E+08 | 1,068 |
| Se-79 | 3.02E+04 | 3.02E+13 | 8,417 |
| Si-32 | 1.70E+03 | 1.70E+12 | 2,230 |
| Sm-151 | 0 | | > 10,000 |
| Sn-121m | 0 | | > 10,000 |
| Sn-126 | 0 | | > 10,000 |
| Sr-90 | 1.54E-08 | 1.54E+01 | 522 |
| Tb-157 | 0 | | > 10,000 |
| Tb-158 | 0 | | > 10,000 |
| Tc-99 | 5.56E-01 | 5.56E+08 | 1,345 |
| Te-123 | 1.12E-04 | 1.12E+05 | 10,431 |
| Th-229 | 0 | | > 10,000 |
| Th-230 | 0 | | > 10,000 |
| Th-232 | 0 | | > 10,000 |
| Ti-44 | 0 | | > 10,000 |
| Tl-204 | 0 | | --- |
| Tm-170 | 0 | | > 10,000 |
| U-232 | 0 | | > 10,000 |
| U-233 | 0 | | > 10,000 |
| U-234 | 0 | | > 10,000 |
| U-235 | 0 | | > 10,000 |
| U-236 | 0 | | > 10,000 |
| U-238 | 0 | | > 10,000 |
| V-50 | 0 | | > 10,000 |
| Zr-93 | 0 | | > 10,000 |

NOTES: -1 indicates that nuclide did not exceed standard within the 1,000 years
--- indicates that concentrations do not peak at the water table within 10,0

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.1E-11 | 1.4E-10 | 8.0E-10 | 3.9E-09 | 1.7E-08 | 6.5E-08 | 2.3E-07 | 7.2E-07 | 2.1E-06 | 5.8E-06 | 1.5E-05 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.4E-11 | 2.9E-10 | 1.7E-09 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6E-11 | 2.2E-10 | 2.2E-09 | 1.9E-08 | 1.3E-07 | 7.6E-07 | 3.9E-06 | 1.7E-05 | 7.0E-05 | 2.5E-04 | 8.3E-04 | 2.5E-03 | 7.1E-03 | 1.9E-02 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.5E-11 | 2.4E-10 | 1.1E-09 | 4.7E-09 | 1.8E-08 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 3.5E-05 | 8.0E-05 | 1.7E-04 | 3.5E-04 | 7.0E-04 | 1.3E-03 | 2.4E-03 | 4.2E-03 | 7.2E-03 | 1.2E-02 | 1.9E-02 | 3.0E-02 | 4.7E-02 | 7.0E-02 | 1.0E-01 | 1.5E-01 | 2.1E-01 | 2.9E-01 | 3.9E-01 | 5.3E-01 | 7.0E-01 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 8.9E-09 | 4.2E-08 | 1.8E-07 | 7.4E-07 | 2.8E-06 | 9.5E-06 | 3.1E-05 | 9.5E-05 | 2.7E-04 | 7.5E-04 | 2.0E-03 | 4.9E-03 | 1.2E-02 | 2.7E-02 | 6.0E-02 | 1.3E-01 | 2.7E-01 | 5.3E-01 | 1.0E+00 | 2.0E+00 | 3.7E+00 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 4.6E-02 | 1.1E-01 | 2.4E-01 | 5.0E-01 | 1.0E+00 | 1.9E+00 | 3.6E+00 | 6.5E+00 | 1.1E+01 | 1.9E+01 | 3.1E+01 | 5.0E+01 | 7.8E+01 | 1.2E+02 | 1.8E+02 | 2.6E+02 | 3.7E+02 | 5.2E+02 | 7.2E+02 | 9.8E+02 | 1.3E+03 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 6.0E-08 | 1.9E-07 | 5.3E-07 | 1.4E-06 | 3.5E-06 | 8.1E-06 | 1.8E-05 | 3.6E-05 | 7.2E-05 | 1.3E-04 | 2.4E-04 | 4.1E-04 | 6.9E-04 | 1.1E-03 | 1.7E-03 | 2.5E-03 | 3.7E-03 | 5.2E-03 | 7.1E-03 | 9.5E-03 | 1.2E-02 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.0E-11 | 3.2E-11 | 9.5E-11 | 2.7E-10 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 275 | 280 | 285 | 290 | 295 | 300 | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 | 410 | 420 | 430 | 440 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 9.1E-01 | 1.2E+00 | 1.5E+00 | 1.9E+00 | 2.3E+00 | 2.8E+00 | 4.1E+00 | 5.8E+00 | 7.8E+00 | 1.0E+01 | 1.3E+01 | 1.6E+01 | 1.9E+01 | 2.3E+01 | 2.6E+01 | 2.9E+01 | 3.2E+01 | 3.5E+01 | 3.8E+01 | 3.9E+01 | 4.1E+01 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 6.6E+00 | 1.2E+01 | 2.0E+01 | 3.4E+01 | 5.6E+01 | 9.2E+01 | 2.3E+02 | 5.4E+02 | 1.2E+03 | 2.5E+03 | 5.1E+03 | 9.7E+03 | 1.8E+04 | 3.1E+04 | 5.4E+04 | 8.9E+04 | 1.4E+05 | 2.2E+05 | 3.4E+05 | 5.0E+05 | 7.3E+05 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 1.7E+03 | 2.3E+03 | 2.9E+03 | 3.7E+03 | 4.7E+03 | 5.8E+03 | 8.7E+03 | 1.2E+04 | 1.7E+04 | 2.3E+04 | 3.0E+04 | 3.8E+04 | 4.7E+04 | 5.6E+04 | 6.6E+04 | 7.6E+04 | 8.5E+04 | 9.4E+04 | 1.0E+05 | 1.1E+05 | 1.2E+05 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 1.6E-02 | 2.0E-02 | 2.5E-02 | 3.0E-02 | 3.5E-02 | 4.1E-02 | 5.3E-02 | 6.4E-02 | 7.4E-02 | 8.1E-02 | 8.5E-02 | 8.6E-02 | 8.3E-02 | 7.8E-02 | 7.1E-02 | 6.3E-02 | 5.4E-02 | 4.5E-02 | 3.7E-02 | 3.0E-02 | 2.3E-02 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 7.5E-10 | 2.0E-09 | 5.1E-09 | 1.3E-08 | 3.0E-08 | 7.0E-08 | 3.5E-07 | 1.5E-06 | 6.3E-06 | 2.3E-05 | 8.0E-05 | 2.6E-04 | 7.7E-04 | 2.2E-03 | 5.7E-03 | 1.4E-02 | 3.5E-02 | 8.0E-02 | 1.8E-01 | 3.7E-01 | 7.6E-01 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 460 | 470 | 480 | 490 | 500 | 510 | 520 | 530 | 540 | 550 | 560 | 570 | 580 | 590 | 600 | 610 | 620 | 630 | 640 | 650 | 660 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 4.2E+01 | 4.2E+01 | 4.2E+01 | 4.2E+01 | 4.1E+01 | 3.9E+01 | 3.8E+01 | 3.6E+01 | 3.4E+01 | 3.2E+01 | 3.0E+01 | 2.7E+01 | 2.5E+01 | 2.3E+01 | 2.1E+01 | 1.9E+01 | 1.7E+01 | 1.5E+01 | 1.3E+01 | 1.2E+01 | 1.0E+01 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 1.0E+06 | 1.4E+06 | 2.0E+06 | 2.7E+06 | 3.5E+06 | 4.6E+06 | 5.9E+06 | 7.5E+06 | 9.4E+06 | 1.2E+07 | 1.4E+07 | 1.7E+07 | 2.0E+07 | 2.4E+07 | 2.8E+07 | 3.3E+07 | 3.8E+07 | 4.3E+07 | 4.9E+07 | 5.5E+07 | 6.2E+07 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 1.2E+05 | 1.2E+05 | 1.3E+05 | 1.3E+05 | 1.3E+05 | 1.3E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 1.0E+05 | 9.6E+04 | 8.9E+04 | 8.3E+04 | 7.6E+04 | 7.0E+04 | 6.3E+04 | 5.7E+04 | 5.2E+04 | 4.7E+04 | 4.2E+04 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 1.8E-02 | 1.3E-02 | 1.0E-02 | 7.3E-03 | 5.3E-03 | 3.7E-03 | 2.6E-03 | 1.8E-03 | 1.2E-03 | 8.3E-04 | 5.6E-04 | 3.7E-04 | 2.4E-04 | 1.6E-04 | 1.0E-04 | 6.4E-05 | 4.0E-05 | 2.5E-05 | 1.6E-05 | 9.7E-06 | 5.9E-06 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.5E+00 | 2.9E+00 | 5.3E+00 | 9.6E+00 | 1.7E+01 | 2.9E+01 | 4.8E+01 | 7.9E+01 | 1.3E+02 | 2.0E+02 | 3.1E+02 | 4.7E+02 | 6.9E+02 | 1.0E+03 | 1.5E+03 | 2.1E+03 | 2.9E+03 | 4.1E+03 | 5.6E+03 | 7.6E+03 | 1.0E+04 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 670 | 680 | 690 | 700 | 720 | 740 | 760 | 780 | 800 | 825 | 850 | 875 | 900 | 925 | 950 | 975 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 9.1E+00 | 8.0E+00 | 7.0E+00 | 6.0E+00 | 4.5E+00 | 3.3E+00 | 2.4E+00 | 1.8E+00 | 1.3E+00 | 8.1E-01 | 5.2E-01 | 3.3E-01 | 2.1E-01 | 1.3E-01 | 8.0E-02 | 4.9E-02 | 3.0E-02 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 6.8E+07 | 7.5E+07 | 8.2E+07 | 8.9E+07 | 1.0E+08 | 1.2E+08 | 1.3E+08 | 1.4E+08 | 1.5E+08 | 1.6E+08 | 1.6E+08 | 1.6E+08 | 1.6E+08 | 1.5E+08 | 1.5E+08 | 1.4E+08 | 1.2E+08 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 3.7E+04 | 3.3E+04 | 2.9E+04 | 2.6E+04 | 2.0E+04 | 1.5E+04 | 1.1E+04 | 8.2E+03 | 6.0E+03 | 4.0E+03 | 2.7E+03 | 1.8E+03 | 1.1E+03 | 7.3E+02 | 4.6E+02 | 2.9E+02 | 1.8E+02 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 3.6E-06 | 2.2E-06 | 1.3E-06 | 7.8E-07 | 2.7E-07 | 9.3E-08 | 3.1E-08 | 1.0E-08 | 3.3E-09 | 7.9E-10 | 1.9E-10 | 4.2E-11 | 0 | 0 | 0 | 0 | 0 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.3E+04 | 1.8E+04 | 2.3E+04 | 2.9E+04 | 4.7E+04 | 7.4E+04 | 1.1E+05 | 1.6E+05 | 2.3E+05 | 3.5E+05 | 5.2E+05 | 7.4E+05 | 1.0E+06 | 1.4E+06 | 1.8E+06 | 2.3E+06 | 2.9E+06 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.3E-11 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Year to exceed GW Year to exceed GWPL reported to next lowest model output year. -1 indicates nuclide does not exceed GWPL in years modeled

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 0 | 0 | 0 | 0 | 4.9E-11 | 2.3E-10 | 9.9E-10 | 3.9E-09 | 1.5E-08 | 5.2E-08 | 1.7E-07 | 5.3E-07 | 1.6E-06 | 4.5E-06 | 1.2E-05 | 3.1E-05 | 7.8E-05 | 1.9E-04 | 4.3E-04 | 9.6E-04 | 2.1E-03 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 1.1E-10 | 4.5E-10 | 1.7E-09 | 6.1E-09 | 2.0E-08 | 6.2E-08 | 1.8E-07 | 4.8E-07 | 1.2E-06 | 3.0E-06 | 7.0E-06 | 1.5E-05 | 3.3E-05 | 6.7E-05 | 1.3E-04 | 2.5E-04 | 4.6E-04 | 8.2E-04 | 1.4E-03 | 2.4E-03 | 3.9E-03 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.3E-11 | 8.8E-11 | 3.1E-10 | 1.0E-09 | 3.3E-09 | 1.0E-08 | 3.0E-08 | 8.3E-08 | 2.2E-07 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 275 | 280 | 285 | 290 | 295 | 300 | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 | 410 | 420 | 430 | 440 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 4.4E-03 | 9.0E-03 | 1.8E-02 | 3.5E-02 | 6.6E-02 | 1.2E-01 | 3.9E-01 | 1.2E+00 | 3.2E+00 | 8.4E+00 | 2.0E+01 | 4.7E+01 | 1.0E+02 | 2.2E+02 | 4.4E+02 | 8.4E+02 | 1.6E+03 | 2.8E+03 | 4.9E+03 | 8.4E+03 | 1.4E+04 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-11 | 1.2E-10 | 6.5E-10 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 6.3E-03 | 9.8E-03 | 1.5E-02 | 2.2E-02 | 3.3E-02 | 4.8E-02 | 9.4E-02 | 1.7E-01 | 3.0E-01 | 5.0E-01 | 7.9E-01 | 1.2E+00 | 1.7E+00 | 2.4E+00 | 3.2E+00 | 4.2E+00 | 5.3E+00 | 6.4E+00 | 7.7E+00 | 9.0E+00 | 1.0E+01 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 5.8E-07 | 1.5E-06 | 3.5E-06 | 8.3E-06 | 1.9E-05 | 4.2E-05 | 1.9E-04 | 7.6E-04 | 2.9E-03 | 9.8E-03 | 3.1E-02 | 9.3E-02 | 2.6E-01 | 6.9E-01 | 1.7E+00 | 4.1E+00 | 9.3E+00 | 2.0E+01 | 4.2E+01 | 8.5E+01 | 1.7E+02 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 460 | 470 | 480 | 490 | 500 | 510 | 520 | 530 | 540 | 550 | 560 | 570 | 580 | 590 | 600 | 610 | 620 | 630 | 640 | 650 | 660 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 2.2E+04 | 3.5E+04 | 5.3E+04 | 8.0E+04 | 1.2E+05 | 1.7E+05 | 2.4E+05 | 3.3E+05 | 4.6E+05 | 6.2E+05 | 8.3E+05 | 1.1E+06 | 1.4E+06 | 1.8E+06 | 2.3E+06 | 2.9E+06 | 3.6E+06 | 4.5E+06 | 5.4E+06 | 6.6E+06 | 7.9E+06 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 3.3E-09 | 1.5E-08 | 6.8E-08 | 2.8E-07 | 1.1E-06 | 4.0E-06 | 1.4E-05 | 4.6E-05 | 1.4E-04 | 4.4E-04 | 1.3E-03 | 3.5E-03 | 9.4E-03 | 2.4E-02 | 6.1E-02 | 1.5E-01 | 3.5E-01 | 7.9E-01 | 1.8E+00 | 3.8E+00 | 8.0E+00 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 1.1E+01 | 1.3E+01 | 1.4E+01 | 1.4E+01 | 1.5E+01 | 1.5E+01 | 1.5E+01 | 1.5E+01 | 1.5E+01 | 1.5E+01 | 1.4E+01 | 1.3E+01 | 1.3E+01 | 1.2E+01 | 1.1E+01 | 9.9E+00 | 8.9E+00 | 8.0E+00 | 7.1E+00 | 6.3E+00 | 5.5E+00 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 3.1E+02 | 5.8E+02 | 1.0E+03 | 1.8E+03 | 3.0E+03 | 4.9E+03 | 8.0E+03 | 1.3E+04 | 2.0E+04 | 3.0E+04 | 4.5E+04 | 6.5E+04 | 9.5E+04 | 1.3E+05 | 1.9E+05 | 2.6E+05 | 3.6E+05 | 4.9E+05 | 6.5E+05 | 8.6E+05 | 1.1E+06 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 35. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR THE CAW CELL TOP SLOPE (0.090 CM/YR INFILTRATION)*

| NUCLIDE: | 670 | 680 | 690 | 700 | 720 | 740 | 760 | 780 | 800 | 825 | 850 | 875 | 900 | 925 | 950 | 975 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 3.6E-11 | 2.2E-10 | 1.2E-09 | 6.1E-09 | 4.1E-08 | 2.5E-07 | 1.4E-06 | 6.6E-06 | 3.0E-05 | 1.2E-04 | 4.8E-04 | 1.7E-03 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 9.4E+06 | 1.1E+07 | 1.3E+07 | 1.5E+07 | 2.0E+07 | 2.6E+07 | 3.3E+07 | 4.1E+07 | 4.9E+07 | 6.1E+07 | 7.3E+07 | 8.6E+07 | 9.8E+07 | 1.1E+08 | 1.2E+08 | 1.3E+08 | 1.3E+08 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 1.6E+01 | 3.3E+01 | 6.4E+01 | 1.2E+02 | 4.3E+02 | 1.4E+03 | 4.1E+03 | 1.2E+04 | 3.1E+04 | 9.8E+04 | 2.8E+05 | 7.7E+05 | 2.0E+06 | 4.7E+06 | 1.1E+07 | 2.3E+07 | 4.6E+07 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 4.8E+00 | 4.2E+00 | 3.6E+00 | 3.1E+00 | 2.2E+00 | 1.5E+00 | 1.0E+00 | 7.0E-01 | 4.6E-01 | 2.6E-01 | 1.5E-01 | 8.2E-02 | 4.4E-02 | 2.3E-02 | 1.2E-02 | 6.2E-03 | 3.1E-03 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.5E+06 | 1.9E+06 | 2.4E+06 | 3.0E+06 | 4.6E+06 | 6.9E+06 | 1.0E+07 | 1.4E+07 | 2.0E+07 | 2.9E+07 | 4.0E+07 | 5.5E+07 | 7.3E+07 | 9.5E+07 | 1.2E+08 | 1.5E+08 | 1.8E+08 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 37.*
*PEAK RADIONUCLIDE CONCENTRATIONS AT THE WATER TABLE,*
*VERTICAL PATHRAE RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE | PEAK CONCENTRATION ($Ci/m^3$) | PEAK CONCENTRATION (pCi/L) | PEAK YEAR |
|---|---|---|---|
| Ac-227 | 0 | | > 10,000 |
| Ag-108m | 0 | | > 10,000 |
| Al-26 | 0 | | > 10,000 |
| Am-241 | 4.82E-06 | 4.82E+03 | 3,779 |
| Am-242m | 1.32E-10 | 1.32E-01 | 2,725 |
| Am-243 | 2.84E-03 | 2.84E+06 | 4,752 |
| Ba-133 | 0 | | > 10,000 |
| Be-10 | 0 | | > 10,000 |
| Bi-207 | 0 | | --- |
| Bi-210m | 2.52E+02 | 2.52E+11 | 4,835 |
| Bk-247 | 2.64E-08 | 2.64E+01 | 270 |
| C-14 | 0 | | > 10,000 |
| Ca-41 | 1.47E-04 | 1.47E+05 | 495 |
| Cd-113 | 1.92E-07 | 1.92E+02 | 4,835 |
| Cd-113m | 0 | | --- |
| Cf-249 | 1.46E-09 | 1.46E+00 | 5,769 |
| Cf-250 | 0 | | --- |
| Cf-251 | 3.68E-06 | 3.68E+03 | 7,449 |
| Cf-252 | 0 | | --- |
| Cl-36 | 7.37E-05 | 7.37E+04 | 279 |
| Cm-243 | 0 | | > 10,000 |
| Cm-244 | 0 | | > 10,000 |
| Cm-245 | 0 | | > 10,000 |
| Cm-246 | 0 | | > 10,000 |
| Cm-247 | 0 | | > 10,000 |
| Cm-248 | 0 | | > 10,000 |
| Co-60 | 0 | | > 10,000 |
| Cs-135 | 0 | | > 10,000 |
| Cs-137 | 0 | | > 10,000 |
| Eu-152 | 0 | | > 10,000 |
| Eu-154 | 0 | | > 10,000 |
| Eu-155 | 0 | | > 10,000 |
| Fe-55 | 0 | | --- |
| Fe-60 | 1.28E+03 | 1.28E+12 | 6,659 |
| Gd-148 | 0 | | > 10,000 |
| H-3 | 1.17E-06 | 1.17E+03 | 254 |
| Hg-194 | 0 | | > 10,000 |
| Ho-166m | 0 | | > 10,000 |
| Ks-20 | 0 | | --- |
| Ks-21 | 0 | | --- |
| Ks-22 | 0 | | --- |
| Ks-23 | 0 | | --- |
| Ks-24 | 0 | | > 10,000 |
| Ks-25 | 0 | | > 10,000 |
| Ks-26 | 0 | | --- |
| Mn-53 | 0 | | > 10,000 |
| Na-22 | 0 | | --- |
| Nb-91 | 1.83E+03 | 1.83E+12 | 5,921 |
| Nb-92 | 3.19E+01 | 3.19E+10 | 7,570 |
| Nb-93m | 0 | | --- |
| Nb-94 | 2.85E-03 | 2.85E+06 | 7,494 |
| Ni-59 | 0 | | > 10,000 |
| Ni-63 | 0 | | > 10,000 |
| Np-237 | 0 | | > 10,000 |
| Os-194 | 0 | | > 10,000 |
| Pa-231 | 0 | | > 10,000 |
| Pb-202 | 0 | | > 10,000 |
| Pt-193 | 2.22E-08 | 2.22E+01 | 1,704 |
| Pb-210 | 0 | | > 10,000 |
| Pd-107 | 3.95E+02 | 3.95E+11 | 2,776 |
| Pm-145 | 0 | | > 10,000 |
| Pm-147 | 0 | | > 10,000 |
| Po-208 | 0 | | > 10,000 |
| Po-209 | 0 | | > 10,000 |
| Pt-193 | 2.22E-08 | 2.22E+01 | 1,704 |
| Pu-236 | 0 | | > 10,000 |
| Pu-238 | 0 | | > 10,000 |
| Pu-239 | 0 | | > 10,000 |
| Pu-240 | 0 | | > 10,000 |
| Pu-241 | 0 | | > 10,000 |
| Pu-242 | 0 | | > 10,000 |
| Pu-244 | 4.99E-05 | 4.99E+04 | 735 |
| Ra-226 | 0 | | > 10,000 |
| Ra-228 | 0 | | > 10,000 |
| Re-187 | 6.72E-02 | 6.72E+07 | 609 |
| Se-79 | 2.93E+04 | 2.93E+13 | 4,821 |
| Si-32 | 9.77E+04 | 9.77E+13 | 1,470 |
| Sm-151 | 0 | | > 10,000 |
| Sn-121m | 0 | | > 10,000 |
| Sn-126 | 0 | | > 10,000 |
| Sr-90 | 5.12E-06 | 5.12E+03 | 354 |
| Tb-157 | 0 | | > 10,000 |
| Tb-158 | 0 | | > 10,000 |
| Tc-99 | 4.79E-03 | 4.79E+06 | 769 |
| Te-123 | 1.05E-04 | 1.05E+05 | 5,975 |
| Th-229 | 0 | | > 10,000 |
| Th-230 | 0 | | > 10,000 |
| Th-232 | 0 | | > 10,000 |
| Ti-44 | 0 | | > 10,000 |
| Tl-204 | 0 | | --- |
| Tm-170 | 0 | | > 10,000 |
| U-232 | 0 | | > 10,000 |
| U-233 | 0 | | > 10,000 |
| U-234 | 0 | | > 10,000 |
| U-235 | 0 | | > 10,000 |
| U-236 | 0 | | > 10,000 |
| U-238 | 0 | | > 10,000 |
| V-50 | 0 | | > 10,000 |
| Zr-93 | 0 | | > 10,000 |

NOTES: -1 indicates that nuclide did not exceed standard within the 1,000 years
--- indicates that concentrations do not peak at the water table within 10,(

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.0E-11 | 2.6E-10 | 4.3E-09 | 4.8E-08 | 3.9E-07 | 2.5E-06 | 1.3E-05 | 5.6E-05 | 2.1E-04 | 6.6E-04 | 1.9E-03 | 4.9E-03 | 1.2E-02 | 2.5E-02 | 5.1E-02 | 9.7E-02 | 1.7E-01 | 3.0E-01 | 4.9E-01 | 7.6E-01 | 1.1E+00 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.7E-11 | 4.6E-10 | 4.5E-09 | 3.6E-08 | 2.4E-07 | 1.4E-06 | 6.8E-06 | 2.9E-05 | 1.1E-04 | 4.0E-04 | 1.3E-03 | 3.8E-03 | 1.0E-02 | 2.7E-02 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.7E-10 | 8.6E-09 | 2.4E-07 | 4.2E-06 | 5.1E-05 | 4.4E-04 | 3.0E-03 | 1.6E-02 | 7.3E-02 | 2.8E-01 | 9.4E-01 | 2.8E+00 | 7.4E+00 | 1.8E+01 | 4.1E+01 | 8.5E+01 | 1.7E+02 | 3.1E+02 | 5.3E+02 | 8.9E+02 | 1.4E+03 | 2.2E+03 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-10 | 5.5E-09 | 9.9E-08 | 1.3E-06 | 1.2E-05 | 8.9E-05 | 5.3E-04 | 2.6E-03 | 1.1E-02 | 3.9E-02 | 1.2E-01 | 3.5E-01 | 8.9E-01 | 2.1E+00 | 4.5E+00 | 8.9E+00 | 1.6E+01 | 2.9E+01 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.2E-11 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 1.7E+00 | 2.3E+00 | 3.2E+00 | 4.2E+00 | 5.4E+00 | 6.7E+00 | 8.2E+00 | 9.9E+00 | 1.2E+01 | 1.4E+01 | 1.5E+01 | 1.7E+01 | 1.9E+01 | 2.1E+01 | 2.2E+01 | 2.3E+01 | 2.4E+01 | 2.5E+01 | 2.6E+01 | 2.6E+01 | 2.6E+01 | 2.6E+01 | 2.6E+01 | 2.5E+01 | 2.5E+01 | 2.4E+01 | 2.3E+01 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 6.5E-02 | 1.5E-01 | 3.2E-01 | 6.7E-01 | 1.3E+00 | 2.5E+00 | 4.6E+00 | 8.2E+00 | 1.4E+01 | 2.3E+01 | 3.8E+01 | 6.0E+01 | 9.2E+01 | 1.4E+02 | 2.0E+02 | 3.0E+02 | 4.2E+02 | 5.9E+02 | 8.0E+02 | 1.1E+03 | 1.4E+03 | 1.9E+03 | 2.5E+03 | 3.2E+03 | 4.0E+03 | 5.0E+03 | 6.2E+03 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 3.2E+03 | 4.6E+03 | 6.4E+03 | 8.6E+03 | 1.1E+04 | 1.5E+04 | 1.8E+04 | 2.2E+04 | 2.7E+04 | 3.1E+04 | 3.6E+04 | 4.1E+04 | 4.6E+04 | 5.1E+04 | 5.6E+04 | 6.0E+04 | 6.4E+04 | 6.7E+04 | 6.9E+04 | 7.1E+04 | 7.3E+04 | 7.4E+04 | 7.4E+04 | 7.3E+04 | 7.2E+04 | 7.1E+04 | 6.9E+04 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 4.8E+01 | 7.5E+01 | 1.1E+02 | 1.6E+02 | 2.2E+02 | 3.0E+02 | 3.8E+02 | 4.8E+02 | 5.8E+02 | 6.8E+02 | 7.8E+02 | 8.8E+02 | 9.7E+02 | 1.0E+03 | 1.1E+03 | 1.1E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.1E+03 | 1.1E+03 | 1.0E+03 | 9.7E+02 | 9.0E+02 | 8.2E+02 | 7.5E+02 | 6.7E+02 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.5E-10 | 6.2E-10 | 2.4E-09 | 8.7E-09 | 2.9E-08 | 9.1E-08 | 2.7E-07 | 7.5E-07 | 2.0E-06 | 5.1E-06 | 1.2E-05 | 2.8E-05 | 6.3E-05 | 1.4E-04 | 2.8E-04 | 5.7E-04 | 1.1E-03 | 2.1E-03 | 3.9E-03 | 6.9E-03 | 1.2E-02 | 2.1E-02 | 3.5E-02 | 5.8E-02 | 9.3E-02 | 1.5E-01 | 2.3E-01 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 | 410 | 420 | 430 | 440 | 450 | 460 | 470 | 480 | 490 | 500 | 510 | 520 | 530 | 540 | 550 | 560 | 570 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 2.1E+01 | 1.8E+01 | 1.6E+01 | 1.3E+01 | 1.1E+01 | 9.3E+00 | 7.5E+00 | 6.0E+00 | 4.8E+00 | 3.7E+00 | 2.9E+00 | 2.2E+00 | 1.7E+00 | 1.3E+00 | 9.5E-01 | 7.0E-01 | 5.2E-01 | 3.8E-01 | 2.8E-01 | 2.0E-01 | 1.5E-01 | 1.1E-01 | 7.5E-02 | 5.4E-02 | 3.8E-02 | 2.7E-02 | 1.9E-02 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 9.2E+03 | 1.3E+04 | 1.8E+04 | 2.4E+04 | 3.2E+04 | 4.0E+04 | 5.0E+04 | 6.0E+04 | 7.1E+04 | 8.2E+04 | 9.3E+04 | 1.0E+05 | 1.1E+05 | 1.2E+05 | 1.3E+05 | 1.4E+05 | 1.4E+05 | 1.5E+05 | 1.5E+05 | 1.5E+05 | 1.5E+05 | 1.4E+05 | 1.4E+05 | 1.3E+05 | 1.3E+05 | 1.2E+05 | 1.1E+05 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 6.4E+04 | 5.8E+04 | 5.1E+04 | 4.5E+04 | 3.8E+04 | 3.2E+04 | 2.7E+04 | 2.2E+04 | 1.8E+04 | 1.4E+04 | 1.1E+04 | 8.7E+03 | 6.7E+03 | 5.2E+03 | 3.9E+03 | 3.0E+03 | 2.2E+03 | 1.7E+03 | 1.3E+03 | 9.3E+02 | 6.8E+02 | 5.0E+02 | 3.6E+02 | 2.6E+02 | 1.9E+02 | 1.4E+02 | 9.9E+01 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 5.3E+02 | 4.0E+02 | 2.9E+02 | 2.1E+02 | 1.4E+02 | 9.7E+01 | 6.4E+01 | 4.1E+01 | 2.6E+01 | 1.6E+01 | 9.8E+00 | 5.9E+00 | 3.5E+00 | 2.0E+00 | 1.2E+00 | 6.5E-01 | 3.6E-01 | 2.0E-01 | 1.1E-01 | 5.9E-02 | 3.2E-02 | 1.7E-02 | 8.9E-03 | 4.7E-03 | 2.4E-03 | 1.2E-03 | 6.4E-04 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 5.3E-01 | 1.2E+00 | 2.4E+00 | 4.7E+00 | 8.7E+00 | 1.6E+01 | 2.7E+01 | 4.5E+01 | 7.3E+01 | 1.1E+02 | 1.7E+02 | 2.6E+02 | 3.8E+02 | 5.4E+02 | 7.4E+02 | 1.0E+03 | 1.4E+03 | 1.8E+03 | 2.3E+03 | 3.0E+03 | 3.7E+03 | 4.6E+03 | 5.7E+03 | 6.9E+03 | 8.3E+03 | 9.8E+03 | 1.2E+04 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.1E-11 | 5.4E-11 | 2.5E-10 | 1.1E-09 | 4.6E-09 | 1.8E-08 | 6.4E-08 | 2.2E-07 | 7.2E-07 | 2.3E-06 | 6.7E-06 | 1.9E-05 | 5.3E-05 | 1.4E-04 | 3.6E-04 | 8.8E-04 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 580 | 590 | 600 | 610 | 620 | 630 | 640 | 650 | 660 | 670 | 680 | 690 | 700 | 720 | 740 | 760 | 780 | 800 | 825 | 850 | 875 | 900 | 925 | 950 | 975 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ac-227 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ag-108m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Al-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6E-11 | 6.8E-11 | 2.7E-10 | 1.0E-09 | 3.5E-09 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2E-11 | 4.0E-11 | 1.3E-10 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2E-11 | 6.1E-11 | 2.7E-10 | 1.1E-09 | 4.4E-09 | 1.6E-08 |
| Ba-133 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Be-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bi-207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.0E-11 | 1.1E-10 | 3.3E-10 | 9.4E-10 | 2.5E-09 | 5.9E-09 | 1.3E-08 | 2.7E-08 |
| Bi-210m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-11 | 1.2E-10 | 6.7E-10 | 3.4E-09 | 2.3E-08 | 1.4E-07 | 7.6E-07 | 3.7E-06 | 1.7E-05 | 7.0E-05 | 2.7E-04 | 9.7E-04 |
| Bk-247 | 1.3E-02 | 9.4E-03 | 6.6E-03 | 4.6E-03 | 3.2E-03 | 2.2E-03 | 1.5E-03 | 1.1E-03 | 7.3E-04 | 5.0E-04 | 3.4E-04 | 2.4E-04 | 1.6E-04 | 7.5E-05 | 3.5E-05 | 1.6E-05 | 7.3E-06 | 3.3E-06 | 1.2E-06 | 4.6E-07 | 1.7E-07 | 6.2E-08 | 2.3E-08 | 8.2E-09 | 3.0E-09 | 1.1E-09 |
| C-14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 1.1E+05 | 9.8E+04 | 9.0E+04 | 8.3E+04 | 7.6E+04 | 6.9E+04 | 6.2E+04 | 5.6E+04 | 5.0E+04 | 4.4E+04 | 3.9E+04 | 3.5E+04 | 3.0E+04 | 2.3E+04 | 1.8E+04 | 1.3E+04 | 9.7E+03 | 7.1E+03 | 4.7E+03 | 3.1E+03 | 2.0E+03 | 1.3E+03 | 8.2E+02 | 5.2E+02 | 3.3E+02 | 2.0E+02 |
| Cd-113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cd-113m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-251 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cf-252 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cl-36 | 7.1E+01 | 5.0E+01 | 3.6E+01 | 2.5E+01 | 1.8E+01 | 1.3E+01 | 8.9E+00 | 6.3E+00 | 4.4E+00 | 3.1E+00 | 2.1E+00 | 1.5E+00 | 1.0E+00 | 5.0E-01 | 2.4E-01 | 1.1E-01 | 5.4E-02 | 2.5E-02 | 9.8E-03 | 3.8E-03 | 1.4E-03 | 5.5E-04 | 2.1E-04 | 7.9E-05 | 3.0E-05 | 1.1E-05 |
| Cm-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-245 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-246 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cm-248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Co-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cs-137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-152 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eu-155 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fe-60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.8E-11 |
| Gd-148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H-3 | 3.3E-04 | 1.6E-04 | 8.3E-05 | 4.2E-05 | 2.1E-05 | 1.0E-05 | 5.1E-06 | 2.5E-06 | 1.2E-06 | 5.9E-07 | 2.9E-07 | 1.4E-07 | 6.7E-08 | 1.6E-08 | 3.5E-09 | 8.0E-10 | 1.8E-10 | 4.0E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hg-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ho-166m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.3E+04 | 1.5E+04 | 1.8E+04 | 2.0E+04 | 2.2E+04 | 2.5E+04 | 2.7E+04 | 3.0E+04 | 3.3E+04 | 3.5E+04 | 3.8E+04 | 4.0E+04 | 4.3E+04 | 4.7E+04 | 5.1E+04 | 5.4E+04 | 5.6E+04 | 5.7E+04 | 5.8E+04 | 5.6E+04 | 5.4E+04 | 5.1E+04 | 4.7E+04 | 4.2E+04 | 3.8E+04 | 3.3E+04 |
| Ks-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ks-26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mn-53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Na-22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-93m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nb-94 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ni-63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Np-237 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Os-194 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pa-231 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-202 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb-210 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | 2.1E-03 | 4.9E-03 | 1.1E-02 | 2.4E-02 | 5.1E-02 | 1.1E-01 | 2.1E-01 | 4.2E-01 | 8.2E-01 | 1.6E+00 | 2.9E+00 | 5.3E+00 | 9.5E+00 | 2.9E+01 | 8.3E+01 | 2.2E+02 | 5.7E+02 | 1.4E+03 | 3.9E+03 | 1.0E+04 | 2.6E+04 | 6.1E+04 | 1.4E+05 | 2.9E+05 | 6.0E+05 | 1.2E+06 |
| Pm-145 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pm-147 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Po-209 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pt-193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-11 | 5.2E-11 | 1.3E-10 | 3.0E-10 | 7.0E-10 | 1.6E-09 | 7.4E-09 | 3.2E-08 | 1.2E-07 | 4.3E-07 | 1.4E-06 | 5.6E-06 | 2.0E-05 | 6.5E-05 | 1.9E-04 | 5.3E-04 | 1.3E-03 | 3.2E-03 | 7.2E-03 |
| Pu-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-10 | 8.6E-09 | 2.1E-07 | 3.2E-06 | 3.5E-05 | 2.8E-04 | 1.7E-03 | 8.6E-03 | 3.6E-02 | 1.3E-01 | 4.1E-01 | 1.1E+00 | 2.9E+00 | 6.8E+00 | 1.5E+01 | 2.9E+01 | 5.5E+01 | 9.7E+01 | 1.7E+02 | 2.7E+02 | 4.2E+02 | 6.2E+02 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.3E-11 | 5.6E-10 | 6.0E-09 | 5.2E-08 | 3.8E-07 | 2.4E-06 | 1.3E-05 | 6.3E-05 | 2.7E-04 | 1.1E-03 | 3.8E-03 | 1.3E-02 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.7E-10 | 2.4E-09 | 2.7E-08 | 2.3E-07 | 1.7E-06 | 9.8E-06 | 5.0E-05 | 2.2E-04 | 8.4E-04 | 2.9E-03 | 9.0E-03 | 2.6E-02 | 6.7E-02 | 1.6E-01 | 3.7E-01 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5.1E-11 | 3.4E-10 | 1.9E-09 | 9.9E-09 | 4.6E-08 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Year to exceed GW Year to exceed GWPL reported to next lowest model output year. -1 indicates nuclide does not exceed GWPL in years modeled

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 9.1E+02 | 1.3E+03 | 1.7E+03 | 2.3E+03 | 3.0E+03 | 3.9E+03 | 4.8E+03 | 6.0E+03 | 7.2E+03 | 8.6E+03 | 1.0E+04 | 1.2E+04 | 1.3E+04 | 1.5E+04 | 1.7E+04 | 1.9E+04 | 2.1E+04 | 2.2E+04 | 2.4E+04 | 2.6E+04 | 2.8E+04 | 3.0E+04 | 3.1E+04 | 3.3E+04 | 3.4E+04 | 3.6E+04 | 3.7E+04 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 3.9E-02 | 1.1E-01 | 3.0E-01 | 7.5E-01 | 1.8E+00 | 4.1E+00 | 9.0E+00 | 1.9E+01 | 3.8E+01 | 7.4E+01 | 1.4E+02 | 2.5E+02 | 4.4E+02 | 7.6E+02 | 1.3E+03 | 2.1E+03 | 3.3E+03 | 5.2E+03 | 8.0E+03 | 1.2E+04 | 1.8E+04 | 2.6E+04 | 3.7E+04 | 5.1E+04 | 7.1E+04 | 9.7E+04 | 1.3E+05 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.5E-11 | 7.6E-11 | 3.5E-10 | 1.5E-09 | 6.4E-09 | 2.5E-08 | 9.2E-08 | 3.3E-07 | 1.1E-06 | 3.6E-06 | 1.1E-05 | 3.3E-05 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 8.0E-01 | 1.6E+00 | 3.1E+00 | 5.7E+00 | 1.0E+01 | 1.7E+01 | 2.7E+01 | 4.3E+01 | 6.6E+01 | 9.7E+01 | 1.4E+02 | 1.9E+02 | 2.7E+02 | 3.6E+02 | 4.7E+02 | 6.0E+02 | 7.5E+02 | 9.3E+02 | 1.1E+03 | 1.4E+03 | 1.6E+03 | 1.9E+03 | 2.1E+03 | 2.4E+03 | 2.7E+03 | 3.0E+03 | 3.3E+03 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.9E-07 | 7.6E-07 | 2.7E-06 | 9.0E-06 | 2.8E-05 | 8.2E-05 | 2.3E-04 | 6.0E-04 | 1.5E-03 | 3.6E-03 | 8.1E-03 | 1.8E-02 | 3.8E-02 | 7.7E-02 | 1.5E-01 | 2.9E-01 | 5.5E-01 | 1.0E+00 | 1.8E+00 | 3.1E+00 | 5.2E+00 | 8.5E+00 | 1.4E+01 | 2.2E+01 | 3.4E+01 | 5.3E+01 | 8.0E+01 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 | 410 | 420 | 430 | 440 | 450 | 460 | 470 | 480 | 490 | 500 | 510 | 520 | 530 | 540 | 550 | 560 | 570 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 4.0E+04 | 4.2E+04 | 4.3E+04 | 4.5E+04 | 4.6E+04 | 4.7E+04 | 4.8E+04 | 4.8E+04 | 4.9E+04 | 4.9E+04 | 4.9E+04 | 4.9E+04 | 4.9E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 2.3E+05 | 3.8E+05 | 6.2E+05 | 9.6E+05 | 1.4E+06 | 2.1E+06 | 3.0E+06 | 4.1E+06 | 5.5E+06 | 7.2E+06 | 9.2E+06 | 1.2E+07 | 1.4E+07 | 1.7E+07 | 2.1E+07 | 2.4E+07 | 2.8E+07 | 3.2E+07 | 3.6E+07 | 4.1E+07 | 4.5E+07 | 4.9E+07 | 5.2E+07 | 5.6E+07 | 5.9E+07 | 6.1E+07 | 6.3E+07 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 2.6E-04 | 1.8E-03 | 1.1E-02 | 6.2E-02 | 3.1E-01 | 1.4E+00 | 5.7E+00 | 2.2E+01 | 7.8E+01 | 2.6E+02 | 8.0E+02 | 2.4E+03 | 6.6E+03 | 1.7E+04 | 4.4E+04 | 1.1E+05 | 2.4E+05 | 5.4E+05 | 1.2E+06 | 2.4E+06 | 4.8E+06 | 9.4E+06 | 1.8E+07 | 3.3E+07 | 5.9E+07 | 1.0E+08 | 1.8E+08 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 3.9E+03 | 4.4E+03 | 4.7E+03 | 5.0E+03 | 5.1E+03 | 5.1E+03 | 4.9E+03 | 4.7E+03 | 4.4E+03 | 4.0E+03 | 3.5E+03 | 3.1E+03 | 2.7E+03 | 2.3E+03 | 1.9E+03 | 1.6E+03 | 1.3E+03 | 1.0E+03 | 8.1E+02 | 6.4E+02 | 5.0E+02 | 3.8E+02 | 2.9E+02 | 2.2E+02 | 1.7E+02 | 1.2E+02 | 9.2E+01 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.7E+02 | 3.6E+02 | 6.9E+02 | 1.3E+03 | 2.3E+03 | 4.0E+03 | 6.6E+03 | 1.1E+04 | 1.6E+04 | 2.5E+04 | 3.6E+04 | 5.2E+04 | 7.3E+04 | 1.0E+05 | 1.4E+05 | 1.8E+05 | 2.3E+05 | 3.0E+05 | 3.8E+05 | 4.7E+05 | 5.7E+05 | 7.0E+05 | 8.3E+05 | 9.9E+05 | 1.2E+06 | 1.3E+06 | 1.5E+06 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 38. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT THE WATER TABLE, VERTICAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YR INFILTRATION)*

| NUCLIDE: | 580 | 590 | 600 | 610 | 620 | 630 | 640 | 650 | 660 | 670 | 680 | 690 | 700 | 720 | 740 | 760 | 780 | 800 | 825 | 850 | 875 | 900 | 925 | 950 | 975 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pu-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-239 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-242 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pu-244 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 | 5.0E+04 |
| Ra-226 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ra-228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 6.5E+07 | 6.6E+07 | 6.7E+07 | 6.7E+07 | 6.7E+07 | 6.6E+07 | 6.5E+07 | 6.4E+07 | 6.2E+07 | 6.0E+07 | 5.7E+07 | 5.5E+07 | 5.2E+07 | 4.7E+07 | 4.1E+07 | 3.5E+07 | 3.0E+07 | 2.5E+07 | 2.0E+07 | 1.6E+07 | 1.2E+07 | 9.0E+06 | 6.7E+06 | 4.9E+06 | 3.6E+06 | 2.6E+06 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6E-11 | 4.7E-11 | 3.6E-10 | 2.4E-09 | 1.5E-08 | 8.1E-08 | 4.1E-07 | 2.8E-06 | 1.7E-05 | 9.2E-05 | 4.5E-04 | 2.0E-03 | 8.5E-03 | 3.3E-02 | 1.2E-01 |
| Si-32 | 3.0E+08 | 4.8E+08 | 7.8E+08 | 1.2E+09 | 1.9E+09 | 2.9E+09 | 4.4E+09 | 6.4E+09 | 9.4E+09 | 1.3E+10 | 1.9E+10 | 2.7E+10 | 3.7E+10 | 6.8E+10 | 1.2E+11 | 2.0E+11 | 3.3E+11 | 5.2E+11 | 8.8E+11 | 1.4E+12 | 2.2E+12 | 3.3E+12 | 4.8E+12 | 6.8E+12 | 9.2E+12 | 1.2E+13 |
| Sm-151 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-121m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sn-126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 6.7E+01 | 4.9E+01 | 3.6E+01 | 2.6E+01 | 1.8E+01 | 1.3E+01 | 9.3E+00 | 6.6E+00 | 4.6E+00 | 3.2E+00 | 2.3E+00 | 1.6E+00 | 1.1E+00 | 5.1E-01 | 2.4E-01 | 1.1E-01 | 5.0E-02 | 2.3E-02 | 8.3E-03 | 3.0E-03 | 1.1E-03 | 3.7E-04 | 1.3E-04 | 4.5E-05 | 1.5E-05 | 5.3E-06 |
| Tb-157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tb-158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.7E+06 | 2.0E+06 | 2.2E+06 | 2.4E+06 | 2.6E+06 | 2.9E+06 | 3.1E+06 | 3.3E+06 | 3.5E+06 | 3.7E+06 | 3.9E+06 | 4.1E+06 | 4.3E+06 | 4.5E+06 | 4.7E+06 | 4.8E+06 | 4.8E+06 | 4.7E+06 | 4.5E+06 | 4.2E+06 | 3.8E+06 | 3.5E+06 | 3.1E+06 | 2.7E+06 | 2.3E+06 | 1.9E+06 |
| Te-123 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-229 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Th-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ti-44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tl-204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tm-170 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-232 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-233 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-235 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-236 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| U-238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V-50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*TABLE 45. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | EXCEEDS | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9E-10 | 2.4E-09 | 1.6E-08 | 3.7E-08 | 8.3E-08 | 1.8E-07 | 3.7E-07 | 7.4E-07 | 1.4E-06 | 2.7E-06 | 5.0E-06 | 8.7E-06 | 1.5E-05 | 2.5E-05 | 4.2E-05 | 6.7E-05 | 1.0E-04 | 1.6E-04 | 2.5E-04 | 3.7E-04 | 5.3E-04 | 7.7E-04 |
| Ca-41 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.7E-11 | 1.6E-10 | 6.0E-10 | 2.1E-09 | 6.8E-09 | 2.1E-08 | 6.1E-08 | 1.7E-07 | 4.5E-07 | 1.2E-06 | 2.8E-06 | 6.5E-06 | 1.4E-05 | 2.8E-05 | 5.8E-05 | 1.3E-04 | 2.6E-04 |
| Cl-36 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5.9E-11 | 1.9E-09 | 3.1E-08 | 3.5E-07 | 3.1E-06 | 2.1E-05 | 5.1E-05 | 1.2E-04 | 2.6E-04 | 5.6E-04 | 1.1E-03 | 2.2E-03 | 4.3E-03 | 8.1E-03 | 1.5E-02 | 2.5E-02 | 4.4E-02 | 7.3E-02 | 1.2E-01 | 1.9E-01 | 3.0E-01 | 4.4E-01 | 6.3E-01 | 9.0E-01 | 1.3E+00 |
| H-3 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.4E-11 | 1.2E-10 | 4.0E-10 | 1.2E-09 | 3.2E-09 | 8.1E-09 | 2.1E-08 | 4.9E-08 |
| Si-32 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7.1E-11 | 1.3E-10 | 2.2E-10 | 3.5E-10 |
| Tc-99 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

NOTE: -1 indicates nuclide does not exceed GWPL within the 2,000 years modeled

*TABLE 45. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 300 | 305 | 310 | 315 | 320 | 325 | 330 | 335 | 340 | 345 | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 | 395 | 400 | 405 | 410 | 415 | 420 | 425 | 430 | 435 | 440 | 445 | 450 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 1.1E-03 | 1.5E-03 | 2.1E-03 | 2.8E-03 | 3.8E-03 | 5.0E-03 | 6.6E-03 | 8.7E-03 | 1.1E-02 | 1.5E-02 | 1.8E-02 | 2.3E-02 | 2.8E-02 | 3.5E-02 | 4.2E-02 | 4.9E-02 | 5.8E-02 | 6.8E-02 | 7.9E-02 | 9.1E-02 | 1.1E-01 | 1.2E-01 | 1.4E-01 | 1.5E-01 | 1.7E-01 | 1.9E-01 | 2.1E-01 | 2.3E-01 | 2.5E-01 | 2.8E-01 | 3.0E-01 |
| Ca-41 | 5.5E-04 | 1.1E-03 | 2.2E-03 | 4.2E-03 | 7.7E-03 | 1.4E-02 | 2.5E-02 | 4.7E-02 | 8.3E-02 | 1.4E-01 | 2.4E-01 | 4.0E-01 | 6.4E-01 | 9.9E-01 | 1.5E+00 | 2.3E+00 | 3.4E+00 | 5.0E+00 | 7.5E+00 | 1.1E+01 | 1.5E+01 | 2.1E+01 | 3.0E+01 | 4.1E+01 | 5.7E+01 | 7.7E+01 | 1.0E+02 | 1.4E+02 | 1.8E+02 | 2.4E+02 | 3.1E+02 |
| Cl-36 | 1.8E+00 | 2.6E+00 | 3.5E+00 | 4.7E+00 | 6.4E+00 | 8.8E+00 | 1.2E+01 | 1.7E+01 | 2.3E+01 | 3.1E+01 | 4.0E+01 | 5.1E+01 | 6.5E+01 | 8.1E+01 | 9.8E+01 | 1.2E+02 | 1.4E+02 | 1.7E+02 | 2.0E+02 | 2.4E+02 | 2.8E+02 | 3.2E+02 | 3.7E+02 | 4.2E+02 | 4.8E+02 | 5.4E+02 | 6.1E+02 | 6.9E+02 | 7.6E+02 | 8.3E+02 | 9.2E+02 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.3E-11 | 8.9E-11 | 2.0E-10 | 4.6E-10 | 9.9E-10 | 2.0E-09 | 3.9E-09 | 7.6E-09 | 1.5E-08 | 2.7E-08 | 5.0E-08 | 9.0E-08 | 1.6E-07 | 2.8E-07 | 4.9E-07 | 8.4E-07 | 1.4E-06 | 2.3E-06 | 3.8E-06 | 6.1E-06 | 9.9E-06 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 1.2E-07 | 2.7E-07 | 5.9E-07 | 1.3E-06 | 2.7E-06 | 5.5E-06 | 1.2E-05 | 2.5E-05 | 5.1E-05 | 1.0E-04 | 2.0E-04 | 3.6E-04 | 6.5E-04 | 1.1E-03 | 1.9E-03 | 3.3E-03 | 5.4E-03 | 8.7E-03 | 1.4E-02 | 2.2E-02 | 3.5E-02 | 5.4E-02 | 8.1E-02 | 1.2E-01 | 1.8E-01 | 2.7E-01 | 4.0E-01 | 5.7E-01 | 8.4E-01 | 1.2E+00 | 1.7E+00 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 5.6E-10 | 8.9E-10 | 1.4E-09 | 2.2E-09 | 3.3E-09 | 4.9E-09 | 7.1E-09 | 1.0E-08 | 1.5E-08 | 2.0E-08 | 2.7E-08 | 3.6E-08 | 4.5E-08 | 5.8E-08 | 7.2E-08 | 8.7E-08 | 1.1E-07 | 1.2E-07 | 1.4E-07 | 1.7E-07 | 1.9E-07 | 2.2E-07 | 2.4E-07 | 2.7E-07 | 3.0E-07 | 3.2E-07 | 3.5E-07 | 3.7E-07 | 4.0E-07 | 4.2E-07 | 4.4E-07 |
| Tc-99 | 0 | 0 | 0 | 2.2E-11 | 1.1E-10 | 3.3E-10 | 9.0E-10 | 2.4E-09 | 6.1E-09 | 1.5E-08 | 3.4E-08 | 7.4E-08 | 1.5E-07 | 3.1E-07 | 6.2E-07 | 1.2E-06 | 2.3E-06 | 4.1E-06 | 7.7E-06 | 1.4E-05 | 2.4E-05 | 4.3E-05 | 7.3E-05 | 1.2E-04 | 2.1E-04 | 3.4E-04 | 5.6E-04 | 9.1E-04 | 1.5E-03 | 2.3E-03 | 3.6E-03 |

*TABLE 45. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 455 | 460 | 465 | 470 | 475 | 480 | 485 | 490 | 495 | 500 | 505 | 510 | 515 | 520 | 525 | 530 | 535 | 540 | 545 | 550 | 555 | 560 | 565 | 570 | 575 | 580 | 585 | 590 | 595 | 600 | 605 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 3.3E-01 | 3.5E-01 | 3.8E-01 | 4.0E-01 | 4.2E-01 | 4.5E-01 | 4.7E-01 | 5.0E-01 | 5.2E-01 | 5.4E-01 | 5.6E-01 | 5.8E-01 | 6.0E-01 | 6.2E-01 | 6.3E-01 | 6.5E-01 | 6.6E-01 | 6.7E-01 | 6.8E-01 | 6.9E-01 | 6.9E-01 | 7.0E-01 | 7.0E-01 | 7.0E-01 | 7.0E-01 | 6.9E-01 | 6.9E-01 | 6.8E-01 | 6.8E-01 | 6.7E-01 | 6.6E-01 |
| Ca-41 | 4.1E+02 | 5.2E+02 | 6.8E+02 | 8.5E+02 | 1.1E+03 | 1.4E+03 | 1.7E+03 | 2.1E+03 | 2.6E+03 | 3.2E+03 | 3.9E+03 | 4.7E+03 | 5.7E+03 | 6.9E+03 | 8.3E+03 | 9.9E+03 | 1.2E+04 | 1.4E+04 | 1.7E+04 | 1.9E+04 | 2.3E+04 | 2.6E+04 | 3.1E+04 | 3.5E+04 | 4.1E+04 | 4.7E+04 | 5.4E+04 | 6.2E+04 | 7.0E+04 | 7.9E+04 | 9.1E+04 |
| Cl-36 | 1.0E+03 | 1.1E+03 | 1.2E+03 | 1.3E+03 | 1.4E+03 | 1.5E+03 | 1.6E+03 | 1.6E+03 | 1.7E+03 | 1.8E+03 | 1.9E+03 | 2.0E+03 | 2.1E+03 | 2.2E+03 | 2.3E+03 | 2.3E+03 | 2.4E+03 | 2.5E+03 | 2.5E+03 | 2.6E+03 | 2.7E+03 | 2.7E+03 | 2.7E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.6E-05 | 2.5E-05 | 3.9E-05 | 6.0E-05 | 9.1E-05 | 1.4E-04 | 2.1E-04 | 3.0E-04 | 4.5E-04 | 6.5E-04 | 9.5E-04 | 1.4E-03 | 1.9E-03 | 2.7E-03 | 3.8E-03 | 5.3E-03 | 7.4E-03 | 1.0E-02 | 1.4E-02 | 1.9E-02 | 2.5E-02 | 3.4E-02 | 4.5E-02 | 6.0E-02 | 7.9E-02 | 1.0E-01 | 1.4E-01 | 1.8E-01 | 2.3E-01 | 2.9E-01 | 3.8E-01 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 2.3E+00 | 3.2E+00 | 4.5E+00 | 6.1E+00 | 8.3E+00 | 1.1E+01 | 1.5E+01 | 2.0E+01 | 2.6E+01 | 3.4E+01 | 4.4E+01 | 5.8E+01 | 7.4E+01 | 9.4E+01 | 1.2E+02 | 1.5E+02 | 1.8E+02 | 2.1E+02 | 2.6E+02 | 3.1E+02 | 3.7E+02 | 4.6E+02 | 5.6E+02 | 7.0E+02 | 8.6E+02 | 1.0E+03 | 1.3E+03 | 1.6E+03 | 1.9E+03 | 2.3E+03 | 2.7E+03 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.8E-11 | 8.1E-11 | 1.6E-10 | 3.1E-10 | 5.4E-10 |
| Sr-90 | 4.6E-07 | 4.8E-07 | 4.9E-07 | 5.0E-07 | 5.1E-07 | 5.1E-07 | 5.1E-07 | 5.1E-07 | 5.1E-07 | 5.0E-07 | 4.9E-07 | 4.8E-07 | 4.6E-07 | 4.5E-07 | 4.3E-07 | 4.1E-07 | 3.9E-07 | 3.7E-07 | 3.5E-07 | 3.3E-07 | 3.1E-07 | 2.9E-07 | 2.7E-07 | 2.5E-07 | 2.3E-07 | 2.2E-07 | 2.0E-07 | 1.8E-07 | 1.7E-07 | 1.5E-07 | 1.4E-07 |
| Tc-99 | 5.5E-03 | 8.4E-03 | 1.3E-02 | 1.9E-02 | 2.8E-02 | 4.1E-02 | 6.0E-02 | 8.8E-02 | 1.3E-01 | 1.8E-01 | 2.5E-01 | 3.6E-01 | 5.0E-01 | 6.9E-01 | 9.4E-01 | 1.3E+00 | 1.7E+00 | 2.3E+00 | 3.2E+00 | 4.2E+00 | 5.6E+00 | 7.3E+00 | 9.6E+00 | 1.2E+01 | 1.6E+01 | 2.1E+01 | 2.7E+01 | 3.4E+01 | 4.3E+01 | 5.5E+01 | 6.9E+01 |

*TABLE 45. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 610 | 615 | 620 | 625 | 630 | 635 | 640 | 645 | 650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720 | 725 | 730 | 735 | 740 | 745 | 750 | 755 | 760 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 6.5E-01 | 6.4E-01 | 6.2E-01 | 6.1E-01 | 6.0E-01 | 5.8E-01 | 5.7E-01 | 5.5E-01 | 5.3E-01 | 5.2E-01 | 5.0E-01 | 4.9E-01 | 4.7E-01 | 4.5E-01 | 4.3E-01 | 4.2E-01 | 4.0E-01 | 3.8E-01 | 3.7E-01 | 3.5E-01 | 3.3E-01 | 3.2E-01 | 3.0E-01 | 2.9E-01 | 2.7E-01 | 2.6E-01 | 2.5E-01 | 2.3E-01 | 2.2E-01 | 2.1E-01 | 2.0E-01 |
| Ca-41 | 1.0E+05 | 1.1E+05 | 1.3E+05 | 1.4E+05 | 1.6E+05 | 1.8E+05 | 2.0E+05 | 2.2E+05 | 2.4E+05 | 2.6E+05 | 2.9E+05 | 3.1E+05 | 3.4E+05 | 3.7E+05 | 4.0E+05 | 4.4E+05 | 4.8E+05 | 5.2E+05 | 5.6E+05 | 6.0E+05 | 6.5E+05 | 7.0E+05 | 7.5E+05 | 8.0E+05 | 8.4E+05 | 9.0E+05 | 9.8E+05 | 1.0E+06 | 1.1E+06 | 1.2E+06 | 1.3E+06 |
| Cl-36 | 2.8E+03 | 2.8E+03 | 2.7E+03 | 2.7E+03 | 2.6E+03 | 2.6E+03 | 2.6E+03 | 2.5E+03 | 2.5E+03 | 2.4E+03 | 2.4E+03 | 2.3E+03 | 2.2E+03 | 2.2E+03 | 2.1E+03 | 2.0E+03 | 2.0E+03 | 1.9E+03 | 1.9E+03 | 1.8E+03 | 1.7E+03 | 1.6E+03 | 1.6E+03 | 1.5E+03 | 1.5E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 | 1.2E+03 | 1.2E+03 | 1.1E+03 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 4.8E-01 | 6.0E-01 | 7.5E-01 | 9.7E-01 | 1.2E+00 | 1.5E+00 | 1.9E+00 | 2.3E+00 | 2.8E+00 | 3.5E+00 | 4.2E+00 | 5.2E+00 | 6.2E+00 | 7.5E+00 | 9.2E+00 | 1.1E+01 | 1.3E+01 | 1.6E+01 | 1.9E+01 | 2.2E+01 | 2.6E+01 | 3.1E+01 | 3.6E+01 | 4.3E+01 | 5.0E+01 | 5.8E+01 | 6.8E+01 | 8.0E+01 | 9.5E+01 | 1.1E+02 | 1.3E+02 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 3.3E+03 | 3.9E+03 | 4.6E+03 | 5.4E+03 | 6.3E+03 | 7.3E+03 | 8.5E+03 | 9.9E+03 | 1.1E+04 | 1.3E+04 | 1.5E+04 | 1.7E+04 | 1.9E+04 | 2.2E+04 | 2.5E+04 | 2.8E+04 | 3.2E+04 | 3.6E+04 | 4.0E+04 | 4.5E+04 | 5.0E+04 | 5.6E+04 | 6.2E+04 | 6.9E+04 | 7.6E+04 | 8.4E+04 | 9.3E+04 | 1.0E+05 | 1.1E+05 | 1.3E+05 | 1.4E+05 |
| Si-32 | 9.5E-10 | 1.6E-09 | 2.8E-09 | 4.8E-09 | 7.9E-09 | 1.3E-08 | 2.2E-08 | 3.5E-08 | 5.7E-08 | 9.2E-08 | 1.5E-07 | 2.3E-07 | 3.6E-07 | 5.6E-07 | 8.8E-07 | 1.4E-06 | 2.1E-06 | 3.1E-06 | 4.7E-06 | 7.0E-06 | 1.0E-05 | 1.5E-05 | 2.3E-05 | 3.3E-05 | 4.8E-05 | 6.9E-05 | 1.0E-04 | 1.4E-04 | 2.0E-04 | 2.9E-04 | 4.2E-04 |
| Sr-90 | 1.2E-07 | 1.1E-07 | 1.0E-07 | 9.0E-08 | 8.1E-08 | 7.2E-08 | 6.4E-08 | 5.7E-08 | 5.1E-08 | 4.5E-08 | 3.9E-08 | 3.5E-08 | 3.1E-08 | 2.7E-08 | 2.3E-08 | 2.0E-08 | 1.8E-08 | 1.5E-08 | 1.3E-08 | 1.2E-08 | 1.0E-08 | 8.7E-09 | 7.5E-09 | 6.4E-09 | 5.5E-09 | 4.7E-09 | 4.1E-09 | 3.4E-09 | 2.9E-09 | 2.5E-09 | 2.1E-09 |
| Tc-99 | 8.7E+01 | 1.1E+02 | 1.3E+02 | 1.7E+02 | 2.0E+02 | 2.5E+02 | 3.0E+02 | 3.7E+02 | 4.5E+02 | 5.4E+02 | 6.5E+02 | 7.8E+02 | 9.4E+02 | 1.1E+03 | 1.3E+03 | 1.6E+03 | 1.9E+03 | 2.2E+03 | 2.6E+03 | 3.0E+03 | 3.5E+03 | 4.1E+03 | 4.8E+03 | 5.5E+03 | 6.4E+03 | 7.4E+03 | 8.7E+03 | 1.0E+04 | 1.2E+04 | 1.3E+04 | 1.6E+04 |

*TABLE 45. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 765 | 770 | 775 | 780 | 785 | 790 | 795 | 800 | 805 | 810 | 815 | 820 | 825 | 830 | 835 | 840 | 845 | 850 | 855 | 860 | 865 | 870 | 875 | 880 | 885 | 890 | 895 | 900 | 905 | 910 | 915 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 1.9E-01 | 1.8E-01 | 1.7E-01 | 1.6E-01 | 1.5E-01 | 1.4E-01 | 1.3E-01 | 1.2E-01 | 1.1E-01 | 1.1E-01 | 9.9E-02 | 9.2E-02 | 8.6E-02 | 7.9E-02 | 7.4E-02 | 6.9E-02 | 6.4E-02 | 6.0E-02 | 5.6E-02 | 5.2E-02 | 4.8E-02 | 4.4E-02 | 4.1E-02 | 3.8E-02 | 3.5E-02 | 3.2E-02 | 3.0E-02 | 2.8E-02 | 2.6E-02 | 2.3E-02 | 2.2E-02 |
| Ca-41 | 1.3E+06 | 1.4E+06 | 1.5E+06 | 1.6E+06 | 1.7E+06 | 1.7E+06 | 1.8E+06 | 1.9E+06 | 2.0E+06 | 2.0E+06 | 2.1E+06 | 2.2E+06 | 2.3E+06 | 2.4E+06 | 2.4E+06 | 2.5E+06 | 2.6E+06 | 2.7E+06 | 2.7E+06 | 2.8E+06 | 2.9E+06 | 3.0E+06 | 3.0E+06 | 3.1E+06 | 3.2E+06 | 3.2E+06 | 3.3E+06 | 3.3E+06 | 3.4E+06 | 3.4E+06 | 3.4E+06 |
| Cl-36 | 1.1E+03 | 1.0E+03 | 9.8E+02 | 9.3E+02 | 8.8E+02 | 8.4E+02 | 7.8E+02 | 7.4E+02 | 7.0E+02 | 6.6E+02 | 6.2E+02 | 5.8E+02 | 5.4E+02 | 5.1E+02 | 4.8E+02 | 4.5E+02 | 4.2E+02 | 3.9E+02 | 3.7E+02 | 3.4E+02 | 3.2E+02 | 3.0E+02 | 2.8E+02 | 2.6E+02 | 2.4E+02 | 2.3E+02 | 2.1E+02 | 1.9E+02 | 1.8E+02 | 1.7E+02 | 1.6E+02 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.5E+02 | 1.8E+02 | 2.0E+02 | 2.3E+02 | 2.7E+02 | 3.1E+02 | 3.5E+02 | 4.0E+02 | 4.5E+02 | 5.1E+02 | 5.8E+02 | 6.5E+02 | 7.2E+02 | 8.1E+02 | 9.0E+02 | 1.0E+03 | 1.1E+03 | 1.2E+03 | 1.4E+03 | 1.5E+03 | 1.7E+03 | 1.9E+03 | 2.1E+03 | 2.3E+03 | 2.5E+03 | 2.8E+03 | 3.1E+03 | 3.4E+03 | 3.7E+03 | 4.0E+03 | 4.4E+03 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 1.6E+05 | 1.7E+05 | 1.9E+05 | 2.1E+05 | 2.2E+05 | 2.4E+05 | 2.6E+05 | 2.8E+05 | 3.0E+05 | 3.3E+05 | 3.5E+05 | 3.7E+05 | 4.0E+05 | 4.3E+05 | 4.5E+05 | 4.9E+05 | 5.2E+05 | 5.5E+05 | 6.0E+05 | 6.2E+05 | 6.8E+05 | 7.1E+05 | 7.5E+05 | 7.9E+05 | 8.3E+05 | 8.8E+05 | 9.2E+05 | 9.7E+05 | 1.0E+06 | 1.1E+06 | 1.1E+06 |
| Si-32 | 6.2E-04 | 8.8E-04 | 1.3E-03 | 1.8E-03 | 2.6E-03 | 3.7E-03 | 5.2E-03 | 7.1E-03 | 9.6E-03 | 1.3E-02 | 1.7E-02 | 2.3E-02 | 3.1E-02 | 4.0E-02 | 5.4E-02 | 6.9E-02 | 9.0E-02 | 1.2E-01 | 1.5E-01 | 1.9E-01 | 2.5E-01 | 3.2E-01 | 4.1E-01 | 5.2E-01 | 6.8E-01 | 8.6E-01 | 1.1E+00 | 1.4E+00 | 1.7E+00 | 2.1E+00 | 2.6E+00 |
| Sr-90 | 1.8E-09 | 1.5E-09 | 1.3E-09 | 1.1E-09 | 9.0E-10 | 7.5E-10 | 6.2E-10 | 5.1E-10 | 4.2E-10 | 3.5E-10 | 2.7E-10 | 2.2E-10 | 1.6E-10 | 1.1E-10 | 3.0E-11 | 2.6E-11 | 1.1E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.8E+04 | 2.1E+04 | 2.4E+04 | 2.7E+04 | 3.1E+04 | 3.5E+04 | 3.9E+04 | 4.4E+04 | 4.8E+04 | 5.5E+04 | 6.1E+04 | 6.7E+04 | 7.4E+04 | 8.3E+04 | 9.2E+04 | 1.0E+05 | 1.1E+05 | 1.2E+05 | 1.4E+05 | 1.5E+05 | 1.7E+05 | 1.8E+05 | 2.0E+05 | 2.2E+05 | 2.4E+05 | 2.6E+05 | 2.8E+05 | 3.1E+05 | 3.3E+05 | 3.6E+05 | 3.8E+05 |

*TABLE 45. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 920 | 925 | 930 | 935 | 940 | 945 | 950 | 955 | 960 | 965 | 970 | 975 | 980 | 985 | 990 | 995 | 1000 | 1010 | 1020 | 1030 | 1040 | 1050 | 1060 | 1070 | 1080 | 1100 | 1300 | 1500 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 2.0E-02 | 1.8E-02 | 1.7E-02 | 1.5E-02 | 1.4E-02 | 1.3E-02 | 1.2E-02 | 1.1E-02 | 1.0E-02 | 9.2E-03 | 8.4E-03 | 7.7E-03 | 7.0E-03 | 6.4E-03 | 5.9E-03 | 5.4E-03 | 4.9E-03 | 4.1E-03 | 3.4E-03 | 2.9E-03 | 2.3E-03 | 1.9E-03 | 1.6E-03 | 1.3E-03 | 9.9E-04 | 6.2E-04 | 3.3E-06 | 1.7E-08 | 0 |
| Ca-41 | 3.5E+06 | 3.5E+06 | 3.6E+06 | 3.6E+06 | 3.6E+06 | 3.6E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.6E+06 | 3.6E+06 | 3.4E+06 | 3.2E+06 | 2.9E+06 | 2.7E+06 | 2.0E+06 | 4.5E+04 | 7.1E+02 | 2.6E-02 |
| Cl-36 | 1.4E+02 | 1.4E+02 | 1.2E+02 | 1.2E+02 | 1.1E+02 | 9.9E+01 | 9.2E+01 | 8.5E+01 | 7.8E+01 | 7.2E+01 | 6.7E+01 | 6.2E+01 | 5.7E+01 | 5.2E+01 | 4.8E+01 | 4.5E+01 | 4.1E+01 | 3.5E+01 | 2.9E+01 | 2.5E+01 | 2.1E+01 | 1.7E+01 | 1.4E+01 | 1.2E+01 | 9.3E+00 | 5.8E+00 | 3.6E-02 | 2.1E-04 | 6.3E-10 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 4.7E+03 | 5.2E+03 | 5.7E+03 | 6.1E+03 | 6.6E+03 | 7.1E+03 | 7.6E+03 | 8.2E+03 | 8.7E+03 | 9.5E+03 | 1.0E+04 | 1.1E+04 | 1.2E+04 | 1.3E+04 | 1.3E+04 | 1.4E+04 | 1.5E+04 | 1.7E+04 | 2.0E+04 | 2.2E+04 | 2.5E+04 | 2.7E+04 | 2.9E+04 | 3.1E+04 | 3.1E+04 | 2.9E+04 | 2.3E+03 | 1.0E+02 | 3.6E-02 |
| Pd-107 | 0 | 0 | 0 | 0 | 1.0E-11 | 2.6E-11 | 3.7E-11 | 5.2E-11 | 8.2E-11 | 1.1E-10 | 1.4E-10 | 1.9E-10 | 2.5E-10 | 3.3E-10 | 4.7E-10 | 6.5E-10 | 9.1E-10 | 1.8E-09 | 3.6E-09 | 7.0E-09 | 1.3E-08 | 2.5E-08 | 4.4E-08 | 7.8E-08 | 1.3E-07 | 3.0E-07 | 2.4E-06 | 1.1E-06 | 5.2E-08 |
| Re-187 | 1.2E+06 | 1.2E+06 | 1.2E+06 | 1.3E+06 | 1.3E+06 | 1.4E+06 | 1.4E+06 | 1.5E+06 | 1.6E+06 | 1.6E+06 | 1.7E+06 | 1.7E+06 | 1.8E+06 | 1.8E+06 | 1.9E+06 | 1.9E+06 | 2.0E+06 | 2.1E+06 | 2.2E+06 | 2.3E+06 | 2.4E+06 | 2.4E+06 | 2.4E+06 | 2.3E+06 | 2.2E+06 | 1.8E+06 | 6.7E+04 | 1.6E+03 | 1.5E-01 |
| Si-32 | 3.3E+00 | 4.1E+00 | 5.0E+00 | 6.1E+00 | 7.4E+00 | 8.9E+00 | 1.1E+01 | 1.3E+01 | 1.6E+01 | 1.9E+01 | 2.3E+01 | 2.7E+01 | 3.3E+01 | 3.9E+01 | 4.6E+01 | 5.5E+01 | 6.5E+01 | 9.2E+01 | 1.3E+02 | 1.7E+02 | 2.3E+02 | 3.1E+02 | 4.1E+02 | 5.4E+02 | 6.6E+02 | 9.3E+02 | 5.0E+02 | 4.8E+01 | 7.1E-02 |
| Sr-90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 4.2E+05 | 4.5E+05 | 4.9E+05 | 5.1E+05 | 5.6E+05 | 6.0E+05 | 6.4E+05 | 6.8E+05 | 7.3E+05 | 7.8E+05 | 8.2E+05 | 8.8E+05 | 9.4E+05 | 9.9E+05 | 1.1E+06 | 1.1E+06 | 1.2E+06 | 1.3E+06 | 1.5E+06 | 1.6E+06 | 1.8E+06 | 2.0E+06 | 2.1E+06 | 2.1E+06 | 2.1E+06 | 1.9E+06 | 1.3E+05 | 5.1E+03 | 1.4E+00 |

*TABLE 46. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | EXCEEDS | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7.2E-11 | 4.1E-09 | 9.9E-08 | 1.4E-06 | 1.2E-05 | 7.5E-05 | 3.4E-04 | 1.2E-03 | 3.8E-03 | 9.6E-03 | 2.1E-02 | 4.3E-02 | 5.7E-02 | 7.5E-02 | 9.6E-02 | 1.2E-01 | 1.5E-01 | 1.8E-01 | 2.1E-01 | 2.4E-01 | 2.8E-01 | 3.1E-01 | 3.5E-01 | 3.8E-01 | 4.1E-01 | 4.4E-01 | 4.6E-01 | 4.8E-01 |
| Ca-41 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.0E-10 | 3.6E-09 | 7.1E-08 | 9.9E-07 | 9.9E-06 | 7.5E-05 | 4.5E-04 | 2.2E-03 | 4.7E-03 | 9.3E-03 | 1.8E-02 | 3.4E-02 | 6.1E-02 | 1.1E-01 | 1.8E-01 | 3.0E-01 | 4.9E-01 | 7.7E-01 | 1.2E+00 | 1.8E+00 | 2.7E+00 | 3.9E+00 | 5.5E+00 | 7.7E+00 |
| Cl-36 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5.3E-10 | 8.5E-08 | 4.8E-06 | 1.3E-04 | 1.9E-03 | 1.8E-02 | 1.2E-01 | 6.0E-01 | 2.3E+00 | 7.2E+00 | 1.9E+01 | 4.5E+01 | 9.1E+01 | 1.3E+02 | 1.7E+02 | 2.2E+02 | 2.8E+02 | 3.5E+02 | 4.4E+02 | 5.2E+02 | 6.2E+02 | 7.2E+02 | 8.4E+02 | 9.4E+02 | 1.1E+03 | 1.2E+03 | 1.3E+03 | 1.4E+03 | 1.4E+03 |
| H-3 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.7E-10 | 5.3E-09 | 4.4E-08 | 2.3E-07 | 8.9E-07 | 2.5E-06 | 5.3E-06 | 9.2E-06 | 1.3E-05 | 1.5E-05 | 1.6E-05 | 1.7E-05 | 1.7E-05 | 1.7E-05 | 1.7E-05 | 1.6E-05 | 1.4E-05 | 1.3E-05 | 1.1E-05 | 9.6E-06 | 8.1E-06 | 6.7E-06 | 5.5E-06 | 4.4E-06 | 3.5E-06 |
| I-129 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.2E-11 | 2.0E-10 | 6.0E-10 | 1.7E-09 | 4.6E-09 | 1.2E-08 | 2.9E-08 | 6.9E-08 | 1.6E-07 | 3.5E-07 | 7.6E-07 | 1.6E-06 | 3.2E-06 | 6.2E-06 | 1.2E-05 |
| Pd-107 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7.1E-11 | 3.6E-09 | 9.1E-08 | 1.6E-06 | 2.0E-05 | 1.9E-04 | 1.4E-03 | 3.6E-03 | 8.5E-03 | 2.0E-02 | 4.4E-02 | 9.4E-02 | 1.9E-01 | 3.8E-01 | 7.3E-01 | 1.4E+00 | 2.4E+00 | 4.3E+00 | 7.4E+00 | 1.2E+01 | 2.0E+01 | 3.3E+01 | 5.2E+01 |
| Se-79 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-10 | 4.3E-09 | 5.4E-08 | 3.1E-07 | 2.8E-06 | 1.5E-05 | 5.7E-05 | 1.8E-04 | 3.0E-04 | 4.7E-04 | 7.3E-04 | 1.1E-03 | 1.5E-03 | 2.2E-03 | 2.9E-03 | 3.9E-03 | 4.9E-03 | 6.2E-03 | 7.7E-03 | 9.3E-03 | 1.1E-02 | 1.3E-02 | 1.4E-02 | 1.6E-02 |
| Tc-99 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.3E-11 | 5.5E-10 | 7.3E-09 | 2.4E-08 | 7.5E-08 | 2.2E-07 | 6.1E-07 | 1.6E-06 | 4.1E-06 | 1.0E-05 | 2.3E-05 | 5.3E-05 | 1.1E-04 | 2.4E-04 | 4.9E-04 | 9.6E-04 | 1.9E-03 | 3.5E-03 | 6.4E-03 |

*TABLE 46. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 | 325 | 330 | 335 | 340 | 345 | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 | 395 | 400 | 405 | 410 | 415 | 420 | 425 | 430 | 435 | 440 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 5.0E-01 | 5.1E-01 | 5.2E-01 | 5.3E-01 | 5.3E-01 | 5.3E-01 | 5.4E-01 | 5.4E-01 | 5.3E-01 | 5.0E-01 | 4.7E-01 | 4.5E-01 | 4.1E-01 | 3.8E-01 | 3.5E-01 | 3.3E-01 | 3.0E-01 | 2.8E-01 | 2.5E-01 | 2.3E-01 | 2.1E-01 | 1.9E-01 | 1.7E-01 | 1.6E-01 | 1.4E-01 | 1.3E-01 | 1.1E-01 | 1.0E-01 | 9.1E-02 | 8.0E-02 | 7.0E-02 | 6.2E-02 |
| Ca-41 | 1.1E+01 | 1.5E+01 | 2.0E+01 | 2.6E+01 | 3.4E+01 | 4.5E+01 | 6.0E+01 | 8.2E+01 | 1.0E+02 | 1.3E+02 | 1.6E+02 | 1.9E+02 | 2.3E+02 | 2.7E+02 | 3.1E+02 | 3.7E+02 | 4.3E+02 | 5.0E+02 | 5.6E+02 | 6.5E+02 | 7.4E+02 | 8.3E+02 | 9.3E+02 | 1.0E+03 | 1.2E+03 | 1.3E+03 | 1.4E+03 | 1.5E+03 | 1.6E+03 | 1.8E+03 | 1.9E+03 | 2.0E+03 |
| Cl-36 | 1.5E+03 | 1.6E+03 | 1.6E+03 | 1.7E+03 | 1.7E+03 | 1.7E+03 | 1.8E+03 | 1.8E+03 | 1.8E+03 | 1.7E+03 | 1.7E+03 | 1.6E+03 | 1.5E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 | 1.2E+03 | 1.1E+03 | 1.0E+03 | 9.5E+02 | 8.8E+02 | 8.2E+02 | 7.4E+02 | 6.8E+02 | 6.2E+02 | 5.6E+02 | 5.0E+02 | 4.5E+02 | 4.2E+02 | 3.7E+02 | 3.3E+02 | 2.9E+02 |
| H-3 | 2.7E-06 | 2.1E-06 | 1.6E-06 | 1.2E-06 | 8.7E-07 | 6.3E-07 | 4.6E-07 | 3.4E-07 | 2.4E-07 | 1.7E-07 | 1.2E-07 | 7.9E-08 | 5.3E-08 | 3.6E-08 | 2.4E-08 | 1.6E-08 | 1.0E-08 | 6.7E-09 | 4.3E-09 | 2.7E-09 | 1.7E-09 | 1.1E-09 | 6.7E-10 | 4.2E-10 | 2.6E-10 | 1.5E-10 | 7.5E-11 | 2.1E-11 | 0 | 0 | 0 | 0 |
| I-129 | 2.2E-05 | 4.0E-05 | 7.1E-05 | 1.2E-04 | 2.1E-04 | 3.5E-04 | 5.9E-04 | 1.1E-03 | 1.8E-03 | 3.0E-03 | 4.6E-03 | 7.0E-03 | 1.0E-02 | 1.5E-02 | 2.2E-02 | 3.1E-02 | 4.3E-02 | 6.0E-02 | 8.3E-02 | 1.1E-01 | 1.5E-01 | 2.0E-01 | 2.7E-01 | 3.5E-01 | 4.5E-01 | 5.9E-01 | 7.5E-01 | 9.7E-01 | 1.2E+00 | 1.5E+00 | 1.9E+00 | 2.4E+00 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 8.0E+01 | 1.2E+02 | 1.8E+02 | 2.7E+02 | 3.9E+02 | 5.5E+02 | 8.0E+02 | 1.2E+03 | 1.7E+03 | 2.4E+03 | 3.1E+03 | 4.1E+03 | 5.3E+03 | 6.9E+03 | 8.7E+03 | 1.1E+04 | 1.4E+04 | 1.7E+04 | 2.1E+04 | 2.6E+04 | 3.1E+04 | 3.8E+04 | 4.5E+04 | 5.4E+04 | 6.3E+04 | 7.5E+04 | 8.7E+04 | 1.0E+05 | 1.2E+05 | 1.3E+05 | 1.5E+05 | 1.7E+05 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 4.8E-11 | 2.1E-10 | 8.1E-10 | 3.3E-09 | 1.1E-08 | 3.4E-08 | 9.3E-08 | 2.5E-07 | 6.1E-07 | 1.5E-06 | 3.6E-06 | 8.2E-06 | 1.8E-05 | 4.1E-05 | 8.8E-05 | 1.9E-04 | 3.8E-04 | 7.8E-04 | 1.5E-03 | 3.0E-03 | 5.8E-03 | 1.1E-02 | 2.0E-02 | 3.8E-02 | 6.6E-02 | 1.2E-01 | 2.1E-01 |
| Sr-90 | 1.8E-02 | 1.9E-02 | 2.0E-02 | 2.1E-02 | 2.2E-02 | 2.3E-02 | 2.4E-02 | 2.5E-02 | 2.6E-02 | 2.5E-02 | 2.4E-02 | 2.4E-02 | 2.2E-02 | 2.1E-02 | 1.9E-02 | 1.8E-02 | 1.7E-02 | 1.5E-02 | 1.4E-02 | 1.2E-02 | 1.1E-02 | 1.0E-02 | 8.7E-03 | 7.8E-03 | 6.9E-03 | 5.9E-03 | 5.1E-03 | 4.5E-03 | 3.8E-03 | 3.3E-03 | 2.8E-03 | 2.4E-03 |
| Tc-99 | 1.2E-02 | 2.0E-02 | 3.4E-02 | 5.8E-02 | 9.4E-02 | 1.5E-01 | 2.5E-01 | 4.3E-01 | 7.0E-01 | 1.1E+00 | 1.7E+00 | 2.4E+00 | 3.5E+00 | 4.9E+00 | 6.9E+00 | 9.6E+00 | 1.3E+01 | 1.8E+01 | 2.4E+01 | 3.2E+01 | 4.2E+01 | 5.6E+01 | 7.2E+01 | 9.4E+01 | 1.2E+02 | 1.5E+02 | 1.9E+02 | 2.4E+02 | 2.9E+02 | 3.6E+02 | 4.4E+02 | 5.4E+02 |

*TABLE 46. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 445 | 450 | 455 | 460 | 465 | 470 | 475 | 480 | 485 | 490 | 495 | 500 | 505 | 510 | 515 | 520 | 525 | 530 | 535 | 540 | 545 | 550 | 555 | 560 | 565 | 570 | 575 | 580 | 585 | 590 | 595 | 600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 5.4E-02 | 4.8E-02 | 4.2E-02 | 3.7E-02 | 3.2E-02 | 2.8E-02 | 2.4E-02 | 2.1E-02 | 1.8E-02 | 1.6E-02 | 1.3E-02 | 1.2E-02 | 9.8E-03 | 8.4E-03 | 7.3E-03 | 6.1E-03 | 5.3E-03 | 4.5E-03 | 3.9E-03 | 3.3E-03 | 2.8E-03 | 2.4E-03 | 2.0E-03 | 1.7E-03 | 1.4E-03 | 1.2E-03 | 1.0E-03 | 8.7E-04 | 7.2E-04 | 6.1E-04 | 5.1E-04 | 4.3E-04 |
| Ca-41 | 2.1E+03 | 2.2E+03 | 2.3E+03 | 2.5E+03 | 2.6E+03 | 2.7E+03 | 2.8E+03 | 2.9E+03 | 3.0E+03 | 3.1E+03 | 3.2E+03 | 3.3E+03 | 3.3E+03 | 3.4E+03 | 3.5E+03 | 3.5E+03 | 3.5E+03 | 3.6E+03 | 3.5E+03 | 3.5E+03 | 3.5E+03 | 3.5E+03 | 3.4E+03 | 3.4E+03 | 3.4E+03 | 3.3E+03 | 3.3E+03 | 3.2E+03 | 3.1E+03 | 3.1E+03 | 2.9E+03 | 2.9E+03 |
| Cl-36 | 2.5E+02 | 2.0E+02 | 1.6E+02 | 1.4E+02 | 1.2E+02 | 1.1E+02 | 1.0E+02 | 9.2E+01 | 8.3E+01 | 7.4E+01 | 6.7E+01 | 5.9E+01 | 5.2E+01 | 4.6E+01 | 4.0E+01 | 3.5E+01 | 3.0E+01 | 2.6E+01 | 2.3E+01 | 2.0E+01 | 1.7E+01 | 1.5E+01 | 1.2E+01 | 1.1E+01 | 9.1E+00 | 7.6E+00 | 6.6E+00 | 5.7E+00 | 4.8E+00 | 4.1E+00 | 3.5E+00 | 3.0E+00 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 2.9E+00 | 3.5E+00 | 4.4E+00 | 5.3E+00 | 6.5E+00 | 7.8E+00 | 9.1E+00 | 1.1E+01 | 1.3E+01 | 1.5E+01 | 1.8E+01 | 2.1E+01 | 2.4E+01 | 2.8E+01 | 3.2E+01 | 3.7E+01 | 4.1E+01 | 4.8E+01 | 5.3E+01 | 6.0E+01 | 6.8E+01 | 7.5E+01 | 8.5E+01 | 9.5E+01 | 1.1E+02 | 1.2E+02 | 1.3E+02 | 1.4E+02 | 1.6E+02 | 1.7E+02 | 1.9E+02 | 2.1E+02 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.3E-11 | 8.9E-11 | 1.7E-10 | 3.2E-10 | 5.9E-10 | 1.1E-09 | 1.9E-09 | 3.3E-09 | 5.8E-09 | 1.0E-08 | 1.7E-08 | 2.9E-08 | 4.8E-08 | 7.9E-08 | 1.3E-07 | 2.1E-07 | 3.5E-07 |
| Re-187 | 2.0E+05 | 2.2E+05 | 2.5E+05 | 2.7E+05 | 3.0E+05 | 3.4E+05 | 3.7E+05 | 4.1E+05 | 4.5E+05 | 4.9E+05 | 5.2E+05 | 5.7E+05 | 6.0E+05 | 6.6E+05 | 7.0E+05 | 7.4E+05 | 8.0E+05 | 8.5E+05 | 8.9E+05 | 9.4E+05 | 1.0E+06 | 1.0E+06 | 1.1E+06 | 1.1E+06 | 1.2E+06 | 1.2E+06 | 1.3E+06 | 1.3E+06 | 1.3E+06 | 1.4E+06 | 1.4E+06 | 1.4E+06 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 3.5E-01 | 6.0E-01 | 1.0E+00 | 1.7E+00 | 2.7E+00 | 4.4E+00 | 7.0E+00 | 1.1E+01 | 1.7E+01 | 2.7E+01 | 4.1E+01 | 6.3E+01 | 9.3E+01 | 1.4E+02 | 2.1E+02 | 3.0E+02 | 4.4E+02 | 6.3E+02 | 8.9E+02 | 1.3E+03 | 1.8E+03 | 2.5E+03 | 3.4E+03 | 4.8E+03 | 6.5E+03 | 8.7E+03 | 1.2E+04 | 1.6E+04 | 2.1E+04 | 2.8E+04 | 3.7E+04 | 4.8E+04 |
| Sr-90 | 2.0E-03 | 1.7E-03 | 1.4E-03 | 1.2E-03 | 9.7E-04 | 8.1E-04 | 6.6E-04 | 5.4E-04 | 4.4E-04 | 3.6E-04 | 2.9E-04 | 2.4E-04 | 1.9E-04 | 1.5E-04 | 1.2E-04 | 9.7E-05 | 7.8E-05 | 6.2E-05 | 4.9E-05 | 3.9E-05 | 3.1E-05 | 2.4E-05 | 1.9E-05 | 1.5E-05 | 1.1E-05 | 8.9E-06 | 7.1E-06 | 5.4E-06 | 4.2E-06 | 3.2E-06 | 2.5E-06 | 1.9E-06 |
| Tc-99 | 6.5E+02 | 7.8E+02 | 9.5E+02 | 1.1E+03 | 1.3E+03 | 1.6E+03 | 1.8E+03 | 2.1E+03 | 2.5E+03 | 2.9E+03 | 3.3E+03 | 3.8E+03 | 4.3E+03 | 4.9E+03 | 5.5E+03 | 6.3E+03 | 7.1E+03 | 7.9E+03 | 8.9E+03 | 1.0E+04 | 1.1E+04 | 1.2E+04 | 1.3E+04 | 1.5E+04 | 1.6E+04 | 1.8E+04 | 2.0E+04 | 2.1E+04 | 2.3E+04 | 2.5E+04 | 2.6E+04 | 2.9E+04 |

*TABLE 46. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 605 | 610 | 615 | 620 | 625 | 630 | 635 | 640 | 645 | 650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720 | 725 | 730 | 735 | 740 | 745 | 750 | 755 | 760 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 3.6E-04 | 3.0E-04 | 2.5E-04 | 2.1E-04 | 1.8E-04 | 1.5E-04 | 1.2E-04 | 1.0E-04 | 8.7E-05 | 7.2E-05 | 5.9E-05 | 4.9E-05 | 4.1E-05 | 3.5E-05 | 2.9E-05 | 2.4E-05 | 2.0E-05 | 1.7E-05 | 1.4E-05 | 1.1E-05 | 9.4E-06 | 7.8E-06 | 6.7E-06 | 5.8E-06 | 4.8E-06 | 3.8E-06 | 3.0E-06 | 2.5E-06 | 2.1E-06 | 1.6E-06 | 1.3E-06 | 1.1E-06 |
| Ca-41 | 2.8E+03 | 2.7E+03 | 2.6E+03 | 2.6E+03 | 2.5E+03 | 2.4E+03 | 2.3E+03 | 2.2E+03 | 2.1E+03 | 2.0E+03 | 1.9E+03 | 1.8E+03 | 1.8E+03 | 1.7E+03 | 1.6E+03 | 1.5E+03 | 1.4E+03 | 1.4E+03 | 1.3E+03 | 1.2E+03 | 1.2E+03 | 1.1E+03 | 1.0E+03 | 1.0E+03 | 1.0E+03 | 9.5E+02 | 8.6E+02 | 8.0E+02 | 7.6E+02 | 6.9E+02 | 6.3E+02 | 5.8E+02 |
| Cl-36 | 2.5E+00 | 2.1E+00 | 1.8E+00 | 1.5E+00 | 1.3E+00 | 1.1E+00 | 9.1E-01 | 7.8E-01 | 6.5E-01 | 5.5E-01 | 4.6E-01 | 3.9E-01 | 3.3E-01 | 2.8E-01 | 2.3E-01 | 2.0E-01 | 1.7E-01 | 1.4E-01 | 1.2E-01 | 9.7E-02 | 8.2E-02 | 6.8E-02 | 5.7E-02 | 5.1E-02 | 4.3E-02 | 3.5E-02 | 2.7E-02 | 2.3E-02 | 1.9E-02 | 1.5E-02 | 1.2E-02 | 1.1E-02 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 2.2E+02 | 2.4E+02 | 2.6E+02 | 2.8E+02 | 3.0E+02 | 3.3E+02 | 3.5E+02 | 3.7E+02 | 4.0E+02 | 4.2E+02 | 4.5E+02 | 4.7E+02 | 5.0E+02 | 5.3E+02 | 5.7E+02 | 6.0E+02 | 6.2E+02 | 6.6E+02 | 6.8E+02 | 7.2E+02 | 7.4E+02 | 7.8E+02 | 8.1E+02 | 8.7E+02 | 9.4E+02 | 1.0E+03 | 1.0E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 |
| Pd-107 | 5.5E-07 | 8.8E-07 | 1.4E-06 | 2.2E-06 | 3.4E-06 | 5.2E-06 | 8.0E-06 | 1.2E-05 | 1.8E-05 | 2.8E-05 | 4.1E-05 | 6.2E-05 | 9.0E-05 | 1.3E-04 | 1.9E-04 | 2.8E-04 | 4.0E-04 | 5.7E-04 | 8.0E-04 | 1.1E-03 | 1.6E-03 | 2.2E-03 | 3.1E-03 | 4.3E-03 | 6.0E-03 | 8.4E-03 | 1.2E-02 | 1.8E-02 | 2.5E-02 | 3.6E-02 | 5.0E-02 | 6.9E-02 |
| Re-187 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.4E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.4E+06 | 1.4E+06 | 1.4E+06 | 1.3E+06 | 1.2E+06 | 1.2E+06 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 6.3E+04 | 8.0E+04 | 1.1E+05 | 1.3E+05 | 1.7E+05 | 2.1E+05 | 2.7E+05 | 3.4E+05 | 4.2E+05 | 5.3E+05 | 6.6E+05 | 8.0E+05 | 9.8E+05 | 1.2E+06 | 1.5E+06 | 1.8E+06 | 2.2E+06 | 2.6E+06 | 3.1E+06 | 3.7E+06 | 4.4E+06 | 5.3E+06 | 6.3E+06 | 7.4E+06 | 8.8E+06 | 1.1E+07 | 1.3E+07 | 1.6E+07 | 1.9E+07 | 2.2E+07 | 2.6E+07 | 3.1E+07 |
| Sr-90 | 1.5E-06 | 1.2E-06 | 8.8E-07 | 6.7E-07 | 5.1E-07 | 3.9E-07 | 3.0E-07 | 2.2E-07 | 1.7E-07 | 1.3E-07 | 9.8E-08 | 7.4E-08 | 5.6E-08 | 4.2E-08 | 3.1E-08 | 2.4E-08 | 1.8E-08 | 1.3E-08 | 1.0E-08 | 7.4E-09 | 5.5E-09 | 4.1E-09 | 3.1E-09 | 2.3E-09 | 1.8E-09 | 1.3E-09 | 9.4E-10 | 7.0E-10 | 5.0E-10 | 3.6E-10 | 2.5E-10 | 1.7E-10 |
| Tc-99 | 3.1E+04 | 3.3E+04 | 3.5E+04 | 3.7E+04 | 4.0E+04 | 4.2E+04 | 4.4E+04 | 4.7E+04 | 4.9E+04 | 5.3E+04 | 5.5E+04 | 5.9E+04 | 6.0E+04 | 6.4E+04 | 6.6E+04 | 6.9E+04 | 7.1E+04 | 7.4E+04 | 7.6E+04 | 8.0E+04 | 8.2E+04 | 8.5E+04 | 8.7E+04 | 9.2E+04 | 1.0E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 |

*TABLE 46. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 765 | 770 | 775 | 780 | 785 | 790 | 795 | 800 | 805 | 810 | 815 | 820 | 825 | 830 | 835 | 840 | 845 | 850 | 855 | 860 | 865 | 870 | 875 | 880 | 885 | 890 | 895 | 900 | 905 | 910 | 915 | 920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 9.0E-07 | 7.2E-07 | 5.7E-07 | 4.9E-07 | 4.0E-07 | 3.1E-07 | 2.6E-07 | 2.1E-07 | 1.8E-07 | 1.4E-07 | 1.1E-07 | 9.9E-08 | 8.5E-08 | 6.8E-08 | 5.2E-08 | 4.1E-08 | 3.5E-08 | 2.9E-08 | 2.4E-08 | 1.8E-08 | 1.4E-08 | 1.2E-08 | 1.1E-08 | 8.6E-09 | 6.6E-09 | 5.2E-09 | 4.5E-09 | 3.9E-09 | 3.2E-09 | 2.4E-09 | 1.9E-09 | 1.6E-09 |
| Ca-41 | 5.5E+02 | 5.0E+02 | 4.5E+02 | 4.2E+02 | 4.0E+02 | 3.7E+02 | 3.3E+02 | 3.1E+02 | 3.0E+02 | 2.7E+02 | 2.5E+02 | 2.3E+02 | 2.3E+02 | 2.1E+02 | 1.9E+02 | 1.7E+02 | 1.5E+02 | 1.5E+02 | 1.4E+02 | 1.2E+02 | 1.1E+02 | 9.9E+01 | 9.6E+01 | 9.0E+01 | 8.0E+01 | 7.0E+01 | 6.4E+01 | 6.2E+01 | 5.8E+01 | 5.2E+01 | 4.5E+01 | 4.1E+01 |
| Cl-36 | 8.9E-03 | 7.0E-03 | 5.6E-03 | 4.9E-03 | 4.0E-03 | 3.3E-03 | 2.6E-03 | 2.3E-03 | 1.9E-03 | 1.6E-03 | 1.3E-03 | 1.1E-03 | 9.5E-04 | 7.7E-04 | 6.1E-04 | 4.8E-04 | 4.1E-04 | 3.6E-04 | 2.9E-04 | 2.3E-04 | 1.8E-04 | 1.5E-04 | 1.3E-04 | 1.1E-04 | 8.4E-05 | 6.7E-05 | 5.9E-05 | 5.0E-05 | 4.2E-05 | 3.2E-05 | 2.5E-05 | 2.2E-05 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.4E+03 | 1.5E+03 | 1.5E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.5E+03 | 1.5E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 | 1.4E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 |
| Pd-107 | 9.5E-02 | 1.3E-01 | 1.7E-01 | 2.2E-01 | 2.9E-01 | 3.8E-01 | 4.8E-01 | 6.3E-01 | 8.1E-01 | 1.0E+00 | 1.3E+00 | 1.7E+00 | 2.1E+00 | 2.7E+00 | 3.5E+00 | 4.5E+00 | 5.8E+00 | 7.5E+00 | 9.5E+00 | 1.2E+01 | 1.5E+01 | 1.8E+01 | 2.3E+01 | 2.7E+01 | 3.4E+01 | 4.2E+01 | 5.1E+01 | 6.1E+01 | 7.4E+01 | 9.0E+01 | 1.1E+02 | 1.3E+02 |
| Re-187 | 1.2E+06 | 1.1E+06 | 1.1E+06 | 1.0E+06 | 9.9E+05 | 9.5E+05 | 8.9E+05 | 8.5E+05 | 8.4E+05 | 8.1E+05 | 7.7E+05 | 7.3E+05 | 7.4E+05 | 7.4E+05 | 6.8E+05 | 6.2E+05 | 6.0E+05 | 5.8E+05 | 5.7E+05 | 5.4E+05 | 4.9E+05 | 4.6E+05 | 4.5E+05 | 4.4E+05 | 4.2E+05 | 3.7E+05 | 3.5E+05 | 3.5E+05 | 3.4E+05 | 3.2E+05 | 2.9E+05 | 2.7E+05 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2E-11 | 2.7E-11 | 5.4E-11 | 9.0E-11 | 1.5E-10 | 2.3E-10 | 3.6E-10 | 5.6E-10 | 8.4E-10 | 1.3E-09 | 1.9E-09 | 2.8E-09 | 4.1E-09 | 5.8E-09 | 8.5E-09 | 1.2E-08 | 1.7E-08 | 2.4E-08 | 3.4E-08 |
| Si-32 | 3.5E+07 | 3.9E+07 | 4.5E+07 | 5.1E+07 | 5.8E+07 | 6.4E+07 | 7.3E+07 | 8.2E+07 | 9.3E+07 | 1.0E+08 | 1.1E+08 | 1.3E+08 | 1.4E+08 | 1.6E+08 | 1.8E+08 | 2.0E+08 | 2.3E+08 | 2.5E+08 | 2.7E+08 | 3.0E+08 | 3.3E+08 | 3.5E+08 | 3.9E+08 | 4.2E+08 | 4.5E+08 | 4.9E+08 | 5.4E+08 | 5.7E+08 | 5.9E+08 | 6.0E+08 | 5.8E+08 | 5.7E+08 |
| Sr-90 | 1.2E-10 | 7.9E-11 | 5.2E-11 | 2.9E-11 | 1.1E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.0E+05 | 9.8E+04 | 9.8E+04 | 9.9E+04 | 9.8E+04 | 9.4E+04 | 9.0E+04 |

*TABLE 46. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 925 | 930 | 935 | 940 | 945 | 950 | 955 | 960 | 965 | 970 | 975 | 980 | 985 | 990 | 995 | 1000 | 1010 | 1020 | 1030 | 1040 | 1050 | 1060 | 1070 | 1080 | 1100 | 1300 | 1500 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2E-11 | 1.6E-11 | 2.3E-11 | 0 | 0 |
| Bk-247 | 1.4E-09 | 1.1E-09 | 8.8E-10 | 6.9E-10 | 5.8E-10 | 5.2E-10 | 4.1E-10 | 3.2E-10 | 2.4E-10 | 2.1E-10 | 1.8E-10 | 1.4E-10 | 1.1E-10 | 7.1E-11 | 6.7E-11 | 6.1E-11 | 3.4E-11 | 1.3E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 4.1E+01 | 3.8E+01 | 3.4E+01 | 2.9E+01 | 2.7E+01 | 2.5E+01 | 2.4E+01 | 2.2E+01 | 1.8E+01 | 1.7E+01 | 1.6E+01 | 1.5E+01 | 1.4E+01 | 1.2E+01 | 1.1E+01 | 1.0E+01 | 8.6E+00 | 6.0E+00 | 3.7E+00 | 2.1E+00 | 1.2E+00 | 6.3E-01 | 3.4E-01 | 1.8E-01 | 5.0E-02 | 1.6E-07 | 0 |
| Cl-36 | 1.9E-05 | 1.6E-05 | 1.2E-05 | 9.8E-06 | 8.5E-06 | 7.5E-06 | 6.0E-06 | 4.7E-06 | 3.8E-06 | 3.2E-06 | 2.8E-06 | 2.4E-06 | 1.8E-06 | 1.4E-06 | 1.2E-06 | 1.1E-06 | 6.8E-07 | 3.6E-07 | 1.8E-07 | 8.5E-08 | 3.9E-08 | 1.7E-08 | 7.9E-09 | 3.6E-09 | 7.2E-10 | 0 | 0 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.0E+03 | 1.0E+03 | 1.0E+03 | 8.6E+02 | 6.6E+02 | 4.7E+02 | 3.2E+02 | 2.0E+02 | 1.3E+02 | 8.3E+01 | 3.1E+01 | 1.8E-03 | 1.2E-07 |
| Pd-107 | 1.6E+02 | 1.9E+02 | 2.3E+02 | 2.8E+02 | 3.3E+02 | 3.9E+02 | 4.7E+02 | 5.6E+02 | 6.5E+02 | 7.7E+02 | 9.2E+02 | 1.1E+03 | 1.3E+03 | 1.5E+03 | 1.7E+03 | 2.0E+03 | 2.7E+03 | 3.7E+03 | 4.9E+03 | 6.2E+03 | 7.1E+03 | 7.6E+03 | 7.8E+03 | 7.6E+03 | 6.4E+03 | 1.8E+02 | 3.0E+00 |
| Re-187 | 2.6E+05 | 2.6E+05 | 2.4E+05 | 2.2E+05 | 2.0E+05 | 2.0E+05 | 1.9E+05 | 1.8E+05 | 1.6E+05 | 1.5E+05 | 1.5E+05 | 1.4E+05 | 1.3E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 9.8E+04 | 7.5E+04 | 5.0E+04 | 3.1E+04 | 1.8E+04 | 1.1E+04 | 6.3E+03 | 3.6E+03 | 1.1E+03 | 1.2E-02 | 1.7E-07 |
| Se-79 | 4.9E-08 | 6.8E-08 | 9.5E-08 | 1.3E-07 | 1.8E-07 | 2.6E-07 | 3.5E-07 | 4.8E-07 | 6.6E-07 | 9.0E-07 | 1.2E-06 | 1.6E-06 | 2.2E-06 | 3.0E-06 | 4.0E-06 | 5.4E-06 | 9.7E-06 | 1.7E-05 | 3.0E-05 | 5.1E-05 | 8.2E-05 | 1.2E-04 | 1.6E-04 | 2.1E-04 | 2.7E-04 | 8.9E-05 | 8.0E-06 |
| Si-32 | 5.4E+08 | 5.1E+08 | 4.8E+08 | 4.3E+08 | 3.9E+08 | 3.5E+08 | 3.1E+08 | 2.8E+08 | 2.5E+08 | 2.2E+08 | 1.9E+08 | 1.7E+08 | 1.4E+08 | 1.3E+08 | 1.1E+08 | 9.4E+07 | 7.0E+07 | 5.2E+07 | 3.8E+07 | 2.8E+07 | 2.0E+07 | 1.5E+07 | 1.1E+07 | 8.0E+06 | 4.2E+06 | 6.9E+03 | 1.2E+01 |
| Sr-90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 9.0E+04 | 9.0E+04 | 9.0E+04 | 8.5E+04 | 8.1E+04 | 8.1E+04 | 8.2E+04 | 8.0E+04 | 7.7E+04 | 7.2E+04 | 7.1E+04 | 7.3E+04 | 7.1E+04 | 6.8E+04 | 6.3E+04 | 6.2E+04 | 6.1E+04 | 5.1E+04 | 3.9E+04 | 2.6E+04 | 1.7E+04 | 1.1E+04 | 7.0E+03 | 4.2E+03 | 1.6E+03 | 6.3E-02 | 3.1E-06 |

*TABLE 47. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | EXCEEDS | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.9E-10 | 2.4E-09 | 1.6E-08 | 3.7E-08 | 8.3E-08 | 1.8E-07 | 3.7E-07 | 7.4E-07 | 1.4E-06 | 2.7E-06 | 5.0E-06 | 8.7E-06 | 1.5E-05 | 2.5E-05 | 4.2E-05 | 6.7E-05 | 1.0E-04 | 1.6E-04 | 2.5E-04 | 3.7E-04 | 5.3E-04 |
| Ca-41 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.7E-11 | 1.6E-10 | 6.0E-10 | 2.1E-09 | 6.8E-09 | 2.1E-08 | 6.1E-08 | 1.7E-07 | 4.5E-07 | 1.2E-06 | 2.8E-06 | 6.5E-06 | 1.4E-05 | 2.8E-05 | 5.8E-05 | 1.3E-04 |
| Cl-36 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5.9E-11 | 1.9E-09 | 3.1E-08 | 3.5E-07 | 3.1E-06 | 2.1E-05 | 5.1E-05 | 1.2E-04 | 2.6E-04 | 5.6E-04 | 1.1E-03 | 2.2E-03 | 4.3E-03 | 8.1E-03 | 1.5E-02 | 2.5E-02 | 4.4E-02 | 7.3E-02 | 1.2E-01 | 1.9E-01 | 3.0E-01 | 4.4E-01 | 6.3E-01 | 9.0E-01 |
| H-3 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pd-107 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.4E-11 | 1.2E-10 | 4.0E-10 | 1.2E-09 | 3.2E-09 | 8.1E-09 | 2.1E-08 |
| Si-32 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7.1E-11 | 1.3E-10 | 2.2E-10 |
| Tc-99 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

NOTE: -1 indicates nuclide does not exceed GWPL within the 2,000 years modeled

*TABLE 47. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 295 | 300 | 305 | 310 | 315 | 320 | 325 | 330 | 335 | 340 | 345 | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 | 395 | 400 | 405 | 410 | 415 | 420 | 425 | 430 | 435 | 440 | 445 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 7.7E-04 | 1.1E-03 | 1.5E-03 | 2.1E-03 | 2.8E-03 | 3.8E-03 | 5.0E-03 | 6.6E-03 | 8.7E-03 | 1.1E-02 | 1.5E-02 | 1.8E-02 | 2.3E-02 | 2.8E-02 | 3.5E-02 | 4.2E-02 | 4.9E-02 | 5.8E-02 | 6.8E-02 | 7.9E-02 | 9.1E-02 | 1.1E-01 | 1.2E-01 | 1.4E-01 | 1.5E-01 | 1.7E-01 | 1.9E-01 | 2.1E-01 | 2.3E-01 | 2.5E-01 | 2.8E-01 |
| Ca-41 | 2.6E-04 | 5.5E-04 | 1.1E-03 | 2.2E-03 | 4.2E-03 | 7.7E-03 | 1.4E-02 | 2.5E-02 | 4.7E-02 | 8.3E-02 | 1.4E-01 | 2.4E-01 | 4.0E-01 | 6.4E-01 | 9.9E-01 | 1.5E+00 | 2.3E+00 | 3.4E+00 | 5.0E+00 | 7.5E+00 | 1.1E+01 | 1.5E+01 | 2.1E+01 | 3.0E+01 | 4.1E+01 | 5.7E+01 | 7.7E+01 | 1.0E+02 | 1.4E+02 | 1.8E+02 | 2.4E+02 |
| Cl-36 | 1.3E+00 | 1.8E+00 | 2.6E+00 | 3.5E+00 | 4.7E+00 | 6.4E+00 | 8.8E+00 | 1.2E+01 | 1.7E+01 | 2.3E+01 | 3.1E+01 | 4.0E+01 | 5.1E+01 | 6.5E+01 | 8.1E+01 | 9.8E+01 | 1.2E+02 | 1.4E+02 | 1.7E+02 | 2.0E+02 | 2.4E+02 | 2.8E+02 | 3.2E+02 | 3.7E+02 | 4.2E+02 | 4.8E+02 | 5.4E+02 | 6.1E+02 | 6.9E+02 | 7.6E+02 | 8.3E+02 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.3E-11 | 8.9E-11 | 2.0E-10 | 4.6E-10 | 9.9E-10 | 2.0E-09 | 3.9E-09 | 7.6E-09 | 1.5E-08 | 2.7E-08 | 5.0E-08 | 9.0E-08 | 1.6E-07 | 2.8E-07 | 4.9E-07 | 8.4E-07 | 1.4E-06 | 2.3E-06 | 3.8E-06 | 6.1E-06 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 4.9E-08 | 1.2E-07 | 2.7E-07 | 5.9E-07 | 1.3E-06 | 2.7E-06 | 5.5E-06 | 1.2E-05 | 2.5E-05 | 5.1E-05 | 1.0E-04 | 2.0E-04 | 3.6E-04 | 6.5E-04 | 1.1E-03 | 1.9E-03 | 3.3E-03 | 5.4E-03 | 8.7E-03 | 1.4E-02 | 2.2E-02 | 3.5E-02 | 5.4E-02 | 8.1E-02 | 1.2E-01 | 1.8E-01 | 2.7E-01 | 4.0E-01 | 5.7E-01 | 8.4E-01 | 1.2E+00 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | 3.5E-10 | 5.6E-10 | 8.9E-10 | 1.4E-09 | 2.2E-09 | 3.3E-09 | 4.9E-09 | 7.1E-09 | 1.0E-08 | 1.5E-08 | 2.0E-08 | 2.7E-08 | 3.6E-08 | 4.5E-08 | 5.8E-08 | 7.2E-08 | 8.7E-08 | 1.1E-07 | 1.2E-07 | 1.4E-07 | 1.7E-07 | 1.9E-07 | 2.2E-07 | 2.4E-07 | 2.7E-07 | 3.0E-07 | 3.2E-07 | 3.5E-07 | 3.7E-07 | 4.0E-07 | 4.2E-07 |
| Tc-99 | 0 | 0 | 0 | 0 | 2.2E-11 | 1.1E-10 | 3.3E-10 | 9.0E-10 | 2.4E-09 | 6.1E-09 | 1.5E-08 | 3.4E-08 | 7.4E-08 | 1.5E-07 | 3.1E-07 | 6.2E-07 | 1.2E-06 | 2.3E-06 | 4.1E-06 | 7.7E-06 | 1.4E-05 | 2.4E-05 | 4.3E-05 | 7.3E-05 | 1.2E-04 | 2.1E-04 | 3.4E-04 | 5.6E-04 | 9.1E-04 | 1.5E-03 | 2.3E-03 |

*TABLE 47. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 450 | 455 | 460 | 465 | 470 | 475 | 480 | 485 | 490 | 495 | 500 | 505 | 510 | 515 | 520 | 525 | 530 | 535 | 540 | 545 | 550 | 555 | 560 | 565 | 570 | 575 | 580 | 585 | 590 | 595 | 600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 3.0E-01 | 3.3E-01 | 3.5E-01 | 3.8E-01 | 4.0E-01 | 4.2E-01 | 4.5E-01 | 4.7E-01 | 5.0E-01 | 5.2E-01 | 5.4E-01 | 5.6E-01 | 5.8E-01 | 6.0E-01 | 6.2E-01 | 6.3E-01 | 6.5E-01 | 6.6E-01 | 6.7E-01 | 6.8E-01 | 6.9E-01 | 6.9E-01 | 7.0E-01 | 7.0E-01 | 7.0E-01 | 7.0E-01 | 6.9E-01 | 6.9E-01 | 6.8E-01 | 6.8E-01 | 6.7E-01 |
| Ca-41 | 3.1E+02 | 4.1E+02 | 5.2E+02 | 6.8E+02 | 8.5E+02 | 1.1E+03 | 1.4E+03 | 1.7E+03 | 2.1E+03 | 2.6E+03 | 3.2E+03 | 3.9E+03 | 4.7E+03 | 5.7E+03 | 6.9E+03 | 8.3E+03 | 9.9E+03 | 1.2E+04 | 1.4E+04 | 1.7E+04 | 1.9E+04 | 2.3E+04 | 2.6E+04 | 3.1E+04 | 3.5E+04 | 4.1E+04 | 4.7E+04 | 5.4E+04 | 6.2E+04 | 7.0E+04 | 7.9E+04 |
| Cl-36 | 9.2E+02 | 1.0E+03 | 1.1E+03 | 1.2E+03 | 1.3E+03 | 1.4E+03 | 1.5E+03 | 1.6E+03 | 1.6E+03 | 1.7E+03 | 1.8E+03 | 1.9E+03 | 2.0E+03 | 2.1E+03 | 2.2E+03 | 2.3E+03 | 2.3E+03 | 2.4E+03 | 2.5E+03 | 2.5E+03 | 2.6E+03 | 2.7E+03 | 2.7E+03 | 2.7E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.8E+03 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 9.9E-06 | 1.6E-05 | 2.5E-05 | 3.9E-05 | 6.0E-05 | 9.1E-05 | 1.4E-04 | 2.1E-04 | 3.0E-04 | 4.5E-04 | 6.5E-04 | 9.5E-04 | 1.4E-03 | 1.9E-03 | 2.7E-03 | 3.8E-03 | 5.3E-03 | 7.4E-03 | 1.0E-02 | 1.4E-02 | 1.9E-02 | 2.5E-02 | 3.4E-02 | 4.5E-02 | 6.0E-02 | 7.9E-02 | 1.0E-01 | 1.4E-01 | 1.8E-01 | 2.3E-01 | 2.9E-01 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 1.7E+00 | 2.3E+00 | 3.2E+00 | 4.5E+00 | 6.1E+00 | 8.3E+00 | 1.1E+01 | 1.5E+01 | 2.0E+01 | 2.6E+01 | 3.4E+01 | 4.4E+01 | 5.8E+01 | 7.4E+01 | 9.4E+01 | 1.2E+02 | 1.5E+02 | 1.8E+02 | 2.1E+02 | 2.6E+02 | 3.1E+02 | 3.7E+02 | 4.6E+02 | 5.6E+02 | 7.0E+02 | 8.6E+02 | 1.0E+03 | 1.3E+03 | 1.6E+03 | 1.9E+03 | 2.3E+03 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.8E-11 | 8.1E-11 | 1.6E-10 | 3.1E-10 |
| Sr-90 | 4.4E-07 | 4.6E-07 | 4.8E-07 | 4.9E-07 | 5.0E-07 | 5.1E-07 | 5.1E-07 | 5.1E-07 | 5.1E-07 | 5.1E-07 | 5.0E-07 | 4.9E-07 | 4.8E-07 | 4.6E-07 | 4.5E-07 | 4.3E-07 | 4.1E-07 | 3.9E-07 | 3.7E-07 | 3.5E-07 | 3.3E-07 | 3.1E-07 | 2.9E-07 | 2.7E-07 | 2.5E-07 | 2.3E-07 | 2.2E-07 | 2.0E-07 | 1.8E-07 | 1.7E-07 | 1.5E-07 |
| Tc-99 | 3.6E-03 | 5.5E-03 | 8.4E-03 | 1.3E-02 | 1.9E-02 | 2.8E-02 | 4.1E-02 | 6.0E-02 | 8.8E-02 | 1.3E-01 | 1.8E-01 | 2.5E-01 | 3.6E-01 | 5.0E-01 | 6.9E-01 | 9.4E-01 | 1.3E+00 | 1.7E+00 | 2.3E+00 | 3.2E+00 | 4.2E+00 | 5.6E+00 | 7.3E+00 | 9.6E+00 | 1.2E+01 | 1.6E+01 | 2.1E+01 | 2.7E+01 | 3.4E+01 | 4.3E+01 | 5.5E+01 |

*TABLE 47. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 605 | 610 | 615 | 620 | 625 | 630 | 635 | 640 | 645 | 650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720 | 725 | 730 | 735 | 740 | 745 | 750 | 755 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 6.6E-01 | 6.5E-01 | 6.4E-01 | 6.2E-01 | 6.1E-01 | 6.0E-01 | 5.8E-01 | 5.7E-01 | 5.5E-01 | 5.3E-01 | 5.2E-01 | 5.0E-01 | 4.9E-01 | 4.7E-01 | 4.5E-01 | 4.3E-01 | 4.2E-01 | 4.0E-01 | 3.8E-01 | 3.7E-01 | 3.5E-01 | 3.3E-01 | 3.2E-01 | 3.0E-01 | 2.9E-01 | 2.7E-01 | 2.6E-01 | 2.5E-01 | 2.3E-01 | 2.2E-01 | 2.1E-01 |
| Ca-41 | 9.1E+04 | 1.0E+05 | 1.1E+05 | 1.3E+05 | 1.4E+05 | 1.6E+05 | 1.8E+05 | 2.0E+05 | 2.2E+05 | 2.4E+05 | 2.6E+05 | 2.9E+05 | 3.1E+05 | 3.4E+05 | 3.7E+05 | 4.0E+05 | 4.4E+05 | 4.8E+05 | 5.2E+05 | 5.6E+05 | 6.0E+05 | 6.5E+05 | 7.0E+05 | 7.5E+05 | 8.0E+05 | 8.4E+05 | 9.0E+05 | 9.8E+05 | 1.0E+06 | 1.1E+06 | 1.2E+06 |
| Cl-36 | 2.8E+03 | 2.8E+03 | 2.8E+03 | 2.7E+03 | 2.7E+03 | 2.6E+03 | 2.6E+03 | 2.6E+03 | 2.5E+03 | 2.5E+03 | 2.4E+03 | 2.4E+03 | 2.3E+03 | 2.2E+03 | 2.2E+03 | 2.1E+03 | 2.0E+03 | 2.0E+03 | 1.9E+03 | 1.9E+03 | 1.8E+03 | 1.7E+03 | 1.6E+03 | 1.6E+03 | 1.5E+03 | 1.5E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 | 1.2E+03 | 1.2E+03 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 3.8E-01 | 4.8E-01 | 6.0E-01 | 7.5E-01 | 9.7E-01 | 1.2E+00 | 1.5E+00 | 1.9E+00 | 2.3E+00 | 2.8E+00 | 3.5E+00 | 4.2E+00 | 5.2E+00 | 6.2E+00 | 7.5E+00 | 9.2E+00 | 1.1E+01 | 1.3E+01 | 1.6E+01 | 1.9E+01 | 2.2E+01 | 2.6E+01 | 3.1E+01 | 3.6E+01 | 4.3E+01 | 5.0E+01 | 5.8E+01 | 6.8E+01 | 8.0E+01 | 9.5E+01 | 1.1E+02 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 2.7E+03 | 3.3E+03 | 3.9E+03 | 4.6E+03 | 5.4E+03 | 6.3E+03 | 7.3E+03 | 8.5E+03 | 9.9E+03 | 1.1E+04 | 1.3E+04 | 1.5E+04 | 1.7E+04 | 1.9E+04 | 2.2E+04 | 2.5E+04 | 2.8E+04 | 3.2E+04 | 3.6E+04 | 4.0E+04 | 4.5E+04 | 5.0E+04 | 5.6E+04 | 6.2E+04 | 6.9E+04 | 7.6E+04 | 8.4E+04 | 9.3E+04 | 1.0E+05 | 1.1E+05 | 1.3E+05 |
| Si-32 | 5.4E-10 | 9.5E-10 | 1.6E-09 | 2.8E-09 | 4.8E-09 | 7.9E-09 | 1.3E-08 | 2.2E-08 | 3.5E-08 | 5.7E-08 | 9.2E-08 | 1.5E-07 | 2.3E-07 | 3.6E-07 | 5.6E-07 | 8.8E-07 | 1.4E-06 | 2.1E-06 | 3.1E-06 | 4.7E-06 | 7.0E-06 | 1.0E-05 | 1.5E-05 | 2.3E-05 | 3.3E-05 | 4.8E-05 | 6.9E-05 | 1.0E-04 | 1.4E-04 | 2.0E-04 | 2.9E-04 |
| Sr-90 | 1.4E-07 | 1.2E-07 | 1.1E-07 | 1.0E-07 | 9.0E-08 | 8.1E-08 | 7.2E-08 | 6.4E-08 | 5.7E-08 | 5.1E-08 | 4.5E-08 | 3.9E-08 | 3.5E-08 | 3.1E-08 | 2.7E-08 | 2.3E-08 | 2.0E-08 | 1.8E-08 | 1.5E-08 | 1.3E-08 | 1.2E-08 | 1.0E-08 | 8.7E-09 | 7.5E-09 | 6.4E-09 | 5.5E-09 | 4.7E-09 | 4.1E-09 | 3.4E-09 | 2.9E-09 | 2.5E-09 |
| Tc-99 | 6.9E+01 | 8.7E+01 | 1.1E+02 | 1.3E+02 | 1.7E+02 | 2.0E+02 | 2.5E+02 | 3.0E+02 | 3.7E+02 | 4.5E+02 | 5.4E+02 | 6.5E+02 | 7.8E+02 | 9.4E+02 | 1.1E+03 | 1.3E+03 | 1.6E+03 | 1.9E+03 | 2.2E+03 | 2.6E+03 | 3.0E+03 | 3.5E+03 | 4.1E+03 | 4.8E+03 | 5.5E+03 | 6.4E+03 | 7.4E+03 | 8.7E+03 | 1.0E+04 | 1.2E+04 | 1.3E+04 |

*TABLE 47. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 760 | 765 | 770 | 775 | 780 | 785 | 790 | 795 | 800 | 805 | 810 | 815 | 820 | 825 | 830 | 835 | 840 | 845 | 850 | 855 | 860 | 865 | 870 | 875 | 880 | 885 | 890 | 895 | 900 | 905 | 910 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 2.0E-01 | 1.9E-01 | 1.8E-01 | 1.7E-01 | 1.6E-01 | 1.5E-01 | 1.4E-01 | 1.3E-01 | 1.2E-01 | 1.1E-01 | 1.1E-01 | 9.9E-02 | 9.2E-02 | 8.6E-02 | 7.9E-02 | 7.4E-02 | 6.9E-02 | 6.4E-02 | 6.0E-02 | 5.6E-02 | 5.2E-02 | 4.8E-02 | 4.4E-02 | 4.1E-02 | 3.8E-02 | 3.5E-02 | 3.2E-02 | 3.0E-02 | 2.8E-02 | 2.6E-02 | 2.3E-02 |
| Ca-41 | 1.3E+06 | 1.3E+06 | 1.4E+06 | 1.5E+06 | 1.6E+06 | 1.7E+06 | 1.7E+06 | 1.8E+06 | 1.9E+06 | 2.0E+06 | 2.0E+06 | 2.1E+06 | 2.2E+06 | 2.3E+06 | 2.4E+06 | 2.4E+06 | 2.5E+06 | 2.6E+06 | 2.7E+06 | 2.7E+06 | 2.8E+06 | 2.9E+06 | 3.0E+06 | 3.0E+06 | 3.1E+06 | 3.2E+06 | 3.2E+06 | 3.3E+06 | 3.3E+06 | 3.4E+06 | 3.4E+06 |
| Cl-36 | 1.1E+03 | 1.1E+03 | 1.0E+03 | 9.8E+02 | 9.3E+02 | 8.8E+02 | 8.4E+02 | 7.8E+02 | 7.4E+02 | 7.0E+02 | 6.6E+02 | 6.2E+02 | 5.8E+02 | 5.4E+02 | 5.1E+02 | 4.8E+02 | 4.5E+02 | 4.2E+02 | 3.9E+02 | 3.7E+02 | 3.4E+02 | 3.2E+02 | 3.0E+02 | 2.8E+02 | 2.6E+02 | 2.4E+02 | 2.3E+02 | 2.1E+02 | 1.9E+02 | 1.8E+02 | 1.7E+02 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.3E+02 | 1.5E+02 | 1.8E+02 | 2.0E+02 | 2.3E+02 | 2.7E+02 | 3.1E+02 | 3.5E+02 | 4.0E+02 | 4.5E+02 | 5.1E+02 | 5.8E+02 | 6.5E+02 | 7.2E+02 | 8.1E+02 | 9.0E+02 | 1.0E+03 | 1.1E+03 | 1.2E+03 | 1.4E+03 | 1.5E+03 | 1.7E+03 | 1.9E+03 | 2.1E+03 | 2.3E+03 | 2.5E+03 | 2.8E+03 | 3.1E+03 | 3.4E+03 | 3.7E+03 | 4.0E+03 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 1.4E+05 | 1.6E+05 | 1.7E+05 | 1.9E+05 | 2.1E+05 | 2.2E+05 | 2.4E+05 | 2.6E+05 | 2.8E+05 | 3.0E+05 | 3.3E+05 | 3.5E+05 | 3.7E+05 | 4.0E+05 | 4.3E+05 | 4.5E+05 | 4.9E+05 | 5.2E+05 | 5.5E+05 | 6.0E+05 | 6.2E+05 | 6.8E+05 | 7.1E+05 | 7.5E+05 | 7.9E+05 | 8.3E+05 | 8.8E+05 | 9.2E+05 | 9.7E+05 | 1.0E+06 | 1.1E+06 |
| Si-32 | 4.2E-04 | 6.2E-04 | 8.8E-04 | 1.3E-03 | 1.8E-03 | 2.6E-03 | 3.7E-03 | 5.2E-03 | 7.1E-03 | 9.6E-03 | 1.3E-02 | 1.7E-02 | 2.3E-02 | 3.1E-02 | 4.0E-02 | 5.4E-02 | 6.9E-02 | 9.0E-02 | 1.2E-01 | 1.5E-01 | 1.9E-01 | 2.5E-01 | 3.2E-01 | 4.1E-01 | 5.2E-01 | 6.8E-01 | 8.6E-01 | 1.1E+00 | 1.4E+00 | 1.7E+00 | 2.1E+00 |
| Sr-90 | 2.1E-09 | 1.8E-09 | 1.5E-09 | 1.3E-09 | 1.1E-09 | 9.0E-10 | 7.5E-10 | 6.2E-10 | 5.1E-10 | 4.2E-10 | 3.5E-10 | 2.7E-10 | 2.2E-10 | 1.6E-10 | 1.1E-10 | 3.0E-11 | 2.6E-11 | 1.1E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.6E+04 | 1.8E+04 | 2.1E+04 | 2.4E+04 | 2.7E+04 | 3.1E+04 | 3.5E+04 | 3.9E+04 | 4.4E+04 | 4.8E+04 | 5.5E+04 | 6.1E+04 | 6.7E+04 | 7.4E+04 | 8.3E+04 | 9.2E+04 | 1.0E+05 | 1.1E+05 | 1.2E+05 | 1.4E+05 | 1.5E+05 | 1.7E+05 | 1.8E+05 | 2.0E+05 | 2.2E+05 | 2.4E+05 | 2.6E+05 | 2.8E+05 | 3.1E+05 | 3.3E+05 | 3.6E+05 |

*TABLE 47. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL TOP SLOPE (0.090 CM/YEAR INFILTRATION)*

| NUCLIDE | 915 | 920 | 925 | 930 | 935 | 940 | 945 | 950 | 955 | 960 | 965 | 970 | 975 | 980 | 985 | 990 | 995 | 1000 | 1010 | 1020 | 1030 | 1040 | 1050 | 1060 | 1070 | 1080 | 1100 | 1300 | 1500 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bk-247 | 2.2E-02 | 2.0E-02 | 1.8E-02 | 1.7E-02 | 1.5E-02 | 1.4E-02 | 1.3E-02 | 1.2E-02 | 1.1E-02 | 1.0E-02 | 9.2E-03 | 8.4E-03 | 7.7E-03 | 7.0E-03 | 6.4E-03 | 5.9E-03 | 5.4E-03 | 4.9E-03 | 4.1E-03 | 3.4E-03 | 2.9E-03 | 2.3E-03 | 1.9E-03 | 1.6E-03 | 1.3E-03 | 9.9E-04 | 6.2E-04 | 3.3E-06 | 1.7E-08 | 0 |
| Ca-41 | 3.4E+06 | 3.5E+06 | 3.5E+06 | 3.6E+06 | 3.6E+06 | 3.6E+06 | 3.6E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.7E+06 | 3.6E+06 | 3.6E+06 | 3.4E+06 | 3.2E+06 | 2.9E+06 | 2.7E+06 | 2.0E+06 | 4.5E+04 | 7.1E+02 | 2.6E-02 |
| Cl-36 | 1.6E+02 | 1.4E+02 | 1.4E+02 | 1.2E+02 | 1.2E+02 | 1.1E+02 | 9.9E+01 | 9.2E+01 | 8.5E+01 | 7.8E+01 | 7.2E+01 | 6.7E+01 | 6.2E+01 | 5.7E+01 | 5.2E+01 | 4.8E+01 | 4.5E+01 | 4.1E+01 | 3.5E+01 | 2.9E+01 | 2.5E+01 | 2.1E+01 | 1.7E+01 | 1.4E+01 | 1.2E+01 | 9.3E+00 | 5.8E+00 | 3.6E-02 | 2.1E-04 | 6.3E-10 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 4.4E+03 | 4.7E+03 | 5.2E+03 | 5.7E+03 | 6.1E+03 | 6.6E+03 | 7.1E+03 | 7.6E+03 | 8.2E+03 | 8.7E+03 | 9.5E+03 | 1.0E+04 | 1.1E+04 | 1.2E+04 | 1.3E+04 | 1.3E+04 | 1.4E+04 | 1.5E+04 | 1.7E+04 | 2.0E+04 | 2.2E+04 | 2.5E+04 | 2.7E+04 | 2.9E+04 | 3.1E+04 | 3.1E+04 | 2.9E+04 | 2.3E+03 | 1.0E+02 | 3.6E-02 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 1.0E-11 | 2.6E-11 | 3.7E-11 | 5.2E-11 | 8.2E-11 | 1.1E-10 | 1.4E-10 | 1.9E-10 | 2.5E-10 | 3.3E-10 | 4.7E-10 | 6.5E-10 | 9.1E-10 | 1.8E-09 | 3.6E-09 | 7.0E-09 | 1.3E-08 | 2.5E-08 | 4.4E-08 | 7.8E-08 | 1.3E-07 | 3.0E-07 | 2.4E-06 | 1.1E-06 | 5.2E-08 |
| Re-187 | 1.1E+06 | 1.2E+06 | 1.2E+06 | 1.2E+06 | 1.3E+06 | 1.3E+06 | 1.4E+06 | 1.4E+06 | 1.5E+06 | 1.6E+06 | 1.6E+06 | 1.7E+06 | 1.7E+06 | 1.8E+06 | 1.8E+06 | 1.9E+06 | 1.9E+06 | 2.0E+06 | 2.1E+06 | 2.2E+06 | 2.3E+06 | 2.4E+06 | 2.4E+06 | 2.4E+06 | 2.3E+06 | 2.2E+06 | 1.8E+06 | 6.7E+04 | 1.6E+03 | 1.5E-01 |
| Si-32 | 2.6E+00 | 3.3E+00 | 4.1E+00 | 5.0E+00 | 6.1E+00 | 7.4E+00 | 8.9E+00 | 1.1E+01 | 1.3E+01 | 1.6E+01 | 1.9E+01 | 2.3E+01 | 2.7E+01 | 3.3E+01 | 3.9E+01 | 4.6E+01 | 5.5E+01 | 6.5E+01 | 9.2E+01 | 1.3E+02 | 1.7E+02 | 2.3E+02 | 3.1E+02 | 4.1E+02 | 5.4E+02 | 6.6E+02 | 9.3E+02 | 5.0E+02 | 4.8E+01 | 7.1E-02 |
| Sr-90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 3.8E+05 | 4.2E+05 | 4.5E+05 | 4.9E+05 | 5.1E+05 | 5.6E+05 | 6.0E+05 | 6.4E+05 | 6.8E+05 | 7.3E+05 | 7.8E+05 | 8.2E+05 | 8.8E+05 | 9.4E+05 | 9.9E+05 | 1.1E+06 | 1.1E+06 | 1.2E+06 | 1.3E+06 | 1.5E+06 | 1.6E+06 | 1.8E+06 | 2.0E+06 | 2.1E+06 | 2.1E+06 | 2.1E+06 | 1.9E+06 | 1.3E+05 | 5.1E+03 | 1.4E+00 |

*TABLE 48. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | EXCEEDS | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7.2E-11 | 4.1E-09 | 9.9E-08 | 1.4E-06 | 1.2E-05 | 7.5E-05 | 3.4E-04 | 1.2E-03 | 3.8E-03 | 9.6E-03 | 2.1E-02 | 4.3E-02 | 5.7E-02 | 7.5E-02 | 9.6E-02 | 1.2E-01 | 1.5E-01 | 1.8E-01 | 2.1E-01 | 2.4E-01 | 2.8E-01 | 3.1E-01 | 3.5E-01 | 3.8E-01 | 4.1E-01 | 4.4E-01 | 4.6E-01 | 4.8E-01 |
| Ca-41 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.0E-10 | 3.6E-09 | 7.1E-08 | 9.9E-07 | 9.9E-06 | 7.5E-05 | 4.5E-04 | 2.2E-03 | 4.7E-03 | 9.3E-03 | 1.8E-02 | 3.4E-02 | 6.1E-02 | 1.1E-01 | 1.8E-01 | 3.0E-01 | 4.9E-01 | 7.7E-01 | 1.2E+00 | 1.8E+00 | 2.7E+00 | 3.9E+00 | 5.5E+00 | 7.7E+00 |
| Cl-36 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5.3E-10 | 8.5E-08 | 4.8E-06 | 1.3E-04 | 1.9E-03 | 1.8E-02 | 1.2E-01 | 6.0E-01 | 2.3E+00 | 7.2E+00 | 1.9E+01 | 4.5E+01 | 9.1E+01 | 1.3E+02 | 1.7E+02 | 2.2E+02 | 2.8E+02 | 3.5E+02 | 4.4E+02 | 5.2E+02 | 6.2E+02 | 7.2E+02 | 8.4E+02 | 9.4E+02 | 1.1E+03 | 1.2E+03 | 1.3E+03 | 1.4E+03 | 1.4E+03 |
| H-3 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.7E-10 | 5.3E-09 | 4.4E-08 | 2.3E-07 | 8.9E-07 | 2.5E-06 | 5.3E-06 | 9.2E-06 | 1.3E-05 | 1.5E-05 | 1.6E-05 | 1.7E-05 | 1.7E-05 | 1.7E-05 | 1.7E-05 | 1.6E-05 | 1.4E-05 | 1.3E-05 | 1.1E-05 | 9.6E-06 | 8.1E-06 | 6.7E-06 | 5.5E-06 | 4.4E-06 | 3.5E-06 |
| I-129 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4.2E-11 | 2.0E-10 | 6.0E-10 | 1.7E-09 | 4.6E-09 | 1.2E-08 | 2.9E-08 | 6.9E-08 | 1.6E-07 | 3.5E-07 | 7.6E-07 | 1.6E-06 | 3.2E-06 | 6.2E-06 | 1.2E-05 |
| Pd-107 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7.1E-11 | 3.6E-09 | 9.1E-08 | 1.6E-06 | 2.0E-05 | 1.9E-04 | 1.4E-03 | 3.6E-03 | 8.5E-03 | 2.0E-02 | 4.4E-02 | 9.4E-02 | 1.9E-01 | 3.8E-01 | 7.3E-01 | 1.4E+00 | 2.4E+00 | 4.3E+00 | 7.4E+00 | 1.2E+01 | 2.0E+01 | 3.3E+01 | 5.2E+01 |
| Se-79 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sr-90 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.0E-10 | 4.3E-09 | 5.4E-08 | 3.1E-07 | 2.8E-06 | 1.5E-05 | 5.7E-05 | 1.8E-04 | 3.0E-04 | 4.7E-04 | 7.3E-04 | 1.1E-03 | 1.5E-03 | 2.2E-03 | 2.9E-03 | 3.9E-03 | 4.9E-03 | 6.2E-03 | 7.7E-03 | 9.3E-03 | 1.1E-02 | 1.3E-02 | 1.4E-02 | 1.6E-02 |
| Tc-99 | >500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.3E-11 | 5.5E-10 | 7.3E-09 | 2.4E-08 | 7.5E-08 | 2.2E-07 | 6.1E-07 | 1.6E-06 | 4.1E-06 | 1.0E-05 | 2.3E-05 | 5.3E-05 | 1.1E-04 | 2.4E-04 | 4.9E-04 | 9.6E-04 | 1.9E-03 | 3.5E-03 | 6.4E-03 |

*TABLE 48. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 | 325 | 330 | 335 | 340 | 345 | 350 | 355 | 360 | 365 | 370 | 375 | 380 | 385 | 390 | 395 | 400 | 405 | 410 | 415 | 420 | 425 | 430 | 435 | 440 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 5.0E-01 | 5.1E-01 | 5.2E-01 | 5.3E-01 | 5.3E-01 | 5.3E-01 | 5.4E-01 | 5.4E-01 | 5.3E-01 | 5.0E-01 | 4.7E-01 | 4.5E-01 | 4.1E-01 | 3.8E-01 | 3.5E-01 | 3.3E-01 | 3.0E-01 | 2.8E-01 | 2.5E-01 | 2.3E-01 | 2.1E-01 | 1.9E-01 | 1.7E-01 | 1.6E-01 | 1.4E-01 | 1.3E-01 | 1.1E-01 | 1.0E-01 | 9.1E-02 | 8.0E-02 | 7.0E-02 | 6.2E-02 |
| Ca-41 | 1.1E+01 | 1.5E+01 | 2.0E+01 | 2.6E+01 | 3.4E+01 | 4.5E+01 | 6.0E+01 | 8.2E+01 | 1.0E+02 | 1.3E+02 | 1.6E+02 | 1.9E+02 | 2.3E+02 | 2.7E+02 | 3.1E+02 | 3.7E+02 | 4.3E+02 | 5.0E+02 | 5.6E+02 | 6.5E+02 | 7.4E+02 | 8.3E+02 | 9.3E+02 | 1.0E+03 | 1.2E+03 | 1.3E+03 | 1.4E+03 | 1.5E+03 | 1.6E+03 | 1.8E+03 | 1.9E+03 | 2.0E+03 |
| Cl-36 | 1.5E+03 | 1.6E+03 | 1.6E+03 | 1.7E+03 | 1.7E+03 | 1.7E+03 | 1.8E+03 | 1.8E+03 | 1.8E+03 | 1.7E+03 | 1.7E+03 | 1.6E+03 | 1.5E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 | 1.2E+03 | 1.1E+03 | 1.0E+03 | 9.5E+02 | 8.8E+02 | 8.2E+02 | 7.4E+02 | 6.8E+02 | 6.2E+02 | 5.6E+02 | 5.0E+02 | 4.5E+02 | 4.2E+02 | 3.7E+02 | 3.3E+02 | 2.9E+02 |
| H-3 | 2.7E-06 | 2.1E-06 | 1.6E-06 | 1.2E-06 | 8.7E-07 | 6.3E-07 | 4.6E-07 | 3.4E-07 | 2.4E-07 | 1.7E-07 | 1.2E-07 | 7.9E-08 | 5.3E-08 | 3.6E-08 | 2.4E-08 | 1.6E-08 | 1.0E-08 | 6.7E-09 | 4.3E-09 | 2.7E-09 | 1.7E-09 | 1.1E-09 | 6.7E-10 | 4.2E-10 | 2.6E-10 | 1.5E-10 | 7.5E-11 | 2.1E-11 | 0 | 0 | 0 | 0 |
| I-129 | 2.2E-05 | 4.0E-05 | 7.1E-05 | 1.2E-04 | 2.1E-04 | 3.5E-04 | 5.9E-04 | 1.1E-03 | 1.8E-03 | 3.0E-03 | 4.6E-03 | 7.0E-03 | 1.0E-02 | 1.5E-02 | 2.2E-02 | 3.1E-02 | 4.3E-02 | 6.0E-02 | 8.3E-02 | 1.1E-01 | 1.5E-01 | 2.0E-01 | 2.7E-01 | 3.5E-01 | 4.5E-01 | 5.9E-01 | 7.5E-01 | 9.7E-01 | 1.2E+00 | 1.5E+00 | 1.9E+00 | 2.4E+00 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Re-187 | 8.0E+01 | 1.2E+02 | 1.8E+02 | 2.7E+02 | 3.9E+02 | 5.5E+02 | 8.0E+02 | 1.2E+03 | 1.7E+03 | 2.4E+03 | 3.1E+03 | 4.1E+03 | 5.3E+03 | 6.9E+03 | 8.7E+03 | 1.1E+04 | 1.4E+04 | 1.7E+04 | 2.1E+04 | 2.6E+04 | 3.1E+04 | 3.8E+04 | 4.5E+04 | 5.4E+04 | 6.3E+04 | 7.5E+04 | 8.7E+04 | 1.0E+05 | 1.2E+05 | 1.3E+05 | 1.5E+05 | 1.7E+05 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 0 | 0 | 0 | 0 | 0 | 4.8E-11 | 2.1E-10 | 8.1E-10 | 3.3E-09 | 1.1E-08 | 3.4E-08 | 9.3E-08 | 2.5E-07 | 6.1E-07 | 1.5E-06 | 3.6E-06 | 8.2E-06 | 1.8E-05 | 4.1E-05 | 8.8E-05 | 1.9E-04 | 3.8E-04 | 7.8E-04 | 1.5E-03 | 3.0E-03 | 5.8E-03 | 1.1E-02 | 2.0E-02 | 3.8E-02 | 6.6E-02 | 1.2E-01 | 2.1E-01 |
| Sr-90 | 1.8E-02 | 1.9E-02 | 2.0E-02 | 2.1E-02 | 2.2E-02 | 2.3E-02 | 2.4E-02 | 2.5E-02 | 2.6E-02 | 2.5E-02 | 2.4E-02 | 2.4E-02 | 2.2E-02 | 2.1E-02 | 1.9E-02 | 1.8E-02 | 1.7E-02 | 1.5E-02 | 1.4E-02 | 1.2E-02 | 1.1E-02 | 1.0E-02 | 8.7E-03 | 7.8E-03 | 6.9E-03 | 5.9E-03 | 5.1E-03 | 4.5E-03 | 3.8E-03 | 3.3E-03 | 2.8E-03 | 2.4E-03 |
| Tc-99 | 1.2E-02 | 2.0E-02 | 3.4E-02 | 5.8E-02 | 9.4E-02 | 1.5E-01 | 2.5E-01 | 4.3E-01 | 7.0E-01 | 1.1E+00 | 1.7E+00 | 2.4E+00 | 3.5E+00 | 4.9E+00 | 6.9E+00 | 9.6E+00 | 1.3E+01 | 1.8E+01 | 2.4E+01 | 3.2E+01 | 4.2E+01 | 5.6E+01 | 7.2E+01 | 9.4E+01 | 1.2E+02 | 1.5E+02 | 1.9E+02 | 2.4E+02 | 2.9E+02 | 3.6E+02 | 4.4E+02 | 5.4E+02 |

*TABLE 48. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 445 | 450 | 455 | 460 | 465 | 470 | 475 | 480 | 485 | 490 | 495 | 500 | 505 | 510 | 515 | 520 | 525 | 530 | 535 | 540 | 545 | 550 | 555 | 560 | 565 | 570 | 575 | 580 | 585 | 590 | 595 | 600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 5.4E-02 | 4.8E-02 | 4.2E-02 | 3.7E-02 | 3.2E-02 | 2.8E-02 | 2.4E-02 | 2.1E-02 | 1.8E-02 | 1.6E-02 | 1.3E-02 | 1.2E-02 | 9.8E-03 | 8.4E-03 | 7.3E-03 | 6.1E-03 | 5.3E-03 | 4.5E-03 | 3.9E-03 | 3.3E-03 | 2.8E-03 | 2.4E-03 | 2.0E-03 | 1.7E-03 | 1.4E-03 | 1.2E-03 | 1.0E-03 | 8.7E-04 | 7.2E-04 | 6.1E-04 | 5.1E-04 | 4.3E-04 |
| Ca-41 | 2.1E+03 | 2.2E+03 | 2.3E+03 | 2.5E+03 | 2.6E+03 | 2.7E+03 | 2.8E+03 | 2.9E+03 | 3.0E+03 | 3.1E+03 | 3.2E+03 | 3.3E+03 | 3.3E+03 | 3.4E+03 | 3.5E+03 | 3.5E+03 | 3.5E+03 | 3.6E+03 | 3.5E+03 | 3.5E+03 | 3.5E+03 | 3.5E+03 | 3.4E+03 | 3.4E+03 | 3.4E+03 | 3.3E+03 | 3.3E+03 | 3.2E+03 | 3.1E+03 | 3.1E+03 | 2.9E+03 | 2.9E+03 |
| Cl-36 | 2.5E+02 | 2.0E+02 | 1.6E+02 | 1.4E+02 | 1.2E+02 | 1.1E+02 | 1.0E+02 | 9.2E+01 | 8.3E+01 | 7.4E+01 | 6.7E+01 | 5.9E+01 | 5.2E+01 | 4.6E+01 | 4.0E+01 | 3.5E+01 | 3.0E+01 | 2.6E+01 | 2.3E+01 | 2.0E+01 | 1.7E+01 | 1.5E+01 | 1.2E+01 | 1.1E+01 | 9.1E+00 | 7.6E+00 | 6.6E+00 | 5.7E+00 | 4.8E+00 | 4.1E+00 | 3.5E+00 | 3.0E+00 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 2.9E+00 | 3.5E+00 | 4.4E+00 | 5.3E+00 | 6.5E+00 | 7.8E+00 | 9.1E+00 | 1.1E+01 | 1.3E+01 | 1.5E+01 | 1.8E+01 | 2.1E+01 | 2.4E+01 | 2.8E+01 | 3.2E+01 | 3.7E+01 | 4.1E+01 | 4.8E+01 | 5.3E+01 | 6.0E+01 | 6.8E+01 | 7.5E+01 | 8.5E+01 | 9.5E+01 | 1.1E+02 | 1.2E+02 | 1.3E+02 | 1.4E+02 | 1.6E+02 | 1.7E+02 | 1.9E+02 | 2.1E+02 |
| Pd-107 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.3E-11 | 8.9E-11 | 1.7E-10 | 3.2E-10 | 5.9E-10 | 1.1E-09 | 1.9E-09 | 3.3E-09 | 5.8E-09 | 1.0E-08 | 1.7E-08 | 2.9E-08 | 4.8E-08 | 7.9E-08 | 1.3E-07 | 2.1E-07 | 3.5E-07 |
| Re-187 | 2.0E+05 | 2.2E+05 | 2.5E+05 | 2.7E+05 | 3.0E+05 | 3.4E+05 | 3.7E+05 | 4.1E+05 | 4.5E+05 | 4.9E+05 | 5.2E+05 | 5.7E+05 | 6.0E+05 | 6.6E+05 | 7.0E+05 | 7.4E+05 | 8.0E+05 | 8.5E+05 | 8.9E+05 | 9.4E+05 | 1.0E+06 | 1.0E+06 | 1.1E+06 | 1.1E+06 | 1.2E+06 | 1.2E+06 | 1.3E+06 | 1.3E+06 | 1.3E+06 | 1.4E+06 | 1.4E+06 | 1.4E+06 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 3.5E-01 | 6.0E-01 | 1.0E+00 | 1.7E+00 | 2.7E+00 | 4.4E+00 | 7.0E+00 | 1.1E+01 | 1.7E+01 | 2.7E+01 | 4.1E+01 | 6.3E+01 | 9.3E+01 | 1.4E+02 | 2.1E+02 | 3.0E+02 | 4.4E+02 | 6.3E+02 | 8.9E+02 | 1.3E+03 | 1.8E+03 | 2.5E+03 | 3.4E+03 | 4.8E+03 | 6.5E+03 | 8.7E+03 | 1.2E+04 | 1.6E+04 | 2.1E+04 | 2.8E+04 | 3.7E+04 | 4.8E+04 |
| Sr-90 | 2.0E-03 | 1.7E-03 | 1.4E-03 | 1.2E-03 | 9.7E-04 | 8.1E-04 | 6.6E-04 | 5.4E-04 | 4.4E-04 | 3.6E-04 | 2.9E-04 | 2.4E-04 | 1.9E-04 | 1.5E-04 | 1.2E-04 | 9.7E-05 | 7.8E-05 | 6.2E-05 | 4.9E-05 | 3.9E-05 | 3.1E-05 | 2.4E-05 | 1.9E-05 | 1.5E-05 | 1.1E-05 | 8.9E-06 | 7.1E-06 | 5.4E-06 | 4.2E-06 | 3.2E-06 | 2.5E-06 | 1.9E-06 |
| Tc-99 | 6.5E+02 | 7.8E+02 | 9.5E+02 | 1.1E+03 | 1.3E+03 | 1.6E+03 | 1.8E+03 | 2.1E+03 | 2.5E+03 | 2.9E+03 | 3.3E+03 | 3.8E+03 | 4.3E+03 | 4.9E+03 | 5.5E+03 | 6.3E+03 | 7.1E+03 | 7.9E+03 | 8.9E+03 | 1.0E+04 | 1.1E+04 | 1.2E+04 | 1.3E+04 | 1.5E+04 | 1.6E+04 | 1.8E+04 | 2.0E+04 | 2.1E+04 | 2.3E+04 | 2.5E+04 | 2.6E+04 | 2.9E+04 |

*TABLE 48. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 605 | 610 | 615 | 620 | 625 | 630 | 635 | 640 | 645 | 650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720 | 725 | 730 | 735 | 740 | 745 | 750 | 755 | 760 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 3.6E-04 | 3.0E-04 | 2.5E-04 | 2.1E-04 | 1.8E-04 | 1.5E-04 | 1.2E-04 | 1.0E-04 | 8.7E-05 | 7.2E-05 | 5.9E-05 | 4.9E-05 | 4.1E-05 | 3.5E-05 | 2.9E-05 | 2.4E-05 | 2.0E-05 | 1.7E-05 | 1.4E-05 | 1.1E-05 | 9.4E-06 | 7.8E-06 | 6.7E-06 | 5.8E-06 | 4.8E-06 | 3.8E-06 | 3.0E-06 | 2.5E-06 | 2.1E-06 | 1.6E-06 | 1.3E-06 | 1.1E-06 |
| Ca-41 | 2.8E+03 | 2.7E+03 | 2.6E+03 | 2.6E+03 | 2.5E+03 | 2.4E+03 | 2.3E+03 | 2.2E+03 | 2.1E+03 | 2.0E+03 | 1.9E+03 | 1.8E+03 | 1.8E+03 | 1.7E+03 | 1.6E+03 | 1.5E+03 | 1.4E+03 | 1.4E+03 | 1.3E+03 | 1.2E+03 | 1.2E+03 | 1.1E+03 | 1.0E+03 | 1.0E+03 | 1.0E+03 | 9.5E+02 | 8.6E+02 | 8.0E+02 | 7.6E+02 | 6.9E+02 | 6.3E+02 | 5.8E+02 |
| Cl-36 | 2.5E+00 | 2.1E+00 | 1.8E+00 | 1.5E+00 | 1.3E+00 | 1.1E+00 | 9.1E-01 | 7.8E-01 | 6.5E-01 | 5.5E-01 | 4.6E-01 | 3.9E-01 | 3.3E-01 | 2.8E-01 | 2.3E-01 | 2.0E-01 | 1.7E-01 | 1.4E-01 | 1.2E-01 | 9.7E-02 | 8.2E-02 | 6.8E-02 | 5.7E-02 | 5.1E-02 | 4.3E-02 | 3.5E-02 | 2.7E-02 | 2.3E-02 | 1.9E-02 | 1.5E-02 | 1.2E-02 | 1.1E-02 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 2.2E+02 | 2.4E+02 | 2.6E+02 | 2.8E+02 | 3.0E+02 | 3.3E+02 | 3.5E+02 | 3.7E+02 | 4.0E+02 | 4.2E+02 | 4.5E+02 | 4.7E+02 | 5.0E+02 | 5.3E+02 | 5.7E+02 | 6.0E+02 | 6.2E+02 | 6.6E+02 | 6.8E+02 | 7.2E+02 | 7.4E+02 | 7.8E+02 | 8.1E+02 | 8.7E+02 | 9.4E+02 | 1.0E+03 | 1.0E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 |
| Pd-107 | 5.5E-07 | 8.8E-07 | 1.4E-06 | 2.2E-06 | 3.4E-06 | 5.2E-06 | 8.0E-06 | 1.2E-05 | 1.8E-05 | 2.8E-05 | 4.1E-05 | 6.2E-05 | 9.0E-05 | 1.3E-04 | 1.9E-04 | 2.8E-04 | 4.0E-04 | 5.7E-04 | 8.0E-04 | 1.1E-03 | 1.6E-03 | 2.2E-03 | 3.1E-03 | 4.3E-03 | 6.0E-03 | 8.4E-03 | 1.2E-02 | 1.8E-02 | 2.5E-02 | 3.6E-02 | 5.0E-02 | 6.9E-02 |
| Re-187 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.6E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.4E+06 | 1.5E+06 | 1.5E+06 | 1.5E+06 | 1.4E+06 | 1.4E+06 | 1.4E+06 | 1.3E+06 | 1.2E+06 | 1.2E+06 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Si-32 | 6.3E+04 | 8.0E+04 | 1.1E+05 | 1.3E+05 | 1.7E+05 | 2.1E+05 | 2.7E+05 | 3.4E+05 | 4.2E+05 | 5.3E+05 | 6.6E+05 | 8.0E+05 | 9.8E+05 | 1.2E+06 | 1.5E+06 | 1.8E+06 | 2.2E+06 | 2.6E+06 | 3.1E+06 | 3.7E+06 | 4.4E+06 | 5.3E+06 | 6.3E+06 | 7.4E+06 | 8.8E+06 | 1.1E+07 | 1.3E+07 | 1.6E+07 | 1.9E+07 | 2.2E+07 | 2.6E+07 | 3.1E+07 |
| Sr-90 | 1.5E-06 | 1.2E-06 | 8.8E-07 | 6.7E-07 | 5.1E-07 | 3.9E-07 | 3.0E-07 | 2.2E-07 | 1.7E-07 | 1.3E-07 | 9.8E-08 | 7.4E-08 | 5.6E-08 | 4.2E-08 | 3.1E-08 | 2.4E-08 | 1.8E-08 | 1.3E-08 | 1.0E-08 | 7.4E-09 | 5.5E-09 | 4.1E-09 | 3.1E-09 | 2.3E-09 | 1.8E-09 | 1.3E-09 | 9.4E-10 | 7.0E-10 | 5.0E-10 | 3.6E-10 | 2.5E-10 | 1.7E-10 |
| Tc-99 | 3.1E+04 | 3.3E+04 | 3.5E+04 | 3.7E+04 | 4.0E+04 | 4.2E+04 | 4.4E+04 | 4.7E+04 | 4.9E+04 | 5.3E+04 | 5.5E+04 | 5.9E+04 | 6.0E+04 | 6.4E+04 | 6.6E+04 | 6.9E+04 | 7.1E+04 | 7.4E+04 | 7.6E+04 | 8.0E+04 | 8.2E+04 | 8.5E+04 | 8.7E+04 | 9.2E+04 | 1.0E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 |

*TABLE 48. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 765 | 770 | 775 | 780 | 785 | 790 | 795 | 800 | 805 | 810 | 815 | 820 | 825 | 830 | 835 | 840 | 845 | 850 | 855 | 860 | 865 | 870 | 875 | 880 | 885 | 890 | 895 | 900 | 905 | 910 | 915 | 920 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bk-247 | 9.0E-07 | 7.2E-07 | 5.7E-07 | 4.9E-07 | 4.0E-07 | 3.1E-07 | 2.6E-07 | 2.1E-07 | 1.8E-07 | 1.4E-07 | 1.1E-07 | 9.9E-08 | 8.5E-08 | 6.8E-08 | 5.2E-08 | 4.1E-08 | 3.5E-08 | 2.9E-08 | 2.4E-08 | 1.8E-08 | 1.4E-08 | 1.2E-08 | 1.1E-08 | 8.6E-09 | 6.6E-09 | 5.2E-09 | 4.5E-09 | 3.9E-09 | 3.2E-09 | 2.4E-09 | 1.9E-09 | 1.6E-09 |
| Ca-41 | 5.5E+02 | 5.0E+02 | 4.5E+02 | 4.2E+02 | 4.0E+02 | 3.7E+02 | 3.3E+02 | 3.1E+02 | 3.0E+02 | 2.7E+02 | 2.5E+02 | 2.3E+02 | 2.3E+02 | 2.1E+02 | 1.9E+02 | 1.7E+02 | 1.5E+02 | 1.5E+02 | 1.4E+02 | 1.2E+02 | 1.1E+02 | 9.9E+01 | 9.6E+01 | 9.0E+01 | 8.0E+01 | 7.0E+01 | 6.4E+01 | 6.2E+01 | 5.8E+01 | 5.2E+01 | 4.5E+01 | 4.1E+01 |
| Cl-36 | 8.9E-03 | 7.0E-03 | 5.6E-03 | 4.9E-03 | 4.0E-03 | 3.3E-03 | 2.6E-03 | 2.3E-03 | 1.9E-03 | 1.6E-03 | 1.3E-03 | 1.1E-03 | 9.5E-04 | 7.7E-04 | 6.1E-04 | 4.8E-04 | 4.1E-04 | 3.6E-04 | 2.9E-04 | 2.3E-04 | 1.8E-04 | 1.5E-04 | 1.3E-04 | 1.1E-04 | 8.4E-05 | 6.7E-05 | 5.9E-05 | 5.0E-05 | 4.2E-05 | 3.2E-05 | 2.5E-05 | 2.2E-05 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.4E+03 | 1.5E+03 | 1.5E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.5E+03 | 1.5E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 | 1.4E+03 | 1.4E+03 | 1.3E+03 | 1.3E+03 |
| Pd-107 | 9.5E-02 | 1.3E-01 | 1.7E-01 | 2.2E-01 | 2.9E-01 | 3.8E-01 | 4.8E-01 | 6.3E-01 | 8.1E-01 | 1.0E+00 | 1.3E+00 | 1.7E+00 | 2.1E+00 | 2.7E+00 | 3.5E+00 | 4.5E+00 | 5.8E+00 | 7.5E+00 | 9.5E+00 | 1.2E+01 | 1.5E+01 | 1.8E+01 | 2.3E+01 | 2.7E+01 | 3.4E+01 | 4.2E+01 | 5.1E+01 | 6.1E+01 | 7.4E+01 | 9.0E+01 | 1.1E+02 | 1.3E+02 |
| Re-187 | 1.2E+06 | 1.1E+06 | 1.1E+06 | 1.0E+06 | 9.9E+05 | 9.5E+05 | 8.9E+05 | 8.5E+05 | 8.4E+05 | 8.1E+05 | 7.7E+05 | 7.3E+05 | 7.4E+05 | 7.4E+05 | 6.8E+05 | 6.2E+05 | 6.0E+05 | 5.8E+05 | 5.7E+05 | 5.4E+05 | 4.9E+05 | 4.6E+05 | 4.5E+05 | 4.4E+05 | 4.2E+05 | 3.7E+05 | 3.5E+05 | 3.5E+05 | 3.4E+05 | 3.2E+05 | 2.9E+05 | 2.7E+05 |
| Se-79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2E-11 | 2.7E-11 | 5.4E-11 | 9.0E-11 | 1.5E-10 | 2.3E-10 | 3.6E-10 | 5.6E-10 | 8.4E-10 | 1.3E-09 | 1.9E-09 | 2.8E-09 | 4.1E-09 | 5.8E-09 | 8.5E-09 | 1.2E-08 | 1.7E-08 | 2.4E-08 | 3.4E-08 |
| Si-32 | 3.5E+07 | 3.9E+07 | 4.5E+07 | 5.1E+07 | 5.8E+07 | 6.4E+07 | 7.3E+07 | 8.2E+07 | 9.3E+07 | 1.0E+08 | 1.1E+08 | 1.3E+08 | 1.4E+08 | 1.6E+08 | 1.8E+08 | 2.0E+08 | 2.3E+08 | 2.5E+08 | 2.7E+08 | 3.0E+08 | 3.3E+08 | 3.5E+08 | 3.9E+08 | 4.2E+08 | 4.5E+08 | 4.9E+08 | 5.4E+08 | 5.7E+08 | 5.9E+08 | 6.0E+08 | 5.8E+08 | 5.7E+08 |
| Sr-90 | 1.2E-10 | 7.9E-11 | 5.2E-11 | 2.9E-11 | 1.1E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.2E+05 | 1.2E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.1E+05 | 1.0E+05 | 9.8E+04 | 9.8E+04 | 9.9E+04 | 9.8E+04 | 9.4E+04 | 9.0E+04 |

*TABLE 48. RADIONUCLIDE CONCENTRATIONS (pCi/L) AT COMPLIANCE WELL, HORIZONTAL PATHRAE MODEL RESULTS FOR CAW CELL SIDE SLOPE (0.168 CM/YEAR INFILTRATION)*

| | 925 | 930 | 935 | 940 | 945 | 950 | 955 | 960 | 965 | 970 | 975 | 980 | 985 | 990 | 995 | 1000 | 1010 | 1020 | 1030 | 1040 | 1050 | 1060 | 1070 | 1080 | 1100 | 1300 | 1500 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Am-241 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-242m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Am-243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2E-11 | 1.6E-11 | 2.3E-11 | 0 | 0 |
| Bk-247 | 1.4E-09 | 1.1E-09 | 8.8E-10 | 6.9E-10 | 5.8E-10 | 5.2E-10 | 4.1E-10 | 3.2E-10 | 2.4E-10 | 2.1E-10 | 1.8E-10 | 1.4E-10 | 1.1E-10 | 7.1E-11 | 6.7E-11 | 6.1E-11 | 3.4E-11 | 1.3E-11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ca-41 | 4.1E+01 | 3.8E+01 | 3.4E+01 | 2.9E+01 | 2.7E+01 | 2.5E+01 | 2.4E+01 | 2.2E+01 | 1.8E+01 | 1.7E+01 | 1.6E+01 | 1.5E+01 | 1.4E+01 | 1.2E+01 | 1.1E+01 | 1.0E+01 | 8.6E+00 | 6.0E+00 | 3.7E+00 | 2.1E+00 | 1.2E+00 | 6.3E-01 | 3.4E-01 | 1.8E-01 | 5.0E-02 | 1.6E-07 | 0 |
| Cl-36 | 1.9E-05 | 1.6E-05 | 1.2E-05 | 9.8E-06 | 8.5E-06 | 7.5E-06 | 6.0E-06 | 4.7E-06 | 3.8E-06 | 3.2E-06 | 2.8E-06 | 2.4E-06 | 1.8E-06 | 1.4E-06 | 1.2E-06 | 1.1E-06 | 6.8E-07 | 3.6E-07 | 1.8E-07 | 8.5E-08 | 3.9E-08 | 1.7E-08 | 7.9E-09 | 3.6E-09 | 7.2E-10 | 0 | 0 |
| H-3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| I-129 | 1.3E+03 | 1.3E+03 | 1.3E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.2E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.1E+03 | 1.0E+03 | 1.0E+03 | 1.0E+03 | 8.6E+02 | 6.6E+02 | 4.7E+02 | 3.2E+02 | 2.0E+02 | 1.3E+02 | 8.3E+01 | 3.1E+01 | 1.8E-03 | 1.2E-07 |
| Pd-107 | 1.6E+02 | 1.9E+02 | 2.3E+02 | 2.8E+02 | 3.3E+02 | 3.9E+02 | 4.7E+02 | 5.6E+02 | 6.5E+02 | 7.7E+02 | 9.2E+02 | 1.1E+03 | 1.3E+03 | 1.5E+03 | 1.7E+03 | 2.0E+03 | 2.7E+03 | 3.7E+03 | 4.9E+03 | 6.2E+03 | 7.1E+03 | 7.6E+03 | 7.8E+03 | 7.6E+03 | 6.4E+03 | 1.8E+02 | 3.0E+00 |
| Re-187 | 2.6E+05 | 2.6E+05 | 2.4E+05 | 2.2E+05 | 2.0E+05 | 2.0E+05 | 1.9E+05 | 1.8E+05 | 1.6E+05 | 1.5E+05 | 1.5E+05 | 1.4E+05 | 1.3E+05 | 1.2E+05 | 1.1E+05 | 1.1E+05 | 9.8E+04 | 7.5E+04 | 5.0E+04 | 3.1E+04 | 1.8E+04 | 1.1E+04 | 6.3E+03 | 3.6E+03 | 1.1E+03 | 1.2E-02 | 1.7E-07 |
| Se-79 | 4.9E-08 | 6.8E-08 | 9.5E-08 | 1.3E-07 | 1.8E-07 | 2.6E-07 | 3.5E-07 | 4.8E-07 | 6.6E-07 | 9.0E-07 | 1.2E-06 | 1.6E-06 | 2.2E-06 | 3.0E-06 | 4.0E-06 | 5.4E-06 | 9.7E-06 | 1.7E-05 | 3.0E-05 | 5.1E-05 | 8.2E-05 | 1.2E-04 | 1.6E-04 | 2.1E-04 | 2.7E-04 | 8.9E-05 | 8.0E-06 |
| Si-32 | 5.4E+08 | 5.1E+08 | 4.8E+08 | 4.3E+08 | 3.9E+08 | 3.5E+08 | 3.1E+08 | 2.8E+08 | 2.5E+08 | 2.2E+08 | 1.9E+08 | 1.7E+08 | 1.4E+08 | 1.3E+08 | 1.1E+08 | 9.4E+07 | 7.0E+07 | 5.2E+07 | 3.8E+07 | 2.8E+07 | 2.0E+07 | 1.5E+07 | 1.1E+07 | 8.0E+06 | 4.2E+06 | 6.9E+03 | 1.2E+01 |
| Sr-90 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tc-99 | 9.0E+04 | 9.0E+04 | 9.0E+04 | 8.5E+04 | 8.1E+04 | 8.1E+04 | 8.2E+04 | 8.0E+04 | 7.7E+04 | 7.2E+04 | 7.1E+04 | 7.3E+04 | 7.1E+04 | 6.8E+04 | 6.3E+04 | 6.2E+04 | 6.1E+04 | 5.1E+04 | 3.9E+04 | 2.6E+04 | 1.7E+04 | 1.1E+04 | 7.0E+03 | 4.2E+03 | 1.6E+03 | 6.3E-02 | 3.1E-06 |

# ATTACHMENT 1
# ENERGYSOLUTIONS
# CLASS A WEST (CAW) CELL
# HELP INFILTRATION MODEL
# OUTPUT FILES

Prepared for

*EnergySolutions, LLC*
*423 West 300 South, Suite 200*
*Salt Lake City, UT  84101*

Prepared by

*Whetstone Associates, Inc.*
*104 W Ruby Avenue*
*Gunnison, Colorado  81230*
*970-641-7471*

*Document 4104K.111128*

November 28, 2011

*INDEX OF HELP MODEL OUTPUT FILES*
*CLASS A WEST (CAW) DISPOSAL CELL*

| RUN: | CASE: | INCLUDED IN APPENDIX | INCLUDED ON CD |
|---|---|---|---|
| **TOP SLOPE:** | | | |
| MT6-2024 | Top Slope, 6" thick Type-B Filter, 24" Rip Rap | ✓ | ✓ |
| **SIDE SLOPE:** | | | |
| S18-24 | Side Slope, 18" thick Type-B Filter, 24" Rip Rap, Without Run-on | ✓ | ✓ |
| S18-24R1 | Side Slope, 18" thick Type-B Filter, 24" Rip Rap, Downslope Drainage, 1st Iteration | | ✓ |
| S18-24R2 | Side Slope, 18" thick Type-B Filter, 24" Rip Rap, Downslope Drainage, 2nd Iteration | ✓ | ✓ |

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******************************************************************************
******************************************************************************
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.06   (17 AUGUST 1996)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:    C:\PROJECTS\4101K_~1\HELP\U100.D4
TEMPERATURE DATA FILE:      C:\PROJECTS\4101K_~1\HELP\U100.D7
SOLAR RADIATION DATA FILE:  C:\PROJECTS\4101K_~1\HELP\U100.D13
EVAPOTRANSPIRATION DATA:    C:\PROJECTS\4101K_~1\HELP\U100-D20.D11
SOIL AND DESIGN DATA FILE:  C:\PROJECTS\4101K_~1\HELP\MT6-2024.D10
OUTPUT DATA FILE:           C:\PROJECTS\4101K_~1\HELP\MT6-2024.OUT
TIME:  17: 6     DATE:  10/20/2011

******************************************************************************
     TITLE:  CAW CELL - TOP SLOPE - 6"FILTER - 942L - 20"EZD - 24"RipRap
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.1900 VOL/VOL
           FIELD CAPACITY             =      0.0240 VOL/VOL
           WILTING POINT              =      0.0070 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0156 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   42.0000000000     CM/SEC

                                LAYER  2
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.1900 VOL/VOL
           FIELD CAPACITY             =      0.0240 VOL/VOL
           WILTING POINT              =      0.0070 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0240 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   42.0000000000     CM/SEC

                                LAYER  3
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.3100 VOL/VOL
           FIELD CAPACITY             =      0.2000 VOL/VOL
           WILTING POINT              =      0.0250 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1322 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.400000019000E-02 CM/SEC

                                LAYER  4
                                --------
                       TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.2800 VOL/VOL
           FIELD CAPACITY             =      0.0320 VOL/VOL
           WILTING POINT              =      0.0130 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0320 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   3.50000000000     CM/SEC
           SLOPE                      =      4.00   PERCENT
           DRAINAGE LENGTH            =    942.0    FEET

                                LAYER  5
                                --------
                         TYPE 3 - BARRIER SOIL LINER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4300 VOL/VOL
           FIELD CAPACITY             =      0.3900 VOL/VOL
           WILTING POINT              =      0.2800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.4300 VOL/VOL
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```
EFFECTIVE SAT. HYD. COND.   =  0.500000006000E-07 CM/SEC

                        LAYER  6
                        --------
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3900 VOL/VOL
WILTING POINT               =      0.2800 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3900 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

                        LAYER  7
                        --------
          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =    100.00   INCHES
POROSITY                    =      0.4370 VOL/VOL
FIELD CAPACITY              =      0.0620 VOL/VOL
WILTING POINT               =      0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0975 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.500000024000E-03 CM/SEC

                        LAYER  8
                        --------
              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3900 VOL/VOL
WILTING POINT               =      0.2800 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4300 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

         GENERAL DESIGN AND EVAPORATIVE ZONE DATA
         ----------------------------------------
NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
         GROUND CONDITIONS, A SURFACE SLOPE OF  4.% AND
         A SLOPE LENGTH OF  942. FEET.
SCS RUNOFF CURVE NUMBER             =     68.30
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      2.163  ACRES
EVAPORATIVE ZONE DEPTH              =     20.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      0.312  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      3.800  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.140  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     32.207  INCHES
TOTAL INITIAL WATER                 =     32.207  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
          EVAPOTRANSPIRATION AND WEATHER DATA
          -----------------------------------
NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         SALT LAKE CITY        UTAH
     STATION LATITUDE                      =  40.69 DEGREES
     MAXIMUM LEAF AREA INDEX               =   0.00
     START OF GROWING SEASON (JULIAN DATE) =    117
     END OF GROWING SEASON (JULIAN DATE)   =    289
     EVAPORATIVE ZONE DEPTH                =  20.0  INCHES
     AVERAGE ANNUAL WIND SPEED             =   7.20 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY =  50.50 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY =  28.60 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY =  22.70 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY =  47.90 %
NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    SALT LAKE CITY      UTAH
         NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.79        0.86        0.85        1.18        0.95        0.89
  0.30        0.33        0.40        0.74        0.50        0.51
NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    SALT LAKE CITY      UTAH
     NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 29.10       32.40       41.40       49.10       60.30       69.60
 79.50       76.80       64.90       50.20       37.00       27.70
NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
```

COEFFICIENTS FOR SALT LAKE CITY UTAH
AND STATION LATITUDE = 40.69 DEGREES

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

| | JAN/JUL | FEB/AUG | MAR/SEP | APR/OCT | MAY/NOV | JUN/DEC |
|---|---|---|---|---|---|---|
| **PRECIPITATION** | | | | | | |
| TOTALS | 0.73 | 0.91 | 0.90 | 1.10 | 0.94 | 1.02 |
| | 0.29 | 0.33 | 0.39 | 0.81 | 0.50 | 0.54 |
| STD. DEVIATIONS | 0.37 | 0.42 | 0.42 | 0.47 | 0.54 | 0.72 |
| | 0.24 | 0.26 | 0.32 | 0.57 | 0.28 | 0.22 |
| **RUNOFF** | | | | | | |
| TOTALS | 0.004 | 0.020 | 0.008 | 0.000 | 0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| STD. DEVIATIONS | 0.013 | 0.055 | 0.029 | 0.000 | 0.000 | 0.000 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **EVAPOTRANSPIRATION** | | | | | | |
| TOTALS | 0.485 | 0.584 | 0.759 | 0.944 | 0.800 | 0.866 |
| | 0.289 | 0.300 | 0.333 | 0.526 | 0.425 | 0.451 |
| STD. DEVIATIONS | 0.195 | 0.211 | 0.283 | 0.328 | 0.428 | 0.515 |
| | 0.207 | 0.225 | 0.253 | 0.316 | 0.194 | 0.173 |
| **LATERAL DRAINAGE COLLECTED FROM LAYER 4** | | | | | | |
| TOTALS | 0.0346 | 0.2228 | 0.4638 | 0.1672 | 0.1285 | 0.1494 |
| | 0.0259 | 0.0191 | 0.0382 | 0.2688 | 0.0841 | 0.0103 |
| STD. DEVIATIONS | 0.0963 | 0.4139 | 0.3811 | 0.1722 | 0.1519 | 0.2152 |
| | 0.0732 | 0.0527 | 0.0746 | 0.2987 | 0.1409 | 0.0421 |
| **PERCOLATION/LEAKAGE THROUGH LAYER 5** | | | | | | |
| TOTALS | 0.0008 | 0.0031 | 0.0076 | 0.0047 | 0.0038 | 0.0038 |
| | 0.0008 | 0.0006 | 0.0012 | 0.0057 | 0.0028 | 0.0006 |
| STD. DEVIATIONS | 0.0020 | 0.0046 | 0.0042 | 0.0039 | 0.0040 | 0.0041 |
| | 0.0017 | 0.0014 | 0.0020 | 0.0047 | 0.0034 | 0.0016 |
| **PERCOLATION/LEAKAGE THROUGH LAYER 8** | | | | | | |
| TOTALS | 0.0067 | 0.0025 | 0.0031 | 0.0028 | 0.0027 | 0.0026 |
| | 0.0023 | 0.0024 | 0.0025 | 0.0029 | 0.0026 | 0.0024 |
| STD. DEVIATIONS | 0.0424 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0008 |
| | 0.0007 | 0.0007 | 0.0007 | 0.0009 | 0.0007 | 0.0007 |

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

| | | | | | | |
|---|---|---|---|---|---|---|
| **DAILY AVERAGE HEAD ON TOP OF LAYER 5** | | | | | | |
| AVERAGES | 0.0013 | 0.0094 | 0.0178 | 0.0066 | 0.0049 | 0.0059 |
| | 0.0010 | 0.0007 | 0.0015 | 0.0103 | 0.0033 | 0.0004 |
| STD. DEVIATIONS | 0.0037 | 0.0174 | 0.0146 | 0.0068 | 0.0058 | 0.0085 |
| | 0.0028 | 0.0020 | 0.0030 | 0.0115 | 0.0056 | 0.0016 |
| **DAILY AVERAGE HEAD ON TOP OF LAYER 8** | | | | | | |
| AVERAGES | 0.0023 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| STD. DEVIATIONS | 0.0227 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

```
*******************************************************************************
     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH  100
-------------------------------------------------------------------------------
                                      INCHES            CU. FEET       PERCENT
                                  -------------------   -------------   ---------
 PRECIPITATION                      8.44    (   1.520)      66273.8     100.00

 RUNOFF                             0.031   (  0.0734)        244.96      0.370

 EVAPOTRANSPIRATION                 6.761   (  1.0288)      53087.92     80.104

 LATERAL DRAINAGE COLLECTED         1.61271 (  0.67664)     12662.476   19.10631
   FROM LAYER  4

 PERCOLATION/LEAKAGE THROUGH        0.03546 (  0.01094)       278.407     0.42009
   LAYER  5

 AVERAGE HEAD ON TOP                0.005 (    0.002)
   OF LAYER  5

 PERCOLATION/LEAKAGE THROUGH        0.03550 (  0.04086)       278.762     0.42062
   LAYER  8

 AVERAGE HEAD ON TOP                0.000 (    0.002)
   OF LAYER  8

 CHANGE IN WATER STORAGE            0.000   (  0.1690)         -0.36     -0.001

*******************************************************************************
*******************************************************************************
                PEAK DAILY VALUES FOR YEARS    1 THROUGH  100
   ------------------------------------------------------------------------
                                                (INCHES)      (CU. FT.)
                                               ----------   -------------
      PRECIPITATION                              1.15          9029.443

      RUNOFF                                     0.182         1432.3633

      DRAINAGE COLLECTED FROM LAYER  4           1.07608       8449.05371

      PERCOLATION/LEAKAGE THROUGH LAYER  5       0.001882        14.77737

      AVERAGE HEAD ON TOP OF LAYER  5            1.279

      MAXIMUM HEAD ON TOP OF LAYER  5            2.497
      LOCATION OF MAXIMUM HEAD IN LAYER  4
            (DISTANCE FROM DRAIN)               21.0 FEET

      PERCOLATION/LEAKAGE THROUGH LAYER  8       0.035575       279.32227

      AVERAGE HEAD ON TOP OF LAYER  8            1.100

      SNOW WATER                                 1.22          9606.3652

      MAXIMUM VEG. SOIL WATER (VOL/VOL)                  0.1004

      MINIMUM VEG. SOIL WATER (VOL/VOL)                  0.0070

       ***  Maximum heads are computed using McEnroe's equations.  ***
            Reference:  Maximum Saturated Depth over Landfill Liner
                        by Bruce M. McEnroe, University of Kansas
                        ASCE Journal of Environmental Engineering
                        Vol. 119, No. 2, March 1993, pp. 262-270.

*******************************************************************************
*******************************************************************************
                  FINAL WATER STORAGE AT END OF YEAR  100
    ----------------------------------------------------------------------
                     LAYER        (INCHES)       (VOL/VOL)
                     -----        --------       ---------
                       1            0.3740         0.0156
                       2            0.1440         0.0240
                       3            1.5868         0.1322
                       4            0.1920         0.0320
                       5            5.1600         0.4300
                       6            4.6800         0.3900
                       7            9.7455         0.0975
                       8           10.3200         0.4300
                  SNOW WATER        0.000

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******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.06   (17 AUGUST 1996)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
PRECIPITATION DATA FILE:    C:\PROJECTS\4101K_~1\HELP\U100.D4
TEMPERATURE DATA FILE:      C:\PROJECTS\4101K_~1\HELP\U100.D7
SOLAR RADIATION DATA FILE:  C:\PROJECTS\4101K_~1\HELP\U100.D13
EVAPOTRANSPIRATION DATA:    C:\PROJECTS\4101K_~1\HELP\U100-D20.D11
SOIL AND DESIGN DATA FILE:  C:\PROJECTS\4101K_~1\HELP\S18-24.D10
OUTPUT DATA FILE:           C:\PROJECTS\4101K_~1\HELP\S18-24.OUT
TIME:  17:14     DATE:  10/24/2011
******************************************************************************
     TITLE:  CAW CELL SIDE SLOPE 18"FILTER,24"RipRap,20"EZD,188L,No RunOn
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     24.00   INCHES
           POROSITY                    =      0.1700 VOL/VOL
           FIELD CAPACITY              =      0.0070 VOL/VOL
           WILTING POINT               =      0.0030 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.0094 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   80.0000000000     CM/SEC

                                LAYER  2
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =      6.00   INCHES
           POROSITY                    =      0.1900 VOL/VOL
           FIELD CAPACITY              =      0.0240 VOL/VOL
           WILTING POINT               =      0.0070 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.0240 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   42.0000000000     CM/SEC

                                LAYER  3
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     12.00   INCHES
           POROSITY                    =      0.3100 VOL/VOL
           FIELD CAPACITY              =      0.2000 VOL/VOL
           WILTING POINT               =      0.0250 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.1322 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.400000019000E-02 CM/SEC

                                LAYER  4
                                --------
                       TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     18.00   INCHES
           POROSITY                    =      0.2800 VOL/VOL
           FIELD CAPACITY              =      0.0320 VOL/VOL
           WILTING POINT               =      0.0130 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.0320 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =   3.50000000000     CM/SEC
           SLOPE                       =     20.00   PERCENT
           DRAINAGE LENGTH             =    188.0    FEET

                                LAYER  5
                                --------
                         TYPE 3 - BARRIER SOIL LINER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                   =     12.00   INCHES
           POROSITY                    =      0.4300 VOL/VOL
           FIELD CAPACITY              =      0.3900 VOL/VOL
           WILTING POINT               =      0.2800 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.4300 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.500000006000E-07 CM/SEC
```

```
                              LAYER  6
                              --------
                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER   0
      THICKNESS                   =     12.00   INCHES
      POROSITY                    =      0.4300 VOL/VOL
      FIELD CAPACITY              =      0.3900 VOL/VOL
      WILTING POINT               =      0.2800 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.3900 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

                              LAYER  7
                              --------
                 TYPE 1 - VERTICAL PERCOLATION LAYER
                     MATERIAL TEXTURE NUMBER   0
      THICKNESS                   =    100.00   INCHES
      POROSITY                    =      0.4370 VOL/VOL
      FIELD CAPACITY              =      0.0620 VOL/VOL
      WILTING POINT               =      0.0240 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.1003 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.500000024000E-03 CM/SEC

                              LAYER  8
                              --------
                     TYPE 3 - BARRIER SOIL LINER
                     MATERIAL TEXTURE NUMBER   0
      THICKNESS                   =     24.00   INCHES
      POROSITY                    =      0.4300 VOL/VOL
      FIELD CAPACITY              =      0.3900 VOL/VOL
      WILTING POINT               =      0.2800 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.4300 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------
    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
             GROUND CONDITIONS, A SURFACE SLOPE OF 20.% AND
             A SLOPE LENGTH OF  188. FEET.
   SCS RUNOFF CURVE NUMBER             =     72.70
   FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =      0.432  ACRES
   EVAPORATIVE ZONE DEPTH              =     20.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      0.188  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =      3.400  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.060  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =     32.722  INCHES
   TOTAL INITIAL WATER                 =     32.722  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------
    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             SALT LAKE CITY        UTAH
        STATION LATITUDE                      =  40.69 DEGREES
        MAXIMUM LEAF AREA INDEX               =   0.00
        START OF GROWING SEASON (JULIAN DATE) =    117
        END OF GROWING SEASON (JULIAN DATE)   =    289
        EVAPORATIVE ZONE DEPTH                =  20.0  INCHES
        AVERAGE ANNUAL WIND SPEED             =   7.20 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY =  50.50 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY =  28.60 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY =  22.70 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY =  47.90 %
    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    SALT LAKE CITY      UTAH
             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.79        0.86        0.85        1.18        0.95        0.89
  0.30        0.33        0.40        0.74        0.50        0.51
    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    SALT LAKE CITY      UTAH
        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 29.10       32.40       41.40       49.10       60.30       69.60
 79.50       76.80       64.90       50.20       37.00       27.70
```

```
        NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                 COEFFICIENTS FOR    SALT LAKE CITY      UTAH
                   AND STATION LATITUDE  =  40.69 DEGREES
*******************************************************************************

        AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH  100
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.73     0.91     0.90     1.10     0.94     1.02
                           0.29     0.33     0.39     0.81     0.50     0.54

    STD. DEVIATIONS        0.37     0.42     0.42     0.47     0.54     0.72
                           0.24     0.26     0.32     0.57     0.28     0.22

  RUNOFF
  ------
    TOTALS                 0.004    0.022    0.009    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.015    0.061    0.033    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.481    0.570    0.723    0.970    0.820    0.887
                           0.296    0.314    0.353    0.547    0.437    0.451

    STD. DEVIATIONS        0.194    0.211    0.298    0.346    0.449    0.534
                           0.220    0.246    0.273    0.322    0.200    0.175

  LATERAL DRAINAGE COLLECTED FROM LAYER  4
  ----------------------------------------
    TOTALS                 0.0426   0.2518   0.4833   0.1466   0.1042   0.1321
                           0.0103   0.0068   0.0228   0.2453   0.0620   0.0054

    STD. DEVIATIONS        0.1154   0.4437   0.4071   0.2021   0.1734   0.2590
                           0.0369   0.0217   0.0703   0.3342   0.1327   0.0180

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  -------------------------------------
    TOTALS                 0.0012   0.0015   0.0044   0.0057   0.0055   0.0048
                           0.0029   0.0020   0.0022   0.0054   0.0044   0.0027

    STD. DEVIATIONS        0.0015   0.0023   0.0033   0.0028   0.0031   0.0029
                           0.0019   0.0015   0.0018   0.0032   0.0027   0.0018

  PERCOLATION/LEAKAGE THROUGH LAYER  8
  -------------------------------------
    TOTALS                 0.0064   0.0018   0.0036   0.0043   0.0043   0.0038
                           0.0031   0.0024   0.0025   0.0038   0.0037   0.0029

    STD. DEVIATIONS        0.0461   0.0012   0.0015   0.0013   0.0015   0.0013
                           0.0012   0.0012   0.0013   0.0016   0.0014   0.0012

-------------------------------------------------------------------------------
              AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------

  DAILY AVERAGE HEAD ON TOP OF LAYER  5
  -------------------------------------
    AVERAGES               0.0007   0.0041   0.0074   0.0024   0.0017   0.0022
                           0.0002   0.0001   0.0004   0.0039   0.0010   0.0001

    STD. DEVIATIONS        0.0018   0.0070   0.0060   0.0032   0.0027   0.0042
                           0.0005   0.0004   0.0012   0.0053   0.0021   0.0003

  DAILY AVERAGE HEAD ON TOP OF LAYER  8
  -------------------------------------
    AVERAGES               0.0027   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

    STD. DEVIATIONS        0.0264   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

*******************************************************************************
```

```
     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH  100
-------------------------------------------------------------------------------
                                      INCHES            CU. FEET       PERCENT
                                 -------------------   -------------   ---------
 PRECIPITATION                     8.44    (   1.520)      13224.1     100.00

 RUNOFF                            0.036   (  0.0827)         55.87      0.422

 EVAPOTRANSPIRATION                6.849   (  1.0561)      10730.86     81.146

 LATERAL DRAINAGE COLLECTED        1.51304 (  0.68510)      2370.494   17.92554
   FROM LAYER  4

 PERCOLATION/LEAKAGE THROUGH       0.04269 (  0.01017)        66.875     0.50571
   LAYER  5

 AVERAGE HEAD ON TOP               0.002 (    0.001)
   OF LAYER  5

 PERCOLATION/LEAKAGE THROUGH       0.04273 (  0.04566)        66.949     0.50626
   LAYER  8

 AVERAGE HEAD ON TOP               0.000 (    0.002)
   OF LAYER  8

 CHANGE IN WATER STORAGE           0.000   (  0.1708)         -0.05      0.000
*******************************************************************************
                 PEAK DAILY VALUES FOR YEARS    1 THROUGH  100
   ----------------------------------------------------------------------
                                                (INCHES)      (CU. FT.)
                                               ----------   -------------
      PRECIPITATION                              1.15          1801.714

      RUNOFF                                     0.206          322.1965

      DRAINAGE COLLECTED FROM LAYER  4           1.77779       2785.28320

      PERCOLATION/LEAKAGE THROUGH LAYER  5       0.001128         1.76744

      AVERAGE HEAD ON TOP OF LAYER  5            0.800

      MAXIMUM HEAD ON TOP OF LAYER  5            0.181
      LOCATION OF MAXIMUM HEAD IN LAYER  4
            (DISTANCE FROM DRAIN)                0.0 FEET

      PERCOLATION/LEAKAGE THROUGH LAYER  8       0.035702        55.93407

      AVERAGE HEAD ON TOP OF LAYER  8            1.190

      SNOW WATER                                 1.22          1916.8318

      MAXIMUM VEG. SOIL WATER (VOL/VOL)                  0.0934

      MINIMUM VEG. SOIL WATER (VOL/VOL)                  0.0030

       ***  Maximum heads are computed using McEnroe's equations.  ***
            Reference:  Maximum Saturated Depth over Landfill Liner
                        by Bruce M. McEnroe, University of Kansas
                        ASCE Journal of Environmental Engineering
                        Vol. 119, No. 2, March 1993, pp. 262-270.

*******************************************************************************
                    FINAL WATER STORAGE AT END OF YEAR  100
    ----------------------------------------------------------------------
                     LAYER        (INCHES)       (VOL/VOL)
                     -----        --------       ---------
                       1           0.2265         0.0094
                       2           0.1440         0.0240
                       3           1.5868         0.1322
                       4           0.5760         0.0320
                       5           5.1600         0.4300
                       6           4.6800         0.3900
                       7          10.0253         0.1003
                       8          10.3200         0.4300
                  SNOW WATER       0.000

*******************************************************************************
*******************************************************************************
```

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.06   (17 AUGUST 1996)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************
PRECIPITATION DATA FILE:    C:\PROJECTS\4101KCAW\HELP\U100.D4
TEMPERATURE DATA FILE:      C:\PROJECTS\4101KCAW\HELP\U100.D7
SOLAR RADIATION DATA FILE:  C:\PROJECTS\4101KCAW\HELP\U100.D13
EVAPOTRANSPIRATION DATA:    C:\PROJECTS\4101KCAW\HELP\U100-D20.D11
SOIL AND DESIGN DATA FILE:  C:\PROJECTS\4101KCAW\HELP\S18-24R2.D10
OUTPUT DATA FILE:           C:\PROJECTS\4101KCAW\HELP\S18-24R2.OUT
TIME:   7:19     DATE:  11/ 2/2011
******************************************************************************
     TITLE:  CAW CELL SIDE SLOPE 18"FILTER,24"RipRap,20"EZD,1208,RunOn R2
******************************************************************************
     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                                LAYER  1
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     24.00   INCHES
           POROSITY                   =      0.1700 VOL/VOL
           FIELD CAPACITY             =      0.0070 VOL/VOL
           WILTING POINT              =      0.0030 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0095 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   80.0000000000     CM/SEC

                                LAYER  2
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =      6.00   INCHES
           POROSITY                   =      0.1900 VOL/VOL
           FIELD CAPACITY             =      0.0240 VOL/VOL
           WILTING POINT              =      0.0070 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0240 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   42.0000000000     CM/SEC

                                LAYER  3
                                --------
                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.3100 VOL/VOL
           FIELD CAPACITY             =      0.2000 VOL/VOL
           WILTING POINT              =      0.0250 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.1322 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.400000019000E-02 CM/SEC

                                LAYER  4
                                --------
                       TYPE 2 - LATERAL DRAINAGE LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     18.00   INCHES
           POROSITY                   =      0.2800 VOL/VOL
           FIELD CAPACITY             =      0.0320 VOL/VOL
           WILTING POINT              =      0.0130 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.0320 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =   3.50000000000     CM/SEC
           SLOPE                      =     20.00   PERCENT
           DRAINAGE LENGTH            =   1208.0    FEET

                                LAYER  5
                                --------
                         TYPE 3 - BARRIER SOIL LINER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4300 VOL/VOL
           FIELD CAPACITY             =      0.3900 VOL/VOL
           WILTING POINT              =      0.2800 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.4300 VOL/VOL
```

```
EFFECTIVE SAT. HYD. COND.   =  0.500000006000E-07 CM/SEC


                        LAYER  6
                        --------
              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3900 VOL/VOL
WILTING POINT               =      0.2800 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3900 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

                        LAYER  7
                        --------
              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   0
THICKNESS                   =    100.00   INCHES
POROSITY                    =      0.4370 VOL/VOL
FIELD CAPACITY              =      0.0620 VOL/VOL
WILTING POINT               =      0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1049 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.500000024000E-03 CM/SEC

                        LAYER  8
                        --------
                  TYPE 3 - BARRIER SOIL LINER
                  MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4300 VOL/VOL
FIELD CAPACITY              =      0.3900 VOL/VOL
WILTING POINT               =      0.2800 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.4300 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999997000E-06 CM/SEC

          GENERAL DESIGN AND EVAPORATIVE ZONE DATA
          ----------------------------------------
 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #21 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF 20.% AND
          A SLOPE LENGTH OF  188. FEET.
SCS RUNOFF CURVE NUMBER             =     72.70
FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =      0.432  ACRES
EVAPORATIVE ZONE DEPTH              =     20.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      0.190  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =      3.400  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.060  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     33.184  INCHES
TOTAL INITIAL WATER                 =     33.184  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR
           EVAPOTRANSPIRATION AND WEATHER DATA
           -----------------------------------
 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          SALT LAKE CITY        UTAH
     STATION LATITUDE                      =  40.69 DEGREES
     MAXIMUM LEAF AREA INDEX               =   0.00
     START OF GROWING SEASON (JULIAN DATE) =    117
     END OF GROWING SEASON (JULIAN DATE)   =    289
     EVAPORATIVE ZONE DEPTH                =  20.0  INCHES
     AVERAGE ANNUAL WIND SPEED             =   7.20 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY =  50.50 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY =  28.60 %
     AVERAGE 3RD QUARTER RELATIVE HUMIDITY =  22.70 %
     AVERAGE 4TH QUARTER RELATIVE HUMIDITY =  47.90 %
 NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    SALT LAKE CITY      UTAH
          NORMAL MEAN MONTHLY PRECIPITATION (INCHES)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.79        0.86        0.85        1.18        0.95        0.89
  0.30        0.33        0.40        0.74        0.50        0.51
 NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
          COEFFICIENTS FOR    SALT LAKE CITY      UTAH
     NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)
JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 29.10       32.40       41.40       49.10       60.30       69.60
```

```
     79.50       76.80       64.90       50.20       37.00       27.70
        NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    SALT LAKE CITY      UTAH
                    AND STATION LATITUDE  =  40.69 DEGREES
*******************************************************************************
         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH  100
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.73     0.91     0.90     1.10     0.94     1.02
                           0.29     0.33     0.39     0.81     0.50     0.54

    STD. DEVIATIONS        0.37     0.42     0.42     0.47     0.54     0.72
                           0.24     0.26     0.32     0.57     0.28     0.22

  RUNOFF
  ------
    TOTALS                 0.004    0.022    0.009    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.015    0.061    0.033    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.481    0.570    0.723    0.970    0.819    0.887
                           0.296    0.314    0.354    0.547    0.437    0.451

    STD. DEVIATIONS        0.194    0.212    0.297    0.346    0.449    0.534
                           0.220    0.246    0.273    0.322    0.199    0.175

  LATERAL DRAINAGE COLLECTED FROM LAYER  4
  ----------------------------------------
    TOTALS                 0.0421   0.2506   0.4806   0.1432   0.1012   0.1293
                           0.0088   0.0058   0.0215   0.2420   0.0595   0.0041

    STD. DEVIATIONS        0.1152   0.4428   0.4074   0.2015   0.1724   0.2580
                           0.0364   0.0208   0.0698   0.3336   0.1316   0.0171

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  -------------------------------------
    TOTALS                 0.0017   0.0024   0.0070   0.0091   0.0087   0.0076
                           0.0044   0.0030   0.0032   0.0084   0.0069   0.0038

    STD. DEVIATIONS        0.0021   0.0037   0.0053   0.0047   0.0050   0.0047
                           0.0029   0.0026   0.0030   0.0051   0.0046   0.0028

  PERCOLATION/LEAKAGE THROUGH LAYER  8
  -------------------------------------
    TOTALS                 0.0080   0.0030   0.0061   0.0072   0.0070   0.0061
                           0.0046   0.0036   0.0039   0.0062   0.0059   0.0044

    STD. DEVIATIONS        0.0517   0.0021   0.0025   0.0021   0.0025   0.0024
                           0.0021   0.0022   0.0022   0.0027   0.0024   0.0020

-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------

  DAILY AVERAGE HEAD ON TOP OF LAYER  5
  -------------------------------------
    AVERAGES               0.0007   0.0044   0.0077   0.0025   0.0017   0.0022
                           0.0002   0.0001   0.0004   0.0040   0.0011   0.0001

    STD. DEVIATIONS        0.0019   0.0076   0.0062   0.0034   0.0028   0.0043
                           0.0006   0.0004   0.0012   0.0054   0.0022   0.0003

  DAILY AVERAGE HEAD ON TOP OF LAYER  8
  -------------------------------------
    AVERAGES               0.0033   0.0000   0.0001   0.0001   0.0001   0.0001
                           0.0000   0.0000   0.0000   0.0001   0.0001   0.0000

    STD. DEVIATIONS        0.0330   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

*******************************************************************************
*******************************************************************************
```

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

| | INCHES | | CU. FEET | PERCENT |
|---|---|---|---|---|
| PRECIPITATION | 8.44 | ( 1.520) | 13224.1 | 100.00 |
| RUNOFF | 0.036 | ( 0.0827) | 55.87 | 0.422 |
| EVAPOTRANSPIRATION | 6.850 | ( 1.0571) | 10731.95 | 81.154 |
| LATERAL DRAINAGE COLLECTED FROM LAYER 4 | 1.48887 | ( 0.68250) | 2332.628 | 17.63920 |
| PERCOLATION/LEAKAGE THROUGH LAYER 5 | 0.06618 | ( 0.01649) | 103.681 | 0.78403 |
| AVERAGE HEAD ON TOP OF LAYER 5 | 0.002 | ( 0.001) | | |
| PERCOLATION/LEAKAGE THROUGH LAYER 8 | 0.06613 | ( 0.05144) | 103.613 | 0.78351 |
| AVERAGE HEAD ON TOP OF LAYER 8 | 0.000 | ( 0.003) | | |
| CHANGE IN WATER STORAGE | 0.000 | ( 0.1730) | 0.06 | 0.000 |

**********

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

| | (INCHES) | (CU. FT.) |
|---|---|---|
| PRECIPITATION | 1.15 | 1801.714 |
| RUNOFF | 0.206 | 322.1854 |
| DRAINAGE COLLECTED FROM LAYER 4 | 1.77693 | 2783.92383 |
| PERCOLATION/LEAKAGE THROUGH LAYER 5 | 0.001530 | 2.39716 |
| AVERAGE HEAD ON TOP OF LAYER 5 | 0.804 | |
| MAXIMUM HEAD ON TOP OF LAYER 5 | 1.092 | |
| LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN) | 0.0 FEET | |
| PERCOLATION/LEAKAGE THROUGH LAYER 8 | 0.035910 | 56.26088 |
| AVERAGE HEAD ON TOP OF LAYER 8 | 1.337 | |
| SNOW WATER | 1.22 | 1916.8318 |
| MAXIMUM VEG. SOIL WATER (VOL/VOL) | 0.0934 | |
| MINIMUM VEG. SOIL WATER (VOL/VOL) | 0.0030 | |

*** Maximum heads are computed using McEnroe's equations. ***
Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

**********

FINAL WATER STORAGE AT END OF YEAR 100

| LAYER | (INCHES) | (VOL/VOL) |
|---|---|---|
| 1 | 0.2269 | 0.0095 |
| 2 | 0.1440 | 0.0240 |
| 3 | 1.5868 | 0.1322 |
| 4 | 0.5760 | 0.0320 |
| 5 | 5.1600 | 0.4300 |
| 6 | 4.6800 | 0.3900 |
| 7 | 10.4944 | 0.1049 |
| 8 | 10.3200 | 0.4300 |
| SNOW WATER | 0.000 | |

**********

# ATTACHMENT 2
# ENERGYSOLUTIONS
# CLASS A WEST (CAW) CELL
# UNSAT-H MODEL INPUT & OUTPUT FILES

Prepared for

*EnergySolutions, LLC*
*423 West 300 South, Suite 200*
*Salt Lake City, UT  84101*

Prepared by

*Whetstone Associates, Inc.*
*104 W Ruby Avenue*
*Gunnison, Colorado  81230*
*970-641-7471*

*Document 4104K.111128*

November 28, 2011

```
-------------------------------------------------------------------------------
                              Program DATAINH
                                Version2.05
-------------------------------------------------------------------------------
 Input Filename: C:\Projects\4101KCAW\UNSATH\T24_08.inp
 Date Processed: 26 Oct 2011
 Time Processed: 14:00:32.20
-------------------------------------------------------------------------------
 Title:
 T24_08.INP: CAW Cell Unsat flow, 6" Type-B Filter, 57' Waste, 0.090 cm/yr infilt
-------------------------------------------------------------------------------
 Options chosen include:
 IPLANT =   0        LOWER  =   2        NGRAV  =   1        ISWDIF =   1
 IHEAT  =   0        UPPERH =   0        LOWERH =   0
 NPRINT =   0        DAYEND = 365        NDAYS  = 365        NYEARS =  50
 IRAIN  =   0        ICONVH =   0
 NSURPE =   0        NFHOUR =   2        ITOPBC =   0        ET_OPT =   0
 ICLOUD =   0
 KOPT   =   4        KEST   =   3        IVAPOR =   0        SH_OPT =   0
 INMAX  =   3        INHMAX =   2
 HIRRI  =   0.00     HDRY   =  1.000E+04 HTOP   =   0.00     DHMAX  =   0.00
 DMAXBA =  5.000E-04 DELMAX =  0.150     DELMIN =  1.500E-08 STOPHR =   24.0
 OUTTIM =  0.150
 TORT   =  0.660     TSOIL  =   288.     VAPDIF =  0.240     QHTOP  =   0.00
 TGRAD  =   0.00     TSMEAN =   288.     TSAMP  =   10.0     QHLEAK =   0.00
 WTF    =  0.500     RFACT  =   1.05     RAINIF =  1.000E-05 DHFACT =   0.00
 MATN   =   5        NPT    = 129
-------------------------------------------------------------------------------
 KOPT = 4:  van Genuchten functions for soil hydraulic properties
 THETA vs H, MAT   1,   Radon Barrier Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.43200
        THTR =  0.10000                           ALPHA =  3.00000E-03
           N =   1.1720                               M =  0.14676
     K vs H, MAT   1,   Radon Barrier Hydraulic Conductivity
      AIRINK =   0.0000                              SK =  1.80000E-04
           A =  3.00000E-03                           N =   1.1720
           M =  0.14676                          KMODEL =   2.0000
        EPIT =   4.5000
 THETA vs H, MAT   2,   Radon Barrier2 Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.43200
        THTR =  0.10000                           ALPHA =  3.00000E-03
           N =   1.1720                               M =  0.14676
     K vs H, MAT   2,   Radon Barrier2 Hydraulic Conductivity
      AIRINK =   0.0000                              SK =  3.60000E-03
           A =  3.00000E-03                           N =   1.1720
           M =  0.14676                          KMODEL =   2.0000
        EPIT =   4.5000
 THETA vs H, MAT   3,   Waste Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.35000
        THTR =  2.00000E-02                       ALPHA =  0.11500
           N =   2.0130                               M =  0.50323
     K vs H, MAT   3,   Waste Hydraulic Conductivity
      AIRINK =   0.0000                              SK =   1.8000
           A =  0.11500                               N =   2.0130
           M =  0.50323                          KMODEL =   2.0000
        EPIT =  0.50000
 THETA vs H, MAT   4,   Clay Liner Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.43200
        THTR =  0.10000                           ALPHA =  3.00000E-03
           N =   1.1720                               M =  0.14676
     K vs H, MAT   4,   Clay Liner Hydraulic Conductivity
      AIRINK =   0.0000                              SK =  3.60000E-03
           A =  3.00000E-03                           N =   1.1720
           M =  0.14676                          KMODEL =   2.0000
        EPIT =   4.5000
 THETA vs H, MAT   5,   Unit 3 Silty Sand Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.34000
        THTR =  2.00000E-02                       ALPHA =  5.50000E-02
           N =   2.5180                               M =  0.60286
     K vs H, MAT   5,   Unit 3 Silty Sand Hydraulic Conductivity
      AIRINK =   0.0000                              SK =   2.7110
           A =  5.50000E-02                           N =   2.5180
           M =  0.60286                          KMODEL =   2.0000
        EPIT =  0.50000
 Surface node hydraulic properties
 HIRRI =      0.0    , THETA = 0.4320, K =   1.8000E-04, C =  -1.9786E-08
 HDRY  =     1.00E+04, THETA = 0.2845, K =   9.2973E-11, C =  -3.1149E-06
 NDAY =   0
```

| NODE | Z | MAT | HEAD | CONDUCTIVITY | CAPACITY | THETA | TEMP |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 1 | 1.0000E+02 | 7.0486E-06 | -1.0843E-04 | 0.4215 | 288.1 |
| 2 | 0.10 | 1 | 1.0000E+02 | 7.0486E-06 | -1.0843E-04 | 0.4215 | 288.1 |
| 3 | 0.30 | 1 | 1.0000E+02 | 7.0486E-06 | -1.0843E-04 | 0.4215 | 288.1 |
| 4 | 0.60 | 1 | 1.0000E+02 | 7.0486E-06 | -1.0843E-04 | 0.4215 | 288.1 |
| 5 | 1.10 | 1 | 1.0100E+02 | 6.9664E-06 | -1.0833E-04 | 0.4214 | 288.1 |
| 6 | 2.00 | 1 | 1.0100E+02 | 6.9664E-06 | -1.0833E-04 | 0.4214 | 288.1 |
| 7 | 3.50 | 1 | 1.0200E+02 | 6.8856E-06 | -1.0823E-04 | 0.4213 | 288.1 |
| 8 | 6.50 | 1 | 1.0300E+02 | 6.8062E-06 | -1.0813E-04 | 0.4212 | 288.1 |
| 9 | 11.50 | 1 | 1.0600E+02 | 6.5755E-06 | -1.0781E-04 | 0.4209 | 288.1 |
| 10 | 19.00 | 1 | 1.1100E+02 | 6.2151E-06 | -1.0725E-04 | 0.4203 | 288.1 |
| 11 | 24.00 | 1 | 1.1500E+02 | 5.9466E-06 | -1.0679E-04 | 0.4199 | 288.1 |
| 12 | 27.00 | 1 | 1.1700E+02 | 5.8185E-06 | -1.0655E-04 | 0.4197 | 288.1 |
| 13 | 28.50 | 1 | 1.1800E+02 | 5.7559E-06 | -1.0643E-04 | 0.4196 | 288.1 |
| 14 | 29.40 | 1 | 1.1900E+02 | 5.6942E-06 | -1.0630E-04 | 0.4195 | 288.1 |
| 15 | 29.90 | 1 | 1.1900E+02 | 5.6942E-06 | -1.0630E-04 | 0.4195 | 288.1 |
| 16 | 30.20 | 1 | 1.1900E+02 | 5.6942E-06 | -1.0630E-04 | 0.4195 | 288.1 |
| 17 | 30.40 | 1 | 1.2000E+02 | 5.6334E-06 | -1.0618E-04 | 0.4194 | 288.1 |
| 18 | 30.50 | 1 | 1.2000E+02 | 5.6334E-06 | -1.0618E-04 | 0.4194 | 288.1 |
| 19 | 30.60 | 2 | 1.2000E+02 | 1.1267E-04 | -1.0618E-04 | 0.4194 | 288.1 |
| 20 | 30.80 | 2 | 1.1900E+02 | 1.1388E-04 | -1.0630E-04 | 0.4195 | 288.1 |
| 21 | 31.10 | 2 | 1.1900E+02 | 1.1388E-04 | -1.0630E-04 | 0.4195 | 288.1 |
| 22 | 31.60 | 2 | 1.1900E+02 | 1.1388E-04 | -1.0630E-04 | 0.4195 | 288.1 |
| 23 | 32.50 | 2 | 1.1800E+02 | 1.1512E-04 | -1.0643E-04 | 0.4196 | 288.1 |
| 24 | 34.00 | 2 | 1.1700E+02 | 1.1637E-04 | -1.0655E-04 | 0.4197 | 288.1 |
| 25 | 37.00 | 2 | 1.1400E+02 | 1.2024E-04 | -1.0691E-04 | 0.4200 | 288.1 |
| 26 | 42.00 | 2 | 1.0900E+02 | 1.2712E-04 | -1.0748E-04 | 0.4206 | 288.1 |
| 27 | 49.50 | 2 | 1.0200E+02 | 1.3771E-04 | -1.0823E-04 | 0.4213 | 288.1 |
| 28 | 54.50 | 2 | 9.7700E+01 | 1.4486E-04 | -1.0866E-04 | 0.4218 | 288.1 |
| 29 | 57.50 | 2 | 9.4900E+01 | 1.4980E-04 | -1.0892E-04 | 0.4221 | 288.1 |
| 30 | 59.00 | 2 | 9.3500E+01 | 1.5237E-04 | -1.0904E-04 | 0.4222 | 288.1 |
| 31 | 59.90 | 2 | 9.2700E+01 | 1.5386E-04 | -1.0911E-04 | 0.4223 | 288.1 |
| 32 | 60.40 | 2 | 9.2200E+01 | 1.5480E-04 | -1.0915E-04 | 0.4224 | 288.1 |
| 33 | 60.70 | 2 | 9.1900E+01 | 1.5538E-04 | -1.0918E-04 | 0.4224 | 288.1 |
| 34 | 60.90 | 2 | 9.1700E+01 | 1.5576E-04 | -1.0920E-04 | 0.4224 | 288.1 |
| 35 | 61.00 | 2 | 9.1700E+01 | 1.5576E-04 | -1.0920E-04 | 0.4224 | 288.1 |
| 36 | 61.10 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 37 | 61.30 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 38 | 61.60 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 39 | 62.10 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 40 | 63.00 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 41 | 64.50 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 42 | 67.50 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 43 | 72.50 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 44 | 82.50 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 45 | 102.50 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 46 | 142.50 | 3 | 9.1600E+01 | 1.0406E-05 | -3.3163E-04 | 0.0502 | 288.1 |
| 47 | 222.50 | 3 | 9.1400E+01 | 1.0508E-05 | -3.3308E-04 | 0.0503 | 288.1 |
| 48 | 372.50 | 3 | 9.1900E+01 | 1.0254E-05 | -3.2949E-04 | 0.0502 | 288.1 |
| 49 | 592.50 | 3 | 9.1300E+01 | 1.0560E-05 | -3.3380E-04 | 0.0503 | 288.1 |
| 50 | 929.50 | 3 | 9.1300E+01 | 1.0560E-05 | -3.3380E-04 | 0.0503 | 288.1 |
| 51 | 1266.50 | 3 | 9.2000E+01 | 1.0203E-05 | -3.2878E-04 | 0.0501 | 288.1 |
| 52 | 1486.50 | 3 | 9.2300E+01 | 1.0055E-05 | -3.2666E-04 | 0.0500 | 288.1 |
| 53 | 1636.50 | 3 | 9.2400E+01 | 1.0006E-05 | -3.2595E-04 | 0.0500 | 288.1 |
| 54 | 1716.50 | 3 | 9.2400E+01 | 1.0006E-05 | -3.2595E-04 | 0.0500 | 288.1 |
| 55 | 1756.50 | 3 | 9.5700E+01 | 8.5434E-06 | -3.0399E-04 | 0.0489 | 288.1 |
| 56 | 1776.50 | 3 | 1.0400E+02 | 5.8728E-06 | -2.5760E-04 | 0.0466 | 288.1 |
| 57 | 1786.50 | 3 | 1.1600E+02 | 3.5884E-06 | -2.0718E-04 | 0.0439 | 288.1 |
| 58 | 1791.50 | 3 | 1.2900E+02 | 2.2213E-06 | -1.6756E-04 | 0.0414 | 288.1 |
| 59 | 1794.50 | 3 | 1.4300E+02 | 1.3945E-06 | -1.3634E-04 | 0.0393 | 288.1 |
| 60 | 1796.00 | 3 | 1.5500E+02 | 9.6874E-07 | -1.1602E-04 | 0.0378 | 288.1 |
| 61 | 1796.90 | 3 | 1.6500E+02 | 7.3015E-07 | -1.0235E-04 | 0.0367 | 288.1 |
| 62 | 1797.40 | 3 | 1.7200E+02 | 6.0504E-07 | -9.4170E-05 | 0.0360 | 288.1 |
| 63 | 1797.70 | 3 | 1.7700E+02 | 5.3148E-07 | -8.8910E-05 | 0.0356 | 288.1 |
| 64 | 1797.90 | 3 | 1.8000E+02 | 4.9256E-07 | -8.5963E-05 | 0.0353 | 288.1 |
| 65 | 1798.00 | 3 | 1.8200E+02 | 4.6854E-07 | -8.4078E-05 | 0.0351 | 288.1 |
| 66 | 1798.10 | 3 | 1.8500E+02 | 4.3513E-07 | -8.1365E-05 | 0.0349 | 288.1 |
| 67 | 1798.20 | 4 | 1.8500E+02 | 6.0817E-05 | -9.7131E-05 | 0.4128 | 288.1 |
| 68 | 1798.40 | 4 | 1.8500E+02 | 6.0817E-05 | -9.7131E-05 | 0.4128 | 288.1 |
| 69 | 1798.70 | 4 | 1.8400E+02 | 6.1336E-05 | -9.7277E-05 | 0.4129 | 288.1 |
| 70 | 1799.20 | 4 | 1.8400E+02 | 6.1336E-05 | -9.7277E-05 | 0.4129 | 288.1 |
| 71 | 1799.90 | 4 | 1.8300E+02 | 6.1861E-05 | -9.7422E-05 | 0.4130 | 288.1 |
| 72 | 1800.90 | 4 | 1.8200E+02 | 6.2393E-05 | -9.7567E-05 | 0.4131 | 288.1 |
| 73 | 1802.40 | 4 | 1.8100E+02 | 6.2931E-05 | -9.7713E-05 | 0.4132 | 288.1 |
| 74 | 1804.10 | 4 | 1.8000E+02 | 6.3475E-05 | -9.7858E-05 | 0.4133 | 288.1 |
| 75 | 1808.10 | 4 | 1.7600E+02 | 6.5715E-05 | -9.8439E-05 | 0.4137 | 288.1 |
| 76 | 1814.10 | 4 | 1.7100E+02 | 6.8670E-05 | -9.9165E-05 | 0.4141 | 288.1 |
| 77 | 1824.10 | 4 | 1.6300E+02 | 7.3786E-05 | -1.0032E-04 | 0.4149 | 288.1 |
| 78 | 1833.10 | 4 | 1.5500E+02 | 7.9436E-05 | -1.0146E-04 | 0.4158 | 288.1 |
| 79 | 1843.10 | 4 | 1.4600E+02 | 8.6527E-05 | -1.0273E-04 | 0.4167 | 288.1 |

```
  80  1849.10   4    1.4100E+02     9.0847E-05    -1.0342E-04   0.4172  288.1
  81  1853.10   4    1.3700E+02     9.4520E-05    -1.0397E-04   0.4176  288.1
  82  1854.80   4    1.3600E+02     9.5470E-05    -1.0410E-04   0.4177  288.1
  83  1856.30   4    1.3400E+02     9.7411E-05    -1.0437E-04   0.4179  288.1
  84  1857.30   4    1.3300E+02     9.8402E-05    -1.0451E-04   0.4180  288.1
  85  1858.00   4    1.3300E+02     9.8402E-05    -1.0451E-04   0.4180  288.1
  86  1858.50   4    1.3200E+02     9.9407E-05    -1.0464E-04   0.4181  288.1
  87  1858.80   4    1.3200E+02     9.9407E-05    -1.0464E-04   0.4181  288.1
  88  1859.00   4    1.3200E+02     9.9407E-05    -1.0464E-04   0.4181  288.1
  89  1859.10   4    1.3200E+02     9.9407E-05    -1.0464E-04   0.4181  288.1
  90  1859.20   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  91  1859.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  92  1859.70   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  93  1860.20   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  94  1860.90   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  95  1861.90   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  96  1863.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  97  1865.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  98  1868.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
  99  1872.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 100  1878.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 101  1888.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 102  1903.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 103  1921.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 104  1942.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 105  1966.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 106  1990.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 107  2014.40   5    1.3200E+02     9.9732E-06    -1.7957E-04   0.0357  288.1
 108  2038.40   5    1.3100E+02     1.0420E-05    -1.8300E-04   0.0359  288.1
 109  2064.50   5    1.3100E+02     1.0420E-05    -1.8300E-04   0.0359  288.1
 110  2088.50   5    1.3000E+02     1.0890E-05    -1.8653E-04   0.0361  288.1
 111  2112.50   5    1.2600E+02     1.3038E-05    -2.0161E-04   0.0369  288.1
 112  2136.50   5    1.1800E+02     1.9019E-05    -2.3731E-04   0.0386  288.1
 113  2160.50   5    1.0300E+02     4.1528E-05    -3.3224E-04   0.0428  288.1
 114  2184.50   5    8.2500E+01     1.4762E-04    -5.7233E-04   0.0518  288.1
 115  2205.50   5    6.2200E+01     7.2703E-04    -1.1247E-03   0.0682  288.1
 116  2223.50   5    4.4300E+01     4.6617E-03    -2.4135E-03   0.0979  288.1
 117  2238.50   5    2.9300E+01     3.7464E-02    -5.2716E-03   0.1524  288.1
 118  2248.50   5    1.9300E+01     2.0945E-01    -8.4987E-03   0.2210  288.1
 119  2254.50   5    1.3300E+01     6.1447E-01    -9.1112E-03   0.2752  288.1
 120  2258.50   5    9.3000E+00     1.1691E+00    -7.3574E-03   0.3089  288.1
 121  2261.50   5    6.3000E+00     1.7337E+00    -4.8016E-03   0.3273  288.1
 122  2263.50   5    4.3000E+00     2.1290E+00    -2.8711E-03   0.3350  288.1
 123  2265.00   5    2.8000E+00     2.3986E+00    -1.5389E-03   0.3383  288.1
 124  2266.00   5    1.8000E+00     2.5494E+00    -7.9452E-04   0.3394  288.1
 125  2266.70   5    1.1000E+00     2.6342E+00    -3.7748E-04   0.3398  288.1
 126  2267.20   5    6.0000E-01     2.6804E+00    -1.5058E-04   0.3400  288.1
 127  2267.50   5    3.0000E-01     2.7003E+00    -5.2590E-05   0.3400  288.1
 128  2267.70   5    1.0000E-01     2.7090E+00    -9.9232E-06   0.3400  288.1
 129  2267.80   5    0.0000E+00     2.7110E+00    -1.5572E-08   0.3400  288.1
 Total Initial Storage = 162.3280 cm
-------------------------------------------------------------------------------
 NSURPE = 0:  There will be no surface evaporation
 IRAIN = 0
 NWATER (number of days of rain/irrigation) =365
                Rainfall/Irrigation Details
 Day    Time   Amount   Application   Efficiency  Changes In
        (hr)    (cm)        Type                   Rate/Head
 ---    ----   ------   -----------   ----------  ----------
   1   0.000   0.0003        1          1.000          2
      24.000   0.0000
   2   0.000   0.0003        1          1.000          2
      24.000   0.0000
   3   0.000   0.0003        1          1.000          2
      24.000   0.0000
*
*
*
 362   0.000   0.0003        1          1.000          2
      24.000   0.0000
 363   0.000   0.0003        1          1.000          2
      24.000   0.0000
 364   0.000   0.0003        1          1.000          2
      24.000   0.0000
 365   0.000   0.0003        1          1.000          2
      24.000   0.0000
 Total Water Applied =   0.0913 cm
```

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 ------------------------------------------------------------------------------
                                Program DATAINH
                                  Version2.05
------------------------------------------------------------------------------
 Input Filename: C:\Projects\4101KCAW\UNSATH\S18_06.inp
 Date Processed: 26 Oct 2011
 Time Processed: 07:50:55.14
------------------------------------------------------------------------------
 Title:
 S18_06.INP: CAW Cell Unsat flow, 18" Type-B Filter, 19' Waste, 0.168 cm/yr infil
------------------------------------------------------------------------------
 Options chosen include:
 IPLANT =   0        LOWER  =   2        NGRAV  =   1        ISWDIF =   1
 IHEAT  =   0        UPPERH =   0        LOWERH =   0
 NPRINT =   0        DAYEND = 365        NDAYS  = 365        NYEARS =  50
 IRAIN  =   0        ICONVH =   0
 NSURPE =   0        NFHOUR =   2        ITOPBC =   0        ET_OPT =   0
 ICLOUD =   0
 KOPT   =   4        KEST   =   3        IVAPOR =   0        SH_OPT =   0
 INMAX  =   3        INHMAX =   2
 HIRRI  =   0.00     HDRY   =  1.000E+04 HTOP   =   0.00     DHMAX  =   0.00
 DMAXBA =  5.000E-04 DELMAX =  0.150     DELMIN =  1.500E-08 STOPHR =   24.0
 OUTTIM =  0.150
 TORT   =  0.660     TSOIL  =   288.     VAPDIF =  0.240     QHTOP  =   0.00
 TGRAD  =   0.00     TSMEAN =   288.     TSAMP  =   10.0     QHLEAK =   0.00
 WTF    =  0.500     RFACT  =   1.05     RAINIF =  1.000E-05 DHFACT =   0.00
 MATN   =   5        NPT    = 125
------------------------------------------------------------------------------
 KOPT = 4:  van Genuchten functions for soil hydraulic properties
 THETA vs H, MAT   1,   Radon Barrier Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.43200
        THTR =  0.10000                           ALPHA =  3.00000E-03
           N =   1.1720                               M =  0.14676
     K vs H, MAT   1,   Radon Barrier Hydraulic Conductivity
      AIRINK =   0.0000                              SK =  1.80000E-04
           A =  3.00000E-03                           N =   1.1720
           M =  0.14676                          KMODEL =   2.0000
        EPIT =   4.5000
 THETA vs H, MAT   2,   Radon Barrier2 Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.43200
        THTR =  0.10000                           ALPHA =  3.00000E-03
           N =   1.1720                               M =  0.14676
     K vs H, MAT   2,   Radon Barrier2 Hydraulic Conductivity
      AIRINK =   0.0000                              SK =  3.60000E-03
           A =  3.00000E-03                           N =   1.1720
           M =  0.14676                          KMODEL =   2.0000
        EPIT =   4.5000
 THETA vs H, MAT   3,   Waste Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.35000
        THTR =  2.00000E-02                       ALPHA =  0.11500
           N =   2.0130                               M =  0.50323
     K vs H, MAT   3,   Waste Hydraulic Conductivity
      AIRINK =   0.0000                              SK =   1.8000
           A =  0.11500                               N =   2.0130
           M =  0.50323                          KMODEL =   2.0000
        EPIT =  0.50000
 THETA vs H, MAT   4,   Clay Liner Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.43200
        THTR =  0.10000                           ALPHA =  3.00000E-03
           N =   1.1720                               M =  0.14676
     K vs H, MAT   4,   Clay Liner Hydraulic Conductivity
      AIRINK =   0.0000                              SK =  3.60000E-03
           A =  3.00000E-03                           N =   1.1720
           M =  0.14676                          KMODEL =   2.0000
        EPIT =   4.5000
 THETA vs H, MAT   5,   Unit 3 Silty Sand Moisture Characteristics
      AIRINT =   0.0000                            THET =  0.34000
        THTR =  2.00000E-02                       ALPHA =  5.50000E-02
           N =   2.5180                               M =  0.60286
     K vs H, MAT   5,   Unit 3 Silty Sand Hydraulic Conductivity
      AIRINK =   0.0000                              SK =   2.7110
           A =  5.50000E-02                           N =   2.5180
           M =  0.60286                          KMODEL =   2.0000
        EPIT =  0.50000
 Surface node hydraulic properties
 HIRRI =      0.0    , THETA = 0.4320, K =   1.8000E-04, C =  -1.9786E-08
 HDRY  =     1.00E+04, THETA = 0.2845, K =   9.2973E-11, C =  -3.1149E-06
 NDAY =   0
```

| NODE | Z | MAT | HEAD | CONDUCTIVITY | CAPACITY | THETA | TEMP |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 1 | 6.8100E+01 | 1.0639E-05 | -1.1046E-04 | 0.4250 | 288.1 |
| 2 | 0.10 | 1 | 6.8200E+01 | 1.0624E-05 | -1.1045E-04 | 0.4250 | 288.1 |
| 3 | 0.30 | 1 | 6.8300E+01 | 1.0609E-05 | -1.1045E-04 | 0.4250 | 288.1 |
| 4 | 0.60 | 1 | 6.8600E+01 | 1.0564E-05 | -1.1045E-04 | 0.4250 | 288.1 |
| 5 | 1.10 | 1 | 6.9000E+01 | 1.0504E-05 | -1.1044E-04 | 0.4249 | 288.1 |
| 6 | 2.00 | 1 | 6.9800E+01 | 1.0385E-05 | -1.1043E-04 | 0.4248 | 288.1 |
| 7 | 3.50 | 1 | 7.1000E+01 | 1.0211E-05 | -1.1040E-04 | 0.4247 | 288.1 |
| 8 | 6.50 | 1 | 7.3800E+01 | 9.8227E-06 | -1.1031E-04 | 0.4244 | 288.1 |
| 9 | 11.50 | 1 | 7.8900E+01 | 9.1695E-06 | -1.1008E-04 | 0.4238 | 288.1 |
| 10 | 19.00 | 1 | 8.8000E+01 | 8.1540E-06 | -1.0949E-04 | 0.4228 | 288.1 |
| 11 | 24.00 | 1 | 9.5300E+01 | 7.4541E-06 | -1.0888E-04 | 0.4220 | 288.1 |
| 12 | 27.00 | 1 | 1.0000E+02 | 7.0486E-06 | -1.0843E-04 | 0.4215 | 288.1 |
| 13 | 28.50 | 1 | 1.0300E+02 | 6.8062E-06 | -1.0813E-04 | 0.4212 | 288.1 |
| 14 | 29.40 | 1 | 1.0500E+02 | 6.6511E-06 | -1.0792E-04 | 0.4210 | 288.1 |
| 15 | 29.90 | 1 | 1.0500E+02 | 6.6511E-06 | -1.0792E-04 | 0.4210 | 288.1 |
| 16 | 30.20 | 1 | 1.0600E+02 | 6.5755E-06 | -1.0781E-04 | 0.4209 | 288.1 |
| 17 | 30.40 | 1 | 1.0600E+02 | 6.5755E-06 | -1.0781E-04 | 0.4209 | 288.1 |
| 18 | 30.50 | 1 | 1.0700E+02 | 6.5011E-06 | -1.0770E-04 | 0.4208 | 288.1 |
| 19 | 30.60 | 2 | 1.0700E+02 | 1.3002E-04 | -1.0770E-04 | 0.4208 | 288.1 |
| 20 | 30.80 | 2 | 1.0600E+02 | 1.3151E-04 | -1.0781E-04 | 0.4209 | 288.1 |
| 21 | 31.10 | 2 | 1.0600E+02 | 1.3151E-04 | -1.0781E-04 | 0.4209 | 288.1 |
| 22 | 31.60 | 2 | 1.0600E+02 | 1.3151E-04 | -1.0781E-04 | 0.4209 | 288.1 |
| 23 | 32.50 | 2 | 1.0500E+02 | 1.3302E-04 | -1.0792E-04 | 0.4210 | 288.1 |
| 24 | 34.00 | 2 | 1.0400E+02 | 1.3456E-04 | -1.0802E-04 | 0.4211 | 288.1 |
| 25 | 37.00 | 2 | 1.0100E+02 | 1.3933E-04 | -1.0833E-04 | 0.4214 | 288.1 |
| 26 | 42.00 | 2 | 9.6800E+01 | 1.4642E-04 | -1.0874E-04 | 0.4219 | 288.1 |
| 27 | 49.50 | 2 | 9.0200E+01 | 1.5867E-04 | -1.0932E-04 | 0.4226 | 288.1 |
| 28 | 54.50 | 2 | 8.5800E+01 | 1.6768E-04 | -1.0966E-04 | 0.4231 | 288.1 |
| 29 | 57.50 | 2 | 8.3200E+01 | 1.7335E-04 | -1.0983E-04 | 0.4234 | 288.1 |
| 30 | 59.00 | 2 | 8.1800E+01 | 1.7653E-04 | -1.0992E-04 | 0.4235 | 288.1 |
| 31 | 59.90 | 2 | 8.1000E+01 | 1.7838E-04 | -1.0997E-04 | 0.4236 | 288.1 |
| 32 | 60.40 | 2 | 8.0600E+01 | 1.7932E-04 | -1.0999E-04 | 0.4237 | 288.1 |
| 33 | 60.70 | 2 | 8.0300E+01 | 1.8003E-04 | -1.1001E-04 | 0.4237 | 288.1 |
| 34 | 60.90 | 2 | 8.0100E+01 | 1.8050E-04 | -1.1002E-04 | 0.4237 | 288.1 |
| 35 | 61.00 | 2 | 8.0000E+01 | 1.8074E-04 | -1.1002E-04 | 0.4237 | 288.1 |
| 36 | 61.10 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 37 | 61.30 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 38 | 61.60 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 39 | 62.10 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 40 | 63.00 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 41 | 64.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 42 | 67.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 43 | 72.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 44 | 82.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 45 | 102.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 46 | 142.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 47 | 222.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 48 | 350.50 | 3 | 7.9900E+01 | 1.9239E-05 | -4.3485E-04 | 0.0547 | 288.1 |
| 49 | 478.50 | 3 | 8.0000E+01 | 1.9131E-05 | -4.3378E-04 | 0.0546 | 288.1 |
| 50 | 558.50 | 3 | 7.9800E+01 | 1.9347E-05 | -4.3593E-04 | 0.0547 | 288.1 |
| 51 | 598.50 | 3 | 8.1900E+01 | 1.7216E-05 | -4.1408E-04 | 0.0538 | 288.1 |
| 52 | 618.50 | 3 | 8.8400E+01 | 1.2212E-05 | -3.5590E-04 | 0.0513 | 288.1 |
| 53 | 628.50 | 3 | 9.8500E+01 | 7.5025E-06 | -2.8704E-04 | 0.0481 | 288.1 |
| 54 | 633.50 | 3 | 1.1000E+02 | 4.5602E-06 | -2.3034E-04 | 0.0452 | 288.1 |
| 55 | 636.50 | 3 | 1.2300E+02 | 2.7544E-06 | -1.8429E-04 | 0.0425 | 288.1 |
| 56 | 638.00 | 3 | 1.3400E+02 | 1.8707E-06 | -1.5528E-04 | 0.0406 | 288.1 |
| 57 | 638.90 | 3 | 1.4400E+02 | 1.3513E-06 | -1.3445E-04 | 0.0392 | 288.1 |
| 58 | 639.40 | 3 | 1.5100E+02 | 1.0903E-06 | -1.2226E-04 | 0.0383 | 288.1 |
| 59 | 639.70 | 3 | 1.5700E+02 | 9.1417E-07 | -1.1307E-04 | 0.0376 | 288.1 |
| 60 | 639.90 | 3 | 1.6100E+02 | 8.1586E-07 | -1.0751E-04 | 0.0371 | 288.1 |
| 61 | 640.00 | 3 | 1.6300E+02 | 7.7155E-07 | -1.0489E-04 | 0.0369 | 288.1 |
| 62 | 640.10 | 3 | 1.6600E+02 | 7.1046E-07 | -1.0112E-04 | 0.0366 | 288.1 |
| 63 | 640.20 | 4 | 1.6600E+02 | 7.1808E-05 | -9.9888E-05 | 0.4146 | 288.1 |
| 64 | 640.40 | 4 | 1.6600E+02 | 7.1808E-05 | -9.9888E-05 | 0.4146 | 288.1 |
| 65 | 640.70 | 4 | 1.6500E+02 | 7.2459E-05 | -1.0003E-04 | 0.4147 | 288.1 |
| 66 | 641.20 | 4 | 1.6500E+02 | 7.2459E-05 | -1.0003E-04 | 0.4147 | 288.1 |
| 67 | 641.90 | 4 | 1.6400E+02 | 7.3118E-05 | -1.0018E-04 | 0.4148 | 288.1 |
| 68 | 642.90 | 4 | 1.6400E+02 | 7.3118E-05 | -1.0018E-04 | 0.4148 | 288.1 |
| 69 | 644.40 | 4 | 1.6300E+02 | 7.3786E-05 | -1.0032E-04 | 0.4149 | 288.1 |
| 70 | 646.10 | 4 | 1.6100E+02 | 7.5145E-05 | -1.0061E-04 | 0.4151 | 288.1 |
| 71 | 650.10 | 4 | 1.5800E+02 | 7.7250E-05 | -1.0104E-04 | 0.4154 | 288.1 |
| 72 | 656.10 | 4 | 1.5400E+02 | 8.0184E-05 | -1.0161E-04 | 0.4159 | 288.1 |
| 73 | 666.10 | 4 | 1.4600E+02 | 8.6527E-05 | -1.0273E-04 | 0.4167 | 288.1 |
| 74 | 675.10 | 4 | 1.3900E+02 | 9.2658E-05 | -1.0370E-04 | 0.4174 | 288.1 |
| 75 | 685.10 | 4 | 1.3100E+02 | 1.0043E-04 | -1.0477E-04 | 0.4182 | 288.1 |
| 76 | 691.10 | 4 | 1.2600E+02 | 1.0575E-04 | -1.0542E-04 | 0.4188 | 288.1 |
| 77 | 695.10 | 4 | 1.2300E+02 | 1.0913E-04 | -1.0581E-04 | 0.4191 | 288.1 |
| 78 | 696.80 | 4 | 1.2100E+02 | 1.1147E-04 | -1.0606E-04 | 0.4193 | 288.1 |
| 79 | 698.30 | 4 | 1.2000E+02 | 1.1267E-04 | -1.0618E-04 | 0.4194 | 288.1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 80 | 699.30 | 4 | 1.1900E+02 | 1.1388E-04 | -1.0630E-04 | 0.4195 | 288.1 |
| 81 | 700.00 | 4 | 1.1900E+02 | 1.1388E-04 | -1.0630E-04 | 0.4195 | 288.1 |
| 82 | 700.50 | 4 | 1.1800E+02 | 1.1512E-04 | -1.0643E-04 | 0.4196 | 288.1 |
| 83 | 700.80 | 4 | 1.1800E+02 | 1.1512E-04 | -1.0643E-04 | 0.4196 | 288.1 |
| 84 | 701.00 | 4 | 1.1800E+02 | 1.1512E-04 | -1.0643E-04 | 0.4196 | 288.1 |
| 85 | 701.10 | 4 | 1.1800E+02 | 1.1512E-04 | -1.0643E-04 | 0.4196 | 288.1 |
| 86 | 701.20 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 87 | 701.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 88 | 701.70 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 89 | 702.20 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 90 | 702.90 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 91 | 703.90 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 92 | 705.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 93 | 707.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 94 | 710.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 95 | 714.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 96 | 720.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 97 | 730.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 98 | 745.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 99 | 763.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 100 | 784.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 101 | 808.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 102 | 832.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 103 | 856.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 104 | 880.40 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 105 | 906.50 | 5 | 1.1800E+02 | 1.9019E-05 | -2.3731E-04 | 0.0386 | 288.1 |
| 106 | 930.50 | 5 | 1.1700E+02 | 1.9973E-05 | -2.4237E-04 | 0.0389 | 288.1 |
| 107 | 954.50 | 5 | 1.1600E+02 | 2.0984E-05 | -2.4759E-04 | 0.0391 | 288.1 |
| 108 | 978.50 | 5 | 1.1200E+02 | 2.5673E-05 | -2.7009E-04 | 0.0401 | 288.1 |
| 109 | 1002.50 | 5 | 1.0100E+02 | 4.6469E-05 | -3.4870E-04 | 0.0435 | 288.1 |
| 110 | 1026.50 | 5 | 8.1900E+01 | 1.5388E-04 | -5.8257E-04 | 0.0521 | 288.1 |
| 111 | 1047.50 | 5 | 6.2100E+01 | 7.3359E-04 | -1.1289E-03 | 0.0683 | 288.1 |
| 112 | 1065.50 | 5 | 4.4300E+01 | 4.6617E-03 | -2.4135E-03 | 0.0979 | 288.1 |
| 113 | 1080.50 | 5 | 2.9300E+01 | 3.7464E-02 | -5.2716E-03 | 0.1524 | 288.1 |
| 114 | 1090.50 | 5 | 1.9300E+01 | 2.0945E-01 | -8.4987E-03 | 0.2210 | 288.1 |
| 115 | 1096.50 | 5 | 1.3300E+01 | 6.1447E-01 | -9.1112E-03 | 0.2752 | 288.1 |
| 116 | 1100.50 | 5 | 9.3000E+00 | 1.1691E+00 | -7.3574E-03 | 0.3089 | 288.1 |
| 117 | 1103.50 | 5 | 6.3000E+00 | 1.7337E+00 | -4.8016E-03 | 0.3273 | 288.1 |
| 118 | 1105.50 | 5 | 4.3000E+00 | 2.1290E+00 | -2.8711E-03 | 0.3350 | 288.1 |
| 119 | 1107.00 | 5 | 2.8000E+00 | 2.3986E+00 | -1.5389E-03 | 0.3383 | 288.1 |
| 120 | 1108.00 | 5 | 1.8000E+00 | 2.5494E+00 | -7.9452E-04 | 0.3394 | 288.1 |
| 121 | 1108.70 | 5 | 1.1000E+00 | 2.6342E+00 | -3.7748E-04 | 0.3398 | 288.1 |
| 122 | 1109.20 | 5 | 6.0000E-01 | 2.6804E+00 | -1.5058E-04 | 0.3400 | 288.1 |
| 123 | 1109.50 | 5 | 3.0000E-01 | 2.7003E+00 | -5.2590E-05 | 0.3400 | 288.1 |
| 124 | 1109.70 | 5 | 1.0000E-01 | 2.7090E+00 | -9.9232E-06 | 0.3400 | 288.1 |
| 125 | 1109.80 | 5 | 0.0000E+00 | 2.7110E+00 | -1.5572E-08 | 0.3400 | 288.1 |

Total Initial Storage = 107.8049 cm

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NSURPE = 0: There will be no surface evaporation
IRAIN = 0
NWATER (number of days of rain/irrigation) =365

Rainfall/Irrigation Details

| Day | Time (hr) | Amount (cm) | Application Type | Efficiency | Changes In Rate/Head |
|---|---|---|---|---|---|
| 1 | 0.000 | 0.0005 | 1 | 1.000 | 2 |
| | 24.000 | 0.0000 | | | |
| 2 | 0.000 | 0.0005 | 1 | 1.000 | 2 |
| | 24.000 | 0.0000 | | | |
| 3 | 0.000 | 0.0005 | 1 | 1.000 | 2 |
| | 24.000 | 0.0000 | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| * | | | | | |
| 363 | 0.000 | 0.0005 | 1 | 1.000 | 2 |
| | 24.000 | 0.0000 | | | |
| 364 | 0.000 | 0.0005 | 1 | 1.000 | 2 |
| | 24.000 | 0.0000 | | | |
| 365 | 0.000 | 0.0005 | 1 | 1.000 | 2 |
| | 24.000 | 0.0000 | | | |

Total Water Applied = 0.1679 cm

```
-- ------------------------------------------------------------------------------
                          UNSAT-H Version 2.05
                          INITIAL CONDITIONS
 Input Filename:   C:\Projects\4101KCAW\UNSATH\T24_08.inp
 Results Filename: C:\Projects\4101KCAW\UNSATH\T24_08.res
 Date of Run:      26 Oct 2011
 Time of Run:      14:00:46.26
 Title:
 T24_08.INP: CAW Cell Unsat flow, 6" Type-B Filter, 57' Waste, 0.090 cm/yr infil
-------------------------------------------------------------------------------
```

| | | Initial Conditions | | | | | Initial Conditions | | |
|---|---|---|---|---|---|---|---|---|---|
| NODE | DEPTH (cm) | HEAD (cm) | THETA (vol.) | TEMP (K) | NODE | DEPTH (cm) | HEAD (cm) | THETA (vol.) | TEMP (K) |
| 1 | 0.000E+00 | 1.001E+02 | 0.4215 | 0.00 | 2 | 1.000E-01 | 1.002E+02 | 0.4215 | 0.00 |
| 3 | 3.000E-01 | 1.003E+02 | 0.4215 | 0.00 | 4 | 6.000E-01 | 1.004E+02 | 0.4215 | 0.00 |
| 5 | 1.100E+00 | 1.007E+02 | 0.4215 | 0.00 | 6 | 2.000E+00 | 1.011E+02 | 0.4214 | 0.00 |
| 7 | 3.500E+00 | 1.019E+02 | 0.4213 | 0.00 | 8 | 6.500E+00 | 1.035E+02 | 0.4212 | 0.00 |
| 9 | 1.150E+01 | 1.063E+02 | 0.4209 | 0.00 | 10 | 1.900E+01 | 1.110E+02 | 0.4203 | 0.00 |
| 11 | 2.400E+01 | 1.146E+02 | 0.4200 | 0.00 | 12 | 2.700E+01 | 1.169E+02 | 0.4197 | 0.00 |
| 13 | 2.850E+01 | 1.181E+02 | 0.4196 | 0.00 | 14 | 2.940E+01 | 1.188E+02 | 0.4195 | 0.00 |
| 15 | 2.990E+01 | 1.192E+02 | 0.4195 | 0.00 | 16 | 3.020E+01 | 1.195E+02 | 0.4194 | 0.00 |
| 17 | 3.040E+01 | 1.196E+02 | 0.4194 | 0.00 | 18 | 3.050E+01 | 1.197E+02 | 0.4194 | 0.00 |
| 19 | 3.060E+01 | 1.196E+02 | 0.4194 | 0.00 | 20 | 3.080E+01 | 1.195E+02 | 0.4194 | 0.00 |
| 21 | 3.110E+01 | 1.192E+02 | 0.4195 | 0.00 | 22 | 3.160E+01 | 1.187E+02 | 0.4195 | 0.00 |
| 23 | 3.250E+01 | 1.179E+02 | 0.4196 | 0.00 | 24 | 3.400E+01 | 1.166E+02 | 0.4198 | 0.00 |
| 25 | 3.700E+01 | 1.138E+02 | 0.4200 | 0.00 | 26 | 4.200E+01 | 1.092E+02 | 0.4205 | 0.00 |
| 27 | 4.950E+01 | 1.023E+02 | 0.4213 | 0.00 | 28 | 5.450E+01 | 9.770E+01 | 0.4218 | 0.00 |
| 29 | 5.750E+01 | 9.491E+01 | 0.4221 | 0.00 | 30 | 5.900E+01 | 9.352E+01 | 0.4222 | 0.00 |
| 31 | 5.990E+01 | 9.268E+01 | 0.4223 | 0.00 | 32 | 6.040E+01 | 9.221E+01 | 0.4224 | 0.00 |
| 33 | 6.070E+01 | 9.193E+01 | 0.4224 | 0.00 | 34 | 6.090E+01 | 9.175E+01 | 0.4224 | 0.00 |
| 35 | 6.100E+01 | 9.165E+01 | 0.4224 | 0.00 | 36 | 6.110E+01 | 9.158E+01 | 0.0503 | 0.00 |
| 37 | 6.130E+01 | 9.158E+01 | 0.0503 | 0.00 | 38 | 6.160E+01 | 9.158E+01 | 0.0503 | 0.00 |
| 39 | 6.210E+01 | 9.158E+01 | 0.0503 | 0.00 | 40 | 6.300E+01 | 9.158E+01 | 0.0503 | 0.00 |
| 41 | 6.450E+01 | 9.158E+01 | 0.0503 | 0.00 | 42 | 6.750E+01 | 9.158E+01 | 0.0503 | 0.00 |
| 43 | 7.250E+01 | 9.158E+01 | 0.0503 | 0.00 | 44 | 8.250E+01 | 9.158E+01 | 0.0503 | 0.00 |
| 45 | 1.025E+02 | 9.158E+01 | 0.0503 | 0.00 | 46 | 1.425E+02 | 9.159E+01 | 0.0503 | 0.00 |
| 47 | 2.225E+02 | 9.158E+01 | 0.0503 | 0.00 | 48 | 3.725E+02 | 9.150E+01 | 0.0503 | 0.00 |
| 49 | 5.925E+02 | 9.177E+01 | 0.0502 | 0.00 | 50 | 9.295E+02 | 9.143E+01 | 0.0503 | 0.00 |
| 51 | 1.267E+03 | 9.134E+01 | 0.0503 | 0.00 | 52 | 1.487E+03 | 9.146E+01 | 0.0503 | 0.00 |
| 53 | 1.637E+03 | 9.161E+01 | 0.0502 | 0.00 | 54 | 1.717E+03 | 9.170E+01 | 0.0502 | 0.00 |
| 55 | 1.757E+03 | 9.506E+01 | 0.0491 | 0.00 | 56 | 1.777E+03 | 1.035E+02 | 0.0468 | 0.00 |
| 57 | 1.787E+03 | 1.155E+02 | 0.0440 | 0.00 | 58 | 1.792E+03 | 1.283E+02 | 0.0415 | 0.00 |
| 59 | 1.795E+03 | 1.426E+02 | 0.0394 | 0.00 | 60 | 1.796E+03 | 1.541E+02 | 0.0379 | 0.00 |
| 61 | 1.797E+03 | 1.640E+02 | 0.0368 | 0.00 | 62 | 1.797E+03 | 1.710E+02 | 0.0361 | 0.00 |
| 63 | 1.798E+03 | 1.760E+02 | 0.0357 | 0.00 | 64 | 1.798E+03 | 1.798E+02 | 0.0353 | 0.00 |
| 65 | 1.798E+03 | 1.818E+02 | 0.0352 | 0.00 | 66 | 1.798E+03 | 1.840E+02 | 0.0350 | 0.00 |
| 67 | 1.798E+03 | 1.841E+02 | 0.4129 | 0.00 | 68 | 1.798E+03 | 1.839E+02 | 0.4129 | 0.00 |
| 69 | 1.799E+03 | 1.837E+02 | 0.4129 | 0.00 | 70 | 1.799E+03 | 1.833E+02 | 0.4129 | 0.00 |
| 71 | 1.800E+03 | 1.827E+02 | 0.4130 | 0.00 | 72 | 1.801E+03 | 1.818E+02 | 0.4131 | 0.00 |
| 73 | 1.802E+03 | 1.806E+02 | 0.4132 | 0.00 | 74 | 1.804E+03 | 1.792E+02 | 0.4133 | 0.00 |
| 75 | 1.808E+03 | 1.758E+02 | 0.4137 | 0.00 | 76 | 1.814E+03 | 1.707E+02 | 0.4142 | 0.00 |
| 77 | 1.824E+03 | 1.622E+02 | 0.4150 | 0.00 | 78 | 1.833E+03 | 1.544E+02 | 0.4158 | 0.00 |
| 79 | 1.843E+03 | 1.456E+02 | 0.4167 | 0.00 | 80 | 1.849E+03 | 1.403E+02 | 0.4173 | 0.00 |
| 81 | 1.853E+03 | 1.367E+02 | 0.4176 | 0.00 | 82 | 1.855E+03 | 1.352E+02 | 0.4178 | 0.00 |
| 83 | 1.856E+03 | 1.339E+02 | 0.4179 | 0.00 | 84 | 1.857E+03 | 1.330E+02 | 0.4180 | 0.00 |
| 85 | 1.858E+03 | 1.323E+02 | 0.4181 | 0.00 | 86 | 1.859E+03 | 1.319E+02 | 0.4181 | 0.00 |
| 87 | 1.859E+03 | 1.316E+02 | 0.4182 | 0.00 | 88 | 1.859E+03 | 1.314E+02 | 0.4182 | 0.00 |
| 89 | 1.859E+03 | 1.314E+02 | 0.4182 | 0.00 | 90 | 1.859E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 91 | 1.859E+03 | 1.313E+02 | 0.0358 | 0.00 | 92 | 1.860E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 93 | 1.860E+03 | 1.313E+02 | 0.0358 | 0.00 | 94 | 1.861E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 95 | 1.862E+03 | 1.313E+02 | 0.0358 | 0.00 | 96 | 1.863E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 97 | 1.865E+03 | 1.313E+02 | 0.0358 | 0.00 | 98 | 1.868E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 99 | 1.872E+03 | 1.313E+02 | 0.0358 | 0.00 | 100 | 1.878E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 101 | 1.888E+03 | 1.313E+02 | 0.0358 | 0.00 | 102 | 1.903E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 103 | 1.921E+03 | 1.314E+02 | 0.0358 | 0.00 | 104 | 1.942E+03 | 1.314E+02 | 0.0358 | 0.00 |
| 105 | 1.966E+03 | 1.314E+02 | 0.0358 | 0.00 | 106 | 1.990E+03 | 1.314E+02 | 0.0358 | 0.00 |
| 107 | 2.014E+03 | 1.314E+02 | 0.0358 | 0.00 | 108 | 2.038E+03 | 1.313E+02 | 0.0358 | 0.00 |
| 109 | 2.065E+03 | 1.310E+02 | 0.0359 | 0.00 | 110 | 2.089E+03 | 1.298E+02 | 0.0361 | 0.00 |
| 111 | 2.113E+03 | 1.266E+02 | 0.0367 | 0.00 | 112 | 2.137E+03 | 1.185E+02 | 0.0385 | 0.00 |
| 113 | 2.161E+03 | 1.034E+02 | 0.0427 | 0.00 | 114 | 2.185E+03 | 8.253E+01 | 0.0518 | 0.00 |
| 115 | 2.206E+03 | 6.219E+01 | 0.0682 | 0.00 | 116 | 2.224E+03 | 4.429E+01 | 0.0979 | 0.00 |
| 117 | 2.239E+03 | 2.930E+01 | 0.1524 | 0.00 | 118 | 2.249E+03 | 1.930E+01 | 0.2210 | 0.00 |
| 119 | 2.255E+03 | 1.330E+01 | 0.2752 | 0.00 | 120 | 2.259E+03 | 9.300E+00 | 0.3089 | 0.00 |
| 121 | 2.262E+03 | 6.300E+00 | 0.3273 | 0.00 | 122 | 2.264E+03 | 4.300E+00 | 0.3350 | 0.00 |
| 123 | 2.265E+03 | 2.800E+00 | 0.3383 | 0.00 | 124 | 2.266E+03 | 1.800E+00 | 0.3394 | 0.00 |
| 125 | 2.267E+03 | 1.100E+00 | 0.3398 | 0.00 | 126 | 2.267E+03 | 6.000E-01 | 0.3400 | 0.00 |
| 127 | 2.268E+03 | 3.000E-01 | 0.3400 | 0.00 | 128 | 2.268E+03 | 1.000E-01 | 0.3400 | 0.00 |
| 129 | 2.268E+03 | 0.000E+00 | 0.3400 | 0.00 | | | | | |

```
 Initial Water Storage = 162.4679 cm
--------------------------------------------------------------------------------
 DAILY SUMMARY:  Day =   1, Simulated Time = 24.0000 hr
 -------------
 Node Number       =      20          40          60          80         120
 Depth (cm)        =    30.80000    63.00000  1796.00000  1849.10000  2258.50000
 Water (cm3/cm3)   =     0.41944     0.05026     0.03791     0.41726     0.30889
 Head (cm)         = 1.19465E+02 9.15783E+01 1.54120E+02 1.40283E+02 9.29995E+00
 Water Flow (cm)   = 2.50000E-04 2.50000E-04 2.47510E-04 2.47164E-04 2.44286E-04
  PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
 162.4679+ 0.0002+ 0.0000 - 0.0000- 0.0000-  0.0002 =162.4679  Versus 162.4679
 Mass Balance = -1.9895E-13 cm;  Time step attempts =  388 and successes =  388
--------------------------------------------------------------------------------
 DAILY SUMMARY:  Day = 365, Simulated Time = 24.0000 hr
 -------------
 Node Number       =      20          40          60          80         120
 Depth (cm)        =    30.80000    63.00000  1796.00000  1849.10000  2258.50000
 Water (cm3/cm3)   =     0.41944     0.05026     0.03791     0.41726     0.30889
 Head (cm)         = 1.19465E+02 9.15783E+01 1.54092E+02 1.40263E+02 9.29995E+00
 Water Flow (cm)   = 2.50000E-04 2.50000E-04 2.47719E-04 2.47377E-04 2.44501E-04
  PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
 162.4699+ 0.0002+ 0.0000 - 0.0000- 0.0000-  0.0002 =162.4699  Versus 162.4699
 Mass Balance = -4.5475E-13 cm;  Time step attempts =  160 and successes =  1601
--------------------------------------------------------------------------------
                            UNSAT-H Version 2.05
                             SIMULATION SUMMARY
 Title:
 T24_08.INP: CAW Cell Unsat flow, 6" Type-B Filter, 57' Waste, 0.090 cm/yr infil
--------------------------------------------------------------------------------
 Transpiration Scheme is:           =    0
 Potential Evapotranspiration       =  0.0000E+00     [cm]
 Potential Transpiration            =  0.0000E+00     [cm]
 Actual Transpiration               =  0.0000E+00     [cm]
 Potential Evaporation              =  0.0000E+00     [cm]
 Actual Evaporation                 =  0.0000E+00     [cm]
 Evaporation during Growth          =  0.0000E+00     [cm]
 Total Runoff                       =  0.0000E+00     [cm]
 Total Infiltration                 =  9.1250E-02     [cm]
 Total Drainage at Base of Profile  =  8.9203E-02     [cm]
 Total Applied Water                =  9.1250E-02     [cm]
 Actual Rainfall                    =  9.1250E-02     [cm]
 Actual Irrigation                  =  0.0000E+00     [cm]
 Total Final Moisture Storage       =  1.6247E+02     [cm]
 Mass Balance Error                 = -1.0280E-10     [cm]
 Total Successful Time Steps        =     58628
 Total Attempted Time Steps         =     58628
 Total Time Step Reductions (DHMAX) =         0
 Total Changes in Surface Boundary  =         0
 Total Time Actually Simulated      =  3.6500E+02     [days]
 Total water flow (cm) across different depths at the end of 3.6500E+02 days:
     DEPTH        FLOW        DEPTH        FLOW        DEPTH        FLOW
    -------   -----------    -------   -----------    -------   -----------
      0.000    9.1250E-02      0.050    9.1250E-02      0.200    9.1250E-02
      0.450    9.1250E-02      0.850    9.1250E-02      1.550    9.1250E-02
      2.750    9.1250E-02      5.000    9.1250E-02      9.000    9.1250E-02
     15.250    9.1250E-02     21.500    9.1250E-02     25.500    9.1250E-02
     27.750    9.1250E-02     28.950    9.1250E-02     29.650    9.1250E-02
     30.050    9.1250E-02     30.300    9.1250E-02     30.450    9.1250E-02
     30.550    9.1250E-02     30.700    9.1250E-02     30.950    9.1250E-02
     31.350    9.1250E-02     32.050    9.1250E-02     33.250    9.1250E-02
     35.500    9.1250E-02     39.500    9.1250E-02     45.750    9.1250E-02
     52.000    9.1250E-02     56.000    9.1250E-02     58.250    9.1250E-02
     59.450    9.1250E-02     60.150    9.1250E-02     60.550    9.1250E-02
     60.800    9.1250E-02     60.950    9.1250E-02     61.050    9.1250E-02
     61.200    9.1250E-02     61.450    9.1250E-02     61.850    9.1250E-02
     62.550    9.1250E-02     63.750    9.1250E-02     66.000    9.1250E-02
     70.000    9.1250E-02     77.500    9.1250E-02     92.500    9.1250E-02
    122.500    9.1250E-02    182.500    9.1221E-02    297.500    9.1369E-02
    482.500    9.1108E-02    761.000    9.1071E-02   1098.000    9.2095E-02
   1376.500    9.2114E-02   1561.500    9.1564E-02   1676.500    9.1035E-02
   1736.500    9.0711E-02   1766.500    9.0536E-02   1781.500    9.0450E-02
   1789.000    9.0410E-02   1793.000    9.0392E-02   1795.250    9.0383E-02
   1796.450    9.0379E-02   1797.150    9.0377E-02   1797.550    9.0376E-02
   1797.800    9.0376E-02   1797.950    9.0375E-02   1798.050    9.0375E-02
   1798.150    9.0375E-02   1798.300    9.0374E-02   1798.550    9.0374E-02
   1798.950    9.0373E-02   1799.550    9.0371E-02   1800.400    9.0369E-02
   1801.650    9.0366E-02   1803.250    9.0362E-02   1806.100    9.0355E-02
   1811.100    9.0344E-02   1819.100    9.0325E-02   1828.600    9.0303E-02
   1838.100    9.0282E-02   1846.100    9.0264E-02   1851.100    9.0254E-02
   1853.950    9.0248E-02   1855.550    9.0244E-02   1856.800    9.0242E-02
   1857.650    9.0240E-02   1858.250    9.0239E-02   1858.650    9.0238E-02
```

| | | | | | |
|---|---|---|---|---|---|
| 1858.900 | 9.0237E-02 | 1859.050 | 9.0237E-02 | 1859.150 | 9.0237E-02 |
| 1859.300 | 9.0236E-02 | 1859.550 | 9.0235E-02 | 1859.950 | 9.0234E-02 |
| 1860.550 | 9.0232E-02 | 1861.400 | 9.0229E-02 | 1862.650 | 9.0224E-02 |
| 1864.400 | 9.0218E-02 | 1866.900 | 9.0209E-02 | 1870.400 | 9.0196E-02 |
| 1875.400 | 9.0178E-02 | 1883.400 | 9.0148E-02 | 1895.900 | 9.0102E-02 |
| 1912.400 | 9.0041E-02 | 1931.900 | 8.9969E-02 | 1954.400 | 8.9885E-02 |
| 1978.400 | 8.9796E-02 | 2002.400 | 8.9706E-02 | 2026.400 | 8.9617E-02 |
| 2051.450 | 8.9524E-02 | 2076.500 | 8.9435E-02 | 2100.500 | 8.9354E-02 |
| 2124.500 | 8.9287E-02 | 2148.500 | 8.9239E-02 | 2172.500 | 8.9215E-02 |
| 2195.000 | 8.9206E-02 | 2214.500 | 8.9204E-02 | 2231.000 | 8.9204E-02 |
| 2243.500 | 8.9204E-02 | 2251.500 | 8.9203E-02 | 2256.500 | 8.9203E-02 |
| 2260.000 | 8.9203E-02 | 2262.500 | 8.9203E-02 | 2264.250 | 8.9203E-02 |
| 2265.500 | 8.9203E-02 | 2266.350 | 8.9203E-02 | 2266.950 | 8.9203E-02 |
| 2267.350 | 8.9203E-02 | 2267.600 | 8.9203E-02 | 2267.750 | 8.9203E-02 |
| 2267.800 | 8.9203E-02 | | | | |

```
--------------------------------------------------------------------------------
                          UNSAT-H Version 2.05
                          INITIAL CONDITIONS
Input Filename:   C:\Projects\4101KCAW\UNSATH\S18_06.inp
Results Filename: C:\Projects\4101KCAW\UNSATH\S18_06.res
Date of Run:      26 Oct 2011
Time of Run:      07:58:32.71
Title:
S18_06.INP: CAW Cell Unsat flow, 18" Type-B Filter, 19' Waste, 0.168 cm/yr infi
--------------------------------------------------------------------------------
                   Initial Conditions                      Initial Conditions
                 -----------------------                 -----------------------
 NODE   DEPTH      HEAD    THETA  TEMP   NODE   DEPTH      HEAD    THETA  TEMP
         (cm)      (cm)   (vol.)   (K)            (cm)      (cm)   (vol.)   (K)
 ---- --------- --------- ------ ------  ---- --------- --------- ------ ------
    1 0.000E+00 6.811E+01 0.4250   0.00     2 1.000E-01 6.819E+01 0.4250   0.00
    3 3.000E-01 6.835E+01 0.4250   0.00     4 6.000E-01 6.859E+01 0.4250   0.00
    5 1.100E+00 6.900E+01 0.4249   0.00     6 2.000E+00 6.975E+01 0.4249   0.00
    7 3.500E+00 7.104E+01 0.4247   0.00     8 6.500E+00 7.378E+01 0.4244   0.00
    9 1.150E+01 7.888E+01 0.4238   0.00    10 1.900E+01 8.800E+01 0.4228   0.00
   11 2.400E+01 9.530E+01 0.4220   0.00    12 2.700E+01 1.002E+02 0.4215   0.00
   13 2.850E+01 1.029E+02 0.4212   0.00    14 2.940E+01 1.045E+02 0.4210   0.00
   15 2.990E+01 1.055E+02 0.4209   0.00    16 3.020E+01 1.061E+02 0.4209   0.00
   17 3.040E+01 1.064E+02 0.4208   0.00    18 3.050E+01 1.066E+02 0.4208   0.00
   19 3.060E+01 1.066E+02 0.4208   0.00    20 3.080E+01 1.064E+02 0.4208   0.00
   21 3.110E+01 1.062E+02 0.4209   0.00    22 3.160E+01 1.058E+02 0.4209   0.00
   23 3.250E+01 1.050E+02 0.4210   0.00    24 3.400E+01 1.037E+02 0.4211   0.00
   25 3.700E+01 1.011E+02 0.4214   0.00    26 4.200E+01 9.679E+01 0.4219   0.00
   27 4.950E+01 9.023E+01 0.4226   0.00    28 5.450E+01 8.582E+01 0.4231   0.00
   29 5.750E+01 8.316E+01 0.4234   0.00    30 5.900E+01 8.182E+01 0.4235   0.00
   31 5.990E+01 8.102E+01 0.4236   0.00    32 6.040E+01 8.057E+01 0.4237   0.00
   33 6.070E+01 8.030E+01 0.4237   0.00    34 6.090E+01 8.012E+01 0.4237   0.00
   35 6.100E+01 8.003E+01 0.4237   0.00    36 6.110E+01 7.997E+01 0.0547   0.00
   37 6.130E+01 7.997E+01 0.0547   0.00    38 6.160E+01 7.997E+01 0.0547   0.00
   39 6.210E+01 7.997E+01 0.0547   0.00    40 6.300E+01 7.997E+01 0.0547   0.00
   41 6.450E+01 7.997E+01 0.0547   0.00    42 6.750E+01 7.997E+01 0.0547   0.00
   43 7.250E+01 7.997E+01 0.0547   0.00    44 8.250E+01 7.997E+01 0.0547   0.00
   45 1.025E+02 7.997E+01 0.0547   0.00    46 1.425E+02 7.996E+01 0.0547   0.00
   47 2.225E+02 7.998E+01 0.0547   0.00    48 3.505E+02 7.994E+01 0.0547   0.00
   49 4.785E+02 8.001E+01 0.0546   0.00    50 5.585E+02 7.984E+01 0.0547   0.00
   51 5.985E+02 8.194E+01 0.0538   0.00    52 6.185E+02 8.843E+01 0.0513   0.00
   53 6.285E+02 9.845E+01 0.0481   0.00    54 6.335E+02 1.097E+02 0.0452   0.00
   55 6.365E+02 1.228E+02 0.0425   0.00    56 6.380E+02 1.339E+02 0.0406   0.00
   57 6.389E+02 1.438E+02 0.0392   0.00    58 6.394E+02 1.511E+02 0.0383   0.00
   59 6.397E+02 1.566E+02 0.0376   0.00    60 6.399E+02 1.608E+02 0.0372   0.00
   61 6.400E+02 1.631E+02 0.0369   0.00    62 6.401E+02 1.655E+02 0.0367   0.00
   63 6.402E+02 1.657E+02 0.4147   0.00    64 6.404E+02 1.656E+02 0.4147   0.00
   65 6.407E+02 1.653E+02 0.4147   0.00    66 6.412E+02 1.650E+02 0.4147   0.00
   67 6.419E+02 1.645E+02 0.4148   0.00    68 6.429E+02 1.637E+02 0.4149   0.00
   69 6.444E+02 1.626E+02 0.4150   0.00    70 6.461E+02 1.614E+02 0.4151   0.00
   71 6.501E+02 1.584E+02 0.4154   0.00    72 6.561E+02 1.538E+02 0.4159   0.00
   73 6.661E+02 1.461E+02 0.4167   0.00    74 6.751E+02 1.391E+02 0.4174   0.00
   75 6.851E+02 1.310E+02 0.4182   0.00    76 6.911E+02 1.262E+02 0.4187   0.00
   77 6.951E+02 1.229E+02 0.4191   0.00    78 6.968E+02 1.215E+02 0.4192   0.00
   79 6.983E+02 1.202E+02 0.4194   0.00    80 6.993E+02 1.194E+02 0.4195   0.00
   81 7.000E+02 1.188E+02 0.4195   0.00    82 7.005E+02 1.184E+02 0.4196   0.00
   83 7.008E+02 1.182E+02 0.4196   0.00    84 7.010E+02 1.180E+02 0.4196   0.00
   85 7.011E+02 1.179E+02 0.4196   0.00    86 7.012E+02 1.178E+02 0.0387   0.00
   87 7.014E+02 1.178E+02 0.0387   0.00    88 7.017E+02 1.178E+02 0.0387   0.00
   89 7.022E+02 1.178E+02 0.0387   0.00    90 7.029E+02 1.178E+02 0.0387   0.00
   91 7.039E+02 1.178E+02 0.0387   0.00    92 7.054E+02 1.178E+02 0.0387   0.00
   93 7.074E+02 1.178E+02 0.0387   0.00    94 7.104E+02 1.178E+02 0.0387   0.00
   95 7.144E+02 1.178E+02 0.0387   0.00    96 7.204E+02 1.178E+02 0.0387   0.00
   97 7.304E+02 1.178E+02 0.0387   0.00    98 7.454E+02 1.178E+02 0.0387   0.00
   99 7.634E+02 1.178E+02 0.0387   0.00   100 7.844E+02 1.178E+02 0.0387   0.00
  101 8.084E+02 1.178E+02 0.0387   0.00   102 8.324E+02 1.178E+02 0.0387   0.00
  103 8.564E+02 1.178E+02 0.0387   0.00   104 8.804E+02 1.178E+02 0.0387   0.00
  105 9.065E+02 1.177E+02 0.0387   0.00   106 9.305E+02 1.173E+02 0.0388   0.00
  107 9.545E+02 1.160E+02 0.0391   0.00   108 9.785E+02 1.115E+02 0.0403   0.00
  109 1.003E+03 1.005E+02 0.0437   0.00   110 1.027E+03 8.189E+01 0.0521   0.00
  111 1.048E+03 6.209E+01 0.0683   0.00   112 1.066E+03 4.428E+01 0.0980   0.00
  113 1.081E+03 2.930E+01 0.1524   0.00   114 1.091E+03 1.930E+01 0.2210   0.00
  115 1.097E+03 1.330E+01 0.2752   0.00   116 1.101E+03 9.300E+00 0.3089   0.00
  117 1.104E+03 6.300E+00 0.3273   0.00   118 1.106E+03 4.300E+00 0.3350   0.00
  119 1.107E+03 2.800E+00 0.3383   0.00   120 1.108E+03 1.800E+00 0.3394   0.00
  121 1.109E+03 1.100E+00 0.3398   0.00   122 1.109E+03 6.000E-01 0.3400   0.00
  123 1.110E+03 3.000E-01 0.3400   0.00   124 1.110E+03 1.000E-01 0.3400   0.00
  125 1.110E+03 0.000E+00 0.3400   0.00
Initial Water Storage = 107.8190 cm
--------------------------------------------------------------------------------
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DAILY SUMMARY:  Day =   1, Simulated Time = 24.0000 hr
 -------------
 Node Number       =      20          40          60          80         120
 Depth (cm)        =    30.80000    63.00000   639.90000   699.30000  1108.00000
 Water (cm3/cm3)   =     0.42084     0.05466     0.03716     0.41945     0.33943
 Head (cm)         = 1.06435E+02 7.99667E+01 1.60763E+02 1.19399E+02 1.79999E+00
 Water Flow (cm)   = 4.60000E-04 4.60000E-04 4.60009E-04 4.60002E-04 4.59895E-04
  PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
 107.8190+ 0.0005+ 0.0000 - 0.0000- 0.0000-  0.0005 =107.8190  Versus 107.8190
 Mass Balance =  1.4211E-14 cm;  Time step attempts =  388 and successes =  388
--------------------------------------------------------------------------------
 DAILY SUMMARY:  Day = 365, Simulated Time = 24.0000 hr
 -------------
 Node Number       =      20          40          60          80         120
 Depth (cm)        =    30.80000    63.00000   639.90000   699.30000  1108.00000
 Water (cm3/cm3)   =     0.42084     0.05466     0.03716     0.41945     0.33943
 Head (cm)         = 1.06435E+02 7.99667E+01 1.60763E+02 1.19398E+02 1.79999E+00
 Water Flow (cm)   = 4.60000E-04 4.60000E-04 4.60013E-04 4.60008E-04 4.59911E-04
  PRESTOR   INFIL  RUNOFF    EVAPO   TRANS    DRAIN   NEWSTOR          STORAGE
 107.8190+ 0.0005+ 0.0000 - 0.0000- 0.0000-  0.0005 =107.8190  Versus 107.8190
 Mass Balance = -4.2633E-14 cm;  Time step attempts =  160 and successes =  160
1
--------------------------------------------------------------------------------
                            UNSAT-H Version 2.05
                             SIMULATION SUMMARY
 Title:
 S18_06.INP: CAW Cell Unsat flow, 18" Type-B Filter, 19' Waste, 0.168 cm/yr infi
--------------------------------------------------------------------------------
 Transpiration Scheme is:           =    0
 Potential Evapotranspiration       =  0.0000E+00     [cm]
 Potential Transpiration            =  0.0000E+00     [cm]
 Actual Transpiration               =  0.0000E+00     [cm]
 Potential Evaporation              =  0.0000E+00     [cm]
 Actual Evaporation                 =  0.0000E+00     [cm]
 Evaporation during Growth          =  0.0000E+00     [cm]
 Total Runoff                       =  0.0000E+00     [cm]
 Total Infiltration                 =  1.6790E-01     [cm]
 Total Drainage at Base of Profile  =  1.6786E-01     [cm]
 Total Applied Water                =  1.6790E-01     [cm]
 Actual Rainfall                    =  1.6790E-01     [cm]
 Actual Irrigation                  =  0.0000E+00     [cm]
 Total Final Moisture Storage       =  1.0782E+02     [cm]
 Mass Balance Error                 =  1.2648E-12     [cm]
 Total Successful Time Steps        =     58628
 Total Attempted Time Steps         =     58628
 Total Time Step Reductions (DHMAX) =         0
 Total Changes in Surface Boundary  =         0
 Total Time Actually Simulated      =  3.6500E+02     [days]
 Total water flow (cm) across different depths at the end of 3.6500E+02 days:
     DEPTH        FLOW        DEPTH        FLOW        DEPTH        FLOW
    -------   -----------    -------   -----------    -------   -----------
      0.000    1.6790E-01      0.050    1.6790E-01      0.200    1.6790E-01
      0.450    1.6790E-01      0.850    1.6790E-01      1.550    1.6790E-01
      2.750    1.6790E-01      5.000    1.6790E-01      9.000    1.6790E-01
     15.250    1.6790E-01     21.500    1.6790E-01     25.500    1.6790E-01
     27.750    1.6790E-01     28.950    1.6790E-01     29.650    1.6790E-01
     30.050    1.6790E-01     30.300    1.6790E-01     30.450    1.6790E-01
     30.550    1.6790E-01     30.700    1.6790E-01     30.950    1.6790E-01
     31.350    1.6790E-01     32.050    1.6790E-01     33.250    1.6790E-01
     35.500    1.6790E-01     39.500    1.6790E-01     45.750    1.6790E-01
     52.000    1.6790E-01     56.000    1.6790E-01     58.250    1.6790E-01
     59.450    1.6790E-01     60.150    1.6790E-01     60.550    1.6790E-01
     60.800    1.6790E-01     60.950    1.6790E-01     61.050    1.6790E-01
     61.200    1.6790E-01     61.450    1.6790E-01     61.850    1.6790E-01
     62.550    1.6790E-01     63.750    1.6790E-01     66.000    1.6790E-01
     70.000    1.6790E-01     77.500    1.6790E-01     92.500    1.6790E-01
    122.500    1.6790E-01    182.500    1.6790E-01    286.500    1.6790E-01
    414.500    1.6790E-01    518.500    1.6791E-01    578.500    1.6791E-01
    608.500    1.6791E-01    623.500    1.6790E-01    631.000    1.6790E-01
    635.000    1.6790E-01    637.250    1.6790E-01    638.450    1.6790E-01
    639.150    1.6790E-01    639.550    1.6790E-01    639.800    1.6790E-01
    639.950    1.6790E-01    640.050    1.6790E-01    640.150    1.6790E-01
    640.300    1.6790E-01    640.550    1.6790E-01    640.950    1.6790E-01
    641.550    1.6790E-01    642.400    1.6790E-01    643.650    1.6790E-01
    645.250    1.6790E-01    648.100    1.6790E-01    653.100    1.6790E-01
    661.100    1.6790E-01    670.600    1.6790E-01    680.100    1.6790E-01
    688.100    1.6790E-01    693.100    1.6790E-01    695.950    1.6790E-01
    697.550    1.6790E-01    698.800    1.6790E-01    699.650    1.6790E-01
    700.250    1.6790E-01    700.650    1.6790E-01    700.900    1.6790E-01
    701.050    1.6790E-01    701.150    1.6790E-01    701.300    1.6790E-01
    701.550    1.6790E-01    701.950    1.6790E-01    702.550    1.6790E-01
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|---|---|---|---|---|---|
| 703.400 | 1.6790E-01 | 704.650 | 1.6790E-01 | 706.400 | 1.6790E-01 |
| 708.900 | 1.6790E-01 | 712.400 | 1.6790E-01 | 717.400 | 1.6790E-01 |
| 725.400 | 1.6790E-01 | 737.900 | 1.6790E-01 | 754.400 | 1.6790E-01 |
| 773.900 | 1.6790E-01 | 796.400 | 1.6789E-01 | 820.400 | 1.6789E-01 |
| 844.400 | 1.6789E-01 | 868.400 | 1.6788E-01 | 893.450 | 1.6788E-01 |
| 918.500 | 1.6788E-01 | 942.500 | 1.6787E-01 | 966.500 | 1.6787E-01 |
| 990.500 | 1.6787E-01 | 1014.500 | 1.6787E-01 | 1037.000 | 1.6786E-01 |
| 1056.500 | 1.6786E-01 | 1073.000 | 1.6786E-01 | 1085.500 | 1.6786E-01 |
| 1093.500 | 1.6786E-01 | 1098.500 | 1.6786E-01 | 1102.000 | 1.6786E-01 |
| 1104.500 | 1.6786E-01 | 1106.250 | 1.6786E-01 | 1107.500 | 1.6786E-01 |
| 1108.350 | 1.6786E-01 | 1108.950 | 1.6786E-01 | 1109.350 | 1.6786E-01 |
| 1109.600 | 1.6786E-01 | 1109.750 | 1.6786E-01 | 1109.800 | 1.6786E-01 |

# ATTACHMENT 3
# ENERGYSOLUTIONS
# CLASS A WEST (CAW) CELL
# PATHRAE MODEL FILES

Prepared for

*EnergySolutions, LLC*
*423 West 300 South, Suite 200*
*Salt Lake City, UT  84101*

Prepared by

*Whetstone Associates, Inc.*
*104 W Ruby Avenue*
*Gunnison, Colorado  81230*
*970-641-7471*

*Document 4104K.111128*

November 28, 2011

# PATHRAE MODEL VERTICAL OUTPUT FILE FILE --09Wa.OUT.docx 0.09 CM/YR CASE -PART 1

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 PATHRAE-RAD(PC)  Version 2.2d  February 1995
   Date: 11- 3-2011
   Time: 14:54:40
 EnergySolns CAW, run VT09a, vert., 0.090 cm/yr, 10 cm d.
 *****  Mirror Image of Input Files  *****
 -- Input File:  ABCDEF.DAT
 EnergySolns CAW, run VT09a, vert., 0.090 cm/yr, 10 cm d.

116,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,11
0.,115.,120.,125.,130.,135.,14
 58,0,1
 1,2
 0,1.,1.,9.00E-04,9.00E-04,4.072,0
 1563.,0.100,0,0,0.235,3.20E-02,2.09,0
 1,0,0,0,0,0
 0,1.,1.,4.072,0,1800.,1.,0,0,0
 0,0,0,0.0,1.
 0,0,0,0,0,0,0
 0,0,0,0,0,0,0,0,0,0,0
 4,7
 1,0,1,0
 0.00090,0.0097,0.100,0,0,1.,0,1.,0,0.354

 -- Input File:  BRCDCF.DAT
 101,Ac-227  0,0,0,0,0,0,0
 102,Ag-108m 0,0,0,0,0,0,0
 103,Al-26   0,0,0,0,0,0,0
 48,Am-241   0,0,0,0,0,0,0
 104,Am-242m 0,0,0,0,0,0,0
 105,Am-243  0,0,0,0,0,0,0
 106,Ba-133  0,0,0,0,0,0,0
 107,Be-10   0,0,0,0,0,0,0
 108,Bi-207  0,0,0,0,0,0,0
 109,Bi-210m 0,0,0,0,0,0,0
 110,Bk-247  0,0,0,0,0,0,0
 111,C-14    0,0,0,0,0,0,0
 112,Ca-41   0,0,0,0,0,0,0
 113,Cd-113  0,0,0,0,0,0,0
 114,Cd-113m 0,0,0,0,0,0,0
 115,Cf-249  0,0,0,0,0,0,0
 116,Cf-250  0,0,0,0,0,0,0
 117,Cf-251  0,0,0,0,0,0,0
 118,Cf-252  0,0,0,0,0,0,0
 119,Cl-36   0,0,0,0,0,0,0
 120,Cm-243  0,0,0,0,0,0,0
 50,Cm-244   0,0,0,0,0,0,0
 121,Cm-245  0,0,0,0,0,0,0
 122,Cm-246  0,0,0,0,0,0,0
 123,Cm-247  0,0,0,0,0,0,0
 124,Cm-248  0,0,0,0,0,0,0
 125,Co-60   0,0,0,0,0,0,0
 126,Cs-135  0,0,0,0,0,0,0
 127,Cs-137  0,0,0,0,0,0,0
 128,Eu-152  0,0,0,0,0,0,0
 129,Eu-154  0,0,0,0,0,0,0
 130,Eu-155  0,0,0,0,0,0,0
 131,Fe-55   0,0,0,0,0,0,0
 132,Fe-60   0,0,0,0,0,0,0
 133,Gd-148  0,0,0,0,0,0,0
 134,H-3     0,0,0,0,0,0,0
 135,Hg-194  0,0,0,0,0,0,0
 136,Ho-166m 0,0,0,0,0,0,0
 137,I-129   0,0,0,0,0,0,0
 138,K-40    0,0,0,0,0,0,0
 139,Mn-53   0,0,0,0,0,0,0
 140,Na-22   0,0,0,0,0,0,0
 141,Nb-91   0,0,0,0,0,0,0
 142,Nb-92   0,0,0,0,0,0,0
 143,Nb-93m  0,0,0,0,0,0,0
 144,Nb-94   0,0,0,0,0,0,0
 146,Ni-59   0,0,0,0,0,0,0
 147,Ni-63   0,0,0,0,0,0,0
 42,Np-237   0,0,0,0,0,0,0
 148,Os-194  0,0,0,0,0,0,0
 149,Pa-231  0,0,0,0,0,0,0
 150,Pb-202  0,0,0,0,0,0,0
 151,Pb-210  0,0,0,0,0,0,0
 152,Pd-107  0,0,0,0,0,0,0
 153,Pm-145  0,0,0,0,0,0,0
 154,Pm-147  0,0,0,0,0,0,0
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155,Po-208  0,0,0,0,0,0,0
156,Po-209  0,0,0,0,0,0,0
157,Pt-193  0,0,0,0,0,0,0
-- Input File:  INVNTRY.DAT
101,2.18E+01,1.30E+08,0,0,0,0,0
102,4.18E+02,4.69E+07,0,0,0,0,0
103,7.40E+05,3.35E+04,0,0,0,0,0
48,4.32E+02,1.80E-02,0,0,0,0,0
104,1.41E+02,1.80E-02,0,0,0,0,0
105,7.37E+03,1.80E-02,0,0,0,0,0
106,1.05E+01,4.61E+08,0,0,0,0,0
107,1.51E+06,3.96E+04,0,0,0,0,0
108,3.16E+01,9.66E+07,0,0,0,0,0
109,3.04E+06,1.02E+03,0,0,0,0,0
110,1.40E+03,1.17e-08,0,0,0,0,0
111,5.73E+03,9.00E+00,0,0,0,0,0
112,1.03E+05,6.35E-02,0,0,0,0,0
113,9.30E+15,7.75E-07,0,0,0,0,0
114,1.41E+01,4.04E+08,0,0,0,0,0
115,3.51E+02,1.80E-02,0,0,0,0,0
116,1.31E+01,1.80E-02,0,0,0,0,0
117,8.98E+02,1.80E-02,0,0,0,0,0
118,2.65E+00,7.92E+02,0,0,0,0,0
119,3.01E+05,2.86E-05,0,0,0,0,0
120,2.91E+01,1.80E-02,0,0,0,0,0
50,1.81E+01,1.80E-02,0,0,0,0,0
121,8.50E+03,1.80E-02,0,0,0,0,0
122,4.73E+03,1.80E-02,0,0,0,0,0
123,1.56E+07,1.80E-02,0,0,0,0,0
124,3.40E+05,1.80E-02,0,0,0,0,0
125,5.27E+00,7.92E+02,0,0,0,0,0
126,2.30E+06,2.07E+03,0,0,0,0,0
127,3.01E+01,1.13E+00,0,0,0,0,0
128,1.35E+01,3.11E+08,0,0,0,0,0
129,8.59E+00,4.87E+08,0,0,0,0,0
130,4.76E+00,7.92E+02,0,0,0,0,0
131,2.73E+00,7.92E+02,0,0,0,0,0
132,1.50E+06,7.15E+03,0,0,0,0,0
133,7.46E+01,5.80E+07,0,0,0,0,0
134,1.23E+01,4.50E+01,0,0,0,0,0
135,4.44E+02,6.38E+06,0,0,0,0,0
136,1.20E+03,3.24E+06,0,0,0,0,0
137,1.57E+07,9.00E-03,0,0,0,0,0
139,3.74E+06,3.24E+03,0,0,0,0,0
140,2.60E+00,7.92E+02,0,0,0,0,0
141,6.80E+02,1.04E+07,0,0,0,0,0
142,3.47E+07,2.02E+02,0,0,0,0,0
143,1.61E+01,4.74E+08,0,0,0,0,0
144,2.03E+04,2.34E-02,0,0,0,0,0
146,7.60E+04,2.52E+01,0,0,0,0,0
147,1.00E+02,3.96E+00,0,0,0,0,0
42,2.14E+06,1.80E-02,0,0,0,0,0
148,6.00E+00,5.53E+08,0,0,0,0,0
149,3.28E+04,8.46E+04,0,0,0,0,0
150,5.25E+04,6.12E+03,0,0,0,0,0
151,2.23E+01,1.37E+08,0,0,0,0,0
152,6.50E+06,9.18E+02,0,0,0,0,0
153,1.77E+01,2.52E+08,0,0,0,0,0
154,2.62E+00,7.92E+02,0,0,0,0,0
155,2.90E+00,7.92E+02,0,0,0,0,0
156,1.02E+02,3.02E+07,0,0,0,0,0
157,5.00E+01,6.66E+07,0,0,0,0,0
-- Input File:  RQSITE.DAT
101,1.10E-04,4.5,4.5
102,1.83E-04,2.7,2.7
103,3.33E-05,15.,15.
48,4.86E-04,1.,1.
104,4.86E-04,1.,1.
105,4.86E-04,1.,1.
106,4.99E-05,10.,10.
107,1.98E-04,2.5,2.5
108,4.86E-04,1.,1.
109,4.86E-04,1.,1.
110,1.73E-02,0.001,0.001
111,5.85E-05,8.52,8.52
112,6.42E-03,0.05,0.05
113,4.86E-04,1.,1.
114,4.86E-04,1.,1.
115,2.47E-04,2.,2.
116,2.47E-04,2.,2.
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117,2.47E-04,2.,2.
118,2.47E-04,2.,2.
119,1.65E-02,0.0025,0.0025
120,5.36E-06,93.3,93.3
50,5.36E-06,93.3,93.3
121,5.36E-06,93.3,93.3
122,5.36E-06,93.3,93.3
123,5.36E-06,93.3,93.3
124,5.36E-06,93.3,93.3
125,1.35E-06,370.,370.
126,3.76E-06,133.,133.
127,3.76E-06,133.,133.
128,7.66E-05,6.5,6.5
129,7.66E-05,6.5,6.5
130,7.66E-05,6.5,6.5
131,3.50E-04,1.4,1.4
132,3.50E-04,1.4,1.4
133,7.66E-05,6.5,6.5
134,7.37E-03,0.04,0.04
135,4.99E-05,10.,10.
136,1.98E-04,2.5,2.5
137,3.38E-03,0.12,0.12
139,7.78E-05,6.4,6.4
140,4.86E-04,1.,1.
141,3.07E-04,1.6,1.6
142,3.07E-04,1.6,1.6
143,3.07E-04,1.6,1.6
144,3.07E-04,1.6,1.6
146,4.99E-05,10.,10.
147,4.99E-05,10.,10.
42,1.65E-04,3.,3.
148,1.10E-04,4.5,4.5
149,9.05E-05,5.5,5.5
150,2.63E-05,19.,19.
151,2.63E-05,19.,19.
152,8.65E-04,0.55,0.55
153,7.66E-05,6.5,6.5
154,7.66E-05,6.5,6.5
155,5.54E-05,9.,9.
156,5.54E-05,9.,9.
157,5.39E-04,0.9,0.9
158,4.99E-05,10.,10.
159,4.99E-05,10.,10.
160,4.99E-05,10.,10.
45,4.99E-05,10.,10.
46,4.99E-05,10.,10.
161,4.99E-05,10.,10.
162,4.99E-05,10.,10.
55,4.99E-05,10.,10.
163,4.99E-05,10.,10.
164,4.86E-03,0.075,0.075
165,4.86E-04,1.,1.
166,1.32E-03,0.35,0.35
167,2.02E-04,2.45,2.45
168,9.99E-06,50.,50.
169,9.99E-06,50.,50.
170,6.42E-03,0.05,0.05
171,7.66E-05,6.5,6.5
172,7.66E-05,6.5,6.5
173,3.63E-03,0.11,0.11
174,3.91E-04,1.25,1.25
175,4.99E-05,10.,10.
36,4.99E-05,10.,10.
176,4.99E-05,10.,10.
177,4.99E-05,10.,10.
178,2.81E-03,0.15,0.15
179,7.66E-05,6.5,6.5
180,8.29E-05,6.,6.
181,8.29E-05,6.,6.
182,8.29E-05,6.,6.
183,8.29E-05,6.,6.
40,8.29E-05,6.,6.
41,8.29E-05,6.,6.
184,4.99E-05,10.,10.
185,4.99E-05,10.,10.
186,1.73E-02,0.001,0.001
187,1.32E-02,0.01,0.01
188,3.91E-03,0.1,0.1
189,4.86E-04,1.,1.
190,9.99E-06,50.,50.
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 191,5.00E-06,100.,100.
 192,4.86E-04,1.,1.
 -- Input File:  UPTAKE.DAT
 9.00E-04,3.54E-01,1.563
 0,0,0,0,0
 0,0,0
 0,0,0,0
 0,0,0,0,0
 0,0,0,0,0,730.,0
 101,0.00E+00,0.0,0.0,0,0,0,0
 102,0.00E+00,0.0,0.0,0,0,0,0
 103,0.00E+00,0.0,0.0,0,0,0,0
 48,0.00E+00,0.0,0.0,0,0,0,0
 104,0.00E+00,0.0,0.0,0,0,0,0
 105,0.00E+00,0.0,0.0,0,0,0,0
 106,0.00E+00,0.0,0.0,0,0,0,0
 107,0.00E+00,0.0,0.0,0,0,0,0
 108,0.00E+00,0.0,0.0,0,0,0,0
 109,0.00E+00,0.0,0.0,0,0,0,0
 110,0.00E+00,0.0,0.0,0,0,0,0
 111,0.00E+00,0.0,0.0,0,0,0,0
 112,0.00E+00,0.0,0.0,0,0,0,0
 113,0.00E+00,0.0,0.0,0,0,0,0
 114,0.00E+00,0.0,0.0,0,0,0,0
 115,0.00E+00,0.0,0.0,0,0,0,0
 116,0.00E+00,0.0,0.0,0,0,0,0
 117,0.00E+00,0.0,0.0,0,0,0,0
 118,0.00E+00,0.0,0.0,0,0,0,0
 119,0.00E+00,0.0,0.0,0,0,0,0
 120,0.00E+00,0.0,0.0,0,0,0,0
 50,0.00E+00,0.0,0.0,0,0,0,0
 121,0.00E+00,0.0,0.0,0,0,0,0
 122,0.00E+00,0.0,0.0,0,0,0,0
 123,0.00E+00,0.0,0.0,0,0,0,0
 124,0.00E+00,0.0,0.0,0,0,0,0
 125,0.00E+00,0.0,0.0,0,0,0,0
 126,0.00E+00,0.0,0.0,0,0,0,0
 127,0.00E+00,0.0,0.0,0,0,0,0
 128,0.00E+00,0.0,0.0,0,0,0,0
 129,0.00E+00,0.0,0.0,0,0,0,0
 130,0.00E+00,0.0,0.0,0,0,0,0
 131,0.00E+00,0.0,0.0,0,0,0,0
 132,0.00E+00,0.0,0.0,0,0,0,0
 133,0.00E+00,0.0,0.0,0,0,0,0
 134,0.00E+00,0.0,0.0,0,0,0,0
 135,0.00E+00,0.0,0.0,0,0,0,0
 136,0.00E+00,0.0,0.0,0,0,0,0
 137,0.00E+00,0.0,0.0,0,0,0,0
 138,0.00E+00,0.0,0.0,0,0,0,0
 139,0.00E+00,0.0,0.0,0,0,0,0
 140,0.00E+00,0.0,0.0,0,0,0,0
 141,0.00E+00,0.0,0.0,0,0,0,0
 142,0.00E+00,0.0,0.0,0,0,0,0
 143,0.00E+00,0.0,0.0,0,0,0,0
 144,0.00E+00,0.0,0.0,0,0,0,0
 146,0.00E+00,0.0,0.0,0,0,0,0
 147,0.00E+00,0.0,0.0,0,0,0,0
 42,0.00E+00,0.0,0.0,0,0,0,0
 148,0.00E+00,0.0,0.0,0,0,0,0
 149,0.00E+00,0.0,0.0,0,0,0,0
 150,0.00E+00,0.0,0.0,0,0,0,0
 151,0.00E+00,0.0,0.0,0,0,0,0
 152,0.00E+00,0.0,0.0,0,0,0,0
 153,0.00E+00,0.0,0.0,0,0,0,0
 154,0.00E+00,0.0,0.0,0,0,0,0
 155,0.00E+00,0.0,0.0,0,0,0,0
 156,0.00E+00,0.0,0.0,0,0,0,0
 157,0.00E+00,0.0,0.0,0,0,0,0
1
                        TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
                 UT(J,1)   UT(J,2)   UT(J,3)   UT(J,4)   UT(J,5)   UT(J,6)
                  RIVER     WELL     EROSION   BATHTUB  SPILLAGE    FOOD
 NUCLIDE          L/YR      L/YR      L/YR      L/YR      L/YR      KG/YR
   Ac-227      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ag-108m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Al-26       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Am-242m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Am-243      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ba-133      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Be-10       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
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  Bi-207      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Bi-210m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Bk-247      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  C-14        0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ca-41       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cd-113      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cd-113m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-249      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-250      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-251      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-252      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cl-36       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-243      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-245      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-246      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-247      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-248      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Co-60       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cs-135      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cs-137      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Eu-152      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Eu-154      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Eu-155      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Fe-55       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Fe-60       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Gd-148      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  H-3         0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Hg-194      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Np-237      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Am-241      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-244      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ho-166m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  I-129       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Mn-53       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Na-22       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-91       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-92       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-93m      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-94       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ni-59       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ni-63       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Os-194      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pa-231      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pb-202      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pb-210      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pd-107      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pm-145      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pm-147      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Po-208      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Po-209      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pt-193      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS116
YEARS TO BE CALCULATED ARE ...
     6.00     9.00    12.00    15.00    18.00
    21.00    24.00    27.00    30.00    35.00
    40.00    45.00    50.00    55.00    60.00
    65.00    70.00    75.00    80.00    85.00
    90.00    95.00   100.00   105.00   110.00
   115.00   120.00   125.00   130.00   135.00
   140.00   145.00   150.00   155.00   160.00
   165.00   170.00   175.00   180.00   185.00
   190.00   195.00   200.00   205.00   210.00
   215.00   220.00   225.00   230.00   235.00
   240.00   245.00   250.00   255.00   260.00
   265.00   270.00   275.00   280.00   285.00
   290.00   295.00   300.00   310.00   320.00
   330.00   340.00   350.00   360.00   370.00
   380.00   390.00   400.00   410.00   420.00
   430.00   440.00   450.00   460.00   470.00
   480.00   490.00   500.00   510.00   520.00
   530.00   540.00   550.00   560.00   570.00
   580.00   590.00   600.00   610.00   620.00
   630.00   640.00   650.00   660.00   670.00
   680.00   690.00   700.00   720.00   740.00
   760.00   780.00   800.00   825.00   850.00
   875.00   900.00   925.00   950.00   975.00
  1000.00
THERE ARE  58 ISOTOPES IN THE INVENTORY FILE
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# PATHRAE MODEL VERTICAL OUTPUT FILE FILE --09Wa.OUT.docx 0.09 CM/YR CASE -PART 1

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THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
           PATHWAY           TYPE OF USAGE
                            FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER         2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                    0.
LENGTH OF REPOSITORY (M)                                        1.
WIDTH OF REPOSITORY (M)                                         1.
RIVER FLOW RATE (M**3/YR)                                       9.00E-04
STREAM FLOW RATE (M**3/YR)                                      9.00E-04
DISTANCE TO RIVER (M)                                           4.
OPERATIONAL SPILLAGE FRACTION                                   0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                 1563.
LONGITUDINAL DISPERSIVITY (M)                                   1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)              0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                1
FLAG FOR GAMMA PATHWAY OPTIONS                                  0
FLAG FOR GAMMA BUILDUP CALCULATION                              0
FLAG FOR ATMOSPHERIC PATHWAY                                    0
COVER THICKNESS OVER WASTE (M)                                   .00
THICKNESS OF WASTE IN PITS (M)                                  1.00
TOTAL WASTE VOLUME (M**3)                                       1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                            4.
DISTANCE TO WELL -- Y COORDINATE (M)                            0.
DENSITY OF WASTE (KG/M**3)                                   1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                 1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                 .000
DEPTH OF PLANT ROOT ZONE (M)                                     .000
AREAL DENSITY OF PLANTS (KG/M**2)                                .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                           0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                           0.
FRACTION OF YEAR EXPOSED TO DUST                                 .000
CANISTER LIFETIME (YEARS)                                       0.
INVENTORY SCALING FACTOR                                        1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                         0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                0.00E+00
RADON EMANATING POWER OF THE WASTE                              0.00E+00
DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                  0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                  0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                            .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                  0.00E+00
ATMOSPHERIC STABILITY CLASS                                     0
AVERAGE WIND SPEED (M/S)                                         .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                      .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                    .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)           0.00E+00
DEPOSITION VELOCITY (M/S)                                        .0000
STACK HEIGHT (M)                                                 .0
STACK INSIDE DIAMETER (M)                                        .00
STACK GAS VELOCITY (M/S)                                         .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                         0.00E+00
DECAY CHAIN FLAGS                        4   7   0   0   0   0   0
FLAG FOR INPUT SUMMARY PRINTOUT                                 1
FLAG FOR DIRECTION OF TRENCH FILLING                            1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                            0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)          9.00E-04
DEGREE OF SOIL SATURATION                                        .235
RESIDUAL SOIL SATURATION                                         .032
PERMEABILITY OF VERTICAL ZONE (M/YR)                            2.09
SOIL NUMBER                                                      .000
POROSITY OF AQUIFER                                              .10
POROSITY OF UNSATURATED ZONE                                     .35
DISTANCE FROM AQUIFER TO WASTE (M)                               .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                    1.08E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                            .0
LENGTH OF PERFORATED WELL CASING (M)                            1.000
SURFACE EROSION RATE (M/YR)                                     0.000E+00
LEACH RATE SCALING FACTOR                                       1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                              0.00E+00
                    INGESTION      INHALATION     DIRECT GAMMA
                   DOSE FACTORS    DOSE FACTORS    DOSE FACTORS        HALF
  NUCLIDE           (MREM/PCI)      (MREM/PCI)   (MREM-M2/PCI-YR)    LIFE (YR)
   Ac-227           0.000E+00       0.000E+00       0.000E+00       2.180E+01
   Ag-108m          0.000E+00       0.000E+00       0.000E+00       4.180E+02
   Al-26            0.000E+00       0.000E+00       0.000E+00       7.400E+05
   Am-242m          0.000E+00       0.000E+00       0.000E+00       1.410E+02
   Am-243           0.000E+00       0.000E+00       0.000E+00       7.370E+03
   Ba-133           0.000E+00       0.000E+00       0.000E+00       1.050E+01
   Be-10            0.000E+00       0.000E+00       0.000E+00       1.510E+06
   Bi-207           0.000E+00       0.000E+00       0.000E+00       3.160E+01
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| | | | | |
|---|---|---|---|---|
| Bi-210m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.040E+06 |
| Bk-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.400E+03 |
| C-14 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.730E+03 |
| Ca-41 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.030E+05 |
| Cd-113 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 9.300E+15 |
| Cd-113m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.410E+01 |
| Cf-249 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.510E+02 |
| Cf-250 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.310E+01 |
| Cf-251 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.980E+02 |
| Cf-252 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.650E+00 |
| Cl-36 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.010E+05 |
| Cm-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.910E+01 |
| Cm-245 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.500E+03 |
| Cm-246 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.730E+03 |
| Cm-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.560E+07 |
| Cm-248 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.400E+05 |
| Co-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.270E+00 |
| Cs-135 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.300E+06 |
| Cs-137 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.010E+01 |
| Eu-152 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.350E+01 |
| Eu-154 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.590E+00 |
| Eu-155 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.760E+00 |
| Fe-55 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.730E+00 |
| Fe-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.500E+06 |
| Gd-148 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.460E+01 |
| H-3 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.230E+01 |
| Hg-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.440E+02 |
| Np-237 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.140E+06 |
| Am-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.320E+02 |
| Cm-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.810E+01 |
| Ho-166m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.200E+03 |
| I-129 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.570E+07 |
| Mn-53 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.740E+06 |
| Na-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.600E+00 |
| Nb-91 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.800E+02 |
| Nb-92 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.470E+07 |
| Nb-93m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.610E+01 |
| Nb-94 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.030E+04 |
| Ni-59 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.600E+04 |
| Ni-63 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+02 |
| Os-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.000E+00 |
| Pa-231 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.280E+04 |
| Pb-202 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.250E+04 |
| Pb-210 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.230E+01 |
| Pd-107 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.500E+06 |
| Pm-145 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.770E+01 |
| Pm-147 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.620E+00 |
| Po-208 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.900E+00 |
| Po-209 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.020E+02 |
| Pt-193 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.000E+01 |

| NUCLIDE | VOLATILITY FRACTION | GAMMA ENERGY (MEV) | GAMMA ATTENUATION (1/M) |
|---|---|---|---|
| Ac-227 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ag-108m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Al-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-242m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ba-133 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Be-10 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bi-207 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bi-210m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bk-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| C-14 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ca-41 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cd-113 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cd-113m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-249 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-250 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-251 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-252 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cl-36 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-245 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-246 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-248 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Co-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cs-135 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cs-137 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| | | | |
|---|---|---|---|
| Eu-152 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Eu-154 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Eu-155 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Fe-55 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Fe-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Gd-148 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| H-3 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Hg-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Np-237 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ho-166m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| I-129 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Mn-53 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Na-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-91 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-92 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-93m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-94 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ni-59 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ni-63 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Os-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pa-231 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pb-202 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pb-210 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pd-107 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pm-145 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pm-147 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Po-208 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Po-209 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pt-193 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| NUCLIDE | INPUT LEACH RATE (1/YR) | FINAL LEACH RATE (1/YR) | SOLUBILITY (MOLE/L) | INPUT INVENTORY (CI) |
|---|---|---|---|---|
| Ac-227 | 1.100E-04 | 1.100E-04 | 0.000E+00 | 1.300E+08 |
| Ag-108m | 1.830E-04 | 1.830E-04 | 0.000E+00 | 4.690E+07 |
| Al-26 | 3.330E-05 | 3.330E-05 | 0.000E+00 | 3.350E+04 |
| Am-242m | 4.860E-04 | 4.860E-04 | 0.000E+00 | 1.800E-02 |
| Am-243 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 1.800E-02 |
| Ba-133 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 4.610E+08 |
| Be-10 | 1.980E-04 | 1.980E-04 | 0.000E+00 | 3.960E+04 |
| Bi-207 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 9.660E+07 |
| Bi-210m | 4.860E-04 | 4.860E-04 | 0.000E+00 | 1.020E+03 |
| Bk-247 | 1.730E-02 | 1.730E-02 | 0.000E+00 | 1.170E-08 |
| C-14 | 5.850E-05 | 5.850E-05 | 0.000E+00 | 9.000E+00 |
| Ca-41 | 6.420E-03 | 6.420E-03 | 0.000E+00 | 6.350E-02 |
| Cd-113 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 7.750E-07 |
| Cd-113m | 4.860E-04 | 4.860E-04 | 0.000E+00 | 4.040E+08 |
| Cf-249 | 2.470E-04 | 2.470E-04 | 0.000E+00 | 1.800E-02 |
| Cf-250 | 2.470E-04 | 2.470E-04 | 0.000E+00 | 1.800E-02 |
| Cf-251 | 2.470E-04 | 2.470E-04 | 0.000E+00 | 1.800E-02 |
| Cf-252 | 2.470E-04 | 2.470E-04 | 0.000E+00 | 7.920E+02 |
| Cl-36 | 1.650E-02 | 1.650E-02 | 0.000E+00 | 2.860E-05 |
| Cm-243 | 5.360E-06 | 5.360E-06 | 0.000E+00 | 1.800E-02 |
| Cm-245 | 5.360E-06 | 5.360E-06 | 0.000E+00 | 1.800E-02 |
| Cm-246 | 5.360E-06 | 5.360E-06 | 0.000E+00 | 1.800E-02 |
| Cm-247 | 5.360E-06 | 5.360E-06 | 0.000E+00 | 1.800E-02 |
| Cm-248 | 5.360E-06 | 5.360E-06 | 0.000E+00 | 1.800E-02 |
| Co-60 | 1.350E-06 | 1.350E-06 | 0.000E+00 | 7.920E+02 |
| Cs-135 | 3.760E-06 | 3.760E-06 | 0.000E+00 | 2.070E+03 |
| Cs-137 | 3.760E-06 | 3.760E-06 | 0.000E+00 | 1.130E+00 |
| Eu-152 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 3.110E+08 |
| Eu-154 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 4.870E+08 |
| Eu-155 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 7.920E+02 |
| Fe-55 | 3.500E-04 | 3.500E-04 | 0.000E+00 | 7.920E+02 |
| Fe-60 | 3.500E-04 | 3.500E-04 | 0.000E+00 | 7.150E+03 |
| Gd-148 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 5.800E+07 |
| H-3 | 7.370E-03 | 7.370E-03 | 0.000E+00 | 4.500E+01 |
| Hg-194 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 6.380E+06 |
| Np-237 | 1.650E-04 | 1.650E-04 | 0.000E+00 | 1.800E-02 |
| Am-241 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 1.800E-02 |
| Cm-244 | 5.360E-06 | 5.360E-06 | 0.000E+00 | 1.800E-02 |
| Ho-166m | 1.980E-04 | 1.980E-04 | 0.000E+00 | 3.240E+06 |
| I-129 | 3.380E-03 | 3.380E-03 | 0.000E+00 | 9.000E-03 |
| Mn-53 | 7.780E-05 | 7.780E-05 | 0.000E+00 | 3.240E+03 |
| Na-22 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 7.920E+02 |
| Nb-91 | 3.070E-04 | 3.070E-04 | 0.000E+00 | 1.040E+07 |
| Nb-92 | 3.070E-04 | 3.070E-04 | 0.000E+00 | 2.020E+02 |
| Nb-93m | 3.070E-04 | 3.070E-04 | 0.000E+00 | 4.740E+08 |
| Nb-94 | 3.070E-04 | 3.070E-04 | 0.000E+00 | 2.340E-02 |
| Ni-59 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 2.520E+01 |

| | | | | |
|---|---|---|---|---|
| Ni-63 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 3.960E+00 |
| Os-194 | 1.100E-04 | 1.100E-04 | 0.000E+00 | 5.530E+08 |
| Pa-231 | 9.050E-05 | 9.050E-05 | 0.000E+00 | 8.460E+04 |
| Pb-202 | 2.630E-05 | 2.630E-05 | 0.000E+00 | 6.120E+03 |
| Pb-210 | 2.630E-05 | 2.630E-05 | 0.000E+00 | 1.370E+08 |
| Pd-107 | 8.650E-04 | 8.650E-04 | 0.000E+00 | 9.180E+02 |
| Pm-145 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 2.520E+08 |
| Pm-147 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 7.920E+02 |
| Po-208 | 5.540E-05 | 5.540E-05 | 0.000E+00 | 7.920E+02 |
| Po-209 | 5.540E-05 | 5.540E-05 | 0.000E+00 | 3.020E+07 |
| Pt-193 | 5.390E-04 | 5.390E-04 | 0.000E+00 | 6.660E+07 |

| NUCLIDE | AQUIFER SORPTION | AQUIFER RETARDATION | VERTICAL SORPTION | VERTICAL RETARDATION |
|---|---|---|---|---|
| Ac-227 | 4.500E+00 | 7.134E+01 | 4.500E+00 | 8.555E+01 |
| Ag-108m | 2.700E+00 | 4.320E+01 | 2.700E+00 | 5.173E+01 |
| Al-26 | 1.500E+01 | 2.355E+02 | 1.500E+01 | 2.828E+02 |
| Am-242m | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Am-243 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Ba-133 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Be-10 | 2.500E+00 | 4.008E+01 | 2.500E+00 | 4.797E+01 |
| Bi-207 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Bi-210m | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Bk-247 | 1.000E-03 | 1.016E+00 | 1.000E-03 | 1.019E+00 |
| C-14 | 8.520E+00 | 1.342E+02 | 8.520E+00 | 1.611E+02 |
| Ca-41 | 5.000E-02 | 1.782E+00 | 5.000E-02 | 1.939E+00 |
| Cd-113 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Cd-113m | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Cf-249 | 2.000E+00 | 3.226E+01 | 2.000E+00 | 3.858E+01 |
| Cf-250 | 2.000E+00 | 3.226E+01 | 2.000E+00 | 3.858E+01 |
| Cf-251 | 2.000E+00 | 3.226E+01 | 2.000E+00 | 3.858E+01 |
| Cf-252 | 2.000E+00 | 3.226E+01 | 2.000E+00 | 3.858E+01 |
| Cl-36 | 2.500E-03 | 1.039E+00 | 2.500E-03 | 1.047E+00 |
| Cm-243 | 9.330E+01 | 1.459E+03 | 9.330E+01 | 1.754E+03 |
| Cm-245 | 9.330E+01 | 1.459E+03 | 9.330E+01 | 1.754E+03 |
| Cm-246 | 9.330E+01 | 1.459E+03 | 9.330E+01 | 1.754E+03 |
| Cm-247 | 9.330E+01 | 1.459E+03 | 9.330E+01 | 1.754E+03 |
| Cm-248 | 9.330E+01 | 1.459E+03 | 9.330E+01 | 1.754E+03 |
| Co-60 | 3.700E+02 | 5.784E+03 | 3.700E+02 | 6.953E+03 |
| Cs-135 | 1.330E+02 | 2.080E+03 | 1.330E+02 | 2.500E+03 |
| Cs-137 | 1.330E+02 | 2.080E+03 | 1.330E+02 | 2.500E+03 |
| Eu-152 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Eu-154 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Eu-155 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Fe-55 | 1.400E+00 | 2.288E+01 | 1.400E+00 | 2.730E+01 |
| Fe-60 | 1.400E+00 | 2.288E+01 | 1.400E+00 | 2.730E+01 |
| Gd-148 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| H-3 | 4.000E-02 | 1.625E+00 | 4.000E-02 | 1.752E+00 |
| Hg-194 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Np-237 | 3.000E+00 | 4.789E+01 | 3.000E+00 | 5.736E+01 |
| Am-241 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Cm-244 | 9.330E+01 | 1.459E+03 | 9.330E+01 | 1.754E+03 |
| Ho-166m | 2.500E+00 | 4.008E+01 | 2.500E+00 | 4.797E+01 |
| I-129 | 1.200E-01 | 2.876E+00 | 1.200E-01 | 3.255E+00 |
| Mn-53 | 6.400E+00 | 1.010E+02 | 6.400E+00 | 1.212E+02 |
| Na-22 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Nb-91 | 1.600E+00 | 2.601E+01 | 1.600E+00 | 3.106E+01 |
| Nb-92 | 1.600E+00 | 2.601E+01 | 1.600E+00 | 3.106E+01 |
| Nb-93m | 1.600E+00 | 2.601E+01 | 1.600E+00 | 3.106E+01 |
| Nb-94 | 1.600E+00 | 2.601E+01 | 1.600E+00 | 3.106E+01 |
| Ni-59 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Ni-63 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Os-194 | 4.500E+00 | 7.134E+01 | 4.500E+00 | 8.555E+01 |
| Pa-231 | 5.500E+00 | 8.697E+01 | 5.500E+00 | 1.043E+02 |
| Pb-202 | 1.900E+01 | 2.980E+02 | 1.900E+01 | 3.580E+02 |
| Pb-210 | 1.900E+01 | 2.980E+02 | 1.900E+01 | 3.580E+02 |
| Pd-107 | 5.500E-01 | 9.597E+00 | 5.500E-01 | 1.133E+01 |
| Pm-145 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Pm-147 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Po-208 | 9.000E+00 | 1.417E+02 | 9.000E+00 | 1.701E+02 |
| Po-209 | 9.000E+00 | 1.417E+02 | 9.000E+00 | 1.701E+02 |
| Pt-193 | 9.000E-01 | 1.507E+01 | 9.000E-01 | 1.791E+01 |

BIOACCUMULATION FACTORS

| NUCLIDE | SOIL-PLANT Bv | SOIL-PLANT Br | FORAGE-MILK Fm (D/L) | FORAGE-MEAT Ff (D/KG) |
|---|---|---|---|---|
| Ac-227 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ag-108m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Al-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-242m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ba-133 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

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    Be-10            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Bi-207           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Bi-210m          0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Bk-247           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    C-14             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ca-41            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cd-113           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cd-113m          0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cf-249           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cf-250           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cf-251           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cf-252           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cl-36            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-243           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-245           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-246           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-247           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-248           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Co-60            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cs-135           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cs-137           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Eu-152           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Eu-154           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Eu-155           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Fe-55            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Fe-60            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Gd-148           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    H-3              0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Hg-194           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Np-237           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Am-241           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-244           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ho-166m          0.000E+00       0.000E+00       0.000E+00       0.000E+00
    I-129            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Mn-53            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Na-22            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-91            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-92            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-93m           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-94            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ni-59            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ni-63            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Os-194           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pa-231           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pb-202           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pb-210           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pd-107           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pm-145           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pm-147           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Po-208           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Po-209           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pt-193           0.000E+00       0.000E+00       0.000E+00       0.000E+00
                                                       PATHWAY  1
                                                GROUNDWATER TO RIVER
********* NUCLIDE DOSES (mrem/yr) ********
  NUCLIDE/TIME          6.        9.       12.       15.       18.       21.       24.       27.
30.       35.       40.       45.       50.       55.       60.       65.       70.       75.
80.       85.       90.       95.      100.      105.      110.      115.      120.      125.
130.      135.      140.      145.      150.      155.      160.      165.      170.      175.
180.      185.      190.      195.      200.      205.      210.      215.      220.      225.
230.      235.      240.      245.      250.      255.      260.      265.      270.      275.
280.      285.      290.      295.      300.      310.      320.      330.      340.      350.
360.      370.      380.      390.      400.      410.      420.      430.      440.      450.
460.      470.      480.      490.      500.      510.      520.      530.      540.      550.
560.      570.      580.      590.      600.      610.      620.      630.      640.      650.
660.      670.      680.      690.      700.      720.      740.      760.      780.      800.
825.      850.      875.      900.      925.      950.      975.     1000.
      Ac-227        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
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      Ag-108m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ba-133          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-210m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bk-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      C-14           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ca-41          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cd-113         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cd-113m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-249         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-250          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-251          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-252          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cl-36           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Cm-246          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-248          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Co-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-135          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-137          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Hg-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Np-237          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-241          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ho-166m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      I-129           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Mn-53           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Na-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Os-194         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pa-231         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-202         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-210         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pd-107         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pm-145         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pm-147         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-208         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-209         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pt-193         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE DOSES FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE RISKS FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE CONCENTRATIONS IN RIVER  (Ci/m**3)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
```

```
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Ac-227          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ag-108m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ba-133          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-210m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bk-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.1E-20    1.4E-19    8.0E-19
3.9E-18    1.7E-17    6.5E-17    2.3E-16    7.2E-16    2.1E-15    5.8E-15    1.5E-14    3.5E-14    8.0E-14
1.7E-13    3.5E-13    7.0E-13    1.3E-12    2.4E-12    4.2E-12    7.2E-12    1.2E-11    1.9E-11    3.0E-11
4.7E-11    7.0E-11    1.0E-10    1.5E-10    2.1E-10    2.9E-10    3.9E-10    5.3E-10    7.0E-10    9.1E-10
1.2E-09    1.5E-09    1.9E-09    2.3E-09    2.8E-09    4.1E-09    5.8E-09    7.8E-09    1.0E-08    1.3E-08
1.6E-08    1.9E-08    2.3E-08    2.6E-08    2.9E-08    3.2E-08    3.5E-08    3.8E-08    3.9E-08    4.1E-08
4.2E-08    4.2E-08    4.2E-08    4.2E-08    4.1E-08    3.9E-08    3.8E-08    3.6E-08    3.4E-08    3.2E-08
3.0E-08    2.7E-08    2.5E-08    2.3E-08    2.1E-08    1.9E-08    1.7E-08    1.5E-08    1.3E-08    1.2E-08
1.0E-08    9.1E-09    8.0E-09    7.0E-09    6.0E-09    4.5E-09    3.3E-09    2.4E-09    1.8E-09    1.3E-09
8.1E-10    5.2E-10    3.3E-10    2.1E-10    1.3E-10    8.0E-11    4.9E-11    3.0E-11
      C-14           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ca-41          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    4.4E-20    2.9E-19    1.7E-18    8.9E-18    4.2E-17
1.8E-16    7.4E-16    2.8E-15    9.5E-15    3.1E-14    9.5E-14    2.7E-13    7.5E-13    2.0E-12    4.9E-12
1.2E-11    2.7E-11    6.0E-11    1.3E-10    2.7E-10    5.3E-10    1.0E-09    2.0E-09    3.7E-09    6.6E-09
1.2E-08    2.0E-08    3.4E-08    5.6E-08    9.2E-08    2.3E-07    5.4E-07    1.2E-06    2.5E-06    5.1E-06
9.7E-06    1.8E-05    3.1E-05    5.4E-05    8.9E-05    1.4E-04    2.2E-04    3.4E-04    5.0E-04    7.3E-04
1.0E-03    1.4E-03    2.0E-03    2.7E-03    3.5E-03    4.6E-03    5.9E-03    7.5E-03    9.4E-03    1.2E-02
1.4E-02    1.7E-02    2.0E-02    2.4E-02    2.8E-02    3.3E-02    3.8E-02    4.3E-02    4.9E-02    5.5E-02
6.2E-02    6.8E-02    7.5E-02    8.2E-02    8.9E-02    1.0E-01    1.2E-01    1.3E-01    1.4E-01    1.5E-01
1.6E-01    1.6E-01    1.6E-01    1.6E-01    1.5E-01    1.5E-01    1.4E-01    1.2E-01
      Cd-113         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Cd-113m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-249         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-250         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-251         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-252         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cl-36          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.6E-20    2.2E-19    2.2E-18    1.9E-17    1.3E-16    7.6E-16
3.9E-15    1.7E-14    7.0E-14    2.5E-13    8.3E-13    2.5E-12    7.1E-12    1.9E-11    4.6E-11    1.1E-10
2.4E-10    5.0E-10    1.0E-09    1.9E-09    3.6E-09    6.5E-09    1.1E-08    1.9E-08    3.1E-08    5.0E-08
7.8E-08    1.2E-07    1.8E-07    2.6E-07    3.7E-07    5.2E-07    7.2E-07    9.8E-07    1.3E-06    1.7E-06
2.3E-06    2.9E-06    3.7E-06    4.7E-06    5.8E-06    8.7E-06    1.2E-05    1.7E-05    2.3E-05    3.0E-05
3.8E-05    4.7E-05    5.6E-05    6.6E-05    7.6E-05    8.5E-05    9.4E-05    1.0E-04    1.1E-04    1.2E-04
1.2E-04    1.2E-04    1.3E-04    1.3E-04    1.3E-04    1.3E-04    1.2E-04    1.2E-04    1.1E-04    1.1E-04
1.0E-04    9.6E-05    8.9E-05    8.3E-05    7.6E-05    7.0E-05    6.3E-05    5.7E-05    5.2E-05    4.7E-05
4.2E-05    3.7E-05    3.3E-05    2.9E-05    2.6E-05    2.0E-05    1.5E-05    1.1E-05    8.2E-06    6.0E-06
4.0E-06    2.7E-06    1.8E-06    1.1E-06    7.3E-07    4.6E-07    2.9E-07    1.8E-07
      Cm-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-248         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Co-60          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-135         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-137         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    4.5E-20    2.4E-19    1.1E-18    4.7E-18    1.8E-17    6.0E-17    1.9E-16
5.3E-16    1.4E-15    3.5E-15    8.1E-15    1.8E-14    3.6E-14    7.2E-14    1.3E-13    2.4E-13    4.1E-13
6.9E-13    1.1E-12    1.7E-12    2.5E-12    3.7E-12    5.2E-12    7.1E-12    9.5E-12    1.2E-11    1.6E-11
2.0E-11    2.5E-11    3.0E-11    3.5E-11    4.1E-11    5.3E-11    6.4E-11    7.4E-11    8.1E-11    8.5E-11
8.6E-11    8.3E-11    7.8E-11    7.1E-11    6.3E-11    5.4E-11    4.5E-11    3.7E-11    3.0E-11    2.3E-11
1.8E-11    1.3E-11    1.0E-11    7.3E-12    5.3E-12    3.7E-12    2.6E-12    1.8E-12    1.2E-12    8.3E-13
5.6E-13    3.7E-13    2.4E-13    1.6E-13    1.0E-13    6.4E-14    4.0E-14    2.5E-14    1.6E-14    9.7E-15
5.9E-15    3.6E-15    2.2E-15    1.3E-15    7.8E-16    2.7E-16    9.3E-17    3.1E-17    1.0E-17    3.3E-18
7.9E-19    1.9E-19    4.2E-20    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Hg-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Np-237          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Am-241          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cm-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ho-166m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      I-129           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.0E-20    3.2E-20    9.5E-20    2.7E-19    7.5E-19
2.0E-18    5.1E-18    1.3E-17    3.0E-17    7.0E-17    3.5E-16    1.5E-15    6.3E-15    2.3E-14    8.0E-14
2.6E-13    7.7E-13    2.2E-12    5.7E-12    1.4E-11    3.5E-11    8.0E-11    1.8E-10    3.7E-10    7.6E-10
```

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1.5E-09   2.9E-09   5.3E-09   9.6E-09   1.7E-08   2.9E-08   4.8E-08   7.9E-08   1.3E-07   2.0E-07
3.1E-07   4.7E-07   6.9E-07   1.0E-06   1.5E-06   2.1E-06   2.9E-06   4.1E-06   5.6E-06   7.6E-06
1.0E-05   1.3E-05   1.8E-05   2.3E-05   2.9E-05   4.7E-05   7.4E-05   1.1E-04   1.6E-04   2.3E-04
3.5E-04   5.2E-04   7.4E-04   1.0E-03   1.4E-03   1.8E-03   2.3E-03   2.9E-03
      Mn-53          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Na-22          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

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0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Os-194         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pa-231         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-202         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-210         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pd-107         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.6E-20    2.2E-19    1.2E-18    6.1E-18
4.1E-17    2.5E-16    1.4E-15    6.6E-15    3.0E-14    1.2E-13    4.8E-13    1.7E-12
```

```
      Pm-145          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pm-147          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-208          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-209          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pt-193          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
 NUCLIDE CONCENTRATIONS IN STREAM (Ci/m**3)
  NUCLIDE/TIME           6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Ac-227          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ag-108m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ba-133         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-210m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bk-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.1E-20    1.4E-19    8.0E-19
3.9E-18    1.7E-17    6.5E-17    2.3E-16    7.2E-16    2.1E-15    5.8E-15    1.5E-14    3.5E-14    8.0E-14
1.7E-13    3.5E-13    7.0E-13    1.3E-12    2.4E-12    4.2E-12    7.2E-12    1.2E-11    1.9E-11    3.0E-11
4.7E-11    7.0E-11    1.0E-10    1.5E-10    2.1E-10    2.9E-10    3.9E-10    5.3E-10    7.0E-10    9.1E-10
1.2E-09    1.5E-09    1.9E-09    2.3E-09    2.8E-09    4.1E-09    5.8E-09    7.8E-09    1.0E-08    1.3E-08
1.6E-08    1.9E-08    2.3E-08    2.6E-08    2.9E-08    3.2E-08    3.5E-08    3.8E-08    3.9E-08    4.1E-08
4.2E-08    4.2E-08    4.2E-08    4.2E-08    4.1E-08    3.9E-08    3.8E-08    3.6E-08    3.4E-08    3.2E-08
3.0E-08    2.7E-08    2.5E-08    2.3E-08    2.1E-08    1.9E-08    1.7E-08    1.5E-08    1.3E-08    1.2E-08
1.0E-08    9.1E-09    8.0E-09    7.0E-09    6.0E-09    4.5E-09    3.3E-09    2.4E-09    1.8E-09    1.3E-09
8.1E-10   5.2E-10   3.3E-10   2.1E-10   1.3E-10   8.0E-11   4.9E-11   3.0E-11
      C-14           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ca-41          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    4.4E-20    2.9E-19    1.7E-18    8.9E-18    4.2E-17
1.8E-16    7.4E-16    2.8E-15    9.5E-15    3.1E-14    9.5E-14    2.7E-13    7.5E-13    2.0E-12    4.9E-12
1.2E-11    2.7E-11    6.0E-11    1.3E-10    2.7E-10    5.3E-10    1.0E-09    2.0E-09    3.7E-09    6.6E-09
1.2E-08    2.0E-08    3.4E-08    5.6E-08    9.2E-08    2.3E-07    5.4E-07    1.2E-06    2.5E-06    5.1E-06
9.7E-06    1.8E-05    3.1E-05    5.4E-05    8.9E-05    1.4E-04    2.2E-04    3.4E-04    5.0E-04    7.3E-04
1.0E-03    1.4E-03    2.0E-03    2.7E-03    3.5E-03    4.6E-03    5.9E-03    7.5E-03    9.4E-03    1.2E-02
1.4E-02    1.7E-02    2.0E-02    2.4E-02    2.8E-02    3.3E-02    3.8E-02    4.3E-02    4.9E-02    5.5E-02
6.2E-02    6.8E-02    7.5E-02    8.2E-02    8.9E-02    1.0E-01    1.2E-01    1.3E-01    1.4E-01    1.5E-01
1.6E-01   1.6E-01   1.6E-01   1.6E-01   1.5E-01   1.5E-01   1.4E-01   1.2E-01
      Cd-113         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cd-113m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-249          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-250          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-251          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-252          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cl-36           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.6E-20    2.2E-19    2.2E-18    1.9E-17    1.3E-16    7.6E-16
3.9E-15    1.7E-14    7.0E-14    2.5E-13    8.3E-13    2.5E-12    7.1E-12    1.9E-11    4.6E-11    1.1E-10
2.4E-10    5.0E-10    1.0E-09    1.9E-09    3.6E-09    6.5E-09    1.1E-08    1.9E-08    3.1E-08    5.0E-08
7.8E-08    1.2E-07    1.8E-07    2.6E-07    3.7E-07    5.2E-07    7.2E-07    9.8E-07    1.3E-06    1.7E-06
2.3E-06    2.9E-06    3.7E-06    4.7E-06    5.8E-06    8.7E-06    1.2E-05    1.7E-05    2.3E-05    3.0E-05
3.8E-05    4.7E-05    5.6E-05    6.6E-05    7.6E-05    8.5E-05    9.4E-05    1.0E-04    1.1E-04    1.2E-04
1.2E-04    1.2E-04    1.3E-04    1.3E-04    1.3E-04    1.3E-04    1.2E-04    1.2E-04    1.1E-04    1.1E-04
1.0E-04    9.6E-05    8.9E-05    8.3E-05    7.6E-05    7.0E-05    6.3E-05    5.7E-05    5.2E-05    4.7E-05
4.2E-05    3.7E-05    3.3E-05    2.9E-05    2.6E-05    2.0E-05    1.5E-05    1.1E-05    8.2E-06    6.0E-06
4.0E-06    2.7E-06    1.8E-06    1.1E-06    7.3E-07    4.6E-07    2.9E-07    1.8E-07
      Cm-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cm-245          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-248          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Co-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-135          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-137          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    4.5E-20    2.4E-19    1.1E-18    4.7E-18    1.8E-17    6.0E-17    1.9E-16
5.3E-16    1.4E-15    3.5E-15    8.1E-15    1.8E-14    3.6E-14    7.2E-14    1.3E-13    2.4E-13    4.1E-13
6.9E-13    1.1E-12    1.7E-12    2.5E-12    3.7E-12    5.2E-12    7.1E-12    9.5E-12    1.2E-11    1.6E-11
2.0E-11    2.5E-11    3.0E-11    3.5E-11    4.1E-11    5.3E-11    6.4E-11    7.4E-11    8.1E-11    8.5E-11
8.6E-11    8.3E-11    7.8E-11    7.1E-11    6.3E-11    5.4E-11    4.5E-11    3.7E-11    3.0E-11    2.3E-11
1.8E-11    1.3E-11    1.0E-11    7.3E-12    5.3E-12    3.7E-12    2.6E-12    1.8E-12    1.2E-12    8.3E-13
5.6E-13    3.7E-13    2.4E-13    1.6E-13    1.0E-13    6.4E-14    4.0E-14    2.5E-14    1.6E-14    9.7E-15
```

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5.9E-15   3.6E-15   2.2E-15   1.3E-15   7.8E-16   2.7E-16   9.3E-17   3.1E-17   1.0E-17   3.3E-18
7.9E-19   1.9E-19   4.2E-20   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Hg-194        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Np-237        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-241        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-244        0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ho-166m       0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      I-129         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.0E-20   3.2E-20   9.5E-20   2.7E-19   7.5E-19
2.0E-18   5.1E-18   1.3E-17   3.0E-17   7.0E-17   3.5E-16   1.5E-15   6.3E-15   2.3E-14   8.0E-14
2.6E-13   7.7E-13   2.2E-12   5.7E-12   1.4E-11   3.5E-11   8.0E-11   1.8E-10   3.7E-10   7.6E-10
1.5E-09   2.9E-09   5.3E-09   9.6E-09   1.7E-08   2.9E-08   4.8E-08   7.9E-08   1.3E-07   2.0E-07
3.1E-07   4.7E-07   6.9E-07   1.0E-06   1.5E-06   2.1E-06   2.9E-06   4.1E-06   5.6E-06   7.6E-06
1.0E-05   1.3E-05   1.8E-05   2.3E-05   2.9E-05   4.7E-05   7.4E-05   1.1E-04   1.6E-04   2.3E-04
3.5E-04   5.2E-04   7.4E-04   1.0E-03   1.4E-03   1.8E-03   2.3E-03   2.9E-03
      Mn-53         0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

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0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Na-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Os-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pa-231          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pb-202          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pb-210          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pd-107          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.6E-20    2.2E-19    1.2E-18    6.1E-18
4.1E-17    2.5E-16    1.4E-15    6.6E-15    3.0E-14    1.2E-13    4.8E-13    1.7E-12
      Pm-145          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pm-147          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-208          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-209          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pt-193          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
 NUCLIDE FLUXES AT OUTCROP (Ci/yr)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Ac-227          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ag-108m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ba-133         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Bi-210m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Bk-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.9E-23    1.3E-22    7.2E-22
3.5E-21    1.5E-20    5.8E-20    2.0E-19    6.5E-19    1.9E-18    5.2E-18    1.3E-17    3.2E-17    7.2E-17
1.6E-16    3.2E-16    6.3E-16    1.2E-15    2.2E-15    3.8E-15    6.5E-15    1.1E-14    1.7E-14    2.7E-14
4.2E-14    6.3E-14    9.2E-14    1.3E-13    1.9E-13    2.6E-13    3.5E-13    4.8E-13    6.3E-13    8.2E-13
1.1E-12    1.3E-12    1.7E-12    2.1E-12    2.6E-12    3.7E-12    5.2E-12    7.0E-12    9.2E-12    1.2E-11
1.4E-11    1.7E-11    2.0E-11    2.3E-11    2.6E-11    2.9E-11    3.2E-11    3.4E-11    3.6E-11    3.7E-11
3.8E-11    3.8E-11    3.8E-11    3.8E-11    3.7E-11    3.6E-11    3.4E-11    3.2E-11    3.1E-11    2.9E-11
2.7E-11    2.5E-11    2.3E-11    2.1E-11    1.9E-11    1.7E-11    1.5E-11    1.4E-11    1.2E-11    1.1E-11
9.4E-12    8.2E-12    7.2E-12    6.3E-12    5.4E-12    4.1E-12    3.0E-12    2.2E-12    1.6E-12    1.1E-12
7.3E-13    4.7E-13    3.0E-13    1.9E-13    1.2E-13    7.2E-14    4.4E-14    2.7E-14
      C-14           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ca-41          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.9E-23    2.6E-22    1.5E-21    8.0E-21    3.8E-20
1.7E-19    6.7E-19    2.5E-18    8.6E-18    2.8E-17    8.5E-17    2.5E-16    6.7E-16    1.8E-15    4.4E-15
1.1E-14    2.4E-14    5.4E-14    1.2E-13    2.4E-13    4.8E-13    9.4E-13    1.8E-12    3.3E-12    5.9E-12
1.0E-11    1.8E-11    3.1E-11    5.1E-11    8.3E-11    2.1E-10    4.9E-10    1.1E-09    2.3E-09    4.6E-09
8.7E-09    1.6E-08    2.8E-08    4.8E-08    8.0E-08    1.3E-07    2.0E-07    3.0E-07    4.5E-07    6.6E-07
9.3E-07    1.3E-06    1.8E-06    2.4E-06    3.2E-06    4.1E-06    5.3E-06    6.7E-06    8.4E-06    1.0E-05
1.3E-05    1.5E-05    1.8E-05    2.2E-05    2.6E-05    3.0E-05    3.4E-05    3.9E-05    4.4E-05    5.0E-05
5.5E-05    6.1E-05    6.7E-05    7.4E-05    8.0E-05    9.2E-05    1.0E-04    1.2E-04    1.3E-04    1.3E-04
1.4E-04    1.4E-04    1.5E-04    1.4E-04    1.4E-04    1.3E-04    1.2E-04    1.1E-04
      Cd-113         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cd-113m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-249         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-250         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-251         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-252         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cl-36          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.5E-23    1.9E-22    2.0E-21    1.7E-20    1.2E-19    6.8E-19
3.5E-18    1.6E-17    6.3E-17    2.3E-16    7.5E-16    2.3E-15    6.4E-15    1.7E-14    4.1E-14    9.6E-14
2.1E-13    4.5E-13    9.0E-13    1.7E-12    3.2E-12    5.8E-12    1.0E-11    1.7E-11    2.8E-11    4.5E-11
7.0E-11    1.1E-10    1.6E-10    2.3E-10    3.3E-10    4.7E-10    6.5E-10    8.9E-10    1.2E-09    1.6E-09
2.0E-09    2.6E-09    3.3E-09    4.2E-09    5.2E-09    7.8E-09    1.1E-08    1.6E-08    2.1E-08    2.7E-08
3.4E-08    4.2E-08    5.0E-08    5.9E-08    6.8E-08    7.7E-08    8.5E-08    9.3E-08    9.9E-08    1.0E-07
1.1E-07    1.1E-07    1.1E-07    1.1E-07    1.1E-07    1.1E-07    1.1E-07    1.1E-07    1.0E-07    9.7E-08
9.2E-08    8.6E-08    8.0E-08    7.4E-08    6.8E-08    6.3E-08    5.7E-08    5.2E-08    4.7E-08    4.2E-08
3.7E-08    3.3E-08    3.0E-08    2.6E-08    2.3E-08    1.8E-08    1.3E-08    1.0E-08    7.4E-09    5.4E-09
3.6E-09   2.4E-09   1.6E-09   1.0E-09   6.5E-10   4.2E-10   2.6E-10   1.6E-10
      Cm-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-248         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Co-60          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-135         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-137         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-152         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    4.1E-23    2.2E-22    1.0E-21    4.2E-21    1.6E-20    5.4E-20    1.7E-19
4.8E-19    1.3E-18    3.1E-18    7.3E-18    1.6E-17    3.3E-17    6.4E-17    1.2E-16    2.2E-16    3.7E-16
6.2E-16    9.9E-16    1.5E-15    2.3E-15    3.3E-15    4.7E-15    6.4E-15    8.6E-15    1.1E-14    1.4E-14
1.8E-14    2.2E-14    2.7E-14    3.2E-14    3.7E-14    4.7E-14    5.8E-14    6.6E-14    7.3E-14    7.7E-14
7.7E-14    7.5E-14    7.0E-14    6.4E-14    5.7E-14    4.9E-14    4.1E-14    3.3E-14    2.7E-14    2.1E-14
1.6E-14    1.2E-14    9.0E-15    6.6E-15    4.7E-15    3.4E-15    2.4E-15    1.6E-15    1.1E-15    7.5E-16
5.0E-16    3.3E-16    2.2E-16    1.4E-16    9.0E-17    5.7E-17    3.6E-17    2.3E-17    1.4E-17    8.7E-18
5.3E-18    3.2E-18    2.0E-18    1.2E-18    7.0E-19    2.4E-19    8.4E-20    2.8E-20    9.2E-21    3.0E-21
7.1E-22    1.7E-22    3.8E-23    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Hg-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Np-237         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-244         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ho-166m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      I-129          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    9.2E-24    2.9E-23    8.6E-23    2.4E-22    6.7E-22
1.8E-21    4.6E-21    1.1E-20    2.7E-20    6.3E-20    3.1E-19    1.4E-18    5.6E-18    2.1E-17    7.2E-17
2.3E-16    6.9E-16    1.9E-15    5.2E-15    1.3E-14    3.1E-14    7.2E-14    1.6E-13    3.4E-13    6.8E-13
1.4E-12    2.6E-12    4.8E-12    8.6E-12    1.5E-11    2.6E-11    4.3E-11    7.1E-11    1.1E-10    1.8E-10
2.8E-10    4.2E-10    6.3E-10    9.2E-10    1.3E-09    1.9E-09    2.7E-09    3.7E-09    5.0E-09    6.8E-09
9.1E-09    1.2E-08    1.6E-08    2.1E-08    2.6E-08    4.3E-08    6.6E-08    1.0E-07    1.5E-07    2.1E-07
3.2E-07   4.7E-07   6.6E-07   9.2E-07   1.2E-06   1.6E-06   2.1E-06   2.6E-06
      Mn-53          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Na-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Os-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pa-231          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-202          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-210          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pd-107          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.2E-23    2.0E-22    1.1E-21    5.5E-21
3.7E-20    2.2E-19    1.2E-18    6.0E-18    2.7E-17    1.1E-16    4.3E-16    1.5E-15
      Pm-145          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pm-147          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-208         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-209         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pt-193         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
*********** CUMULATIVE TOTAL DOSES PER YEAR FOR GIVEN TIMES **********
      1              0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
*********** CUMULATIVE TOTAL RISKS PER YEAR FOR GIVEN TIMES **********
      1              0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
        NUCLIDE HALFLIFE AND INVENTORY (CI) ASSUMING NO TRANSPORT FROM THE FACILITY
 (TIMES IN YEARS) HALFLIFE          6.         9.        12.        15.        18.        21.        24.
27.        30.        35.        40.        45.        50.        55.        60.        65.        70.
75.        80.        85.        90.        95.       100.       105.       110.       115.       120.
125.       130.       135.       140.       145.       150.       155.       160.       165.       170.
175.       180.       185.       190.       195.       200.       205.       210.       215.       220.
225.       230.       235.       240.       245.       250.       255.       260.       265.       270.
275.       280.       285.       290.       295.       300.       310.       320.       330.       340.
350.       360.       370.       380.       390.       400.       410.       420.       430.       440.
450.       460.       470.       480.       490.       500.       510.       520.       530.       540.
550.       560.       570.       580.       590.       600.       610.       620.       630.       640.
650.       660.       670.       680.       690.       700.       720.       740.       760.       780.
800.      825.      850.      875.      900.      925.      950.      975.     1000.
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   Ac-227            2.18E+01  1.30E+08  9.76E+07  8.88E+07  8.07E+07  7.33E+07  6.67E+07  6.06E+07
5.51E+07  5.01E+07  4.27E+07  3.64E+07  3.11E+07  2.65E+07  2.26E+07  1.93E+07  1.65E+07  1.40E+07
1.20E+07  1.02E+07  8.71E+06  7.43E+06  6.34E+06  5.41E+06  4.61E+06  3.94E+06  3.36E+06  2.86E+06
2.44E+06  2.08E+06  1.78E+06  1.52E+06  1.29E+06  1.10E+06  9.41E+05  8.03E+05  6.85E+05  5.84E+05
4.98E+05  4.25E+05  3.63E+05  3.09E+05  2.64E+05  2.25E+05  1.92E+05  1.64E+05  1.40E+05  1.19E+05
1.02E+05  8.67E+04  7.39E+04  6.31E+04  5.38E+04  4.59E+04  3.91E+04  3.34E+04  2.85E+04  2.43E+04
2.07E+04  1.77E+04  1.51E+04  1.29E+04  1.10E+04  9.36E+03  6.81E+03  4.96E+03  3.61E+03  2.62E+03
1.91E+03  1.39E+03  1.01E+03  7.36E+02  5.35E+02  3.89E+02  2.83E+02  2.06E+02  1.50E+02  1.09E+02
7.94E+01  5.78E+01  4.21E+01  3.06E+01  2.23E+01  1.62E+01  1.18E+01  8.58E+00  6.24E+00  4.54E+00
3.30E+00  2.40E+00  1.75E+00  1.27E+00  9.26E-01  6.74E-01  4.90E-01  3.57E-01  2.60E-01  1.89E-01
1.37E-01  1.00E-01  7.28E-02  5.30E-02  3.85E-02  2.80E-02  1.48E-02  7.86E-03  4.16E-03  2.20E-03
1.17E-03  5.27E-04  2.38E-04  1.07E-04  4.85E-05  2.19E-05  9.90E-06  4.47E-06  2.02E-06
   Ag-108m           4.18E+02  4.69E+07  4.62E+07  4.60E+07  4.57E+07  4.55E+07  4.53E+07  4.51E+07
4.48E+07  4.46E+07  4.43E+07  4.39E+07  4.35E+07  4.32E+07  4.28E+07  4.25E+07  4.21E+07  4.18E+07
4.14E+07  4.11E+07  4.07E+07  4.04E+07  4.01E+07  3.97E+07  3.94E+07  3.91E+07  3.88E+07  3.84E+07
3.81E+07  3.78E+07  3.75E+07  3.72E+07  3.69E+07  3.66E+07  3.63E+07  3.60E+07  3.57E+07  3.54E+07
3.51E+07  3.48E+07  3.45E+07  3.42E+07  3.39E+07  3.37E+07  3.34E+07  3.31E+07  3.28E+07  3.26E+07
3.23E+07  3.20E+07  3.18E+07  3.15E+07  3.12E+07  3.10E+07  3.07E+07  3.05E+07  3.02E+07  3.00E+07
2.97E+07  2.95E+07  2.92E+07  2.90E+07  2.88E+07  2.85E+07  2.80E+07  2.76E+07  2.71E+07  2.67E+07
2.62E+07  2.58E+07  2.54E+07  2.50E+07  2.46E+07  2.42E+07  2.38E+07  2.34E+07  2.30E+07  2.26E+07
2.22E+07  2.19E+07  2.15E+07  2.12E+07  2.08E+07  2.05E+07  2.01E+07  1.98E+07  1.95E+07  1.92E+07
1.88E+07  1.85E+07  1.82E+07  1.79E+07  1.76E+07  1.73E+07  1.71E+07  1.68E+07  1.65E+07  1.62E+07
1.60E+07  1.57E+07  1.54E+07  1.52E+07  1.49E+07  1.47E+07  1.42E+07  1.37E+07  1.33E+07  1.29E+07
1.24E+07  1.19E+07  1.15E+07  1.10E+07  1.05E+07  1.01E+07  9.71E+06  9.31E+06  8.93E+06
   Al-26             7.40E+05  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
   Am-242m           1.41E+02  1.80E-02  1.72E-02  1.70E-02  1.67E-02  1.65E-02  1.62E-02  1.60E-02
1.58E-02  1.55E-02  1.52E-02  1.48E-02  1.44E-02  1.41E-02  1.37E-02  1.34E-02  1.31E-02  1.28E-02
1.24E-02  1.21E-02  1.19E-02  1.16E-02  1.13E-02  1.10E-02  1.07E-02  1.05E-02  1.02E-02  9.98E-03
9.74E-03  9.50E-03  9.27E-03  9.04E-03  8.82E-03  8.61E-03  8.40E-03  8.20E-03  8.00E-03  7.80E-03
7.61E-03  7.43E-03  7.25E-03  7.07E-03  6.90E-03  6.73E-03  6.57E-03  6.41E-03  6.26E-03  6.10E-03
5.96E-03  5.81E-03  5.67E-03  5.53E-03  5.40E-03  5.27E-03  5.14E-03  5.01E-03  4.89E-03  4.77E-03
4.66E-03  4.54E-03  4.43E-03  4.33E-03  4.22E-03  4.12E-03  3.92E-03  3.73E-03  3.55E-03  3.38E-03
3.22E-03  3.07E-03  2.92E-03  2.78E-03  2.65E-03  2.52E-03  2.40E-03  2.28E-03  2.17E-03  2.07E-03
1.97E-03  1.88E-03  1.79E-03  1.70E-03  1.62E-03  1.54E-03  1.47E-03  1.40E-03  1.33E-03  1.27E-03
1.21E-03  1.15E-03  1.09E-03  1.04E-03  9.90E-04  9.43E-04  8.97E-04  8.54E-04  8.13E-04  7.74E-04
7.37E-04  7.02E-04  6.68E-04  6.36E-04  6.06E-04  5.76E-04  5.23E-04  4.74E-04  4.29E-04  3.89E-04
3.53E-04  3.12E-04  2.76E-04  2.44E-04  2.16E-04  1.91E-04  1.69E-04  1.49E-04  1.32E-04
   Am-243            7.37E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02
1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02
1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02
   Ba-133            1.05E+01  4.61E+08  2.54E+08  2.09E+08  1.71E+08  1.40E+08  1.15E+08  9.45E+07
7.76E+07  6.36E+07  4.57E+07  3.29E+07  2.36E+07  1.70E+07  1.22E+07  8.78E+06  6.31E+06  4.54E+06
3.26E+06  2.34E+06  1.69E+06  1.21E+06  8.71E+05  6.26E+05  4.50E+05  3.24E+05  2.33E+05  1.67E+05
1.20E+05  8.64E+04  6.21E+04  4.47E+04  3.21E+04  2.31E+04  1.66E+04  1.19E+04  8.57E+03  6.16E+03
4.43E+03  3.19E+03  2.29E+03  1.65E+03  1.18E+03  8.51E+02  6.12E+02  4.40E+02  3.16E+02  2.27E+02
1.63E+02  1.17E+02  8.44E+01  6.07E+01  4.36E+01  3.14E+01  2.25E+01  1.62E+01  1.16E+01  8.37E+00
6.02E+00  4.33E+00  3.11E+00  2.24E+00  1.61E+00  1.16E+00  5.97E-01  3.09E-01  1.59E-01  8.24E-02
4.26E-02  2.20E-02  1.14E-02  5.88E-03  3.04E-03  1.57E-03  8.11E-04  4.19E-04  2.17E-04  1.12E-04
5.79E-05  2.99E-05  1.55E-05  7.99E-06  4.13E-06  2.13E-06  1.10E-06  5.70E-07  2.94E-07  1.52E-07
7.86E-08  4.06E-08  2.10E-08  1.08E-08  5.61E-09  2.90E-09  1.50E-09  7.74E-10  4.00E-10  2.07E-10
1.07E-10  5.52E-11  2.85E-11  1.47E-11  7.62E-12  3.94E-12  1.05E-12  2.81E-13  7.50E-14  2.00E-14
5.35E-15  1.03E-15  1.97E-16  3.78E-17  7.26E-18  1.39E-18  2.68E-19  5.14E-20  9.87E-21
   Be-10             1.51E+06  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
```

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3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
   Bi-207            3.16E+01  9.66E+07  7.93E+07  7.42E+07  6.95E+07  6.51E+07  6.09E+07  5.71E+07
5.34E+07  5.00E+07  4.48E+07  4.02E+07  3.60E+07  3.23E+07  2.89E+07  2.59E+07  2.32E+07  2.08E+07
1.86E+07  1.67E+07  1.50E+07  1.34E+07  1.20E+07  1.08E+07  9.65E+06  8.65E+06  7.75E+06  6.95E+06
6.23E+06  5.58E+06  5.00E+06  4.48E+06  4.01E+06  3.60E+06  3.22E+06  2.89E+06  2.59E+06  2.32E+06
2.08E+06  1.86E+06  1.67E+06  1.50E+06  1.34E+06  1.20E+06  1.08E+06  9.65E+05  8.65E+05  7.75E+05
6.94E+05  6.22E+05  5.58E+05  5.00E+05  4.48E+05  4.01E+05  3.60E+05  3.22E+05  2.89E+05  2.59E+05
2.32E+05  2.08E+05  1.86E+05  1.67E+05  1.50E+05  1.34E+05  1.08E+05  8.64E+04  6.94E+04  5.57E+04
4.47E+04  3.59E+04  2.89E+04  2.32E+04  1.86E+04  1.49E+04  1.20E+04  9.64E+03  7.74E+03  6.21E+03
4.99E+03  4.01E+03  3.22E+03  2.58E+03  2.08E+03  1.67E+03  1.34E+03  1.07E+03  8.63E+02  6.93E+02
5.57E+02  4.47E+02  3.59E+02  2.88E+02  2.31E+02  1.86E+02  1.49E+02  1.20E+02  9.63E+01  7.73E+01
6.21E+01  4.98E+01  4.00E+01  3.21E+01  2.58E+01  2.07E+01  1.34E+01  8.62E+00  5.56E+00  3.59E+00
2.31E+00  1.34E+00  7.72E-01  4.46E-01  2.58E-01  1.49E-01  8.61E-02  4.98E-02  2.88E-02
   Bi-210m           3.04E+06  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
   Bk-247            1.40E+03  1.17E-08  1.16E-08  1.16E-08  1.16E-08  1.16E-08  1.16E-08  1.16E-08
1.15E-08  1.15E-08  1.15E-08  1.15E-08  1.14E-08  1.14E-08  1.14E-08  1.14E-08  1.13E-08  1.13E-08
1.13E-08  1.12E-08  1.12E-08  1.12E-08  1.12E-08  1.11E-08  1.11E-08  1.11E-08  1.11E-08  1.10E-08
1.10E-08  1.10E-08  1.09E-08  1.09E-08  1.09E-08  1.09E-08  1.08E-08  1.08E-08  1.08E-08  1.08E-08
1.07E-08  1.07E-08  1.07E-08  1.06E-08  1.06E-08  1.06E-08  1.06E-08  1.05E-08  1.05E-08  1.05E-08
1.05E-08  1.04E-08  1.04E-08  1.04E-08  1.04E-08  1.03E-08  1.03E-08  1.03E-08  1.03E-08  1.02E-08
1.02E-08  1.02E-08  1.02E-08  1.01E-08  1.01E-08  1.01E-08  1.00E-08  9.99E-09  9.94E-09  9.89E-09
9.84E-09  9.79E-09  9.74E-09  9.69E-09  9.65E-09  9.60E-09  9.55E-09  9.50E-09  9.46E-09  9.41E-09
9.36E-09  9.32E-09  9.27E-09  9.23E-09  9.18E-09  9.13E-09  9.09E-09  9.04E-09  9.00E-09  8.96E-09
8.91E-09  8.87E-09  8.82E-09  8.78E-09  8.74E-09  8.69E-09  8.65E-09  8.61E-09  8.56E-09  8.52E-09
8.48E-09  8.44E-09  8.40E-09  8.36E-09  8.31E-09  8.27E-09  8.19E-09  8.11E-09  8.03E-09  7.95E-09
7.87E-09  7.78E-09  7.68E-09  7.59E-09  7.49E-09  7.40E-09  7.31E-09  7.22E-09  7.13E-09
   C-14              5.73E+03  9.00E+00  8.99E+00  8.99E+00  8.98E+00  8.98E+00  8.98E+00  8.97E+00
8.97E+00  8.97E+00  8.96E+00  8.96E+00  8.95E+00  8.95E+00  8.94E+00  8.93E+00  8.93E+00  8.92E+00
8.92E+00  8.91E+00  8.91E+00  8.90E+00  8.90E+00  8.89E+00  8.89E+00  8.88E+00  8.88E+00  8.87E+00
8.86E+00  8.86E+00  8.85E+00  8.85E+00  8.84E+00  8.84E+00  8.83E+00  8.83E+00  8.82E+00  8.82E+00
8.81E+00  8.81E+00  8.80E+00  8.80E+00  8.79E+00  8.78E+00  8.78E+00  8.77E+00  8.77E+00  8.76E+00
8.76E+00  8.75E+00  8.75E+00  8.74E+00  8.74E+00  8.73E+00  8.73E+00  8.72E+00  8.72E+00  8.71E+00
8.71E+00  8.70E+00  8.70E+00  8.69E+00  8.68E+00  8.68E+00  8.67E+00  8.66E+00  8.65E+00  8.64E+00
8.63E+00  8.62E+00  8.61E+00  8.60E+00  8.59E+00  8.57E+00  8.56E+00  8.55E+00  8.54E+00  8.53E+00
8.52E+00  8.51E+00  8.50E+00  8.49E+00  8.48E+00  8.47E+00  8.46E+00  8.45E+00  8.44E+00  8.43E+00
8.42E+00  8.41E+00  8.40E+00  8.39E+00  8.38E+00  8.37E+00  8.36E+00  8.35E+00  8.34E+00  8.33E+00
8.32E+00  8.31E+00  8.30E+00  8.29E+00  8.28E+00  8.27E+00  8.25E+00  8.23E+00  8.21E+00  8.19E+00
8.17E+00  8.15E+00  8.12E+00  8.10E+00  8.07E+00  8.05E+00  8.02E+00  8.00E+00  7.97E+00
   Ca-41             1.03E+05  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02
6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02
6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.35E-02  6.34E-02
6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02
6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02
6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02
6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02  6.34E-02
6.34E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02
6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.33E-02
6.33E-02  6.33E-02  6.33E-02  6.33E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02
6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02  6.32E-02
6.32E-02  6.31E-02  6.31E-02  6.31E-02  6.31E-02  6.31E-02  6.31E-02  6.31E-02  6.31E-02
   Cd-113            9.30E+15  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
   Cd-113m           1.41E+01  4.04E+08  2.60E+08  2.24E+08  1.93E+08  1.67E+08  1.44E+08  1.24E+08
1.07E+08  9.24E+07  7.23E+07  5.65E+07  4.42E+07  3.46E+07  2.70E+07  2.12E+07  1.65E+07  1.29E+07
1.01E+07  7.91E+06  6.19E+06  4.84E+06  3.79E+06  2.96E+06  2.32E+06  1.81E+06  1.42E+06  1.11E+06
8.66E+05  6.78E+05  5.30E+05  4.14E+05  3.24E+05  2.53E+05  1.98E+05  1.55E+05  1.21E+05  9.48E+04
```

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7.42E+04  5.80E+04  4.54E+04  3.55E+04  2.77E+04  2.17E+04  1.70E+04  1.33E+04  1.04E+04  8.12E+03
6.35E+03  4.97E+03  3.88E+03  3.04E+03  2.38E+03  1.86E+03  1.45E+03  1.14E+03  8.89E+02  6.95E+02
5.44E+02  4.25E+02  3.32E+02  2.60E+02  2.03E+02  1.59E+02  9.73E+01  5.95E+01  3.64E+01  2.23E+01
1.36E+01  8.33E+00  5.09E+00  3.12E+00  1.91E+00  1.17E+00  7.13E-01  4.36E-01  2.67E-01  1.63E-01
9.98E-02  6.10E-02  3.73E-02  2.28E-02  1.40E-02  8.54E-03  5.22E-03  3.20E-03  1.95E-03  1.20E-03
7.31E-04  4.47E-04  2.74E-04  1.67E-04  1.02E-04  6.26E-05  3.83E-05  2.34E-05  1.43E-05  8.76E-06
5.36E-06  3.28E-06  2.01E-06  1.23E-06  7.50E-07  4.59E-07  1.72E-07  6.42E-08  2.40E-08  8.99E-09
3.36E-09  9.84E-10  2.88E-10  8.42E-11  2.46E-11  7.21E-12  2.11E-12  6.17E-13  1.81E-13
   Cf-249            3.51E+02  1.80E-02  1.77E-02  1.76E-02  1.75E-02  1.74E-02  1.73E-02  1.72E-02
1.71E-02  1.70E-02  1.68E-02  1.66E-02  1.65E-02  1.63E-02  1.61E-02  1.60E-02  1.58E-02  1.57E-02
1.55E-02  1.54E-02  1.52E-02  1.51E-02  1.49E-02  1.48E-02  1.46E-02  1.45E-02  1.43E-02  1.42E-02
1.41E-02  1.39E-02  1.38E-02  1.37E-02  1.35E-02  1.34E-02  1.33E-02  1.31E-02  1.30E-02  1.29E-02
1.27E-02  1.26E-02  1.25E-02  1.24E-02  1.22E-02  1.21E-02  1.20E-02  1.19E-02  1.18E-02  1.17E-02
1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.11E-02  1.10E-02  1.09E-02  1.08E-02  1.07E-02  1.06E-02
1.05E-02  1.04E-02  1.03E-02  1.02E-02  1.01E-02  9.95E-03  9.76E-03  9.57E-03  9.38E-03  9.20E-03
9.02E-03  8.84E-03  8.67E-03  8.50E-03  8.33E-03  8.17E-03  8.01E-03  7.85E-03  7.70E-03  7.55E-03
7.40E-03  7.26E-03  7.12E-03  6.98E-03  6.84E-03  6.71E-03  6.57E-03  6.45E-03  6.32E-03  6.20E-03
6.08E-03  5.96E-03  5.84E-03  5.73E-03  5.61E-03  5.50E-03  5.40E-03  5.29E-03  5.19E-03  5.09E-03
4.99E-03  4.89E-03  4.79E-03  4.70E-03  4.61E-03  4.52E-03  4.34E-03  4.17E-03  4.01E-03  3.86E-03
3.71E-03  3.53E-03  3.36E-03  3.20E-03  3.04E-03  2.90E-03  2.76E-03  2.62E-03  2.50E-03
   Cf-250            1.31E+01  1.80E-02  1.12E-02  9.54E-03  8.14E-03  6.94E-03  5.93E-03  5.06E-03
4.31E-03  3.68E-03  2.82E-03  2.17E-03  1.66E-03  1.28E-03  9.80E-04  7.53E-04  5.78E-04  4.43E-04
3.40E-04  2.61E-04  2.00E-04  1.54E-04  1.18E-04  9.06E-05  6.96E-05  5.34E-05  4.10E-05  3.15E-05
2.41E-05  1.85E-05  1.42E-05  1.09E-05  8.38E-06  6.43E-06  4.94E-06  3.79E-06  2.91E-06  2.23E-06
1.71E-06  1.32E-06  1.01E-06  7.75E-07  5.95E-07  4.56E-07  3.50E-07  2.69E-07  2.06E-07  1.58E-07
1.22E-07  9.33E-08  7.16E-08  5.50E-08  4.22E-08  3.24E-08  2.49E-08  1.91E-08  1.46E-08  1.12E-08
8.63E-09  6.62E-09  5.08E-09  3.90E-09  2.99E-09  2.30E-09  1.35E-09  7.98E-10  4.70E-10  2.77E-10
1.63E-10  9.61E-11  5.66E-11  3.34E-11  1.96E-11  1.16E-11  6.82E-12  4.02E-12  2.37E-12  1.39E-12
8.21E-13  4.84E-13  2.85E-13  1.68E-13  9.89E-14  5.83E-14  3.43E-14  2.02E-14  1.19E-14  7.02E-15
4.14E-15  2.44E-15  1.44E-15  8.46E-16  4.98E-16  2.94E-16  1.73E-16  1.02E-16  6.00E-17  3.54E-17
2.08E-17  1.23E-17  7.23E-18  4.26E-18  2.51E-18  1.48E-18  5.13E-19  1.78E-19  6.18E-20  2.14E-20
7.44E-21  1.98E-21  5.28E-22  1.41E-22  3.75E-23  9.98E-24  2.66E-24  7.09E-25  1.89E-25
   Cf-251            8.98E+02  1.80E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02
1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.74E-02  1.73E-02  1.73E-02  1.72E-02  1.71E-02  1.71E-02
1.70E-02  1.69E-02  1.69E-02  1.68E-02  1.67E-02  1.67E-02  1.66E-02  1.65E-02  1.65E-02  1.64E-02
1.63E-02  1.63E-02  1.62E-02  1.62E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02  1.58E-02  1.58E-02
1.57E-02  1.57E-02  1.56E-02  1.55E-02  1.55E-02  1.54E-02  1.54E-02  1.53E-02  1.52E-02  1.52E-02
1.51E-02  1.51E-02  1.50E-02  1.50E-02  1.49E-02  1.48E-02  1.48E-02  1.47E-02  1.47E-02  1.46E-02
1.46E-02  1.45E-02  1.44E-02  1.44E-02  1.43E-02  1.43E-02  1.42E-02  1.41E-02  1.40E-02  1.38E-02
1.37E-02  1.36E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.31E-02  1.30E-02  1.29E-02  1.28E-02
1.27E-02  1.26E-02  1.25E-02  1.24E-02  1.23E-02  1.22E-02  1.21E-02  1.20E-02  1.20E-02  1.19E-02
1.18E-02  1.17E-02  1.16E-02  1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.12E-02  1.11E-02  1.10E-02
1.09E-02  1.08E-02  1.07E-02  1.06E-02  1.06E-02  1.05E-02  1.03E-02  1.02E-02  1.00E-02  9.86E-03
9.71E-03  9.52E-03  9.34E-03  9.16E-03  8.99E-03  8.81E-03  8.65E-03  8.48E-03  8.32E-03
   Cf-252            2.65E+00  7.92E+02  7.52E+01  3.43E+01  1.57E+01  7.14E+00  3.26E+00  1.49E+00
6.79E-01  3.10E-01  8.37E-02  2.26E-02  6.12E-03  1.66E-03  4.48E-04  1.21E-04  3.27E-05  8.85E-06
2.39E-06  6.47E-07  1.75E-07  4.73E-08  1.28E-08  3.46E-09  9.36E-10  2.53E-10  6.84E-11  1.85E-11
5.00E-12  1.35E-12  3.66E-13  9.89E-14  2.67E-14  7.23E-15  1.96E-15  5.29E-16  1.43E-16  3.87E-17
1.05E-17  2.83E-18  7.65E-19  2.07E-19  5.59E-20  1.51E-20  4.09E-21  1.11E-21  2.99E-22  8.08E-23
2.19E-23  5.91E-24  1.60E-24  4.32E-25  1.17E-25  3.16E-26  8.54E-27  2.31E-27  6.25E-28  1.69E-28
4.57E-29  1.24E-29  3.34E-30  9.03E-31  2.44E-31  6.60E-32  4.83E-33  3.53E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cl-36             3.01E+05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05
2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.86E-05  2.85E-05
2.85E-05  2.85E-05  2.85E-05  2.85E-05  2.85E-05  2.85E-05  2.85E-05  2.85E-05  2.85E-05
   Cm-243            2.91E+01  1.80E-02  1.45E-02  1.35E-02  1.26E-02  1.17E-02  1.09E-02  1.02E-02
9.46E-03  8.81E-03  7.82E-03  6.94E-03  6.16E-03  5.47E-03  4.86E-03  4.31E-03  3.83E-03  3.40E-03
3.02E-03  2.68E-03  2.38E-03  2.11E-03  1.87E-03  1.66E-03  1.48E-03  1.31E-03  1.16E-03  1.03E-03
9.17E-04  8.14E-04  7.22E-04  6.41E-04  5.69E-04  5.05E-04  4.49E-04  3.98E-04  3.54E-04  3.14E-04
2.79E-04  2.47E-04  2.20E-04  1.95E-04  1.73E-04  1.54E-04  1.36E-04  1.21E-04  1.07E-04  9.54E-05
8.47E-05  7.52E-05  6.67E-05  5.92E-05  5.26E-05  4.67E-05  4.14E-05  3.68E-05  3.27E-05  2.90E-05
2.57E-05  2.28E-05  2.03E-05  1.80E-05  1.60E-05  1.42E-05  1.12E-05  8.81E-06  6.94E-06  5.47E-06
4.31E-06  3.40E-06  2.68E-06  2.11E-06  1.66E-06  1.31E-06  1.03E-06  8.14E-07  6.41E-07  5.05E-07
3.98E-07  3.14E-07  2.47E-07  1.95E-07  1.54E-07  1.21E-07  9.54E-08  7.52E-08  5.92E-08  4.67E-08
3.68E-08  2.90E-08  2.28E-08  1.80E-08  1.42E-08  1.12E-08  8.81E-09  6.94E-09  5.47E-09  4.31E-09
3.40E-09  2.68E-09  2.11E-09  1.66E-09  1.31E-09  1.03E-09  6.41E-10  3.98E-10  2.47E-10  1.54E-10
9.54E-11  5.26E-11  2.90E-11  1.60E-11  8.81E-12  4.86E-12  2.68E-12  1.48E-12  8.14E-13
```

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   Cm-245            8.50E+03   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02
1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02
1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02
1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02
1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02
1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.75E-02   1.75E-02   1.75E-02
1.75E-02   1.75E-02   1.75E-02   1.75E-02   1.74E-02   1.74E-02   1.74E-02   1.74E-02   1.74E-02   1.74E-02
1.74E-02   1.73E-02   1.73E-02   1.73E-02   1.73E-02   1.73E-02   1.73E-02   1.73E-02   1.72E-02   1.72E-02
1.72E-02   1.72E-02   1.72E-02   1.72E-02   1.72E-02   1.71E-02   1.71E-02   1.71E-02   1.71E-02   1.71E-02
1.71E-02   1.71E-02   1.70E-02   1.70E-02   1.70E-02   1.70E-02   1.70E-02   1.69E-02   1.69E-02   1.69E-02
1.69E-02   1.68E-02   1.68E-02   1.68E-02   1.67E-02   1.67E-02   1.67E-02   1.66E-02   1.66E-02
   Cm-246            4.73E+03   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.79E-02   1.79E-02
1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.79E-02   1.78E-02   1.78E-02   1.78E-02
1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.78E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02   1.77E-02
1.77E-02   1.77E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02   1.76E-02
1.75E-02   1.75E-02   1.75E-02   1.75E-02   1.75E-02   1.75E-02   1.75E-02   1.75E-02   1.74E-02   1.74E-02
1.74E-02   1.74E-02   1.74E-02   1.74E-02   1.74E-02   1.74E-02   1.73E-02   1.73E-02   1.73E-02   1.73E-02
1.73E-02   1.73E-02   1.73E-02   1.73E-02   1.72E-02   1.72E-02   1.72E-02   1.72E-02   1.72E-02   1.71E-02
1.71E-02   1.71E-02   1.71E-02   1.70E-02   1.70E-02   1.70E-02   1.70E-02   1.69E-02   1.69E-02   1.69E-02
1.69E-02   1.68E-02   1.68E-02   1.68E-02   1.68E-02   1.67E-02   1.67E-02   1.67E-02   1.67E-02   1.66E-02
1.66E-02   1.66E-02   1.66E-02   1.65E-02   1.65E-02   1.65E-02   1.65E-02   1.64E-02   1.64E-02   1.64E-02
1.64E-02   1.63E-02   1.63E-02   1.63E-02   1.63E-02   1.62E-02   1.62E-02   1.62E-02   1.61E-02   1.61E-02
1.60E-02   1.60E-02   1.59E-02   1.58E-02   1.58E-02   1.57E-02   1.57E-02   1.56E-02   1.55E-02
   Cm-247            1.56E+07   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02   1.80E-02
   Co-60             5.27E+00   7.92E+02   2.42E+02   1.63E+02   1.10E+02   7.42E+01   5.00E+01   3.37E+01
2.27E+01   1.53E+01   7.93E+00   4.11E+00   2.13E+00   1.10E+00   5.72E-01   2.96E-01   1.53E-01   7.95E-02
4.12E-02   2.13E-02   1.11E-02   5.73E-03   2.97E-03   1.54E-03   7.96E-04   4.12E-04   2.14E-04   1.11E-04
5.74E-05   2.97E-05   1.54E-05   7.97E-06   4.13E-06   2.14E-06   1.11E-06   5.75E-07   2.98E-07   1.54E-07
7.99E-08   4.14E-08   2.14E-08   1.11E-08   5.75E-09   2.98E-09   1.54E-09   8.00E-10   4.15E-10   2.15E-10
1.11E-10   5.76E-11   2.99E-11   1.55E-11   8.02E-12   4.15E-12   2.15E-12   1.11E-12   5.77E-13   2.99E-13
1.55E-13   8.03E-14   4.16E-14   2.16E-14   1.12E-14   5.78E-15   1.55E-15   4.17E-16   1.12E-16   3.00E-17
8.06E-18   2.16E-18   5.80E-19   1.56E-19   4.18E-20   1.12E-20   3.01E-21   8.09E-22   2.17E-22   5.82E-23
1.56E-23   4.20E-24   1.13E-24   3.02E-25   8.11E-26   2.18E-26   5.85E-27   1.57E-27   4.21E-28   1.13E-28
3.03E-29   8.14E-30   2.19E-30   5.87E-31   1.57E-31   4.23E-32   1.13E-32   3.04E-33   8.17E-34   2.19E-34
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
   Cs-135            2.30E+06   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03   2.07E+03
   Cs-137            3.01E+01   1.13E+00   9.18E-01   8.57E-01   8.00E-01   7.47E-01   6.97E-01   6.50E-01
6.07E-01   5.66E-01   5.05E-01   4.50E-01   4.01E-01   3.57E-01   3.18E-01   2.84E-01   2.53E-01   2.25E-01
2.01E-01   1.79E-01   1.60E-01   1.42E-01   1.27E-01   1.13E-01   1.01E-01   8.97E-02   8.00E-02   7.13E-02
6.35E-02   5.66E-02   5.05E-02   4.50E-02   4.01E-02   3.57E-02   3.18E-02   2.84E-02   2.53E-02   2.25E-02
2.01E-02   1.79E-02   1.60E-02   1.42E-02   1.27E-02   1.13E-02   1.01E-02   8.97E-03   8.00E-03   7.13E-03
6.35E-03   5.66E-03   5.04E-03   4.50E-03   4.01E-03   3.57E-03   3.18E-03   2.84E-03   2.53E-03   2.25E-03
2.01E-03   1.79E-03   1.60E-03   1.42E-03   1.27E-03   1.13E-03   8.97E-04   7.12E-04   5.66E-04   4.50E-04
3.57E-04   2.84E-04   2.25E-04   1.79E-04   1.42E-04   1.13E-04   8.97E-05   7.12E-05   5.66E-05   4.49E-05
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3.57E-05  2.84E-05  2.25E-05  1.79E-05  1.42E-05  1.13E-05  8.97E-06  7.12E-06  5.66E-06  4.49E-06
3.57E-06  2.83E-06  2.25E-06  1.79E-06  1.42E-06  1.13E-06  8.96E-07  7.12E-07  5.66E-07  4.49E-07
3.57E-07  2.83E-07  2.25E-07  1.79E-07  1.42E-07  1.13E-07  7.12E-08  4.49E-08  2.83E-08  1.79E-08
1.13E-08  6.34E-09  3.57E-09  2.01E-09  1.13E-09  6.34E-10  3.57E-10  2.00E-10  1.13E-10
   Eu-152            1.35E+01  3.11E+08  1.96E+08  1.68E+08  1.44E+08  1.23E+08  1.06E+08  9.07E+07
7.78E+07  6.67E+07  5.16E+07  3.99E+07  3.09E+07  2.39E+07  1.85E+07  1.43E+07  1.10E+07  8.55E+06
6.61E+06  5.12E+06  3.96E+06  3.06E+06  2.37E+06  1.83E+06  1.42E+06  1.10E+06  8.48E+05  6.56E+05
5.08E+05  3.93E+05  3.04E+05  2.35E+05  1.82E+05  1.41E+05  1.09E+05  8.41E+04  6.51E+04  5.04E+04
3.90E+04  3.01E+04  2.33E+04  1.80E+04  1.39E+04  1.08E+04  8.35E+03  6.46E+03  5.00E+03  3.86E+03
2.99E+03  2.31E+03  1.79E+03  1.38E+03  1.07E+03  8.28E+02  6.41E+02  4.96E+02  3.83E+02  2.97E+02
2.29E+02  1.77E+02  1.37E+02  1.06E+02  8.22E+01  6.36E+01  3.80E+01  2.28E+01  1.36E+01  8.15E+00
4.88E+00  2.92E+00  1.75E+00  1.05E+00  6.26E-01  3.74E-01  2.24E-01  1.34E-01  8.02E-02  4.80E-02
2.87E-02  1.72E-02  1.03E-02  6.16E-03  3.69E-03  2.21E-03  1.32E-03  7.90E-04  4.73E-04  2.83E-04
1.69E-04  1.01E-04  6.06E-05  3.63E-05  2.17E-05  1.30E-05  7.77E-06  4.65E-06  2.78E-06  1.67E-06
9.97E-07  5.97E-07  3.57E-07  2.14E-07  1.28E-07  7.65E-08  2.74E-08  9.81E-09  3.51E-09  1.26E-09
4.51E-10  1.25E-10  3.46E-11  9.58E-12  2.66E-12  7.36E-13  2.04E-13  5.65E-14  1.56E-14
   Eu-154            8.59E+00  4.87E+08  2.36E+08  1.85E+08  1.45E+08  1.14E+08  8.95E+07  7.02E+07
5.51E+07  4.33E+07  2.89E+07  1.93E+07  1.29E+07  8.62E+06  5.76E+06  3.84E+06  2.57E+06  1.72E+06
1.15E+06  7.66E+05  5.11E+05  3.42E+05  2.28E+05  1.52E+05  1.02E+05  6.80E+04  4.54E+04  3.04E+04
2.03E+04  1.35E+04  9.05E+03  6.04E+03  4.04E+03  2.70E+03  1.80E+03  1.20E+03  8.04E+02  5.37E+02
3.59E+02  2.40E+02  1.60E+02  1.07E+02  7.14E+01  4.77E+01  3.19E+01  2.13E+01  1.42E+01  9.50E+00
6.35E+00  4.24E+00  2.83E+00  1.89E+00  1.26E+00  8.44E-01  5.64E-01  3.77E-01  2.52E-01  1.68E-01
1.12E-01  7.50E-02  5.01E-02  3.35E-02  2.24E-02  1.49E-02  6.67E-03  2.97E-03  1.33E-03  5.92E-04
2.64E-04  1.18E-04  5.26E-05  2.35E-05  1.05E-05  4.68E-06  2.09E-06  9.31E-07  4.15E-07  1.85E-07
8.27E-08  3.69E-08  1.65E-08  7.35E-09  3.28E-09  1.46E-09  6.53E-10  2.91E-10  1.30E-10  5.80E-11
2.59E-11  1.16E-11  5.16E-12  2.30E-12  1.03E-12  4.58E-13  2.04E-13  9.12E-14  4.07E-14  1.82E-14
8.11E-15  3.62E-15  1.61E-15  7.20E-16  3.21E-16  1.43E-16  2.86E-17  5.69E-18  1.13E-18  2.25E-19
4.49E-20  5.97E-21  7.94E-22  1.06E-22  1.41E-23  1.87E-24  2.49E-25  3.31E-26  4.40E-27
   Eu-155            4.76E+00  7.92E+02  2.14E+02  1.38E+02  8.91E+01  5.76E+01  3.72E+01  2.40E+01
1.55E+01  1.00E+01  4.84E+00  2.34E+00  1.13E+00  5.45E-01  2.63E-01  1.27E-01  6.14E-02  2.96E-02
1.43E-02  6.91E-03  3.34E-03  1.61E-03  7.78E-04  3.75E-04  1.81E-04  8.75E-05  4.23E-05  2.04E-05
9.85E-06  4.76E-06  2.30E-06  1.11E-06  5.35E-07  2.59E-07  1.25E-07  6.03E-08  2.91E-08  1.40E-08
6.78E-09  3.28E-09  1.58E-09  7.64E-10  3.69E-10  1.78E-10  8.59E-11  4.15E-11  2.00E-11  9.67E-12
4.67E-12  2.26E-12  1.09E-12  5.26E-13  2.54E-13  1.23E-13  5.92E-14  2.86E-14  1.38E-14  6.66E-15
3.22E-15  1.55E-15  7.50E-16  3.62E-16  1.75E-16  8.44E-17  1.97E-17  4.59E-18  1.07E-18  2.49E-19
5.81E-20  1.35E-20  3.16E-21  7.36E-22  1.72E-22  4.00E-23  9.33E-24  2.17E-24  5.07E-25  1.18E-25
2.75E-26  6.42E-27  1.50E-27  3.49E-28  8.13E-29  1.90E-29  4.42E-30  1.03E-30  2.40E-31  5.60E-32
1.31E-32  3.04E-33  7.10E-34  1.65E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-55             2.73E+00  7.92E+02  8.06E+01  3.76E+01  1.76E+01  8.20E+00  3.83E+00  1.79E+00
8.35E-01  3.90E-01  1.09E-01  3.08E-02  8.64E-03  2.43E-03  6.82E-04  1.92E-04  5.39E-05  1.51E-05
4.25E-06  1.19E-06  3.36E-07  9.43E-08  2.65E-08  7.45E-09  2.09E-09  5.88E-10  1.65E-10  4.64E-11
1.30E-11  3.66E-12  1.03E-12  2.89E-13  8.13E-14  2.28E-14  6.42E-15  1.80E-15  5.07E-16  1.42E-16
4.00E-17  1.12E-17  3.16E-18  8.87E-19  2.49E-19  7.00E-20  1.97E-20  5.53E-21  1.55E-21  4.36E-22
1.23E-22  3.45E-23  9.68E-24  2.72E-24  7.64E-25  2.15E-25  6.03E-26  1.70E-26  4.76E-27  1.34E-27
3.76E-28  1.06E-28  2.97E-29  8.34E-30  2.34E-30  6.58E-31  5.20E-32  4.10E-33  3.24E-34  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-60             1.50E+06  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
   Gd-148            7.46E+01  5.80E+07  5.33E+07  5.19E+07  5.05E+07  4.91E+07  4.77E+07  4.64E+07
4.51E+07  4.39E+07  4.19E+07  4.00E+07  3.82E+07  3.64E+07  3.48E+07  3.32E+07  3.17E+07  3.03E+07
2.89E+07  2.76E+07  2.63E+07  2.51E+07  2.40E+07  2.29E+07  2.19E+07  2.09E+07  1.99E+07  1.90E+07
1.82E+07  1.73E+07  1.65E+07  1.58E+07  1.51E+07  1.44E+07  1.37E+07  1.31E+07  1.25E+07  1.20E+07
1.14E+07  1.09E+07  1.04E+07  9.92E+06  9.47E+06  9.04E+06  8.63E+06  8.24E+06  7.87E+06  7.51E+06
7.17E+06  6.84E+06  6.53E+06  6.24E+06  5.95E+06  5.68E+06  5.43E+06  5.18E+06  4.94E+06  4.72E+06
4.51E+06  4.30E+06  4.11E+06  3.92E+06  3.74E+06  3.57E+06  3.25E+06  2.97E+06  2.70E+06  2.46E+06
2.24E+06  2.05E+06  1.86E+06  1.70E+06  1.55E+06  1.41E+06  1.29E+06  1.17E+06  1.07E+06  9.73E+05
8.86E+05  8.08E+05  7.36E+05  6.71E+05  6.11E+05  5.57E+05  5.08E+05  4.62E+05  4.21E+05  3.84E+05
3.50E+05  3.19E+05  2.91E+05  2.65E+05  2.41E+05  2.20E+05  2.00E+05  1.83E+05  1.66E+05  1.52E+05
1.38E+05  1.26E+05  1.15E+05  1.05E+05  9.53E+04  8.68E+04  7.21E+04  5.99E+04  4.97E+04  4.13E+04
3.43E+04  2.72E+04  2.16E+04  1.71E+04  1.35E+04  1.07E+04  8.51E+03  6.75E+03  5.35E+03
   H-3               1.23E+01  4.50E+01  2.71E+01  2.29E+01  1.93E+01  1.63E+01  1.38E+01  1.16E+01
9.83E+00  8.30E+00  6.26E+00  4.72E+00  3.56E+00  2.69E+00  2.03E+00  1.53E+00  1.15E+00  8.71E-01
6.57E-01  4.96E-01  3.74E-01  2.82E-01  2.13E-01  1.61E-01  1.21E-01  9.14E-02  6.90E-02  5.20E-02
3.93E-02  2.96E-02  2.23E-02  1.69E-02  1.27E-02  9.60E-03  7.24E-03  5.46E-03  4.12E-03  3.11E-03
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2.35E-03  1.77E-03  1.34E-03  1.01E-03  7.60E-04  5.73E-04  4.33E-04  3.26E-04  2.46E-04  1.86E-04
1.40E-04  1.06E-04  7.98E-05  6.02E-05  4.54E-05  3.43E-05  2.58E-05  1.95E-05  1.47E-05  1.11E-05
8.37E-06  6.32E-06  4.77E-06  3.60E-06  2.71E-06  2.05E-06  1.16E-06  6.63E-07  3.77E-07  2.15E-07
1.22E-07  6.96E-08  3.96E-08  2.25E-08  1.28E-08  7.30E-09  4.16E-09  2.37E-09  1.35E-09  7.67E-10
4.36E-10  2.48E-10  1.41E-10  8.05E-11  4.58E-11  2.61E-11  1.48E-11  8.45E-12  4.81E-12  2.74E-12
1.56E-12  8.87E-13  5.05E-13  2.87E-13  1.64E-13  9.31E-14  5.30E-14  3.02E-14  1.72E-14  9.77E-15
5.56E-15  3.17E-15  1.80E-15  1.03E-15  5.84E-16  3.32E-16  1.08E-16  3.49E-17  1.13E-17  3.66E-18
1.19E-18  2.90E-19  7.08E-20  1.73E-20  4.23E-21  1.03E-21  2.53E-22  6.18E-23  1.51E-23
   Hg-194            4.44E+02  6.38E+06  6.29E+06  6.26E+06  6.23E+06  6.20E+06  6.17E+06  6.15E+06
6.12E+06  6.09E+06  6.04E+06  5.99E+06  5.95E+06  5.90E+06  5.86E+06  5.81E+06  5.76E+06  5.72E+06
5.68E+06  5.63E+06  5.59E+06  5.54E+06  5.50E+06  5.46E+06  5.42E+06  5.37E+06  5.33E+06  5.29E+06
5.25E+06  5.21E+06  5.17E+06  5.13E+06  5.09E+06  5.05E+06  5.01E+06  4.97E+06  4.93E+06  4.89E+06
4.85E+06  4.82E+06  4.78E+06  4.74E+06  4.71E+06  4.67E+06  4.63E+06  4.60E+06  4.56E+06  4.53E+06
4.49E+06  4.46E+06  4.42E+06  4.39E+06  4.35E+06  4.32E+06  4.28E+06  4.25E+06  4.22E+06  4.19E+06
4.15E+06  4.12E+06  4.09E+06  4.06E+06  4.03E+06  3.99E+06  3.93E+06  3.87E+06  3.81E+06  3.75E+06
3.69E+06  3.64E+06  3.58E+06  3.53E+06  3.47E+06  3.42E+06  3.36E+06  3.31E+06  3.26E+06  3.21E+06
3.16E+06  3.11E+06  3.06E+06  3.02E+06  2.97E+06  2.92E+06  2.88E+06  2.83E+06  2.79E+06  2.75E+06
2.70E+06  2.66E+06  2.62E+06  2.58E+06  2.54E+06  2.50E+06  2.46E+06  2.42E+06  2.39E+06  2.35E+06
2.31E+06  2.28E+06  2.24E+06  2.21E+06  2.17E+06  2.14E+06  2.07E+06  2.01E+06  1.95E+06  1.89E+06
1.83E+06  1.76E+06  1.69E+06  1.63E+06  1.57E+06  1.51E+06  1.45E+06  1.39E+06  1.34E+06
   Np-237            2.14E+06  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
   Am-241            4.32E+02  1.80E-02  1.77E-02  1.77E-02  1.76E-02  1.75E-02  1.74E-02  1.73E-02
1.72E-02  1.72E-02  1.70E-02  1.69E-02  1.67E-02  1.66E-02  1.65E-02  1.63E-02  1.62E-02  1.61E-02
1.60E-02  1.58E-02  1.57E-02  1.56E-02  1.55E-02  1.53E-02  1.52E-02  1.51E-02  1.50E-02  1.48E-02
1.47E-02  1.46E-02  1.45E-02  1.44E-02  1.43E-02  1.41E-02  1.40E-02  1.39E-02  1.38E-02  1.37E-02
1.36E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.31E-02  1.30E-02  1.29E-02  1.27E-02  1.26E-02
1.25E-02  1.24E-02  1.23E-02  1.22E-02  1.21E-02  1.21E-02  1.20E-02  1.19E-02  1.18E-02  1.17E-02
1.16E-02  1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.11E-02  1.09E-02  1.08E-02  1.06E-02  1.04E-02
1.03E-02  1.01E-02  9.94E-03  9.78E-03  9.63E-03  9.47E-03  9.32E-03  9.17E-03  9.03E-03  8.89E-03
8.74E-03  8.60E-03  8.47E-03  8.33E-03  8.20E-03  8.07E-03  7.94E-03  7.81E-03  7.69E-03  7.57E-03
7.45E-03  7.33E-03  7.21E-03  7.10E-03  6.98E-03  6.87E-03  6.76E-03  6.66E-03  6.55E-03  6.45E-03
6.34E-03  6.24E-03  6.14E-03  6.05E-03  5.95E-03  5.85E-03  5.67E-03  5.49E-03  5.32E-03  5.15E-03
4.99E-03  4.79E-03  4.60E-03  4.42E-03  4.25E-03  4.08E-03  3.92E-03  3.77E-03  3.62E-03
   Cm-244            1.81E+01  1.80E-02  1.28E-02  1.14E-02  1.01E-02  9.03E-03  8.05E-03  7.18E-03
6.40E-03  5.71E-03  4.71E-03  3.89E-03  3.21E-03  2.65E-03  2.19E-03  1.81E-03  1.49E-03  1.23E-03
1.02E-03  8.41E-04  6.94E-04  5.73E-04  4.73E-04  3.91E-04  3.23E-04  2.67E-04  2.20E-04  1.82E-04
1.50E-04  1.24E-04  1.02E-04  8.45E-05  6.98E-05  5.76E-05  4.76E-05  3.93E-05  3.24E-05  2.68E-05
2.21E-05  1.83E-05  1.51E-05  1.25E-05  1.03E-05  8.49E-06  7.01E-06  5.79E-06  4.78E-06  3.95E-06
3.26E-06  2.69E-06  2.22E-06  1.84E-06  1.52E-06  1.25E-06  1.03E-06  8.53E-07  7.05E-07  5.82E-07
4.80E-07  3.97E-07  3.28E-07  2.70E-07  2.23E-07  1.84E-07  1.26E-07  8.57E-08  5.85E-08  3.99E-08
2.72E-08  1.85E-08  1.26E-08  8.62E-09  5.87E-09  4.01E-09  2.73E-09  1.86E-09  1.27E-09  8.66E-10
5.90E-10  4.03E-10  2.74E-10  1.87E-10  1.28E-10  8.70E-11  5.93E-11  4.04E-11  2.76E-11  1.88E-11
1.28E-11  8.74E-12  5.96E-12  4.06E-12  2.77E-12  1.89E-12  1.29E-12  8.79E-13  5.99E-13  4.08E-13
2.78E-13  1.90E-13  1.29E-13  8.83E-14  6.02E-14  4.10E-14  1.91E-14  8.87E-15  4.12E-15  1.92E-15
8.91E-16  3.42E-16  1.31E-16  5.04E-17  1.94E-17  7.43E-18  2.85E-18  1.10E-18  4.21E-19
   Ho-166m           1.20E+03  3.24E+06  3.22E+06  3.22E+06  3.21E+06  3.21E+06  3.20E+06  3.20E+06
3.19E+06  3.18E+06  3.18E+06  3.17E+06  3.16E+06  3.15E+06  3.14E+06  3.13E+06  3.12E+06  3.11E+06
3.10E+06  3.09E+06  3.08E+06  3.08E+06  3.07E+06  3.06E+06  3.05E+06  3.04E+06  3.03E+06  3.02E+06
3.01E+06  3.01E+06  3.00E+06  2.99E+06  2.98E+06  2.97E+06  2.96E+06  2.95E+06  2.95E+06  2.94E+06
2.93E+06  2.92E+06  2.91E+06  2.90E+06  2.89E+06  2.89E+06  2.88E+06  2.87E+06  2.86E+06  2.85E+06
2.85E+06  2.84E+06  2.83E+06  2.82E+06  2.81E+06  2.80E+06  2.80E+06  2.79E+06  2.78E+06  2.77E+06
2.76E+06  2.76E+06  2.75E+06  2.74E+06  2.73E+06  2.72E+06  2.71E+06  2.69E+06  2.68E+06  2.66E+06
2.65E+06  2.63E+06  2.62E+06  2.60E+06  2.59E+06  2.57E+06  2.56E+06  2.54E+06  2.53E+06  2.51E+06
2.50E+06  2.48E+06  2.47E+06  2.46E+06  2.44E+06  2.43E+06  2.41E+06  2.40E+06  2.39E+06  2.37E+06
2.36E+06  2.34E+06  2.33E+06  2.32E+06  2.30E+06  2.29E+06  2.28E+06  2.26E+06  2.25E+06  2.24E+06
2.23E+06  2.21E+06  2.20E+06  2.19E+06  2.17E+06  2.16E+06  2.14E+06  2.11E+06  2.09E+06  2.06E+06
2.04E+06  2.01E+06  1.98E+06  1.95E+06  1.93E+06  1.90E+06  1.87E+06  1.84E+06  1.82E+06
   I-129             1.57E+07  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03  9.00E-03
```

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   Mn-53            3.74E+06  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
   Na-22            2.60E+00  7.92E+02  7.19E+01  3.23E+01  1.45E+01  6.53E+00  2.93E+00  1.32E+00
5.92E-01  2.66E-01  7.02E-02  1.85E-02  4.88E-03  1.29E-03  3.39E-04  8.95E-05  2.36E-05  6.22E-06
1.64E-06  4.33E-07  1.14E-07  3.01E-08  7.94E-09  2.09E-09  5.52E-10  1.45E-10  3.84E-11  1.01E-11
2.67E-12  7.03E-13  1.85E-13  4.89E-14  1.29E-14  3.40E-15  8.97E-16  2.36E-16  6.24E-17  1.64E-17
4.34E-18  1.14E-18  3.01E-19  7.95E-20  2.10E-20  5.53E-21  1.46E-21  3.84E-22  1.01E-22  2.67E-23
7.05E-24  1.86E-24  4.90E-25  1.29E-25  3.41E-26  8.99E-27  2.37E-27  6.25E-28  1.65E-28  4.34E-29
1.15E-29  3.02E-30  7.97E-31  2.10E-31  5.54E-32  1.46E-32  1.02E-33  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Nb-91            6.80E+02  1.04E+07  1.03E+07  1.03E+07  1.02E+07  1.02E+07  1.02E+07  1.01E+07
1.01E+07  1.01E+07  1.00E+07  9.98E+06  9.93E+06  9.88E+06  9.83E+06  9.78E+06  9.73E+06  9.68E+06
9.63E+06  9.59E+06  9.54E+06  9.49E+06  9.44E+06  9.39E+06  9.34E+06  9.30E+06  9.25E+06  9.20E+06
9.16E+06  9.11E+06  9.06E+06  9.02E+06  8.97E+06  8.93E+06  8.88E+06  8.83E+06  8.79E+06  8.75E+06
8.70E+06  8.66E+06  8.61E+06  8.57E+06  8.53E+06  8.48E+06  8.44E+06  8.40E+06  8.35E+06  8.31E+06
8.27E+06  8.23E+06  8.18E+06  8.14E+06  8.10E+06  8.06E+06  8.02E+06  7.98E+06  7.94E+06  7.90E+06
7.86E+06  7.82E+06  7.78E+06  7.74E+06  7.70E+06  7.66E+06  7.58E+06  7.51E+06  7.43E+06  7.35E+06
7.28E+06  7.21E+06  7.13E+06  7.06E+06  6.99E+06  6.92E+06  6.85E+06  6.78E+06  6.71E+06  6.64E+06
6.57E+06  6.51E+06  6.44E+06  6.38E+06  6.31E+06  6.25E+06  6.18E+06  6.12E+06  6.06E+06  6.00E+06
5.94E+06  5.88E+06  5.82E+06  5.76E+06  5.70E+06  5.64E+06  5.58E+06  5.53E+06  5.47E+06  5.42E+06
5.36E+06  5.31E+06  5.25E+06  5.20E+06  5.15E+06  5.10E+06  4.99E+06  4.89E+06  4.79E+06  4.70E+06
4.60E+06  4.49E+06  4.37E+06  4.26E+06  4.16E+06  4.05E+06  3.95E+06  3.85E+06  3.75E+06
   Nb-92            3.47E+07  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
   Nb-93m           1.61E+01  4.74E+08  3.22E+08  2.83E+08  2.48E+08  2.18E+08  1.92E+08  1.69E+08
1.48E+08  1.30E+08  1.05E+08  8.47E+07  6.83E+07  5.51E+07  4.44E+07  3.58E+07  2.89E+07  2.33E+07
1.88E+07  1.51E+07  1.22E+07  9.84E+06  7.93E+06  6.40E+06  5.16E+06  4.16E+06  3.35E+06  2.70E+06
2.18E+06  1.76E+06  1.42E+06  1.14E+06  9.22E+05  7.43E+05  5.99E+05  4.83E+05  3.90E+05  3.14E+05
2.53E+05  2.04E+05  1.65E+05  1.33E+05  1.07E+05  8.64E+04  6.96E+04  5.61E+04  4.53E+04  3.65E+04
2.94E+04  2.37E+04  1.91E+04  1.54E+04  1.24E+04  1.00E+04  8.09E+03  6.52E+03  5.26E+03  4.24E+03
3.42E+03  2.76E+03  2.22E+03  1.79E+03  1.45E+03  1.17E+03  7.58E+02  4.93E+02  3.20E+02  2.08E+02
1.35E+02  8.80E+01  5.72E+01  3.72E+01  2.42E+01  1.57E+01  1.02E+01  6.65E+00  4.32E+00  2.81E+00
1.83E+00  1.19E+00  7.73E-01  5.02E-01  3.27E-01  2.12E-01  1.38E-01  8.98E-02  5.84E-02  3.79E-02
2.47E-02  1.60E-02  1.04E-02  6.78E-03  4.41E-03  2.87E-03  1.86E-03  1.21E-03  7.88E-04  5.12E-04
3.33E-04  2.16E-04  1.41E-04  9.15E-05  5.95E-05  3.87E-05  1.64E-05  6.91E-06  2.92E-06  1.24E-06
5.22E-07  1.78E-07  6.07E-08  2.07E-08  7.05E-09  2.40E-09  8.19E-10  2.79E-10  9.51E-11
   Nb-94            2.03E+04  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02
2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.33E-02  2.33E-02
2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02
2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02
2.33E-02  2.33E-02  2.33E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02
2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02
2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.31E-02  2.31E-02  2.31E-02
2.31E-02  2.31E-02  2.31E-02  2.31E-02  2.31E-02  2.31E-02  2.31E-02  2.31E-02  2.31E-02  2.31E-02
2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02
2.30E-02  2.30E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02
2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.28E-02  2.28E-02  2.28E-02  2.28E-02  2.28E-02
2.28E-02  2.28E-02  2.27E-02  2.27E-02  2.27E-02  2.27E-02  2.27E-02  2.26E-02  2.26E-02
   Ni-59            7.60E+04  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
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2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01
2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01
   Ni-63            1.00E+02  3.96E+00  3.72E+00  3.64E+00  3.57E+00  3.50E+00  3.42E+00  3.35E+00
3.28E+00  3.22E+00  3.11E+00  3.00E+00  2.90E+00  2.80E+00  2.70E+00  2.61E+00  2.52E+00  2.44E+00
2.35E+00  2.27E+00  2.20E+00  2.12E+00  2.05E+00  1.98E+00  1.91E+00  1.85E+00  1.78E+00  1.72E+00
1.66E+00  1.61E+00  1.55E+00  1.50E+00  1.45E+00  1.40E+00  1.35E+00  1.31E+00  1.26E+00  1.22E+00
1.18E+00  1.14E+00  1.10E+00  1.06E+00  1.02E+00  9.90E-01  9.56E-01  9.24E-01  8.92E-01  8.62E-01
8.32E-01  8.04E-01  7.77E-01  7.50E-01  7.25E-01  7.00E-01  6.76E-01  6.53E-01  6.31E-01  6.09E-01
5.89E-01  5.69E-01  5.49E-01  5.31E-01  5.12E-01  4.95E-01  4.62E-01  4.31E-01  4.02E-01  3.75E-01
3.50E-01  3.27E-01  3.05E-01  2.84E-01  2.65E-01  2.48E-01  2.31E-01  2.15E-01  2.01E-01  1.88E-01
1.75E-01  1.63E-01  1.52E-01  1.42E-01  1.33E-01  1.24E-01  1.15E-01  1.08E-01  1.01E-01  9.38E-02
8.75E-02  8.16E-02  7.62E-02  7.11E-02  6.63E-02  6.19E-02  5.77E-02  5.39E-02  5.03E-02  4.69E-02
4.38E-02  4.08E-02  3.81E-02  3.55E-02  3.32E-02  3.09E-02  2.69E-02  2.34E-02  2.04E-02  1.78E-02
1.55E-02  1.30E-02  1.09E-02  9.20E-03  7.73E-03  6.50E-03  5.47E-03  4.60E-03  3.87E-03
   Os-194           6.00E+00  5.53E+08  1.96E+08  1.38E+08  9.78E+07  6.91E+07  4.89E+07  3.46E+07
2.44E+07  1.73E+07  9.70E+06  5.44E+06  3.05E+06  1.71E+06  9.62E+05  5.40E+05  3.03E+05  1.70E+05
9.55E+04  5.36E+04  3.01E+04  1.69E+04  9.47E+03  5.32E+03  2.98E+03  1.67E+03  9.40E+02  5.27E+02
2.96E+02  1.66E+02  9.32E+01  5.23E+01  2.94E+01  1.65E+01  9.25E+00  5.19E+00  2.91E+00  1.64E+00
9.18E-01  5.15E-01  2.89E-01  1.62E-01  9.10E-02  5.11E-02  2.87E-02  1.61E-02  9.03E-03  5.07E-03
2.85E-03  1.60E-03  8.96E-04  5.03E-04  2.82E-04  1.58E-04  8.89E-05  4.99E-05  2.80E-05  1.57E-05
8.82E-06  4.95E-06  2.78E-06  1.56E-06  8.75E-07  4.91E-07  1.55E-07  4.87E-08  1.53E-08  4.83E-09
1.52E-09  4.80E-10  1.51E-10  4.76E-11  1.50E-11  4.72E-12  1.49E-12  4.68E-13  1.48E-13  4.65E-14
1.46E-14  4.61E-15  1.45E-15  4.57E-16  1.44E-16  4.54E-17  1.43E-17  4.50E-18  1.42E-18  4.47E-19
1.41E-19  4.43E-20  1.40E-20  4.40E-21  1.38E-21  4.36E-22  1.37E-22  4.33E-23  1.36E-23  4.29E-24
1.35E-24  4.26E-25  1.34E-25  4.23E-26  1.33E-26  4.19E-27  4.16E-28  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pa-231           3.28E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04
8.46E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04
8.45E+04  8.45E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04
8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04
8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04
8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.41E+04  8.41E+04  8.41E+04  8.41E+04
8.41E+04  8.41E+04  8.41E+04  8.41E+04  8.41E+04  8.41E+04  8.40E+04  8.40E+04  8.40E+04  8.40E+04
8.40E+04  8.40E+04  8.39E+04  8.39E+04  8.39E+04  8.39E+04  8.39E+04  8.39E+04  8.38E+04  8.38E+04
8.38E+04  8.38E+04  8.38E+04  8.37E+04  8.37E+04  8.37E+04  8.37E+04  8.37E+04  8.37E+04  8.36E+04
8.36E+04  8.36E+04  8.36E+04  8.36E+04  8.36E+04  8.35E+04  8.35E+04  8.35E+04  8.35E+04  8.35E+04
8.34E+04  8.34E+04  8.34E+04  8.34E+04  8.34E+04  8.34E+04  8.33E+04  8.33E+04  8.33E+04  8.32E+04
8.32E+04  8.31E+04  8.31E+04  8.31E+04  8.30E+04  8.30E+04  8.29E+04  8.29E+04  8.28E+04
   Pb-202           5.25E+04  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03
6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03
6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03
6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.09E+03  6.09E+03  6.09E+03
6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.08E+03
6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03
6.08E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03
6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03
6.06E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.04E+03  6.04E+03  6.04E+03
   Pb-210           2.23E+01  1.37E+08  1.04E+08  9.43E+07  8.59E+07  7.83E+07  7.13E+07  6.50E+07
5.92E+07  5.39E+07  4.62E+07  3.95E+07  3.38E+07  2.90E+07  2.48E+07  2.12E+07  1.82E+07  1.56E+07
1.33E+07  1.14E+07  9.76E+06  8.35E+06  7.15E+06  6.12E+06  5.24E+06  4.49E+06  3.84E+06  3.29E+06
2.81E+06  2.41E+06  2.06E+06  1.77E+06  1.51E+06  1.29E+06  1.11E+06  9.48E+05  8.12E+05  6.95E+05
5.95E+05  5.09E+05  4.36E+05  3.73E+05  3.19E+05  2.73E+05  2.34E+05  2.00E+05  1.72E+05  1.47E+05
1.26E+05  1.08E+05  9.21E+04  7.89E+04  6.75E+04  5.78E+04  4.95E+04  4.24E+04  3.63E+04  3.10E+04
2.66E+04  2.27E+04  1.95E+04  1.67E+04  1.43E+04  1.22E+04  8.95E+03  6.56E+03  4.81E+03  3.52E+03
2.58E+03  1.89E+03  1.39E+03  1.02E+03  7.45E+02  5.46E+02  4.00E+02  2.93E+02  2.15E+02  1.57E+02
1.15E+02  8.46E+01  6.20E+01  4.54E+01  3.33E+01  2.44E+01  1.79E+01  1.31E+01  9.60E+00  7.03E+00
5.15E+00  3.78E+00  2.77E+00  2.03E+00  1.49E+00  1.09E+00  7.98E-01  5.85E-01  4.29E-01  3.14E-01
2.30E-01  1.69E-01  1.24E-01  9.06E-02  6.64E-02  4.87E-02  2.61E-02  1.40E-02  7.54E-03  4.05E-03
2.17E-03  1.00E-03  4.60E-04  2.11E-04  9.72E-05  4.47E-05  2.05E-05  9.44E-06  4.34E-06
   Pd-107           6.50E+06  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
   Pm-145           1.77E+01  2.52E+08  1.77E+08  1.58E+08  1.40E+08  1.25E+08  1.11E+08  9.85E+07
8.75E+07  7.78E+07  6.40E+07  5.26E+07  4.33E+07  3.56E+07  2.92E+07  2.40E+07  1.98E+07  1.63E+07
1.34E+07  1.10E+07  9.03E+06  7.43E+06  6.11E+06  5.02E+06  4.13E+06  3.39E+06  2.79E+06  2.29E+06
1.89E+06  1.55E+06  1.27E+06  1.05E+06  8.62E+05  7.08E+05  5.82E+05  4.79E+05  3.94E+05  3.24E+05
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2.66E+05  2.19E+05  1.80E+05  1.48E+05  1.22E+05  1.00E+05  8.22E+04  6.76E+04  5.56E+04  4.57E+04
3.76E+04  3.09E+04  2.54E+04  2.09E+04  1.72E+04  1.41E+04  1.16E+04  9.54E+03  7.84E+03  6.45E+03
5.30E+03  4.36E+03  3.58E+03  2.95E+03  2.42E+03  1.99E+03  1.35E+03  9.10E+02  6.15E+02  4.16E+02
2.81E+02  1.90E+02  1.28E+02  8.68E+01  5.87E+01  3.97E+01  2.68E+01  1.81E+01  1.23E+01  8.28E+00
5.60E+00  3.78E+00  2.56E+00  1.73E+00  1.17E+00  7.90E-01  5.34E-01  3.61E-01  2.44E-01  1.65E-01
1.12E-01  7.54E-02  5.10E-02  3.44E-02  2.33E-02  1.57E-02  1.06E-02  7.19E-03  4.86E-03  3.29E-03
2.22E-03  1.50E-03  1.02E-03  6.86E-04  4.64E-04  3.14E-04  1.43E-04  6.55E-05  2.99E-05  1.37E-05
6.24E-06  2.35E-06  8.81E-07  3.31E-07  1.24E-07  4.67E-08  1.76E-08  6.60E-09  2.48E-09
   Pm-147            2.62E+00  7.92E+02  7.32E+01  3.31E+01  1.50E+01  6.77E+00  3.06E+00  1.38E+00
6.26E-01  2.83E-01  7.54E-02  2.01E-02  5.35E-03  1.43E-03  3.80E-04  1.01E-04  2.69E-05  7.18E-06
1.91E-06  5.09E-07  1.36E-07  3.61E-08  9.63E-09  2.56E-09  6.83E-10  1.82E-10  4.85E-11  1.29E-11
3.44E-12  9.16E-13  2.44E-13  6.50E-14  1.73E-14  4.62E-15  1.23E-15  3.28E-16  8.72E-17  2.32E-17
6.19E-18  1.65E-18  4.39E-19  1.17E-19  3.12E-20  8.30E-21  2.21E-21  5.89E-22  1.57E-22  4.18E-23
1.11E-23  2.97E-24  7.91E-25  2.11E-25  5.61E-26  1.49E-26  3.98E-27  1.06E-27  2.83E-28  7.53E-29
2.00E-29  5.34E-30  1.42E-30  3.79E-31  1.01E-31  2.69E-32  1.91E-33  1.35E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-208            2.90E+00  7.92E+02  9.21E+01  4.50E+01  2.20E+01  1.07E+01  5.23E+00  2.56E+00
1.25E+00  6.09E-01  1.84E-01  5.58E-02  1.69E-02  5.11E-03  1.55E-03  4.68E-04  1.42E-04  4.29E-05
1.30E-05  3.93E-06  1.19E-06  3.60E-07  1.09E-07  3.30E-08  9.99E-09  3.02E-09  9.15E-10  2.77E-10
8.38E-11  2.54E-11  7.68E-12  2.32E-12  7.03E-13  2.13E-13  6.44E-14  1.95E-14  5.90E-15  1.79E-15
5.41E-16  1.64E-16  4.96E-17  1.50E-17  4.54E-18  1.37E-18  4.16E-19  1.26E-19  3.81E-20  1.15E-20
3.49E-21  1.06E-21  3.20E-22  9.68E-23  2.93E-23  8.87E-24  2.68E-24  8.13E-25  2.46E-25  7.44E-26
2.25E-26  6.82E-27  2.06E-27  6.25E-28  1.89E-28  5.72E-29  5.24E-30  4.80E-31  4.40E-32  4.03E-33
3.69E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-209            1.02E+02  3.02E+07  2.84E+07  2.78E+07  2.73E+07  2.67E+07  2.62E+07  2.57E+07
2.51E+07  2.46E+07  2.38E+07  2.30E+07  2.22E+07  2.15E+07  2.08E+07  2.01E+07  1.94E+07  1.88E+07
1.81E+07  1.75E+07  1.69E+07  1.64E+07  1.58E+07  1.53E+07  1.48E+07  1.43E+07  1.38E+07  1.34E+07
1.29E+07  1.25E+07  1.21E+07  1.17E+07  1.13E+07  1.09E+07  1.05E+07  1.02E+07  9.84E+06  9.51E+06
9.19E+06  8.89E+06  8.59E+06  8.30E+06  8.03E+06  7.76E+06  7.50E+06  7.25E+06  7.01E+06  6.77E+06
6.55E+06  6.33E+06  6.12E+06  5.91E+06  5.71E+06  5.52E+06  5.34E+06  5.16E+06  4.99E+06  4.82E+06
4.66E+06  4.50E+06  4.35E+06  4.21E+06  4.07E+06  3.93E+06  3.67E+06  3.43E+06  3.21E+06  3.00E+06
2.80E+06  2.62E+06  2.44E+06  2.28E+06  2.13E+06  1.99E+06  1.86E+06  1.74E+06  1.63E+06  1.52E+06
1.42E+06  1.33E+06  1.24E+06  1.16E+06  1.08E+06  1.01E+06  9.44E+05  8.82E+05  8.24E+05  7.70E+05
7.19E+05  6.72E+05  6.28E+05  5.86E+05  5.48E+05  5.12E+05  4.78E+05  4.47E+05  4.18E+05  3.90E+05
3.64E+05  3.41E+05  3.18E+05  2.97E+05  2.78E+05  2.59E+05  2.27E+05  1.98E+05  1.73E+05  1.51E+05
1.32E+05  1.11E+05  9.36E+04  7.90E+04  6.67E+04  5.62E+04  4.75E+04  4.00E+04  3.38E+04
   Pt-193            5.00E+01  6.66E+07  5.88E+07  5.64E+07  5.41E+07  5.19E+07  4.98E+07  4.78E+07
4.58E+07  4.39E+07  4.10E+07  3.83E+07  3.57E+07  3.33E+07  3.11E+07  2.90E+07  2.70E+07  2.52E+07
2.35E+07  2.20E+07  2.05E+07  1.91E+07  1.78E+07  1.67E+07  1.55E+07  1.45E+07  1.35E+07  1.26E+07
1.18E+07  1.10E+07  1.02E+07  9.56E+06  8.92E+06  8.33E+06  7.77E+06  7.25E+06  6.76E+06  6.31E+06
5.89E+06  5.49E+06  5.12E+06  4.78E+06  4.46E+06  4.16E+06  3.88E+06  3.62E+06  3.38E+06  3.15E+06
2.94E+06  2.75E+06  2.56E+06  2.39E+06  2.23E+06  2.08E+06  1.94E+06  1.81E+06  1.69E+06  1.58E+06
1.47E+06  1.37E+06  1.28E+06  1.20E+06  1.12E+06  1.04E+06  9.06E+05  7.89E+05  6.87E+05  5.98E+05
5.20E+05  4.53E+05  3.94E+05  3.43E+05  2.99E+05  2.60E+05  2.26E+05  1.97E+05  1.72E+05  1.49E+05
1.30E+05  1.13E+05  9.86E+04  8.58E+04  7.47E+04  6.50E+04  5.66E+04  4.93E+04  4.29E+04  3.74E+04
3.25E+04  2.83E+04  2.46E+04  2.15E+04  1.87E+04  1.63E+04  1.42E+04  1.23E+04  1.07E+04  9.34E+03
8.13E+03  7.08E+03  6.16E+03  5.36E+03  4.67E+03  4.06E+03  3.08E+03  2.33E+03  1.77E+03  1.34E+03
1.02E+03  7.19E+02  5.08E+02  3.59E+02  2.54E+02  1.80E+02  1.27E+02  8.98E+01  6.35E+01
        NUCLIDE HALFLIFE AND INVENTORY (CI) REMAINING IN THE FACILITY
 (TIMES IN YEARS) HALFLIFE         6.         9.        12.        15.        18.        21.        24.
27.        30.        35.        40.        45.        50.        55.        60.        65.        70.
75.        80.        85.        90.        95.       100.       105.       110.       115.       120.
125.       130.       135.       140.       145.       150.       155.       160.       165.       170.
175.       180.       185.       190.       195.       200.       205.       210.       215.       220.
225.       230.       235.       240.       245.       250.       255.       260.       265.       270.
275.       280.       285.       290.       295.       300.       310.       320.       330.       340.
350.       360.       370.       380.       390.       400.       410.       420.       430.       440.
450.       460.       470.       480.       490.       500.       510.       520.       530.       540.
550.       560.       570.       580.       590.       600.       610.       620.       630.       640.
650.       660.       670.       680.       690.       700.       720.       740.       760.       780.
800.       825.       850.       875.       900.       925.       950.       975.      1000.
   Ac-227            2.18E+01  1.30E+08  9.76E+07  8.86E+07  8.06E+07  7.32E+07  6.65E+07  6.04E+07
5.49E+07  4.99E+07  4.26E+07  3.63E+07  3.09E+07  2.64E+07  2.25E+07  1.92E+07  1.63E+07  1.39E+07
1.19E+07  1.01E+07  8.63E+06  7.36E+06  6.27E+06  5.35E+06  4.56E+06  3.89E+06  3.31E+06  2.83E+06
2.41E+06  2.05E+06  1.75E+06  1.49E+06  1.27E+06  1.09E+06  9.25E+05  7.89E+05  6.72E+05  5.73E+05
4.89E+05  4.17E+05  3.55E+05  3.03E+05  2.58E+05  2.20E+05  1.88E+05  1.60E+05  1.36E+05  1.16E+05
9.91E+04  8.45E+04  7.21E+04  6.14E+04  5.24E+04  4.46E+04  3.81E+04  3.25E+04  2.77E+04  2.36E+04
2.01E+04  1.71E+04  1.46E+04  1.25E+04  1.06E+04  9.06E+03  6.58E+03  4.78E+03  3.48E+03  2.53E+03
1.84E+03  1.34E+03  9.71E+02  7.05E+02  5.13E+02  3.73E+02  2.71E+02  1.97E+02  1.43E+02  1.04E+02
7.56E+01  5.49E+01  3.99E+01  2.90E+01  2.11E+01  1.53E+01  1.11E+01  8.10E+00  5.89E+00  4.28E+00
3.11E+00  2.26E+00  1.64E+00  1.19E+00  8.68E-01  6.31E-01  4.59E-01  3.33E-01  2.42E-01  1.76E-01
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1.28E-01  9.30E-02  6.76E-02  4.92E-02  3.57E-02  2.60E-02  1.37E-02  7.25E-03  3.83E-03  2.02E-03
1.07E-03  4.81E-04  2.17E-04  9.76E-05  4.40E-05  1.98E-05  8.92E-06  4.02E-06  1.81E-06
   Ag-108m          4.18E+02  4.69E+07  4.61E+07  4.59E+07  4.56E+07  4.54E+07  4.51E+07  4.49E+07
4.46E+07  4.44E+07  4.40E+07  4.36E+07  4.32E+07  4.28E+07  4.24E+07  4.20E+07  4.16E+07  4.12E+07
4.09E+07  4.05E+07  4.01E+07  3.97E+07  3.94E+07  3.90E+07  3.87E+07  3.83E+07  3.80E+07  3.76E+07
3.73E+07  3.69E+07  3.66E+07  3.62E+07  3.59E+07  3.56E+07  3.53E+07  3.49E+07  3.46E+07  3.43E+07
3.40E+07  3.37E+07  3.34E+07  3.31E+07  3.28E+07  3.25E+07  3.22E+07  3.19E+07  3.16E+07  3.13E+07
3.10E+07  3.07E+07  3.04E+07  3.01E+07  2.99E+07  2.96E+07  2.93E+07  2.91E+07  2.88E+07  2.85E+07
2.83E+07  2.80E+07  2.78E+07  2.75E+07  2.72E+07  2.70E+07  2.65E+07  2.60E+07  2.55E+07  2.51E+07
2.46E+07  2.42E+07  2.37E+07  2.33E+07  2.29E+07  2.25E+07  2.20E+07  2.16E+07  2.12E+07  2.09E+07
2.05E+07  2.01E+07  1.97E+07  1.94E+07  1.90E+07  1.87E+07  1.83E+07  1.80E+07  1.77E+07  1.74E+07
1.70E+07  1.67E+07  1.64E+07  1.61E+07  1.58E+07  1.55E+07  1.53E+07  1.50E+07  1.47E+07  1.44E+07
1.42E+07  1.39E+07  1.37E+07  1.34E+07  1.32E+07  1.29E+07  1.25E+07  1.20E+07  1.16E+07  1.12E+07
1.08E+07  1.03E+07  9.81E+06  9.36E+06  8.94E+06  8.54E+06  8.16E+06  7.79E+06  7.44E+06
   Al-26            7.40E+05  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04
3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04
3.34E+04  3.34E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04
3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.32E+04
3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04
3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.31E+04  3.31E+04  3.31E+04  3.31E+04
3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.30E+04
3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.29E+04  3.29E+04  3.29E+04  3.29E+04  3.29E+04  3.29E+04
3.29E+04  3.29E+04  3.29E+04  3.28E+04  3.28E+04  3.28E+04  3.28E+04  3.28E+04  3.28E+04  3.28E+04
3.28E+04  3.28E+04  3.27E+04  3.27E+04  3.27E+04  3.27E+04  3.27E+04  3.27E+04  3.26E+04  3.26E+04
3.26E+04  3.26E+04  3.25E+04  3.25E+04  3.25E+04  3.25E+04  3.24E+04  3.24E+04  3.24E+04
   Am-242m          1.41E+02  1.80E-02  1.71E-02  1.69E-02  1.66E-02  1.63E-02  1.61E-02  1.58E-02
1.56E-02  1.53E-02  1.49E-02  1.45E-02  1.41E-02  1.37E-02  1.34E-02  1.30E-02  1.27E-02  1.23E-02
1.20E-02  1.17E-02  1.14E-02  1.11E-02  1.08E-02  1.05E-02  1.02E-02  9.94E-03  9.67E-03  9.41E-03
9.16E-03  8.92E-03  8.68E-03  8.45E-03  8.22E-03  8.01E-03  7.79E-03  7.58E-03  7.38E-03  7.19E-03
6.99E-03  6.81E-03  6.63E-03  6.45E-03  6.28E-03  6.11E-03  5.95E-03  5.79E-03  5.63E-03  5.48E-03
5.34E-03  5.20E-03  5.06E-03  4.92E-03  4.79E-03  4.66E-03  4.54E-03  4.42E-03  4.30E-03  4.19E-03
4.07E-03  3.97E-03  3.86E-03  3.76E-03  3.66E-03  3.56E-03  3.37E-03  3.20E-03  3.03E-03  2.87E-03
2.72E-03  2.57E-03  2.44E-03  2.31E-03  2.19E-03  2.07E-03  1.97E-03  1.86E-03  1.76E-03  1.67E-03
1.58E-03  1.50E-03  1.42E-03  1.35E-03  1.28E-03  1.21E-03  1.14E-03  1.08E-03  1.03E-03  9.74E-04
9.22E-04  8.74E-04  8.28E-04  7.84E-04  7.43E-04  7.04E-04  6.67E-04  6.32E-04  5.99E-04  5.67E-04
5.37E-04  5.09E-04  4.82E-04  4.57E-04  4.33E-04  4.10E-04  3.68E-04  3.31E-04  2.97E-04  2.66E-04
2.39E-04  2.09E-04  1.82E-04  1.59E-04  1.39E-04  1.22E-04  1.06E-04  9.29E-05  8.11E-05
   Am-243           7.37E+03  1.80E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02
1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02
1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.63E-02
1.63E-02  1.62E-02  1.62E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02  1.59E-02  1.58E-02
1.58E-02  1.58E-02  1.57E-02  1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.55E-02  1.54E-02  1.54E-02
1.53E-02  1.53E-02  1.53E-02  1.52E-02  1.52E-02  1.51E-02  1.50E-02  1.50E-02  1.49E-02  1.48E-02
1.47E-02  1.46E-02  1.45E-02  1.44E-02  1.44E-02  1.43E-02  1.42E-02  1.41E-02  1.40E-02  1.39E-02
1.39E-02  1.38E-02  1.37E-02  1.36E-02  1.35E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.32E-02
1.31E-02  1.30E-02  1.29E-02  1.29E-02  1.28E-02  1.27E-02  1.26E-02  1.26E-02  1.25E-02  1.24E-02
1.23E-02  1.23E-02  1.22E-02  1.21E-02  1.21E-02  1.20E-02  1.19E-02  1.17E-02  1.16E-02  1.14E-02
1.13E-02  1.12E-02  1.10E-02  1.08E-02  1.07E-02  1.05E-02  1.04E-02  1.02E-02  1.01E-02
   Ba-133           1.05E+01  4.61E+08  2.54E+08  2.09E+08  1.71E+08  1.40E+08  1.15E+08  9.44E+07
7.75E+07  6.35E+07  4.57E+07  3.28E+07  2.36E+07  1.69E+07  1.22E+07  8.75E+06  6.29E+06  4.52E+06
3.25E+06  2.34E+06  1.68E+06  1.21E+06  8.67E+05  6.23E+05  4.48E+05  3.22E+05  2.31E+05  1.66E+05
1.19E+05  8.59E+04  6.17E+04  4.44E+04  3.19E+04  2.29E+04  1.65E+04  1.18E+04  8.50E+03  6.11E+03
4.39E+03  3.16E+03  2.27E+03  1.63E+03  1.17E+03  8.42E+02  6.05E+02  4.35E+02  3.13E+02  2.25E+02
1.62E+02  1.16E+02  8.34E+01  6.00E+01  4.31E+01  3.10E+01  2.23E+01  1.60E+01  1.15E+01  8.26E+00
5.94E+00  4.27E+00  3.07E+00  2.20E+00  1.58E+00  1.14E+00  5.88E-01  3.04E-01  1.57E-01  8.10E-02
4.19E-02  2.16E-02  1.12E-02  5.77E-03  2.98E-03  1.54E-03  7.95E-04  4.11E-04  2.12E-04  1.10E-04
5.66E-05  2.92E-05  1.51E-05  7.80E-06  4.03E-06  2.08E-06  1.07E-06  5.55E-07  2.87E-07  1.48E-07
7.65E-08  3.95E-08  2.04E-08  1.05E-08  5.44E-09  2.81E-09  1.45E-09  7.50E-10  3.87E-10  2.00E-10
1.03E-10  5.34E-11  2.76E-11  1.42E-11  7.36E-12  3.80E-12  1.01E-12  2.71E-13  7.22E-14  1.93E-14
5.14E-15  9.85E-16  1.89E-16  3.62E-17  6.94E-18  1.33E-18  2.55E-19  4.90E-20  9.39E-21
   Be-10            1.51E+06  3.96E+04  3.95E+04  3.95E+04  3.95E+04  3.95E+04  3.94E+04  3.94E+04
3.94E+04  3.94E+04  3.93E+04  3.93E+04  3.92E+04  3.92E+04  3.92E+04  3.91E+04  3.91E+04  3.91E+04
3.90E+04  3.90E+04  3.89E+04  3.89E+04  3.89E+04  3.88E+04  3.88E+04  3.87E+04  3.87E+04  3.87E+04
3.86E+04  3.86E+04  3.86E+04  3.85E+04  3.85E+04  3.84E+04  3.84E+04  3.84E+04  3.83E+04  3.83E+04
3.82E+04  3.82E+04  3.82E+04  3.81E+04  3.81E+04  3.81E+04  3.80E+04  3.80E+04  3.79E+04  3.79E+04
3.79E+04  3.78E+04  3.78E+04  3.78E+04  3.77E+04  3.77E+04  3.76E+04  3.76E+04  3.76E+04  3.75E+04
3.75E+04  3.75E+04  3.74E+04  3.74E+04  3.73E+04  3.73E+04  3.72E+04  3.72E+04  3.71E+04  3.70E+04
3.69E+04  3.69E+04  3.68E+04  3.67E+04  3.67E+04  3.66E+04  3.65E+04  3.64E+04  3.64E+04  3.63E+04
3.62E+04  3.61E+04  3.61E+04  3.60E+04  3.59E+04  3.59E+04  3.58E+04  3.57E+04  3.56E+04  3.56E+04
3.55E+04  3.54E+04  3.54E+04  3.53E+04  3.52E+04  3.52E+04  3.51E+04  3.50E+04  3.49E+04  3.49E+04
3.48E+04  3.47E+04  3.47E+04  3.46E+04  3.45E+04  3.45E+04  3.43E+04  3.42E+04  3.41E+04  3.39E+04
3.38E+04  3.36E+04  3.35E+04  3.33E+04  3.31E+04  3.30E+04  3.28E+04  3.26E+04  3.25E+04
   Bi-207           3.16E+01  9.66E+07  7.89E+07  7.38E+07  6.90E+07  6.45E+07  6.03E+07  5.64E+07
5.27E+07  4.93E+07  4.41E+07  3.94E+07  3.52E+07  3.15E+07  2.81E+07  2.52E+07  2.25E+07  2.01E+07
1.80E+07  1.61E+07  1.44E+07  1.28E+07  1.15E+07  1.03E+07  9.17E+06  8.20E+06  7.33E+06  6.55E+06
5.86E+06  5.24E+06  4.68E+06  4.19E+06  3.74E+06  3.34E+06  2.99E+06  2.67E+06  2.39E+06  2.14E+06
1.91E+06  1.71E+06  1.53E+06  1.36E+06  1.22E+06  1.09E+06  9.75E+05  8.71E+05  7.79E+05  6.96E+05
6.22E+05  5.56E+05  4.97E+05  4.45E+05  3.97E+05  3.55E+05  3.18E+05  2.84E+05  2.54E+05  2.27E+05
```

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2.03E+05  1.81E+05  1.62E+05  1.45E+05  1.30E+05  1.16E+05  9.26E+04  7.40E+04  5.91E+04  4.72E+04
3.77E+04  3.02E+04  2.41E+04  1.93E+04  1.54E+04  1.23E+04  9.83E+03  7.86E+03  6.28E+03  5.02E+03
4.01E+03  3.20E+03  2.56E+03  2.05E+03  1.64E+03  1.31E+03  1.04E+03  8.35E+02  6.67E+02  5.33E+02
4.26E+02  3.40E+02  2.72E+02  2.17E+02  1.74E+02  1.39E+02  1.11E+02  8.87E+01  7.09E+01  5.66E+01
4.53E+01  3.62E+01  2.89E+01  2.31E+01  1.85E+01  1.48E+01  9.42E+00  6.02E+00  3.84E+00  2.45E+00
1.57E+00  8.95E-01  5.11E-01  2.92E-01  1.66E-01  9.50E-02  5.43E-02  3.10E-02  1.77E-02
   Bi-210m          3.04E+06  1.02E+03  1.02E+03  1.01E+03  1.01E+03  1.01E+03  1.01E+03  1.01E+03
1.01E+03  1.01E+03  1.00E+03  1.00E+03  9.98E+02  9.96E+02  9.93E+02  9.91E+02  9.88E+02  9.86E+02
9.83E+02  9.81E+02  9.79E+02  9.76E+02  9.74E+02  9.72E+02  9.69E+02  9.67E+02  9.65E+02  9.62E+02
9.60E+02  9.58E+02  9.55E+02  9.53E+02  9.51E+02  9.48E+02  9.46E+02  9.44E+02  9.41E+02  9.39E+02
9.37E+02  9.35E+02  9.32E+02  9.30E+02  9.28E+02  9.25E+02  9.23E+02  9.21E+02  9.19E+02  9.17E+02
9.14E+02  9.12E+02  9.10E+02  9.08E+02  9.05E+02  9.03E+02  9.01E+02  8.99E+02  8.97E+02  8.95E+02
8.92E+02  8.90E+02  8.88E+02  8.86E+02  8.84E+02  8.82E+02  8.77E+02  8.73E+02  8.69E+02  8.65E+02
8.60E+02  8.56E+02  8.52E+02  8.48E+02  8.44E+02  8.40E+02  8.36E+02  8.32E+02  8.28E+02  8.24E+02
8.20E+02  8.16E+02  8.12E+02  8.08E+02  8.04E+02  8.00E+02  7.96E+02  7.92E+02  7.88E+02  7.84E+02
7.81E+02  7.77E+02  7.73E+02  7.69E+02  7.66E+02  7.62E+02  7.58E+02  7.55E+02  7.51E+02  7.47E+02
7.44E+02  7.40E+02  7.36E+02  7.33E+02  7.29E+02  7.26E+02  7.19E+02  7.12E+02  7.05E+02  6.98E+02
6.91E+02  6.83E+02  6.75E+02  6.67E+02  6.58E+02  6.51E+02  6.43E+02  6.35E+02  6.27E+02
   Bk-247           1.40E+03  1.17E-08  9.97E-09  9.45E-09  8.96E-09  8.49E-09  8.05E-09  7.63E-09
7.24E-09  6.86E-09  6.28E-09  5.74E-09  5.25E-09  4.81E-09  4.40E-09  4.02E-09  3.68E-09  3.37E-09
3.08E-09  2.82E-09  2.58E-09  2.36E-09  2.16E-09  1.97E-09  1.81E-09  1.65E-09  1.51E-09  1.38E-09
1.27E-09  1.16E-09  1.06E-09  9.69E-10  8.86E-10  8.11E-10  7.42E-10  6.79E-10  6.21E-10  5.68E-10
5.20E-10  4.75E-10  4.35E-10  3.98E-10  3.64E-10  3.33E-10  3.05E-10  2.79E-10  2.55E-10  2.33E-10
2.13E-10  1.95E-10  1.79E-10  1.63E-10  1.50E-10  1.37E-10  1.25E-10  1.15E-10  1.05E-10  9.58E-11
8.77E-11  8.02E-11  7.34E-11  6.71E-11  6.14E-11  5.62E-11  4.70E-11  3.94E-11  3.29E-11  2.76E-11
2.31E-11  1.93E-11  1.62E-11  1.35E-11  1.13E-11  9.48E-12  7.94E-12  6.64E-12  5.56E-12  4.65E-12
3.89E-12  3.26E-12  2.73E-12  2.28E-12  1.91E-12  1.60E-12  1.34E-12  1.12E-12  9.38E-13  7.85E-13
6.57E-13  5.50E-13  4.60E-13  3.85E-13  3.22E-13  2.70E-13  2.26E-13  1.89E-13  1.58E-13  1.32E-13
1.11E-13  9.28E-14  7.77E-14  6.50E-14  5.44E-14  4.55E-14  3.19E-14  2.23E-14  1.57E-14  1.10E-14
7.68E-15  4.92E-15  3.16E-15  2.02E-15  1.30E-15  8.31E-16  5.32E-16  3.41E-16  2.19E-16
   C-14             5.73E+03  9.00E+00  8.99E+00  8.98E+00  8.98E+00  8.97E+00  8.97E+00  8.96E+00
8.96E+00  8.95E+00  8.94E+00  8.94E+00  8.93E+00  8.92E+00  8.91E+00  8.90E+00  8.90E+00  8.89E+00
8.88E+00  8.87E+00  8.86E+00  8.86E+00  8.85E+00  8.84E+00  8.83E+00  8.82E+00  8.82E+00  8.81E+00
8.80E+00  8.79E+00  8.78E+00  8.78E+00  8.77E+00  8.76E+00  8.75E+00  8.75E+00  8.74E+00  8.73E+00
8.72E+00  8.71E+00  8.71E+00  8.70E+00  8.69E+00  8.68E+00  8.67E+00  8.67E+00  8.66E+00  8.65E+00
8.64E+00  8.64E+00  8.63E+00  8.62E+00  8.61E+00  8.61E+00  8.60E+00  8.59E+00  8.58E+00  8.57E+00
8.57E+00  8.56E+00  8.55E+00  8.54E+00  8.54E+00  8.53E+00  8.51E+00  8.50E+00  8.48E+00  8.47E+00
8.45E+00  8.44E+00  8.42E+00  8.41E+00  8.39E+00  8.38E+00  8.36E+00  8.35E+00  8.33E+00  8.32E+00
8.30E+00  8.29E+00  8.27E+00  8.26E+00  8.24E+00  8.23E+00  8.21E+00  8.20E+00  8.18E+00  8.17E+00
8.15E+00  8.14E+00  8.12E+00  8.11E+00  8.10E+00  8.08E+00  8.07E+00  8.05E+00  8.04E+00  8.02E+00
8.01E+00  7.99E+00  7.98E+00  7.97E+00  7.95E+00  7.94E+00  7.91E+00  7.88E+00  7.85E+00  7.82E+00
7.80E+00  7.76E+00  7.73E+00  7.69E+00  7.66E+00  7.62E+00  7.59E+00  7.56E+00  7.52E+00
   Ca-41            1.03E+05  6.35E-02  5.99E-02  5.88E-02  5.77E-02  5.66E-02  5.55E-02  5.44E-02
5.34E-02  5.24E-02  5.07E-02  4.91E-02  4.76E-02  4.60E-02  4.46E-02  4.32E-02  4.18E-02  4.05E-02
3.92E-02  3.80E-02  3.68E-02  3.56E-02  3.45E-02  3.34E-02  3.23E-02  3.13E-02  3.03E-02  2.94E-02
2.84E-02  2.75E-02  2.67E-02  2.58E-02  2.50E-02  2.42E-02  2.35E-02  2.27E-02  2.20E-02  2.13E-02
2.06E-02  2.00E-02  1.93E-02  1.87E-02  1.81E-02  1.76E-02  1.70E-02  1.65E-02  1.59E-02  1.54E-02
1.50E-02  1.45E-02  1.40E-02  1.36E-02  1.32E-02  1.27E-02  1.23E-02  1.19E-02  1.16E-02  1.12E-02
1.08E-02  1.05E-02  1.02E-02  9.85E-03  9.54E-03  9.24E-03  8.66E-03  8.12E-03  7.62E-03  7.14E-03
6.70E-03  6.28E-03  5.89E-03  5.52E-03  5.18E-03  4.86E-03  4.55E-03  4.27E-03  4.01E-03  3.76E-03
3.52E-03  3.30E-03  3.10E-03  2.90E-03  2.72E-03  2.55E-03  2.40E-03  2.25E-03  2.11E-03  1.98E-03
1.85E-03  1.74E-03  1.63E-03  1.53E-03  1.43E-03  1.34E-03  1.26E-03  1.18E-03  1.11E-03  1.04E-03
9.74E-04  9.13E-04  8.57E-04  8.03E-04  7.53E-04  7.06E-04  6.21E-04  5.46E-04  4.80E-04  4.22E-04
3.71E-04  3.16E-04  2.69E-04  2.29E-04  1.95E-04  1.66E-04  1.42E-04  1.21E-04  1.03E-04
   Cd-113           9.30E+15  7.75E-07  7.72E-07  7.70E-07  7.69E-07  7.68E-07  7.67E-07  7.66E-07
7.65E-07  7.64E-07  7.62E-07  7.60E-07  7.58E-07  7.56E-07  7.55E-07  7.53E-07  7.51E-07  7.49E-07
7.47E-07  7.45E-07  7.44E-07  7.42E-07  7.40E-07  7.38E-07  7.36E-07  7.35E-07  7.33E-07  7.31E-07
7.29E-07  7.28E-07  7.26E-07  7.24E-07  7.22E-07  7.21E-07  7.19E-07  7.17E-07  7.15E-07  7.14E-07
7.12E-07  7.10E-07  7.08E-07  7.07E-07  7.05E-07  7.03E-07  7.02E-07  7.00E-07  6.98E-07  6.96E-07
6.95E-07  6.93E-07  6.91E-07  6.90E-07  6.88E-07  6.86E-07  6.85E-07  6.83E-07  6.81E-07  6.80E-07
6.78E-07  6.76E-07  6.75E-07  6.73E-07  6.71E-07  6.70E-07  6.67E-07  6.63E-07  6.60E-07  6.57E-07
6.54E-07  6.51E-07  6.47E-07  6.44E-07  6.41E-07  6.38E-07  6.35E-07  6.32E-07  6.29E-07  6.26E-07
6.23E-07  6.20E-07  6.17E-07  6.14E-07  6.11E-07  6.08E-07  6.05E-07  6.02E-07  5.99E-07  5.96E-07
5.93E-07  5.90E-07  5.87E-07  5.85E-07  5.82E-07  5.79E-07  5.76E-07  5.73E-07  5.71E-07  5.68E-07
5.65E-07  5.62E-07  5.60E-07  5.57E-07  5.54E-07  5.52E-07  5.46E-07  5.41E-07  5.36E-07  5.30E-07
5.25E-07  5.19E-07  5.13E-07  5.07E-07  5.00E-07  4.94E-07  4.88E-07  4.83E-07  4.77E-07
   Cd-113m          1.41E+01  4.04E+08  2.58E+08  2.23E+08  1.92E+08  1.65E+08  1.42E+08  1.23E+08
1.06E+08  9.11E+07  7.11E+07  5.55E+07  4.33E+07  3.38E+07  2.63E+07  2.05E+07  1.60E+07  1.25E+07
9.76E+06  7.61E+06  5.94E+06  4.63E+06  3.62E+06  2.82E+06  2.20E+06  1.72E+06  1.34E+06  1.04E+06
8.15E+05  6.36E+05  4.96E+05  3.87E+05  3.02E+05  2.36E+05  1.84E+05  1.43E+05  1.12E+05  8.73E+04
6.81E+04  5.31E+04  4.15E+04  3.23E+04  2.52E+04  1.97E+04  1.54E+04  1.20E+04  9.35E+03  7.29E+03
5.69E+03  4.44E+03  3.46E+03  2.70E+03  2.11E+03  1.65E+03  1.28E+03  1.00E+03  7.81E+02  6.10E+02
4.76E+02  3.71E+02  2.89E+02  2.26E+02  1.76E+02  1.37E+02  8.37E+01  5.09E+01  3.10E+01  1.89E+01
1.15E+01  6.99E+00  4.26E+00  2.59E+00  1.58E+00  9.60E-01  5.84E-01  3.56E-01  2.16E-01  1.32E-01
8.02E-02  4.88E-02  2.97E-02  1.81E-02  1.10E-02  6.70E-03  4.08E-03  2.48E-03  1.51E-03  9.20E-04
5.60E-04  3.41E-04  2.07E-04  1.26E-04  7.68E-05  4.68E-05  2.85E-05  1.73E-05  1.05E-05  6.42E-06
3.91E-06  2.38E-06  1.45E-06  8.81E-07  5.36E-07  3.26E-07  1.21E-07  4.48E-08  1.66E-08  6.15E-09
2.28E-09  6.59E-10  1.90E-10  5.51E-11  1.59E-11  4.60E-12  1.33E-12  3.84E-13  1.11E-13
   Cf-249           3.51E+02  1.80E-02  1.76E-02  1.75E-02  1.74E-02  1.73E-02  1.72E-02  1.71E-02
1.70E-02  1.68E-02  1.67E-02  1.65E-02  1.63E-02  1.61E-02  1.59E-02  1.58E-02  1.56E-02  1.54E-02
```

```
1.52E-02  1.51E-02  1.49E-02  1.47E-02  1.46E-02  1.44E-02  1.43E-02  1.41E-02  1.39E-02  1.38E-02
1.36E-02  1.35E-02  1.33E-02  1.32E-02  1.30E-02  1.29E-02  1.28E-02  1.26E-02  1.25E-02  1.23E-02
1.22E-02  1.21E-02  1.19E-02  1.18E-02  1.17E-02  1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.10E-02
1.09E-02  1.08E-02  1.07E-02  1.06E-02  1.04E-02  1.03E-02  1.02E-02  1.01E-02  9.99E-03  9.88E-03
9.77E-03  9.66E-03  9.56E-03  9.45E-03  9.35E-03  9.24E-03  9.04E-03  8.84E-03  8.65E-03  8.46E-03
8.27E-03  8.09E-03  7.91E-03  7.74E-03  7.57E-03  7.40E-03  7.24E-03  7.08E-03  6.92E-03  6.77E-03
6.62E-03  6.48E-03  6.34E-03  6.20E-03  6.06E-03  5.93E-03  5.80E-03  5.67E-03  5.54E-03  5.42E-03
5.30E-03  5.19E-03  5.07E-03  4.96E-03  4.85E-03  4.75E-03  4.64E-03  4.54E-03  4.44E-03  4.34E-03
4.25E-03  4.15E-03  4.06E-03  3.97E-03  3.89E-03  3.80E-03  3.64E-03  3.48E-03  3.33E-03  3.18E-03
3.04E-03  2.88E-03  2.72E-03  2.58E-03  2.44E-03  2.31E-03  2.18E-03  2.06E-03  1.95E-03
   Cf-250           1.31E+01  1.80E-02  1.12E-02  9.51E-03  8.11E-03  6.91E-03  5.89E-03  5.03E-03
4.28E-03  3.65E-03  2.80E-03  2.15E-03  1.65E-03  1.26E-03  9.67E-04  7.41E-04  5.68E-04  4.36E-04
3.34E-04  2.56E-04  1.96E-04  1.50E-04  1.15E-04  8.84E-05  6.78E-05  5.20E-05  3.98E-05  3.05E-05
2.34E-05  1.79E-05  1.38E-05  1.05E-05  8.09E-06  6.20E-06  4.75E-06  3.64E-06  2.79E-06  2.14E-06
1.64E-06  1.26E-06  9.64E-07  7.39E-07  5.67E-07  4.34E-07  3.33E-07  2.55E-07  1.96E-07  1.50E-07
1.15E-07  8.82E-08  6.76E-08  5.18E-08  3.97E-08  3.05E-08  2.33E-08  1.79E-08  1.37E-08  1.05E-08
8.06E-09  6.18E-09  4.74E-09  3.63E-09  2.78E-09  2.13E-09  1.25E-09  7.37E-10  4.33E-10  2.55E-10
1.50E-10  8.79E-11  5.17E-11  3.04E-11  1.78E-11  1.05E-11  6.16E-12  3.62E-12  2.13E-12  1.25E-12
7.35E-13  4.32E-13  2.54E-13  1.49E-13  8.77E-14  5.15E-14  3.03E-14  1.78E-14  1.05E-14  6.14E-15
3.61E-15  2.12E-15  1.25E-15  7.33E-16  4.31E-16  2.53E-16  1.49E-16  8.74E-17  5.14E-17  3.02E-17
1.77E-17  1.04E-17  6.13E-18  3.60E-18  2.12E-18  1.24E-18  4.29E-19  1.48E-19  5.12E-20  1.77E-20
6.11E-21  1.62E-21  4.28E-22  1.13E-22  3.00E-23  7.95E-24  2.10E-24  5.57E-25  1.47E-25
   Cf-251           8.98E+02  1.80E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02
1.75E-02  1.75E-02  1.74E-02  1.73E-02  1.72E-02  1.71E-02  1.70E-02  1.69E-02  1.68E-02  1.68E-02
1.67E-02  1.66E-02  1.65E-02  1.64E-02  1.63E-02  1.63E-02  1.62E-02  1.61E-02  1.60E-02  1.59E-02
1.58E-02  1.58E-02  1.57E-02  1.56E-02  1.55E-02  1.54E-02  1.54E-02  1.53E-02  1.52E-02  1.51E-02
1.51E-02  1.50E-02  1.49E-02  1.48E-02  1.48E-02  1.47E-02  1.46E-02  1.45E-02  1.45E-02  1.44E-02
1.43E-02  1.42E-02  1.42E-02  1.41E-02  1.40E-02  1.40E-02  1.39E-02  1.38E-02  1.37E-02  1.37E-02
1.36E-02  1.35E-02  1.35E-02  1.34E-02  1.33E-02  1.33E-02  1.31E-02  1.30E-02  1.29E-02  1.27E-02
1.26E-02  1.25E-02  1.23E-02  1.22E-02  1.21E-02  1.20E-02  1.19E-02  1.17E-02  1.16E-02  1.15E-02
1.14E-02  1.13E-02  1.12E-02  1.10E-02  1.09E-02  1.08E-02  1.07E-02  1.06E-02  1.05E-02  1.04E-02
1.03E-02  1.02E-02  1.01E-02  9.97E-03  9.87E-03  9.77E-03  9.67E-03  9.57E-03  9.47E-03  9.38E-03
9.28E-03  9.19E-03  9.09E-03  9.00E-03  8.91E-03  8.82E-03  8.64E-03  8.47E-03  8.30E-03  8.13E-03
7.97E-03  7.77E-03  7.57E-03  7.38E-03  7.19E-03  7.01E-03  6.84E-03  6.67E-03  6.50E-03
   Cf-252           2.65E+00  7.92E+02  7.51E+01  3.42E+01  1.56E+01  7.11E+00  3.24E+00  1.48E+00
6.74E-01  3.07E-01  8.30E-02  2.24E-02  6.05E-03  1.64E-03  4.42E-04  1.19E-04  3.22E-05  8.70E-06
2.35E-06  6.35E-07  1.71E-07  4.63E-08  1.25E-08  3.38E-09  9.12E-10  2.46E-10  6.65E-11  1.80E-11
4.85E-12  1.31E-12  3.54E-13  9.56E-14  2.58E-14  6.97E-15  1.88E-15  5.08E-16  1.37E-16  3.71E-17
1.00E-17  2.70E-18  7.30E-19  1.97E-19  5.33E-20  1.44E-20  3.89E-21  1.05E-21  2.83E-22  7.66E-23
2.07E-23  5.58E-24  1.51E-24  4.07E-25  1.10E-25  2.97E-26  8.02E-27  2.17E-27  5.85E-28  1.58E-28
4.27E-29  1.15E-29  3.11E-30  8.41E-31  2.27E-31  6.13E-32  4.47E-33  3.26E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cl-36            3.01E+05  2.86E-05  2.47E-05  2.35E-05  2.23E-05  2.13E-05  2.02E-05  1.92E-05
1.83E-05  1.74E-05  1.61E-05  1.48E-05  1.36E-05  1.25E-05  1.15E-05  1.06E-05  9.78E-06  9.01E-06
8.30E-06  7.64E-06  7.03E-06  6.48E-06  5.96E-06  5.49E-06  5.06E-06  4.66E-06  4.29E-06  3.95E-06
3.64E-06  3.35E-06  3.08E-06  2.84E-06  2.61E-06  2.41E-06  2.22E-06  2.04E-06  1.88E-06  1.73E-06
1.59E-06  1.47E-06  1.35E-06  1.24E-06  1.15E-06  1.05E-06  9.71E-07  8.94E-07  8.23E-07  7.58E-07
6.98E-07  6.43E-07  5.92E-07  5.45E-07  5.02E-07  4.62E-07  4.25E-07  3.92E-07  3.61E-07  3.32E-07
3.06E-07  2.82E-07  2.59E-07  2.39E-07  2.20E-07  2.02E-07  1.72E-07  1.46E-07  1.23E-07  1.05E-07
8.87E-08  7.52E-08  6.38E-08  5.41E-08  4.58E-08  3.89E-08  3.30E-08  2.79E-08  2.37E-08  2.01E-08
1.70E-08  1.44E-08  1.22E-08  1.04E-08  8.80E-09  7.46E-09  6.33E-09  5.37E-09  4.55E-09  3.86E-09
3.27E-09  2.77E-09  2.35E-09  1.99E-09  1.69E-09  1.43E-09  1.22E-09  1.03E-09  8.73E-10  7.41E-10
6.28E-10  5.32E-10  4.51E-10  3.83E-10  3.25E-10  2.75E-10  1.98E-10  1.42E-10  1.02E-10  7.35E-11
5.28E-11  3.50E-11  2.31E-11  1.53E-11  1.01E-11  6.71E-12  4.44E-12  2.94E-12  1.95E-12
   Cm-243           2.91E+01  1.80E-02  1.45E-02  1.35E-02  1.26E-02  1.17E-02  1.09E-02  1.02E-02
9.46E-03  8.81E-03  7.82E-03  6.94E-03  6.16E-03  5.47E-03  4.85E-03  4.31E-03  3.83E-03  3.40E-03
3.01E-03  2.68E-03  2.38E-03  2.11E-03  1.87E-03  1.66E-03  1.48E-03  1.31E-03  1.16E-03  1.03E-03
9.16E-04  8.13E-04  7.22E-04  6.41E-04  5.69E-04  5.05E-04  4.48E-04  3.98E-04  3.53E-04  3.14E-04
2.78E-04  2.47E-04  2.19E-04  1.95E-04  1.73E-04  1.53E-04  1.36E-04  1.21E-04  1.07E-04  9.53E-05
8.46E-05  7.51E-05  6.66E-05  5.92E-05  5.25E-05  4.66E-05  4.14E-05  3.67E-05  3.26E-05  2.89E-05
2.57E-05  2.28E-05  2.02E-05  1.80E-05  1.60E-05  1.42E-05  1.12E-05  8.79E-06  6.93E-06  5.46E-06
4.30E-06  3.39E-06  2.67E-06  2.11E-06  1.66E-06  1.31E-06  1.03E-06  8.12E-07  6.40E-07  5.04E-07
3.97E-07  3.13E-07  2.47E-07  1.94E-07  1.53E-07  1.21E-07  9.51E-08  7.50E-08  5.91E-08  4.65E-08
3.67E-08  2.89E-08  2.28E-08  1.79E-08  1.41E-08  1.11E-08  8.78E-09  6.92E-09  5.45E-09  4.30E-09
3.39E-09  2.67E-09  2.10E-09  1.66E-09  1.31E-09  1.03E-09  6.39E-10  3.97E-10  2.46E-10  1.53E-10
9.50E-11  5.24E-11  2.89E-11  1.59E-11  8.77E-12  4.83E-12  2.66E-12  1.47E-12  8.10E-13
   Cm-245           8.50E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02
1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02
1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02
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1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02
1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02
   Cm-246           4.73E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02
1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02
1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.64E-02  1.64E-02  1.63E-02
1.63E-02  1.63E-02  1.63E-02  1.62E-02  1.62E-02  1.62E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02
1.59E-02  1.59E-02  1.58E-02  1.58E-02  1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.55E-02
   Cm-247           1.56E+07  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
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1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
   Cm-248           3.40E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
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1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
   Co-60            5.27E+00  7.92E+02  2.42E+02  1.63E+02  1.10E+02  7.42E+01  5.00E+01  3.37E+01
2.27E+01  1.53E+01  7.93E+00  4.11E+00  2.13E+00  1.10E+00  5.71E-01  2.96E-01  1.53E-01  7.95E-02
4.12E-02  2.13E-02  1.10E-02  5.72E-03  2.97E-03  1.54E-03  7.96E-04  4.12E-04  2.14E-04  1.11E-04
5.73E-05  2.97E-05  1.54E-05  7.97E-06  4.13E-06  2.14E-06  1.11E-06  5.74E-07  2.98E-07  1.54E-07
7.99E-08  4.14E-08  2.14E-08  1.11E-08  5.75E-09  2.98E-09  1.54E-09  8.00E-10  4.14E-10  2.15E-10
1.11E-10  5.76E-11  2.99E-11  1.55E-11  8.01E-12  4.15E-12  2.15E-12  1.11E-12  5.77E-13  2.99E-13
1.55E-13  8.03E-14  4.16E-14  2.15E-14  1.12E-14  5.78E-15  1.55E-15  4.17E-16  1.12E-16  3.00E-17
8.05E-18  2.16E-18  5.80E-19  1.56E-19  4.18E-20  1.12E-20  3.01E-21  8.08E-22  2.17E-22  5.82E-23
1.56E-23  4.19E-24  1.13E-24  3.02E-25  8.11E-26  2.18E-26  5.84E-27  1.57E-27  4.21E-28  1.13E-28
3.03E-29  8.14E-30  2.18E-30  5.86E-31  1.57E-31  4.22E-32  1.13E-32  3.04E-33  8.16E-34  2.19E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cs-135           2.30E+06  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
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2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03
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2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03
   Cs-137           3.01E+01  1.13E+00  9.18E-01  8.57E-01  8.00E-01  7.47E-01  6.97E-01  6.50E-01
6.07E-01  5.66E-01  5.05E-01  4.50E-01  4.01E-01  3.57E-01  3.18E-01  2.84E-01  2.53E-01  2.25E-01
2.01E-01  1.79E-01  1.60E-01  1.42E-01  1.27E-01  1.13E-01  1.01E-01  8.97E-02  7.99E-02  7.12E-02
6.35E-02  5.66E-02  5.04E-02  4.49E-02  4.01E-02  3.57E-02  3.18E-02  2.84E-02  2.53E-02  2.25E-02
2.01E-02  1.79E-02  1.59E-02  1.42E-02  1.27E-02  1.13E-02  1.01E-02  8.96E-03  7.99E-03  7.12E-03
6.35E-03  5.66E-03  5.04E-03  4.49E-03  4.00E-03  3.57E-03  3.18E-03  2.83E-03  2.53E-03  2.25E-03
2.01E-03  1.79E-03  1.59E-03  1.42E-03  1.27E-03  1.13E-03  8.96E-04  7.12E-04  5.65E-04  4.49E-04
3.57E-04  2.83E-04  2.25E-04  1.79E-04  1.42E-04  1.13E-04  8.95E-05  7.11E-05  5.65E-05  4.49E-05
3.56E-05  2.83E-05  2.25E-05  1.79E-05  1.42E-05  1.13E-05  8.95E-06  7.11E-06  5.65E-06  4.48E-06
3.56E-06  2.83E-06  2.25E-06  1.78E-06  1.42E-06  1.13E-06  8.94E-07  7.10E-07  5.64E-07  4.48E-07
3.56E-07  2.83E-07  2.25E-07  1.78E-07  1.42E-07  1.13E-07  7.10E-08  4.48E-08  2.83E-08  1.78E-08
1.12E-08  6.32E-09  3.56E-09  2.00E-09  1.12E-09  6.32E-10  3.55E-10  2.00E-10  1.12E-10
   Eu-152           1.35E+01  3.11E+08  1.96E+08  1.68E+08  1.44E+08  1.23E+08  1.06E+08  9.05E+07
7.76E+07  6.65E+07  5.14E+07  3.98E+07  3.07E+07  2.38E+07  1.84E+07  1.42E+07  1.10E+07  8.50E+06
6.57E+06  5.08E+06  3.93E+06  3.04E+06  2.35E+06  1.82E+06  1.41E+06  1.09E+06  8.41E+05  6.50E+05
5.03E+05  3.89E+05  3.01E+05  2.32E+05  1.80E+05  1.39E+05  1.07E+05  8.31E+04  6.43E+04  4.97E+04
3.84E+04  2.97E+04  2.30E+04  1.78E+04  1.37E+04  1.06E+04  8.22E+03  6.35E+03  4.91E+03  3.80E+03
2.94E+03  2.27E+03  1.76E+03  1.36E+03  1.05E+03  8.12E+02  6.28E+02  4.86E+02  3.76E+02  2.91E+02
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2.25E+02  1.74E+02  1.34E+02  1.04E+02  8.03E+01  6.21E+01  3.71E+01  2.22E+01  1.33E+01  7.94E+00
4.75E+00  2.84E+00  1.70E+00  1.02E+00  6.07E-01  3.63E-01  2.17E-01  1.30E-01  7.76E-02  4.64E-02
2.78E-02  1.66E-02  9.93E-03  5.94E-03  3.55E-03  2.12E-03  1.27E-03  7.59E-04  4.54E-04  2.71E-04
1.62E-04  9.70E-05  5.80E-05  3.47E-05  2.07E-05  1.24E-05  7.42E-06  4.44E-06  2.65E-06  1.59E-06
9.49E-07  5.67E-07  3.39E-07  2.03E-07  1.21E-07  7.25E-08  2.59E-08  9.27E-09  3.32E-09  1.19E-09
4.24E-10  1.17E-10  3.24E-11  8.96E-12  2.48E-12  6.85E-13  1.89E-13  5.24E-14  1.45E-14
   Eu-154            8.59E+00  4.87E+08  2.35E+08  1.85E+08  1.45E+08  1.14E+08  8.93E+07  7.01E+07
5.50E+07  4.32E+07  2.88E+07  1.92E+07  1.29E+07  8.58E+06  5.73E+06  3.83E+06  2.56E+06  1.71E+06
1.14E+06  7.61E+05  5.08E+05  3.39E+05  2.27E+05  1.51E+05  1.01E+05  6.75E+04  4.50E+04  3.01E+04
2.01E+04  1.34E+04  8.96E+03  5.98E+03  3.99E+03  2.67E+03  1.78E+03  1.19E+03  7.94E+02  5.30E+02
3.54E+02  2.36E+02  1.58E+02  1.05E+02  7.04E+01  4.70E+01  3.14E+01  2.10E+01  1.40E+01  9.34E+00
6.24E+00  4.17E+00  2.78E+00  1.86E+00  1.24E+00  8.28E-01  5.53E-01  3.69E-01  2.47E-01  1.65E-01
1.10E-01  7.34E-02  4.90E-02  3.27E-02  2.19E-02  1.46E-02  6.51E-03  2.90E-03  1.29E-03  5.77E-04
2.57E-04  1.15E-04  5.12E-05  2.28E-05  1.02E-05  4.53E-06  2.02E-06  9.02E-07  4.02E-07  1.79E-07
7.99E-08  3.56E-08  1.59E-08  7.08E-09  3.16E-09  1.41E-09  6.28E-10  2.80E-10  1.25E-10  5.57E-11
2.48E-11  1.11E-11  4.94E-12  2.20E-12  9.81E-13  4.38E-13  1.95E-13  8.70E-14  3.88E-14  1.73E-14
7.71E-15  3.44E-15  1.53E-15  6.84E-16  3.05E-16  1.36E-16  2.70E-17  5.37E-18  1.07E-18  2.12E-19
4.22E-20  5.61E-21  7.44E-22  9.88E-23  1.31E-23  1.74E-24  2.31E-25  3.07E-26  4.07E-27
   Eu-155            4.76E+00  7.92E+02  2.13E+02  1.38E+02  8.90E+01  5.75E+01  3.71E+01  2.40E+01
1.55E+01  1.00E+01  4.83E+00  2.33E+00  1.13E+00  5.43E-01  2.62E-01  1.27E-01  6.11E-02  2.95E-02
1.42E-02  6.87E-03  3.31E-03  1.60E-03  7.72E-04  3.73E-04  1.80E-04  8.68E-05  4.19E-05  2.02E-05
9.76E-06  4.71E-06  2.27E-06  1.10E-06  5.30E-07  2.56E-07  1.23E-07  5.95E-08  2.87E-08  1.39E-08
6.69E-09  3.23E-09  1.56E-09  7.52E-10  3.63E-10  1.75E-10  8.46E-11  4.08E-11  1.97E-11  9.51E-12
4.59E-12  2.22E-12  1.07E-12  5.16E-13  2.49E-13  1.20E-13  5.80E-14  2.80E-14  1.35E-14  6.52E-15
3.15E-15  1.52E-15  7.33E-16  3.54E-16  1.71E-16  8.25E-17  1.92E-17  4.47E-18  1.04E-18  2.43E-19
5.66E-20  1.32E-20  3.07E-21  7.15E-22  1.67E-22  3.88E-23  9.04E-24  2.11E-24  4.90E-25  1.14E-25
2.66E-26  6.20E-27  1.44E-27  3.36E-28  7.84E-29  1.83E-29  4.25E-30  9.90E-31  2.31E-31  5.37E-32
1.25E-32  2.92E-33  6.79E-34  1.58E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-55             2.73E+00  7.92E+02  8.03E+01  3.75E+01  1.75E+01  8.15E+00  3.80E+00  1.77E+00
8.27E-01  3.86E-01  1.08E-01  3.03E-02  8.51E-03  2.39E-03  6.69E-04  1.88E-04  5.27E-05  1.48E-05
4.14E-06  1.16E-06  3.26E-07  9.14E-08  2.56E-08  7.19E-09  2.02E-09  5.66E-10  1.59E-10  4.45E-11
1.25E-11  3.50E-12  9.82E-13  2.75E-13  7.73E-14  2.17E-14  6.08E-15  1.70E-15  4.78E-16  1.34E-16
3.76E-17  1.05E-17  2.96E-18  8.30E-19  2.33E-19  6.53E-20  1.83E-20  5.14E-21  1.44E-21  4.04E-22
1.13E-22  3.18E-23  8.92E-24  2.50E-24  7.01E-25  1.97E-25  5.52E-26  1.55E-26  4.34E-27  1.22E-27
3.41E-28  9.58E-29  2.69E-29  7.54E-30  2.11E-30  5.93E-31  4.66E-32  3.67E-33  2.89E-34  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-60             1.50E+06  7.15E+03  7.13E+03  7.12E+03  7.11E+03  7.11E+03  7.10E+03  7.09E+03
7.08E+03  7.08E+03  7.06E+03  7.05E+03  7.04E+03  7.03E+03  7.01E+03  7.00E+03  6.99E+03  6.98E+03
6.96E+03  6.95E+03  6.94E+03  6.93E+03  6.92E+03  6.90E+03  6.89E+03  6.88E+03  6.87E+03  6.86E+03
6.84E+03  6.83E+03  6.82E+03  6.81E+03  6.80E+03  6.78E+03  6.77E+03  6.76E+03  6.75E+03  6.74E+03
6.72E+03  6.71E+03  6.70E+03  6.69E+03  6.68E+03  6.67E+03  6.65E+03  6.64E+03  6.63E+03  6.62E+03
6.61E+03  6.60E+03  6.58E+03  6.57E+03  6.56E+03  6.55E+03  6.54E+03  6.53E+03  6.52E+03  6.50E+03
6.49E+03  6.48E+03  6.47E+03  6.46E+03  6.45E+03  6.44E+03  6.41E+03  6.39E+03  6.37E+03  6.35E+03
6.32E+03  6.30E+03  6.28E+03  6.26E+03  6.24E+03  6.21E+03  6.19E+03  6.17E+03  6.15E+03  6.13E+03
6.11E+03  6.09E+03  6.06E+03  6.04E+03  6.02E+03  6.00E+03  5.98E+03  5.96E+03  5.94E+03  5.92E+03
5.90E+03  5.88E+03  5.86E+03  5.83E+03  5.81E+03  5.79E+03  5.77E+03  5.75E+03  5.73E+03  5.71E+03
5.69E+03  5.67E+03  5.65E+03  5.63E+03  5.61E+03  5.59E+03  5.56E+03  5.52E+03  5.48E+03  5.44E+03
5.40E+03  5.35E+03  5.31E+03  5.26E+03  5.22E+03  5.17E+03  5.13E+03  5.08E+03  5.04E+03
   Gd-148            7.46E+01  5.80E+07  5.33E+07  5.18E+07  5.04E+07  4.90E+07  4.76E+07  4.63E+07
4.50E+07  4.38E+07  4.18E+07  3.99E+07  3.80E+07  3.63E+07  3.46E+07  3.31E+07  3.15E+07  3.01E+07
2.87E+07  2.74E+07  2.62E+07  2.50E+07  2.38E+07  2.27E+07  2.17E+07  2.07E+07  1.97E+07  1.88E+07
1.80E+07  1.72E+07  1.64E+07  1.56E+07  1.49E+07  1.42E+07  1.36E+07  1.30E+07  1.24E+07  1.18E+07
1.13E+07  1.07E+07  1.03E+07  9.78E+06  9.33E+06  8.91E+06  8.50E+06  8.11E+06  7.74E+06  7.39E+06
7.05E+06  6.72E+06  6.42E+06  6.12E+06  5.84E+06  5.58E+06  5.32E+06  5.08E+06  4.84E+06  4.62E+06
4.41E+06  4.21E+06  4.02E+06  3.83E+06  3.66E+06  3.49E+06  3.18E+06  2.89E+06  2.64E+06  2.40E+06
2.18E+06  1.99E+06  1.81E+06  1.65E+06  1.50E+06  1.37E+06  1.25E+06  1.13E+06  1.03E+06  9.40E+05
8.56E+05  7.80E+05  7.10E+05  6.46E+05  5.89E+05  5.36E+05  4.88E+05  4.44E+05  4.05E+05  3.68E+05
3.36E+05  3.06E+05  2.78E+05  2.53E+05  2.31E+05  2.10E+05  1.91E+05  1.74E+05  1.59E+05  1.44E+05
1.31E+05  1.20E+05  1.09E+05  9.93E+04  9.04E+04  8.23E+04  6.82E+04  5.66E+04  4.69E+04  3.89E+04
3.23E+04  2.55E+04  2.02E+04  1.60E+04  1.26E+04  1.00E+04  7.91E+03  6.26E+03  4.95E+03
   H-3               1.23E+01  4.50E+01  2.54E+01  2.09E+01  1.73E+01  1.43E+01  1.18E+01  9.75E+00
8.05E+00  6.65E+00  4.84E+00  3.52E+00  2.56E+00  1.86E+00  1.35E+00  9.83E-01  7.15E-01  5.20E-01
3.78E-01  2.75E-01  2.00E-01  1.45E-01  1.06E-01  7.69E-02  5.59E-02  4.06E-02  2.96E-02  2.15E-02
1.56E-02  1.14E-02  8.26E-03  6.01E-03  4.37E-03  3.18E-03  2.31E-03  1.68E-03  1.22E-03  8.88E-04
6.46E-04  4.70E-04  3.41E-04  2.48E-04  1.81E-04  1.31E-04  9.55E-05  6.94E-05  5.05E-05  3.67E-05
2.67E-05  1.94E-05  1.41E-05  1.03E-05  7.46E-06  5.43E-06  3.95E-06  2.87E-06  2.09E-06  1.52E-06
1.10E-06  8.02E-07  5.83E-07  4.24E-07  3.08E-07  2.24E-07  1.19E-07  6.27E-08  3.32E-08  1.75E-08
9.27E-09  4.90E-09  2.59E-09  1.37E-09  7.25E-10  3.83E-10  2.03E-10  1.07E-10  5.66E-11  2.99E-11
1.58E-11  8.37E-12  4.43E-12  2.34E-12  1.24E-12  6.54E-13  3.46E-13  1.83E-13  9.67E-14  5.12E-14
2.70E-14  1.43E-14  7.56E-15  4.00E-15  2.11E-15  1.12E-15  5.91E-16  3.13E-16  1.65E-16  8.74E-17
4.62E-17  2.44E-17  1.29E-17  6.83E-18  3.61E-18  1.91E-18  5.34E-19  1.49E-19  4.17E-20  1.17E-20
3.26E-21  6.63E-22  1.35E-22  2.74E-23  5.57E-24  1.13E-24  2.30E-25  4.68E-26  9.52E-27
   Hg-194            4.44E+02  6.38E+06  6.29E+06  6.26E+06  6.23E+06  6.20E+06  6.17E+06  6.14E+06
6.11E+06  6.08E+06  6.03E+06  5.98E+06  5.93E+06  5.89E+06  5.84E+06  5.79E+06  5.75E+06  5.70E+06
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5.65E+06  5.61E+06  5.56E+06  5.52E+06  5.47E+06  5.43E+06  5.39E+06  5.34E+06  5.30E+06  5.26E+06
5.22E+06  5.17E+06  5.13E+06  5.09E+06  5.05E+06  5.01E+06  4.97E+06  4.93E+06  4.89E+06  4.85E+06
4.81E+06  4.77E+06  4.74E+06  4.70E+06  4.66E+06  4.62E+06  4.59E+06  4.55E+06  4.51E+06  4.48E+06
4.44E+06  4.40E+06  4.37E+06  4.33E+06  4.30E+06  4.26E+06  4.23E+06  4.20E+06  4.16E+06  4.13E+06
4.10E+06  4.06E+06  4.03E+06  4.00E+06  3.97E+06  3.93E+06  3.87E+06  3.81E+06  3.75E+06  3.69E+06
3.63E+06  3.57E+06  3.52E+06  3.46E+06  3.40E+06  3.35E+06  3.30E+06  3.24E+06  3.19E+06  3.14E+06
3.09E+06  3.04E+06  2.99E+06  2.94E+06  2.90E+06  2.85E+06  2.81E+06  2.76E+06  2.72E+06  2.67E+06
2.63E+06  2.59E+06  2.55E+06  2.51E+06  2.47E+06  2.43E+06  2.39E+06  2.35E+06  2.31E+06  2.28E+06
2.24E+06  2.20E+06  2.17E+06  2.13E+06  2.10E+06  2.07E+06  2.00E+06  1.94E+06  1.88E+06  1.82E+06
1.76E+06  1.69E+06  1.62E+06  1.56E+06  1.50E+06  1.44E+06  1.38E+06  1.33E+06  1.27E+06
   Np-237           2.14E+06  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02
1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02
1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02
1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.65E-02
1.64E-02  1.64E-02  1.64E-02  1.64E-02  1.63E-02  1.63E-02  1.63E-02  1.62E-02  1.62E-02  1.62E-02
1.62E-02  1.61E-02  1.61E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02  1.59E-02  1.58E-02
1.58E-02  1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.54E-02  1.54E-02  1.53E-02  1.53E-02
   Am-241           4.32E+02  1.80E-02  1.77E-02  1.76E-02  1.74E-02  1.73E-02  1.72E-02  1.71E-02
1.70E-02  1.69E-02  1.67E-02  1.66E-02  1.64E-02  1.62E-02  1.60E-02  1.59E-02  1.57E-02  1.55E-02
1.54E-02  1.52E-02  1.51E-02  1.49E-02  1.48E-02  1.46E-02  1.45E-02  1.43E-02  1.42E-02  1.40E-02
1.39E-02  1.37E-02  1.36E-02  1.34E-02  1.33E-02  1.32E-02  1.30E-02  1.29E-02  1.27E-02  1.26E-02
1.25E-02  1.24E-02  1.22E-02  1.21E-02  1.20E-02  1.18E-02  1.17E-02  1.16E-02  1.15E-02  1.14E-02
1.12E-02  1.11E-02  1.10E-02  1.09E-02  1.08E-02  1.07E-02  1.06E-02  1.05E-02  1.03E-02  1.02E-02
1.01E-02  1.00E-02  9.92E-03  9.82E-03  9.72E-03  9.61E-03  9.42E-03  9.22E-03  9.03E-03  8.84E-03
8.66E-03  8.48E-03  8.31E-03  8.13E-03  7.97E-03  7.80E-03  7.64E-03  7.48E-03  7.33E-03  7.17E-03
7.03E-03  6.88E-03  6.74E-03  6.60E-03  6.46E-03  6.33E-03  6.20E-03  6.07E-03  5.94E-03  5.82E-03
5.70E-03  5.58E-03  5.47E-03  5.35E-03  5.24E-03  5.13E-03  5.03E-03  4.92E-03  4.82E-03  4.72E-03
4.63E-03  4.53E-03  4.44E-03  4.34E-03  4.25E-03  4.17E-03  4.00E-03  3.83E-03  3.68E-03  3.52E-03
3.38E-03  3.21E-03  3.04E-03  2.89E-03  2.74E-03  2.60E-03  2.47E-03  2.34E-03  2.23E-03
   Cm-244           1.81E+01  1.80E-02  1.28E-02  1.14E-02  1.01E-02  9.03E-03  8.05E-03  7.18E-03
6.40E-03  5.71E-03  4.71E-03  3.89E-03  3.21E-03  2.65E-03  2.19E-03  1.81E-03  1.49E-03  1.23E-03
1.02E-03  8.41E-04  6.94E-04  5.73E-04  4.73E-04  3.91E-04  3.23E-04  2.66E-04  2.20E-04  1.82E-04
1.50E-04  1.24E-04  1.02E-04  8.44E-05  6.97E-05  5.76E-05  4.75E-05  3.93E-05  3.24E-05  2.68E-05
2.21E-05  1.82E-05  1.51E-05  1.24E-05  1.03E-05  8.48E-06  7.00E-06  5.78E-06  4.78E-06  3.94E-06
3.26E-06  2.69E-06  2.22E-06  1.83E-06  1.51E-06  1.25E-06  1.03E-06  8.52E-07  7.04E-07  5.81E-07
4.80E-07  3.96E-07  3.27E-07  2.70E-07  2.23E-07  1.84E-07  1.26E-07  8.56E-08  5.84E-08  3.98E-08
2.71E-08  1.85E-08  1.26E-08  8.60E-09  5.86E-09  4.00E-09  2.73E-09  1.86E-09  1.27E-09  8.64E-10
5.89E-10  4.02E-10  2.74E-10  1.87E-10  1.27E-10  8.68E-11  5.92E-11  4.03E-11  2.75E-11  1.88E-11
1.28E-11  8.72E-12  5.94E-12  4.05E-12  2.76E-12  1.88E-12  1.28E-12  8.76E-13  5.97E-13  4.07E-13
2.78E-13  1.89E-13  1.29E-13  8.80E-14  6.00E-14  4.09E-14  1.90E-14  8.84E-15  4.11E-15  1.91E-15
8.88E-16  3.41E-16  1.31E-16  5.02E-17  1.93E-17  7.40E-18  2.84E-18  1.09E-18  4.18E-19
   Ho-166m          1.20E+03  3.24E+06  3.22E+06  3.21E+06  3.20E+06  3.20E+06  3.19E+06  3.18E+06
3.17E+06  3.17E+06  3.15E+06  3.14E+06  3.13E+06  3.12E+06  3.10E+06  3.09E+06  3.08E+06  3.07E+06
3.06E+06  3.05E+06  3.03E+06  3.02E+06  3.01E+06  3.00E+06  2.99E+06  2.98E+06  2.96E+06  2.95E+06
2.94E+06  2.93E+06  2.92E+06  2.91E+06  2.90E+06  2.88E+06  2.87E+06  2.86E+06  2.85E+06  2.84E+06
2.83E+06  2.82E+06  2.81E+06  2.80E+06  2.79E+06  2.77E+06  2.76E+06  2.75E+06  2.74E+06  2.73E+06
2.72E+06  2.71E+06  2.70E+06  2.69E+06  2.68E+06  2.67E+06  2.66E+06  2.65E+06  2.64E+06  2.63E+06
2.62E+06  2.61E+06  2.60E+06  2.59E+06  2.58E+06  2.57E+06  2.55E+06  2.53E+06  2.51E+06  2.49E+06
2.47E+06  2.45E+06  2.43E+06  2.41E+06  2.39E+06  2.38E+06  2.36E+06  2.34E+06  2.32E+06  2.30E+06
2.29E+06  2.27E+06  2.25E+06  2.23E+06  2.22E+06  2.20E+06  2.18E+06  2.16E+06  2.15E+06  2.13E+06
2.11E+06  2.10E+06  2.08E+06  2.07E+06  2.05E+06  2.03E+06  2.02E+06  2.00E+06  1.99E+06  1.97E+06
1.96E+06  1.94E+06  1.93E+06  1.91E+06  1.90E+06  1.88E+06  1.85E+06  1.83E+06  1.80E+06  1.77E+06
1.74E+06  1.71E+06  1.68E+06  1.64E+06  1.61E+06  1.58E+06  1.55E+06  1.52E+06  1.49E+06
   I-129            1.57E+07  9.00E-03  8.73E-03  8.64E-03  8.56E-03  8.47E-03  8.38E-03  8.30E-03
8.22E-03  8.13E-03  8.00E-03  7.86E-03  7.73E-03  7.60E-03  7.47E-03  7.35E-03  7.22E-03  7.10E-03
6.98E-03  6.87E-03  6.75E-03  6.64E-03  6.53E-03  6.42E-03  6.31E-03  6.21E-03  6.10E-03  6.00E-03
5.90E-03  5.80E-03  5.70E-03  5.61E-03  5.51E-03  5.42E-03  5.33E-03  5.24E-03  5.15E-03  5.07E-03
4.98E-03  4.90E-03  4.82E-03  4.74E-03  4.66E-03  4.58E-03  4.50E-03  4.43E-03  4.35E-03  4.28E-03
4.21E-03  4.14E-03  4.07E-03  4.00E-03  3.93E-03  3.87E-03  3.80E-03  3.74E-03  3.67E-03  3.61E-03
3.55E-03  3.49E-03  3.43E-03  3.38E-03  3.32E-03  3.26E-03  3.16E-03  3.05E-03  2.95E-03  2.85E-03
2.76E-03  2.67E-03  2.58E-03  2.49E-03  2.41E-03  2.33E-03  2.25E-03  2.18E-03  2.10E-03  2.03E-03
1.97E-03  1.90E-03  1.84E-03  1.78E-03  1.72E-03  1.66E-03  1.61E-03  1.55E-03  1.50E-03  1.45E-03
1.40E-03  1.36E-03  1.31E-03  1.27E-03  1.23E-03  1.18E-03  1.14E-03  1.11E-03  1.07E-03  1.03E-03
1.00E-03  9.67E-04  9.35E-04  9.04E-04  8.74E-04  8.45E-04  7.89E-04  7.38E-04  6.90E-04  6.45E-04
6.02E-04  5.54E-04  5.09E-04  4.68E-04  4.30E-04  3.95E-04  3.63E-04  3.33E-04  3.06E-04
   Mn-53            3.74E+06  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.23E+03  3.23E+03
3.23E+03  3.23E+03  3.23E+03  3.23E+03  3.23E+03  3.23E+03  3.23E+03  3.22E+03  3.22E+03  3.22E+03
3.22E+03  3.22E+03  3.22E+03  3.22E+03  3.22E+03  3.21E+03  3.21E+03  3.21E+03  3.21E+03  3.21E+03
3.21E+03  3.21E+03  3.21E+03  3.20E+03  3.20E+03  3.20E+03  3.20E+03  3.20E+03  3.20E+03  3.20E+03
3.20E+03  3.19E+03  3.19E+03  3.19E+03  3.19E+03  3.19E+03  3.19E+03  3.19E+03  3.19E+03  3.18E+03
3.18E+03  3.18E+03  3.18E+03  3.18E+03  3.18E+03  3.18E+03  3.18E+03  3.17E+03  3.17E+03  3.17E+03
3.17E+03  3.17E+03  3.17E+03  3.17E+03  3.17E+03  3.17E+03  3.16E+03  3.16E+03  3.16E+03  3.16E+03
3.15E+03  3.15E+03  3.15E+03  3.15E+03  3.14E+03  3.14E+03  3.14E+03  3.14E+03  3.13E+03  3.13E+03
3.13E+03  3.13E+03  3.12E+03  3.12E+03  3.12E+03  3.12E+03  3.11E+03  3.11E+03  3.11E+03  3.11E+03
3.10E+03  3.10E+03  3.10E+03  3.10E+03  3.09E+03  3.09E+03  3.09E+03  3.09E+03  3.08E+03  3.08E+03
```

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3.08E+03  3.08E+03  3.08E+03  3.07E+03  3.07E+03  3.07E+03  3.06E+03  3.06E+03  3.05E+03  3.05E+03
3.04E+03  3.04E+03  3.03E+03  3.03E+03  3.02E+03  3.01E+03  3.01E+03  3.00E+03  3.00E+03
   Na-22            2.60E+00  7.92E+02  7.16E+01  3.21E+01  1.44E+01  6.47E+00  2.90E+00  1.30E+00
5.85E-01  2.62E-01  6.90E-02  1.82E-02  4.78E-03  1.26E-03  3.31E-04  8.69E-05  2.29E-05  6.02E-06
1.58E-06  4.16E-07  1.10E-07  2.88E-08  7.58E-09  1.99E-09  5.24E-10  1.38E-10  3.63E-11  9.54E-12
2.51E-12  6.60E-13  1.74E-13  4.57E-14  1.20E-14  3.16E-15  8.32E-16  2.19E-16  5.76E-17  1.51E-17
3.98E-18  1.05E-18  2.76E-19  7.25E-20  1.91E-20  5.02E-21  1.32E-21  3.47E-22  9.13E-23  2.40E-23
6.32E-24  1.66E-24  4.37E-25  1.15E-25  3.03E-26  7.96E-27  2.09E-27  5.51E-28  1.45E-28  3.81E-29
1.00E-29  2.64E-30  6.94E-31  1.82E-31  4.80E-32  1.26E-32  8.73E-34  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Nb-91            6.80E+02  1.04E+07  1.03E+07  1.02E+07  1.02E+07  1.02E+07  1.01E+07  1.01E+07
1.00E+07  9.99E+06  9.93E+06  9.86E+06  9.80E+06  9.73E+06  9.67E+06  9.60E+06  9.54E+06  9.48E+06
9.42E+06  9.35E+06  9.29E+06  9.23E+06  9.17E+06  9.11E+06  9.05E+06  8.99E+06  8.93E+06  8.87E+06
8.81E+06  8.75E+06  8.70E+06  8.64E+06  8.58E+06  8.52E+06  8.47E+06  8.41E+06  8.36E+06  8.30E+06
8.25E+06  8.19E+06  8.14E+06  8.08E+06  8.03E+06  7.98E+06  7.92E+06  7.87E+06  7.82E+06  7.77E+06
7.72E+06  7.67E+06  7.61E+06  7.56E+06  7.51E+06  7.46E+06  7.42E+06  7.37E+06  7.32E+06  7.27E+06
7.22E+06  7.17E+06  7.13E+06  7.08E+06  7.03E+06  6.99E+06  6.89E+06  6.80E+06  6.71E+06  6.63E+06
6.54E+06  6.45E+06  6.37E+06  6.28E+06  6.20E+06  6.12E+06  6.04E+06  5.96E+06  5.88E+06  5.80E+06
5.73E+06  5.65E+06  5.58E+06  5.50E+06  5.43E+06  5.36E+06  5.29E+06  5.22E+06  5.15E+06  5.08E+06
5.01E+06  4.95E+06  4.88E+06  4.82E+06  4.76E+06  4.69E+06  4.63E+06  4.57E+06  4.51E+06  4.45E+06
4.39E+06  4.33E+06  4.28E+06  4.22E+06  4.16E+06  4.11E+06  4.00E+06  3.90E+06  3.80E+06  3.70E+06
3.60E+06  3.48E+06  3.37E+06  3.26E+06  3.15E+06  3.05E+06  2.95E+06  2.85E+06  2.76E+06
   Nb-92            3.47E+07  2.02E+02  2.01E+02  2.01E+02  2.01E+02  2.01E+02  2.01E+02  2.01E+02
2.00E+02  2.00E+02  2.00E+02  2.00E+02  1.99E+02  1.99E+02  1.99E+02  1.98E+02  1.98E+02  1.98E+02
1.97E+02  1.97E+02  1.97E+02  1.96E+02  1.96E+02  1.96E+02  1.96E+02  1.95E+02  1.95E+02  1.95E+02
1.94E+02  1.94E+02  1.94E+02  1.94E+02  1.93E+02  1.93E+02  1.93E+02  1.92E+02  1.92E+02  1.92E+02
1.91E+02  1.91E+02  1.91E+02  1.91E+02  1.90E+02  1.90E+02  1.90E+02  1.89E+02  1.89E+02  1.89E+02
1.89E+02  1.88E+02  1.88E+02  1.88E+02  1.87E+02  1.87E+02  1.87E+02  1.87E+02  1.86E+02  1.86E+02
1.86E+02  1.85E+02  1.85E+02  1.85E+02  1.85E+02  1.84E+02  1.84E+02  1.83E+02  1.83E+02  1.82E+02
1.81E+02  1.81E+02  1.80E+02  1.80E+02  1.79E+02  1.79E+02  1.78E+02  1.78E+02  1.77E+02  1.76E+02
1.76E+02  1.75E+02  1.75E+02  1.74E+02  1.74E+02  1.73E+02  1.73E+02  1.72E+02  1.72E+02  1.71E+02
1.71E+02  1.70E+02  1.70E+02  1.69E+02  1.69E+02  1.68E+02  1.68E+02  1.67E+02  1.66E+02  1.66E+02
1.65E+02  1.65E+02  1.64E+02  1.64E+02  1.63E+02  1.63E+02  1.62E+02  1.61E+02  1.60E+02  1.59E+02
1.58E+02  1.57E+02  1.56E+02  1.54E+02  1.53E+02  1.52E+02  1.51E+02  1.50E+02  1.49E+02
   Nb-93m           1.61E+01  4.74E+08  3.21E+08  2.82E+08  2.47E+08  2.17E+08  1.91E+08  1.67E+08
1.47E+08  1.29E+08  1.04E+08  8.37E+07  6.74E+07  5.42E+07  4.37E+07  3.52E+07  2.83E+07  2.28E+07
1.83E+07  1.48E+07  1.19E+07  9.57E+06  7.71E+06  6.20E+06  5.00E+06  4.02E+06  3.24E+06  2.61E+06
2.10E+06  1.69E+06  1.36E+06  1.10E+06  8.82E+05  7.10E+05  5.71E+05  4.60E+05  3.70E+05  2.98E+05
2.40E+05  1.93E+05  1.56E+05  1.25E+05  1.01E+05  8.12E+04  6.54E+04  5.26E+04  4.24E+04  3.41E+04
2.75E+04  2.21E+04  1.78E+04  1.43E+04  1.15E+04  9.29E+03  7.48E+03  6.02E+03  4.85E+03  3.90E+03
3.14E+03  2.53E+03  2.04E+03  1.64E+03  1.32E+03  1.06E+03  6.89E+02  4.47E+02  2.89E+02  1.88E+02
1.22E+02  7.88E+01  5.11E+01  3.31E+01  2.15E+01  1.39E+01  9.02E+00  5.85E+00  3.79E+00  2.46E+00
1.59E+00  1.03E+00  6.69E-01  4.33E-01  2.81E-01  1.82E-01  1.18E-01  7.65E-02  4.96E-02  3.21E-02
2.08E-02  1.35E-02  8.75E-03  5.67E-03  3.68E-03  2.38E-03  1.55E-03  1.00E-03  6.49E-04  4.21E-04
2.73E-04  1.77E-04  1.15E-04  7.43E-05  4.81E-05  3.12E-05  1.31E-05  5.51E-06  2.31E-06  9.72E-07
4.08E-07  1.38E-07  4.67E-08  1.58E-08  5.35E-09  1.81E-09  6.12E-10  2.07E-10  7.00E-11
   Nb-94            2.03E+04  2.34E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.32E-02  2.32E-02
2.32E-02  2.32E-02  2.31E-02  2.31E-02  2.30E-02  2.30E-02  2.30E-02  2.29E-02  2.29E-02  2.28E-02
2.28E-02  2.28E-02  2.27E-02  2.27E-02  2.27E-02  2.26E-02  2.26E-02  2.25E-02  2.25E-02  2.25E-02
2.24E-02  2.24E-02  2.23E-02  2.23E-02  2.23E-02  2.22E-02  2.22E-02  2.22E-02  2.21E-02  2.21E-02
2.20E-02  2.20E-02  2.20E-02  2.19E-02  2.19E-02  2.19E-02  2.18E-02  2.18E-02  2.17E-02  2.17E-02
2.17E-02  2.16E-02  2.16E-02  2.16E-02  2.15E-02  2.15E-02  2.15E-02  2.14E-02  2.14E-02  2.13E-02
2.13E-02  2.13E-02  2.12E-02  2.12E-02  2.12E-02  2.11E-02  2.11E-02  2.10E-02  2.09E-02  2.08E-02
2.08E-02  2.07E-02  2.06E-02  2.06E-02  2.05E-02  2.04E-02  2.03E-02  2.03E-02  2.02E-02  2.01E-02
2.01E-02  2.00E-02  1.99E-02  1.99E-02  1.98E-02  1.97E-02  1.97E-02  1.96E-02  1.95E-02  1.95E-02
1.94E-02  1.93E-02  1.93E-02  1.92E-02  1.91E-02  1.91E-02  1.90E-02  1.89E-02  1.89E-02  1.88E-02
1.87E-02  1.87E-02  1.86E-02  1.86E-02  1.85E-02  1.84E-02  1.83E-02  1.82E-02  1.81E-02  1.79E-02
1.78E-02  1.77E-02  1.75E-02  1.74E-02  1.72E-02  1.71E-02  1.69E-02  1.68E-02  1.66E-02
   Ni-59            7.60E+04  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
2.52E+01  2.52E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01
2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.49E+01
2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01
2.49E+01  2.49E+01  2.49E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01
2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.47E+01  2.47E+01  2.47E+01  2.47E+01
2.47E+01  2.47E+01  2.47E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01
2.45E+01  2.45E+01  2.45E+01  2.45E+01  2.45E+01  2.45E+01  2.45E+01  2.44E+01  2.44E+01  2.44E+01
2.44E+01  2.44E+01  2.44E+01  2.44E+01  2.43E+01  2.43E+01  2.43E+01  2.43E+01  2.43E+01  2.43E+01
2.43E+01  2.42E+01  2.42E+01  2.42E+01  2.42E+01  2.42E+01  2.42E+01  2.41E+01  2.41E+01  2.41E+01
2.40E+01  2.40E+01  2.40E+01  2.39E+01  2.39E+01  2.39E+01  2.38E+01  2.38E+01  2.38E+01
   Ni-63            1.00E+02  3.96E+00  3.72E+00  3.64E+00  3.57E+00  3.49E+00  3.42E+00  3.35E+00
3.28E+00  3.21E+00  3.10E+00  3.00E+00  2.89E+00  2.79E+00  2.70E+00  2.60E+00  2.52E+00  2.43E+00
2.35E+00  2.27E+00  2.19E+00  2.11E+00  2.04E+00  1.97E+00  1.90E+00  1.84E+00  1.77E+00  1.71E+00
1.65E+00  1.60E+00  1.54E+00  1.49E+00  1.44E+00  1.39E+00  1.34E+00  1.30E+00  1.25E+00  1.21E+00
1.17E+00  1.13E+00  1.09E+00  1.05E+00  1.01E+00  9.80E-01  9.47E-01  9.14E-01  8.83E-01  8.52E-01
8.23E-01  7.95E-01  7.68E-01  7.41E-01  7.16E-01  6.91E-01  6.68E-01  6.45E-01  6.23E-01  6.01E-01
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5.81E-01  5.61E-01  5.41E-01  5.23E-01  5.05E-01  4.88E-01  4.55E-01  4.24E-01  3.95E-01  3.69E-01
3.44E-01  3.21E-01  2.99E-01  2.79E-01  2.60E-01  2.43E-01  2.26E-01  2.11E-01  1.97E-01  1.83E-01
1.71E-01  1.60E-01  1.49E-01  1.39E-01  1.29E-01  1.21E-01  1.13E-01  1.05E-01  9.79E-02  9.13E-02
8.51E-02  7.94E-02  7.40E-02  6.90E-02  6.44E-02  6.00E-02  5.60E-02  5.22E-02  4.87E-02  4.54E-02
4.24E-02  3.95E-02  3.68E-02  3.44E-02  3.20E-02  2.99E-02  2.60E-02  2.26E-02  1.97E-02  1.71E-02
1.49E-02  1.25E-02  1.05E-02  8.80E-03  7.39E-03  6.21E-03  5.22E-03  4.38E-03  3.68E-03
   Os-194           6.00E+00  5.53E+08  1.95E+08  1.38E+08  9.76E+07  6.90E+07  4.88E+07  3.45E+07
2.44E+07  1.72E+07  9.66E+06  5.42E+06  3.04E+06  1.71E+06  9.56E+05  5.36E+05  3.01E+05  1.69E+05
9.47E+04  5.31E+04  2.98E+04  1.67E+04  9.37E+03  5.26E+03  2.95E+03  1.65E+03  9.28E+02  5.20E+02
2.92E+02  1.64E+02  9.19E+01  5.15E+01  2.89E+01  1.62E+01  9.09E+00  5.10E+00  2.86E+00  1.60E+00
9.00E-01  5.05E-01  2.83E-01  1.59E-01  8.91E-02  5.00E-02  2.80E-02  1.57E-02  8.82E-03  4.95E-03
2.78E-03  1.56E-03  8.73E-04  4.90E-04  2.75E-04  1.54E-04  8.65E-05  4.85E-05  2.72E-05  1.53E-05
8.56E-06  4.80E-06  2.69E-06  1.51E-06  8.47E-07  4.75E-07  1.50E-07  4.70E-08  1.48E-08  4.66E-09
1.47E-09  4.61E-10  1.45E-10  4.56E-11  1.44E-11  4.52E-12  1.42E-12  4.47E-13  1.41E-13  4.43E-14
1.39E-14  4.38E-15  1.38E-15  4.34E-16  1.37E-16  4.30E-17  1.35E-17  4.25E-18  1.34E-18  4.21E-19
1.32E-19  4.17E-20  1.31E-20  4.13E-21  1.30E-21  4.08E-22  1.28E-22  4.04E-23  1.27E-23  4.00E-24
1.26E-24  3.96E-25  1.25E-25  3.92E-26  1.23E-26  3.88E-27  3.84E-28  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pa-231           3.28E+04  8.46E+04  8.45E+04  8.45E+04  8.45E+04  8.44E+04  8.44E+04  8.44E+04
8.43E+04  8.43E+04  8.43E+04  8.42E+04  8.42E+04  8.41E+04  8.41E+04  8.40E+04  8.40E+04  8.39E+04
8.39E+04  8.38E+04  8.38E+04  8.38E+04  8.37E+04  8.37E+04  8.36E+04  8.36E+04  8.35E+04  8.35E+04
8.34E+04  8.34E+04  8.33E+04  8.33E+04  8.32E+04  8.32E+04  8.31E+04  8.31E+04  8.31E+04  8.30E+04
8.30E+04  8.29E+04  8.29E+04  8.28E+04  8.28E+04  8.27E+04  8.27E+04  8.26E+04  8.26E+04  8.25E+04
8.25E+04  8.25E+04  8.24E+04  8.24E+04  8.23E+04  8.23E+04  8.22E+04  8.22E+04  8.21E+04  8.21E+04
8.20E+04  8.20E+04  8.20E+04  8.19E+04  8.19E+04  8.18E+04  8.17E+04  8.16E+04  8.15E+04  8.14E+04
8.14E+04  8.13E+04  8.12E+04  8.11E+04  8.10E+04  8.09E+04  8.08E+04  8.07E+04  8.06E+04  8.05E+04
8.05E+04  8.04E+04  8.03E+04  8.02E+04  8.01E+04  8.00E+04  7.99E+04  7.98E+04  7.97E+04  7.97E+04
7.96E+04  7.95E+04  7.94E+04  7.93E+04  7.92E+04  7.91E+04  7.90E+04  7.89E+04  7.89E+04  7.88E+04
7.87E+04  7.86E+04  7.85E+04  7.84E+04  7.83E+04  7.82E+04  7.81E+04  7.79E+04  7.77E+04  7.75E+04
7.74E+04  7.72E+04  7.69E+04  7.67E+04  7.65E+04  7.63E+04  7.61E+04  7.59E+04  7.57E+04
   Pb-202           5.25E+04  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.10E+03  6.10E+03
6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03
6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03
6.08E+03  6.08E+03  6.08E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03
6.07E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03
6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.04E+03  6.04E+03  6.04E+03
6.04E+03  6.03E+03  6.03E+03  6.03E+03  6.03E+03  6.02E+03  6.02E+03  6.02E+03  6.02E+03  6.01E+03
6.01E+03  6.01E+03  6.01E+03  6.01E+03  6.00E+03  6.00E+03  6.00E+03  6.00E+03  5.99E+03  5.99E+03
5.99E+03  5.99E+03  5.98E+03  5.98E+03  5.98E+03  5.98E+03  5.97E+03  5.97E+03  5.97E+03  5.97E+03
5.96E+03  5.96E+03  5.96E+03  5.96E+03  5.96E+03  5.95E+03  5.95E+03  5.94E+03  5.94E+03  5.93E+03
5.93E+03  5.92E+03  5.92E+03  5.91E+03  5.91E+03  5.90E+03  5.89E+03  5.89E+03  5.88E+03
   Pb-210           2.23E+01  1.37E+08  1.04E+08  9.43E+07  8.59E+07  7.83E+07  7.13E+07  6.49E+07
5.91E+07  5.39E+07  4.61E+07  3.95E+07  3.38E+07  2.89E+07  2.48E+07  2.12E+07  1.81E+07  1.55E+07
1.33E+07  1.14E+07  9.73E+06  8.33E+06  7.13E+06  6.10E+06  5.23E+06  4.47E+06  3.83E+06  3.28E+06
2.80E+06  2.40E+06  2.05E+06  1.76E+06  1.51E+06  1.29E+06  1.10E+06  9.44E+05  8.08E+05  6.92E+05
5.92E+05  5.07E+05  4.34E+05  3.71E+05  3.18E+05  2.72E+05  2.33E+05  1.99E+05  1.71E+05  1.46E+05
1.25E+05  1.07E+05  9.16E+04  7.84E+04  6.71E+04  5.74E+04  4.92E+04  4.21E+04  3.60E+04  3.08E+04
2.64E+04  2.26E+04  1.93E+04  1.65E+04  1.42E+04  1.21E+04  8.88E+03  6.51E+03  4.77E+03  3.49E+03
2.56E+03  1.87E+03  1.37E+03  1.01E+03  7.37E+02  5.40E+02  3.96E+02  2.90E+02  2.12E+02  1.56E+02
1.14E+02  8.35E+01  6.12E+01  4.48E+01  3.29E+01  2.41E+01  1.76E+01  1.29E+01  9.47E+00  6.93E+00
5.08E+00  3.72E+00  2.73E+00  2.00E+00  1.46E+00  1.07E+00  7.86E-01  5.76E-01  4.22E-01  3.09E-01
2.26E-01  1.66E-01  1.22E-01  8.90E-02  6.52E-02  4.78E-02  2.57E-02  1.38E-02  7.39E-03  3.97E-03
2.13E-03  9.78E-04  4.50E-04  2.07E-04  9.49E-05  4.36E-05  2.00E-05  9.20E-06  4.23E-06
   Pd-107           6.50E+06  9.18E+02  9.11E+02  9.09E+02  9.06E+02  9.04E+02  9.01E+02  8.99E+02
8.97E+02  8.94E+02  8.91E+02  8.87E+02  8.83E+02  8.79E+02  8.75E+02  8.72E+02  8.68E+02  8.64E+02
8.60E+02  8.57E+02  8.53E+02  8.49E+02  8.46E+02  8.42E+02  8.38E+02  8.35E+02  8.31E+02  8.27E+02
8.24E+02  8.20E+02  8.17E+02  8.13E+02  8.10E+02  8.06E+02  8.03E+02  7.99E+02  7.96E+02  7.92E+02
7.89E+02  7.86E+02  7.82E+02  7.79E+02  7.75E+02  7.72E+02  7.69E+02  7.65E+02  7.62E+02  7.59E+02
7.56E+02  7.52E+02  7.49E+02  7.46E+02  7.43E+02  7.39E+02  7.36E+02  7.33E+02  7.30E+02  7.27E+02
7.24E+02  7.21E+02  7.17E+02  7.14E+02  7.11E+02  7.08E+02  7.02E+02  6.96E+02  6.90E+02  6.84E+02
6.78E+02  6.72E+02  6.67E+02  6.61E+02  6.55E+02  6.49E+02  6.44E+02  6.38E+02  6.33E+02  6.27E+02
6.22E+02  6.17E+02  6.11E+02  6.06E+02  6.01E+02  5.96E+02  5.91E+02  5.85E+02  5.80E+02  5.75E+02
5.70E+02  5.66E+02  5.61E+02  5.56E+02  5.51E+02  5.46E+02  5.42E+02  5.37E+02  5.32E+02  5.28E+02
5.23E+02  5.19E+02  5.14E+02  5.10E+02  5.05E+02  5.01E+02  4.92E+02  4.84E+02  4.76E+02  4.68E+02
4.59E+02  4.50E+02  4.40E+02  4.31E+02  4.21E+02  4.12E+02  4.04E+02  3.95E+02  3.86E+02
   Pm-145           1.77E+01  2.52E+08  1.77E+08  1.57E+08  1.40E+08  1.24E+08  1.11E+08  9.83E+07
8.74E+07  7.77E+07  6.38E+07  5.25E+07  4.31E+07  3.54E+07  2.91E+07  2.39E+07  1.97E+07  1.62E+07
1.33E+07  1.09E+07  8.97E+06  7.37E+06  6.06E+06  4.98E+06  4.09E+06  3.36E+06  2.77E+06  2.27E+06
1.87E+06  1.54E+06  1.26E+06  1.04E+06  8.52E+05  7.00E+05  5.76E+05  4.73E+05  3.89E+05  3.20E+05
2.63E+05  2.16E+05  1.77E+05  1.46E+05  1.20E+05  9.85E+04  8.09E+04  6.65E+04  5.47E+04  4.49E+04
3.69E+04  3.03E+04  2.49E+04  2.05E+04  1.68E+04  1.38E+04  1.14E+04  9.35E+03  7.68E+03  6.32E+03
5.19E+03  4.27E+03  3.51E+03  2.88E+03  2.37E+03  1.95E+03  1.31E+03  8.88E+02  6.00E+02  4.05E+02
2.74E+02  1.85E+02  1.25E+02  8.43E+01  5.70E+01  3.85E+01  2.60E+01  1.76E+01  1.19E+01  8.01E+00
5.41E+00  3.65E+00  2.47E+00  1.67E+00  1.13E+00  7.60E-01  5.14E-01  3.47E-01  2.34E-01  1.58E-01
1.07E-01  7.22E-02  4.88E-02  3.29E-02  2.23E-02  1.50E-02  1.02E-02  6.86E-03  4.63E-03  3.13E-03
2.11E-03  1.43E-03  9.64E-04  6.51E-04  4.40E-04  2.97E-04  1.36E-04  6.19E-05  2.82E-05  1.29E-05
5.87E-06  2.20E-06  8.26E-07  3.10E-07  1.16E-07  4.35E-08  1.63E-08  6.12E-09  2.30E-09
   Pm-147           2.62E+00  7.92E+02  7.32E+01  3.31E+01  1.50E+01  6.76E+00  3.06E+00  1.38E+00
6.25E-01  2.82E-01  7.52E-02  2.00E-02  5.33E-03  1.42E-03  3.78E-04  1.01E-04  2.68E-05  7.14E-06
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1.90E-06  5.06E-07  1.35E-07  3.59E-08  9.56E-09  2.55E-09  6.78E-10  1.80E-10  4.81E-11  1.28E-11
3.41E-12  9.07E-13  2.42E-13  6.43E-14  1.71E-14  4.56E-15  1.21E-15  3.24E-16  8.61E-17  2.29E-17
6.11E-18  1.63E-18  4.33E-19  1.15E-19  3.07E-20  8.18E-21  2.18E-21  5.80E-22  1.54E-22  4.11E-23
1.10E-23  2.92E-24  7.76E-25  2.07E-25  5.51E-26  1.47E-26  3.90E-27  1.04E-27  2.77E-28  7.37E-29
1.96E-29  5.23E-30  1.39E-30  3.71E-31  9.87E-32  2.63E-32  1.86E-33  1.32E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-208           2.90E+00  7.92E+02  9.21E+01  4.50E+01  2.19E+01  1.07E+01  5.23E+00  2.55E+00
1.25E+00  6.08E-01  1.84E-01  5.57E-02  1.68E-02  5.10E-03  1.54E-03  4.67E-04  1.41E-04  4.27E-05
1.29E-05  3.91E-06  1.18E-06  3.58E-07  1.08E-07  3.28E-08  9.93E-09  3.00E-09  9.09E-10  2.75E-10
8.32E-11  2.52E-11  7.62E-12  2.31E-12  6.98E-13  2.11E-13  6.39E-14  1.93E-14  5.85E-15  1.77E-15
5.36E-16  1.62E-16  4.90E-17  1.48E-17  4.49E-18  1.36E-18  4.11E-19  1.24E-19  3.77E-20  1.14E-20
3.45E-21  1.04E-21  3.16E-22  9.55E-23  2.89E-23  8.75E-24  2.65E-24  8.01E-25  2.42E-25  7.33E-26
2.22E-26  6.71E-27  2.03E-27  6.15E-28  1.86E-28  5.63E-29  5.15E-30  4.72E-31  4.32E-32  3.96E-33
3.62E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-209           1.02E+02  3.02E+07  2.84E+07  2.78E+07  2.73E+07  2.67E+07  2.62E+07  2.56E+07
2.51E+07  2.46E+07  2.38E+07  2.30E+07  2.22E+07  2.14E+07  2.07E+07  2.00E+07  1.93E+07  1.87E+07
1.81E+07  1.75E+07  1.69E+07  1.63E+07  1.58E+07  1.52E+07  1.47E+07  1.42E+07  1.37E+07  1.33E+07
1.28E+07  1.24E+07  1.20E+07  1.16E+07  1.12E+07  1.08E+07  1.04E+07  1.01E+07  9.75E+06  9.42E+06
9.11E+06  8.80E+06  8.50E+06  8.22E+06  7.94E+06  7.67E+06  7.41E+06  7.16E+06  6.92E+06  6.69E+06
6.46E+06  6.25E+06  6.04E+06  5.83E+06  5.64E+06  5.45E+06  5.26E+06  5.09E+06  4.92E+06  4.75E+06
4.59E+06  4.44E+06  4.29E+06  4.14E+06  4.00E+06  3.87E+06  3.61E+06  3.37E+06  3.15E+06  2.94E+06
2.75E+06  2.56E+06  2.39E+06  2.24E+06  2.09E+06  1.95E+06  1.82E+06  1.70E+06  1.59E+06  1.48E+06
1.38E+06  1.29E+06  1.21E+06  1.13E+06  1.05E+06  9.83E+05  9.17E+05  8.57E+05  8.00E+05  7.47E+05
6.98E+05  6.51E+05  6.08E+05  5.68E+05  5.30E+05  4.95E+05  4.62E+05  4.32E+05  4.03E+05  3.77E+05
3.52E+05  3.28E+05  3.07E+05  2.86E+05  2.67E+05  2.50E+05  2.18E+05  1.90E+05  1.65E+05  1.44E+05
1.26E+05  1.06E+05  8.93E+04  7.53E+04  6.34E+04  5.34E+04  4.50E+04  3.79E+04  3.20E+04
   Pt-193           5.00E+01  6.66E+07  5.85E+07  5.60E+07  5.37E+07  5.14E+07  4.92E+07  4.71E+07
4.51E+07  4.32E+07  4.02E+07  3.74E+07  3.48E+07  3.24E+07  3.02E+07  2.81E+07  2.61E+07  2.43E+07
2.26E+07  2.10E+07  1.96E+07  1.82E+07  1.70E+07  1.58E+07  1.47E+07  1.37E+07  1.27E+07  1.18E+07
1.10E+07  1.02E+07  9.53E+06  8.87E+06  8.25E+06  7.68E+06  7.14E+06  6.65E+06  6.19E+06  5.76E+06
5.36E+06  4.98E+06  4.64E+06  4.32E+06  4.02E+06  3.74E+06  3.48E+06  3.24E+06  3.01E+06  2.80E+06
2.61E+06  2.43E+06  2.26E+06  2.10E+06  1.95E+06  1.82E+06  1.69E+06  1.57E+06  1.47E+06  1.36E+06
1.27E+06  1.18E+06  1.10E+06  1.02E+06  9.51E+05  8.85E+05  7.67E+05  6.64E+05  5.75E+05  4.98E+05
4.31E+05  3.73E+05  3.23E+05  2.80E+05  2.42E+05  2.10E+05  1.82E+05  1.57E+05  1.36E+05  1.18E+05
1.02E+05  8.84E+04  7.65E+04  6.63E+04  5.74E+04  4.97E+04  4.30E+04  3.72E+04  3.22E+04  2.79E+04
2.42E+04  2.09E+04  1.81E+04  1.57E+04  1.36E+04  1.18E+04  1.02E+04  8.82E+03  7.64E+03  6.61E+03
5.73E+03  4.96E+03  4.29E+03  3.72E+03  3.22E+03  2.79E+03  2.09E+03  1.57E+03  1.17E+03  8.81E+02
6.60E+02  4.61E+02  3.21E+02  2.24E+02  1.56E+02  1.09E+02  7.61E+01  5.31E+01  3.71E+01
*********** MAXIMUM DOSES & DOMINANT NUCLIDES BY PATHWAY **********
 EnergySolns CAW, run VT09a, vert., 0.090 cm/yr, 10 cm d.
            PATHWAY        DUST          ATMOSPHERIC          GAMMA              WELL              FOOD
        ANNUAL DOSE     0.00E+00          0.00E+00          0.00E+00          0.00E+00          0.00E+00
               YEAR        0                 0                 0                 0                 0
   DOMINANT NUCLIDE
```

# PATHRAE MODEL VERTICAL OUTPUT FILE FILE --09Wb.OUT.docx 0.09 CM/YR CASE -PART 2

```
 PATHRAE-RAD(PC)  Version 2.2d  February 1995
   Date: 11- 3-2011
   Time: 13:11: 7
 EnergySolns LARW, run VS238bw, vert., 0.238 cm/yr, 10 cm d.
 *****  Mirror Image of Input Files  *****
 -- Input File:  ABCDEF.DAT
 EnergySolns LARW, run VS238bw, vert., 0.238 cm/yr, 10 cm d.

116,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,11
0.,115.,120.,125.,130.,135.,14
 41,0,1
 1,2
 0,1.,1.,9.00E-04,9.00E-04,4.072,0
 1563.,0.100,0,0,0.235,3.20E-02,2.09,0
 1,0,0,0,0,0
 0,1.,1.,4.072,0,1800.,1.,0,0,0
 0,0,0,0.0,1.
 0,0,0,0,0,0,0
 0,0,0,0,0,0,0,0,0,0,0
 4,7
 1,0,1,0
 0.00090,0.0097,0.100,0,0,1.,0,1.,0,0.354

 -- Input File:  BRCDCF.DAT
 158,Pu-236  0,0,0,0,0,0,0
 159,Pu-238  0,0,0,0,0,0,0
 160,Pu-239  0,0,0,0,0,0,0
 45,Pu-240   0,0,0,0,0,0,0
 46,Pu-241   0,0,0,0,0,0,0
 161,Pu-242  0,0,0,0,0,0,0
 162,Pu-244  0,0,0,0,0,0,0
 55,Ra-226   0,0,0,0,0,0,0
 163,Ra-228  0,0,0,0,0,0,0
 164,Re-187  0,0,0,0,0,0,0
 165,Se-79   0,0,0,0,0,0,0
 166,Si-32   0,0,0,0,0,0,0
 167,Sm-151  0,0,0,0,0,0,0
 168,Sn-121m 0,0,0,0,0,0,0
 169,Sn-126  0,0,0,0,0,0,0
 170,Sr-90   0,0,0,0,0,0,0
 171,Tb-157  0,0,0,0,0,0,0
 172,Tb-158  0,0,0,0,0,0,0
 173,Tc-99   0,0,0,0,0,0,0
 174,Te-123  0,0,0,0,0,0,0
 175,Th-229  0,0,0,0,0,0,0
 36,Th-230   0,0,0,0,0,0,0
 176,Th-232  0,0,0,0,0,0,0
 177,Ti-44   0,0,0,0,0,0,0
 178,Tl-204  0,0,0,0,0,0,0
 179,Tm-170  0,0,0,0,0,0,0
 180,U-232   0,0,0,0,0,0,0
 181,U-233   0,0,0,0,0,0,0
 182,U-234   0,0,0,0,0,0,0
 183,U-235   0,0,0,0,0,0,0
 40,U-236    0,0,0,0,0,0,0
 41,U-238    0,0,0,0,0,0,0
 184,V-50    0,0,0,0,0,0,0
 185,Zr-93   0,0,0,0,0,0,0
 186,Ks-20   0,0,0,0,0,0,0
 187,Ks-21   0,0,0,0,0,0,0
 188,Ks-22   0,0,0,0,0,0,0
 189,Ks-23   0,0,0,0,0,0,0
 190,Ks-24   0,0,0,0,0,0,0
 191,Ks-25   0,0,0,0,0,0,0
 192,Ks-26   0,0,0,0,0,0,0
 -- Input File:  INVNTRY.DAT
 55,1.60E+03,1.80E-02,0,0,0,0,0
 45,6.56E+03,1.80E-02,0,0,0,0,0
 46,1.44E+01,6.30E-01,0,0,0,0,0
 36,7.54E+04,3.71E+04,0,0,0,0,0
 40,2.34E+07,1.16E+02,0,0,0,0,0
 41,4.47E+09,6.05E-01,0,0,0,0,0
 158,2.86E+00,9.00E-04,0,0,0,0,0
 159,8.77E+01,1.80E-02,0,0,0,0,0
 160,2.41E+04,1.80E-02,0,0,0,0,0
 161,3.73E+05,1.80E-02,0,0,0,0,0
 162,8.08E+07,9.00E-04,0,0,0,0,0
 163,5.75E+00,4.90E+08,0,0,0,0,0
 164,4.35E+10,6.84E-02,0,0,0,0,0
 165,6.50E+04,1.25E+05,0,0,0,0,0
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166,1.72E+02,1.17E+08,0,0,0,0,0
167,9.00E+01,4.74E+07,0,0,0,0,0
168,5.50E+01,9.68E+07,0,0,0,0,0
169,1.00E+05,5.11E+04,0,0,0,0,0
170,2.88E+01,4.50E-02,0,0,0,0,0
171,7.10E+01,2.70E+07,0,0,0,0,0
172,1.80E+02,2.70E+07,0,0,0,0,0
173,2.11E+05,3.38E-01,0,0,0,0,0
174,1.00E+13,5.24E-04,0,0,0,0,0
175,7.88E+03,3.83E+05,0,0,0,0,0
176,1.41E+10,1.98E-01,0,0,0,0,0
177,6.30E+01,2.81E+08,0,0,0,0,0
178,3.78E+00,7.92E+02,0,0,0,0,0
179,3.52E-01,7.92E+02,0,0,0,0,0
180,6.89E+01,3.97E+07,0,0,0,0,0
181,1.59E+05,1.35E-01,0,0,0,0,0
182,2.46E+05,1.12E+04,0,0,0,0,0
183,7.04E+08,2.79E-02,0,0,0,0,0
184,1.40E+17,9.20E-08,0,0,0,0,0
185,1.53E+06,4.53E+03,0,0,0,0,0
186,1.00E+00,7.92E+02,0,0,0,0,0
187,1.00E+00,7.92E+02,0,0,0,0,0
188,1.00E+00,7.92E+02,0,0,0,0,0
189,1.00E+00,7.92E+02,0,0,0,0,0
190,4.00E+00,7.92E+02,0,0,0,0,0
191,4.00E+00,7.92E+02,0,0,0,0,0
192,2.00E+00,7.92E+02,0,0,0,0,0

-- Input File:  RQSITE.DAT
101,1.10E-04,4.5,4.5
102,1.83E-04,2.7,2.7
103,3.33E-05,15.,15.
48,4.86E-04,1.,1.
104,4.86E-04,1.,1.
105,4.86E-04,1.,1.
106,4.99E-05,10.,10.
107,1.98E-04,2.5,2.5
108,4.86E-04,1.,1.
109,4.86E-04,1.,1.
110,1.73E-02,0.001,0.001
111,5.85E-05,8.52,8.52
112,6.42E-03,0.05,0.05
113,4.86E-04,1.,1.
114,4.86E-04,1.,1.
115,2.47E-04,2.,2.
116,2.47E-04,2.,2.
117,2.47E-04,2.,2.
118,2.47E-04,2.,2.
119,1.65E-02,0.0025,0.0025
120,5.36E-06,93.3,93.3
50,5.36E-06,93.3,93.3
121,5.36E-06,93.3,93.3
122,5.36E-06,93.3,93.3
123,5.36E-06,93.3,93.3
124,5.36E-06,93.3,93.3
125,1.35E-06,370.,370.
126,3.76E-06,133.,133.
127,3.76E-06,133.,133.
128,7.66E-05,6.5,6.5
129,7.66E-05,6.5,6.5
130,7.66E-05,6.5,6.5
131,3.50E-04,1.4,1.4
132,3.50E-04,1.4,1.4
133,7.66E-05,6.5,6.5
134,7.37E-03,0.04,0.04
135,4.99E-05,10.,10.
136,1.98E-04,2.5,2.5
137,3.38E-03,0.12,0.12
139,7.78E-05,6.4,6.4
140,4.86E-04,1.,1.
141,3.07E-04,1.6,1.6
142,3.07E-04,1.6,1.6
143,3.07E-04,1.6,1.6
144,3.07E-04,1.6,1.6
146,4.99E-05,10.,10.
147,4.99E-05,10.,10.
42,1.65E-04,3.,3.
148,1.10E-04,4.5,4.5
149,9.05E-05,5.5,5.5
150,2.63E-05,19.,19.
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151,2.63E-05,19.,19.
152,8.65E-04,0.55,0.55
153,7.66E-05,6.5,6.5
154,7.66E-05,6.5,6.5
155,5.54E-05,9.,9.
156,5.54E-05,9.,9.
157,5.39E-04,0.9,0.9
158,4.99E-05,10.,10.
159,4.99E-05,10.,10.
160,4.99E-05,10.,10.
45,4.99E-05,10.,10.
46,4.99E-05,10.,10.
161,4.99E-05,10.,10.
162,4.99E-05,10.,10.
55,4.99E-05,10.,10.
163,4.99E-05,10.,10.
164,4.86E-03,0.075,0.075
165,4.86E-04,1.,1.
166,1.32E-03,0.35,0.35
167,2.02E-04,2.45,2.45
168,9.99E-06,50.,50.
169,9.99E-06,50.,50.
170,6.42E-03,0.05,0.05
171,7.66E-05,6.5,6.5
172,7.66E-05,6.5,6.5
173,3.63E-03,0.11,0.11
174,3.91E-04,1.25,1.25
175,4.99E-05,10.,10.
36,4.99E-05,10.,10.
176,4.99E-05,10.,10.
177,4.99E-05,10.,10.
178,2.81E-03,0.15,0.15
179,7.66E-05,6.5,6.5
180,8.29E-05,6.,6.
181,8.29E-05,6.,6.
182,8.29E-05,6.,6.
183,8.29E-05,6.,6.
40,8.29E-05,6.,6.
41,8.29E-05,6.,6.
184,4.99E-05,10.,10.
185,4.99E-05,10.,10.
186,1.73E-02,0.001,0.001
187,1.32E-02,0.01,0.01
188,3.91E-03,0.1,0.1
189,4.86E-04,1.,1.
190,9.99E-06,50.,50.
191,5.00E-06,100.,100.
192,4.86E-04,1.,1.
-- Input File:  UPTAKE.DAT
9.00E-04,3.54E-01,1.563
0,0,0,0,0
0,0,0
0,0,0,0
0,0,0,0,0
0,0,0,0,0,730.,0
158,0.00E+00,0.0,0.0,0,0,0,0
159,0.00E+00,0.0,0.0,0,0,0,0
160,0.00E+00,0.0,0.0,0,0,0,0
45,0.00E+00,0.0,0.0,0,0,0,0
46,0.00E+00,0.0,0.0,0,0,0,0
161,0.00E+00,0.0,0.0,0,0,0,0
162,0.00E+00,0.0,0.0,0,0,0,0
55,0.00E+00,0.0,0.0,0,0,0,0
163,0.00E+00,0.0,0.0,0,0,0,0
164,0.00E+00,0.0,0.0,0,0,0,0
165,0.00E+00,0.0,0.0,0,0,0,0
166,0.00E+00,0.0,0.0,0,0,0,0
167,0.00E+00,0.0,0.0,0,0,0,0
168,0.00E+00,0.0,0.0,0,0,0,0
169,0.00E+00,0.0,0.0,0,0,0,0
170,0.00E+00,0.0,0.0,0,0,0,0
171,0.00E+00,0.0,0.0,0,0,0,0
172,0.00E+00,0.0,0.0,0,0,0,0
173,0.00E+00,0.0,0.0,0,0,0,0
174,0.00E+00,0.0,0.0,0,0,0,0
175,0.00E+00,0.0,0.0,0,0,0,0
36,0.00E+00,0.0,0.0,0,0,0,0
176,0.00E+00,0.0,0.0,0,0,0,0
177,0.00E+00,0.0,0.0,0,0,0,0
178,0.00E+00,0.0,0.0,0,0,0,0
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179,0.00E+00,0.0,0.0,0,0,0,0
180,0.00E+00,0.0,0.0,0,0,0,0
181,0.00E+00,0.0,0.0,0,0,0,0
182,0.00E+00,0.0,0.0,0,0,0,0
183,0.00E+00,0.0,0.0,0,0,0,0
40,0.00E+00,0.0,0.0,0,0,0,0
41,0.00E+00,0.0,0.0,0,0,0,0
184,0.00E+00,0.0,0.0,0,0,0,0
185,0.00E+00,0.0,0.0,0,0,0,0
186,0.00E+00,0.0,0.0,0,0,0,0
187,0.00E+00,0.0,0.0,0,0,0,0
188,0.00E+00,0.0,0.0,0,0,0,0
189,0.00E+00,0.0,0.0,0,0,0,0
190,0.00E+00,0.0,0.0,0,0,0,0
191,0.00E+00,0.0,0.0,0,0,0,0
192,0.00E+00,0.0,0.0,0,0,0,0

1
                    TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
              UT(J,1)   UT(J,2)   UT(J,3)   UT(J,4)   UT(J,5)   UT(J,6)
               RIVER     WELL     EROSION   BATHTUB  SPILLAGE    FOOD
NUCLIDE         L/YR      L/YR      L/YR      L/YR      L/YR      KG/YR
  Pu-236      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-238      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-239      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-242      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-244      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ra-228      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Re-187      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Se-79       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Si-32       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Sm-151      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Sn-121m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Sn-126      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Sr-90       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Tb-157      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Tb-158      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Tc-99       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Te-123      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Th-229      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Th-232      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ti-44       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Tl-204      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Tm-170      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  U-232       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  U-233       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  U-234       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  U-235       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  V-50        0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Zr-93       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-20       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-21       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-22       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-23       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-24       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-25       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ks-26       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Th-230      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  U-236       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  U-238       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-240      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pu-241      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ra-226      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS116
YEARS TO BE CALCULATED ARE ...
     6.00     9.00    12.00    15.00    18.00
    21.00    24.00    27.00    30.00    35.00
    40.00    45.00    50.00    55.00    60.00
    65.00    70.00    75.00    80.00    85.00
    90.00    95.00   100.00   105.00   110.00
   115.00   120.00   125.00   130.00   135.00
   140.00   145.00   150.00   155.00   160.00
   165.00   170.00   175.00   180.00   185.00
   190.00   195.00   200.00   205.00   210.00
   215.00   220.00   225.00   230.00   235.00
   240.00   245.00   250.00   255.00   260.00
   265.00   270.00   275.00   280.00   285.00
   290.00   295.00   300.00   310.00   320.00
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   330.00   340.00   350.00   360.00   370.00
   380.00   390.00   400.00   410.00   420.00
   430.00   440.00   450.00   460.00   470.00
   480.00   490.00   500.00   510.00   520.00
   530.00   540.00   550.00   560.00   570.00
   580.00   590.00   600.00   610.00   620.00
   630.00   640.00   650.00   660.00   670.00
   680.00   690.00   700.00   720.00   740.00
   760.00   780.00   800.00   825.00   850.00
   875.00   900.00   925.00   950.00   975.00
  1000.00
THERE ARE  41 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
           PATHWAY           TYPE OF USAGE
                            FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER        2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                    0.
LENGTH OF REPOSITORY (M)                                        1.
WIDTH OF REPOSITORY (M)                                         1.
RIVER FLOW RATE (M**3/YR)                                       9.00E-04
STREAM FLOW RATE (M**3/YR)                                      9.00E-04
DISTANCE TO RIVER (M)                                           4.
OPERATIONAL SPILLAGE FRACTION                                   0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                 1563.
LONGITUDINAL DISPERSIVITY (M)                                   1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)              0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                1
FLAG FOR GAMMA PATHWAY OPTIONS                                  0
FLAG FOR GAMMA BUILDUP CALCULATION                              0
FLAG FOR ATMOSPHERIC PATHWAY                                    0
COVER THICKNESS OVER WASTE (M)                                   .00
THICKNESS OF WASTE IN PITS (M)                                  1.00
TOTAL WASTE VOLUME (M**3)                                       1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                            4.
DISTANCE TO WELL -- Y COORDINATE (M)                            0.
DENSITY OF WASTE (KG/M**3)                                   1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                 1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                 .000
DEPTH OF PLANT ROOT ZONE (M)                                     .000
AREAL DENSITY OF PLANTS (KG/M**2)                                .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                           0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                           0.
FRACTION OF YEAR EXPOSED TO DUST                                 .000
CANISTER LIFETIME (YEARS)                                       0.
INVENTORY SCALING FACTOR                                        1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                         0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                0.00E+00
RADON EMANATING POWER OF THE WASTE                              0.00E+00
DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                  0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                  0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                            .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                  0.00E+00
ATMOSPHERIC STABILITY CLASS                                     0
AVERAGE WIND SPEED (M/S)                                         .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                      .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                    .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)           0.00E+00
DEPOSITION VELOCITY (M/S)                                        .0000
STACK HEIGHT (M)                                                 .0
STACK INSIDE DIAMETER (M)                                        .00
STACK GAS VELOCITY (M/S)                                         .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                         0.00E+00
DECAY CHAIN FLAGS                        4   7   0   0   0   0  0
FLAG FOR INPUT SUMMARY PRINTOUT                                 1
FLAG FOR DIRECTION OF TRENCH FILLING                            1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                            0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)          9.00E-04
DEGREE OF SOIL SATURATION                                        .235
RESIDUAL SOIL SATURATION                                         .032
PERMEABILITY OF VERTICAL ZONE (M/YR)                            2.09
SOIL NUMBER                                                      .000
POROSITY OF AQUIFER                                              .10
POROSITY OF UNSATURATED ZONE                                     .35
DISTANCE FROM AQUIFER TO WASTE (M)                               .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                    1.08E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                            .0
LENGTH OF PERFORATED WELL CASING (M)                            1.000
SURFACE EROSION RATE (M/YR)                                     0.000E+00
LEACH RATE SCALING FACTOR                                       1.000E+00
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ANNUAL RUNOFF OF PRECIPITATION (M) 0.00E+00

| NUCLIDE | INGESTION DOSE FACTORS (MREM/PCI) | INHALATION DOSE FACTORS (MREM/PCI) | DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR) | HALF LIFE (YR) |
|---|---|---|---|---|
| Pu-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.860E+00 |
| Pu-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.770E+01 |
| Pu-239 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.410E+04 |
| Pu-242 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.730E+05 |
| Pu-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.080E+07 |
| Ra-228 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.750E+00 |
| Re-187 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.350E+10 |
| Se-79 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.500E+04 |
| Si-32 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.720E+02 |
| Sm-151 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 9.000E+01 |
| Sn-121m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.500E+01 |
| Sn-126 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+05 |
| Sr-90 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.880E+01 |
| Tb-157 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.100E+01 |
| Tb-158 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.800E+02 |
| Tc-99 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.110E+05 |
| Te-123 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+13 |
| Th-229 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.880E+03 |
| Th-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.410E+10 |
| Ti-44 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.300E+01 |
| Tl-204 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.780E+00 |
| Tm-170 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.520E-01 |
| U-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.890E+01 |
| U-233 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.590E+05 |
| U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.460E+05 |
| U-235 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.040E+08 |
| V-50 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.400E+17 |
| Zr-93 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.530E+06 |
| Ks-20 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-21 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-23 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-24 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.000E+00 |
| Ks-25 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.000E+00 |
| Ks-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.000E+00 |
| Th-230 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.540E+04 |
| U-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.340E+07 |
| U-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.470E+09 |
| Pu-240 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.560E+03 |
| Pu-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.440E+01 |
| Ra-226 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.600E+03 |

| NUCLIDE | VOLATILITY FRACTION | GAMMA ENERGY (MEV) | GAMMA ATTENUATION (1/M) |
|---|---|---|---|
| Pu-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-239 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-242 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-228 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Re-187 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Se-79 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Si-32 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sm-151 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-121m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-126 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sr-90 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-157 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-158 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tc-99 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Te-123 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-229 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ti-44 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tl-204 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tm-170 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-233 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-235 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| V-50 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Zr-93 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-20 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-21 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-23 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| | | | |
|---|---|---|---|
| Ks-24 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-25 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-230 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-240 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-226 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| NUCLIDE | INPUT LEACH RATE (1/YR) | FINAL LEACH RATE (1/YR) | SOLUBILITY (MOLE/L) | INPUT INVENTORY (CI) |
|---|---|---|---|---|
| Pu-236 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 9.000E-04 |
| Pu-238 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 1.800E-02 |
| Pu-239 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 1.800E-02 |
| Pu-242 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 1.800E-02 |
| Pu-244 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 9.000E-04 |
| Ra-228 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 4.900E+08 |
| Re-187 | 4.860E-03 | 4.860E-03 | 0.000E+00 | 6.840E-02 |
| Se-79 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 1.250E+05 |
| Si-32 | 1.320E-03 | 1.320E-03 | 0.000E+00 | 1.170E+08 |
| Sm-151 | 2.020E-04 | 2.020E-04 | 0.000E+00 | 4.740E+07 |
| Sn-121m | 9.990E-06 | 9.990E-06 | 0.000E+00 | 9.680E+07 |
| Sn-126 | 9.990E-06 | 9.990E-06 | 0.000E+00 | 5.110E+04 |
| Sr-90 | 6.420E-03 | 6.420E-03 | 0.000E+00 | 4.500E-02 |
| Tb-157 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 2.700E+07 |
| Tb-158 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 2.700E+07 |
| Tc-99 | 3.630E-03 | 3.630E-03 | 0.000E+00 | 3.380E-01 |
| Te-123 | 3.910E-04 | 3.910E-04 | 0.000E+00 | 5.240E-04 |
| Th-229 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 3.830E+05 |
| Th-232 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 1.980E-01 |
| Ti-44 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 2.810E+08 |
| Tl-204 | 2.810E-03 | 2.810E-03 | 0.000E+00 | 7.920E+02 |
| Tm-170 | 7.660E-05 | 7.660E-05 | 0.000E+00 | 7.920E+02 |
| U-232 | 8.290E-05 | 8.290E-05 | 0.000E+00 | 3.970E+07 |
| U-233 | 8.290E-05 | 8.290E-05 | 0.000E+00 | 1.350E-01 |
| U-234 | 8.290E-05 | 8.290E-05 | 0.000E+00 | 1.120E+04 |
| U-235 | 8.290E-05 | 8.290E-05 | 0.000E+00 | 2.790E-02 |
| V-50 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 9.200E-08 |
| Zr-93 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 4.530E+03 |
| Ks-20 | 1.730E-02 | 1.730E-02 | 0.000E+00 | 7.920E+02 |
| Ks-21 | 1.320E-02 | 1.320E-02 | 0.000E+00 | 7.920E+02 |
| Ks-22 | 3.910E-03 | 3.910E-03 | 0.000E+00 | 7.920E+02 |
| Ks-23 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 7.920E+02 |
| Ks-24 | 9.990E-06 | 9.990E-06 | 0.000E+00 | 7.920E+02 |
| Ks-25 | 5.000E-06 | 5.000E-06 | 0.000E+00 | 7.920E+02 |
| Ks-26 | 4.860E-04 | 4.860E-04 | 0.000E+00 | 7.920E+02 |
| Th-230 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 3.710E+04 |
| U-236 | 8.290E-05 | 8.290E-05 | 0.000E+00 | 1.160E+02 |
| U-238 | 8.290E-05 | 8.290E-05 | 0.000E+00 | 6.050E-01 |
| Pu-240 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 1.800E-02 |
| Pu-241 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 6.300E-01 |
| Ra-226 | 4.990E-05 | 4.990E-05 | 0.000E+00 | 1.800E-02 |

| NUCLIDE | AQUIFER SORPTION | AQUIFER RETARDATION | VERTICAL SORPTION | VERTICAL RETARDATION |
|---|---|---|---|---|
| Pu-236 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Pu-238 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Pu-239 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Pu-242 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Pu-244 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Ra-228 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Re-187 | 7.500E-02 | 2.172E+00 | 7.500E-02 | 2.409E+00 |
| Se-79 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Si-32 | 3.500E-01 | 6.471E+00 | 3.500E-01 | 7.576E+00 |
| Sm-151 | 2.450E+00 | 3.929E+01 | 2.450E+00 | 4.703E+01 |
| Sn-121m | 5.000E+01 | 7.825E+02 | 5.000E+01 | 9.404E+02 |
| Sn-126 | 5.000E+01 | 7.825E+02 | 5.000E+01 | 9.404E+02 |
| Sr-90 | 5.000E-02 | 1.782E+00 | 5.000E-02 | 1.939E+00 |
| Tb-157 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Tb-158 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| Tc-99 | 1.100E-01 | 2.719E+00 | 1.100E-01 | 3.067E+00 |
| Te-123 | 1.250E+00 | 2.054E+01 | 1.250E+00 | 2.449E+01 |
| Th-229 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Th-232 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Ti-44 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Tl-204 | 1.500E-01 | 3.345E+00 | 1.500E-01 | 3.818E+00 |
| Tm-170 | 6.500E+00 | 1.026E+02 | 6.500E+00 | 1.231E+02 |
| U-232 | 6.000E+00 | 9.478E+01 | 6.000E+00 | 1.137E+02 |
| U-233 | 6.000E+00 | 9.478E+01 | 6.000E+00 | 1.137E+02 |
| U-234 | 6.000E+00 | 9.478E+01 | 6.000E+00 | 1.137E+02 |
| U-235 | 6.000E+00 | 9.478E+01 | 6.000E+00 | 1.137E+02 |

| | | | | |
|---|---|---|---|---|
| V-50 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Zr-93 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Ks-20 | 1.000E-03 | 1.016E+00 | 1.000E-03 | 1.019E+00 |
| Ks-21 | 1.000E-02 | 1.156E+00 | 1.000E-02 | 1.188E+00 |
| Ks-22 | 1.000E-01 | 2.563E+00 | 1.000E-01 | 2.879E+00 |
| Ks-23 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Ks-24 | 5.000E+01 | 7.825E+02 | 5.000E+01 | 9.404E+02 |
| Ks-25 | 1.000E+02 | 1.564E+03 | 1.000E+02 | 1.880E+03 |
| Ks-26 | 1.000E+00 | 1.663E+01 | 1.000E+00 | 1.979E+01 |
| Th-230 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| U-236 | 6.000E+00 | 9.478E+01 | 6.000E+00 | 1.137E+02 |
| U-238 | 6.000E+00 | 9.478E+01 | 6.000E+00 | 1.137E+02 |
| Pu-240 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Pu-241 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |
| Ra-226 | 1.000E+01 | 1.573E+02 | 1.000E+01 | 1.889E+02 |

BIOACCUMULATION FACTORS

| NUCLIDE | SOIL-PLANT Bv | SOIL-PLANT Br | FORAGE-MILK Fm (D/L) | FORAGE-MEAT Ff (D/KG) |
|---|---|---|---|---|
| Pu-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-239 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-242 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-228 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Re-187 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Se-79 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Si-32 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sm-151 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-121m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-126 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sr-90 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-157 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-158 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tc-99 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Te-123 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-229 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ti-44 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tl-204 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tm-170 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-233 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-235 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| V-50 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Zr-93 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-20 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-21 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-23 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-24 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-25 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-230 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-240 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-226 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

PATHWAY 1
GROUNDWATER TO RIVER

********* NUCLIDE DOSES (mrem/yr) ********

| NUCLIDE/TIME | 6. | 9. | 12. | 15. | 18. | 21. | 24. | 27. |
|---|---|---|---|---|---|---|---|---|
| 30. | 35. | 40. | 45. | 50. | 55. | 60. | 65. | 70. | 75. |
| 80. | 85. | 90. | 95. | 100. | 105. | 110. | 115. | 120. | 125. |
| 130. | 135. | 140. | 145. | 150. | 155. | 160. | 165. | 170. | 175. |
| 180. | 185. | 190. | 195. | 200. | 205. | 210. | 215. | 220. | 225. |
| 230. | 235. | 240. | 245. | 250. | 255. | 260. | 265. | 270. | 275. |
| 280. | 285. | 290. | 295. | 300. | 310. | 320. | 330. | 340. | 350. |
| 360. | 370. | 380. | 390. | 400. | 410. | 420. | 430. | 440. | 450. |
| 460. | 470. | 480. | 490. | 500. | 510. | 520. | 530. | 540. | 550. |
| 560. | 570. | 580. | 590. | 600. | 610. | 620. | 630. | 640. | 650. |
| 660. | 670. | 680. | 690. | 700. | 720. | 740. | 760. | 780. | 800. |
| 825. | 850. | 875. | 900. | 925. | 950. | 975. | 1000. | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pu-236 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-242          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-228          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Re-187          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Se-79           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Si-32          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sm-151         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-121m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-126         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-158          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tc-99           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Te-123          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-229          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ti-44           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tl-204          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tm-170          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-232           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-233           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-234           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-235           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      V-50            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Zr-93           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-20          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-21          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-23          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
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```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE DOSES FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE RISKS FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE CONCENTRATIONS IN RIVER  (Ci/m**3)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Pu-236         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-242          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ra-228          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Re-187          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    4.9E-20    2.3E-19    9.9E-19    3.9E-18    1.5E-17    5.2E-17    1.7E-16    5.3E-16
1.6E-15    4.5E-15    1.2E-14    3.1E-14    7.8E-14    1.9E-13    4.3E-13    9.6E-13    2.1E-12    4.4E-12
9.0E-12    1.8E-11    3.5E-11    6.6E-11    1.2E-10    3.9E-10    1.2E-09    3.2E-09    8.4E-09    2.0E-08
4.7E-08    1.0E-07    2.2E-07    4.4E-07    8.4E-07    1.6E-06    2.8E-06    4.9E-06    8.4E-06    1.4E-05
2.2E-05    3.5E-05    5.3E-05    8.0E-05    1.2E-04    1.7E-04    2.4E-04    3.3E-04    4.6E-04    6.2E-04
8.3E-04    1.1E-03    1.4E-03    1.8E-03    2.3E-03    2.9E-03    3.6E-03    4.5E-03    5.4E-03    6.6E-03
7.9E-03    9.4E-03    1.1E-02    1.3E-02    1.5E-02    2.0E-02    2.6E-02    3.3E-02    4.1E-02    4.9E-02
6.1E-02    7.3E-02    8.6E-02    9.8E-02    1.1E-01    1.2E-01    1.3E-01    1.3E-01
      Se-79           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Si-32           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-20    1.2E-19    6.5E-19
3.3E-18    1.5E-17    6.8E-17    2.8E-16    1.1E-15    4.0E-15    1.4E-14    4.6E-14    1.4E-13    4.4E-13
1.3E-12    3.5E-12    9.4E-12    2.4E-11    6.1E-11    1.5E-10    3.5E-10    7.9E-10    1.8E-09    3.8E-09
8.0E-09    1.6E-08    3.3E-08    6.4E-08    1.2E-07    4.3E-07    1.4E-06    4.1E-06    1.2E-05    3.1E-05
9.8E-05    2.8E-04    7.7E-04    2.0E-03    4.7E-03    1.1E-02    2.3E-02    4.6E-02
      Sm-151          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-121m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-126         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.3E-20    1.1E-19    4.5E-19
1.7E-18    6.1E-18    2.0E-17    6.2E-17    1.8E-16    4.8E-16    1.2E-15    3.0E-15    7.0E-15    1.5E-14
3.3E-14    6.7E-14    1.3E-13    2.5E-13    4.6E-13    8.2E-13    1.4E-12    2.4E-12    3.9E-12    6.3E-12
9.8E-12    1.5E-11    2.2E-11    3.3E-11    4.8E-11    9.4E-11    1.7E-10    3.0E-10    5.0E-10    7.9E-10
1.2E-09    1.7E-09    2.4E-09    3.2E-09    4.2E-09    5.3E-09    6.4E-09    7.7E-09    9.0E-09    1.0E-08
1.1E-08    1.3E-08    1.4E-08    1.4E-08    1.5E-08    1.5E-08    1.5E-08    1.5E-08    1.5E-08    1.5E-08
1.4E-08    1.3E-08    1.3E-08    1.2E-08    1.1E-08    9.9E-09    8.9E-09    8.0E-09    7.1E-09    6.3E-09
5.5E-09    4.8E-09    4.2E-09    3.6E-09    3.1E-09    2.2E-09    1.5E-09    1.0E-09    7.0E-10    4.6E-10
2.6E-10    1.5E-10    8.2E-11    4.4E-11    2.3E-11    1.2E-11    6.2E-12    3.1E-12
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-158         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tc-99          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
2.3E-20    8.8E-20    3.1E-19    1.0E-18    3.3E-18    1.0E-17    3.0E-17    8.3E-17    2.2E-16    5.8E-16
1.5E-15    3.5E-15    8.3E-15    1.9E-14    4.2E-14    1.9E-13    7.6E-13    2.9E-12    9.8E-12    3.1E-11
9.3E-11    2.6E-10    6.9E-10    1.7E-09    4.1E-09    9.3E-09    2.0E-08    4.2E-08    8.5E-08    1.7E-07
3.1E-07    5.8E-07    1.0E-06    1.8E-06    3.0E-06    4.9E-06    8.0E-06    1.3E-05    2.0E-05    3.0E-05
4.5E-05    6.5E-05    9.5E-05    1.3E-04    1.9E-04    2.6E-04    3.6E-04    4.9E-04    6.5E-04    8.6E-04
1.1E-03    1.5E-03    1.9E-03    2.4E-03    3.0E-03    4.6E-03    6.9E-03    1.0E-02    1.4E-02    2.0E-02
2.9E-02    4.0E-02    5.5E-02    7.3E-02    9.5E-02    1.2E-01    1.5E-01    1.8E-01
      Te-123         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-229          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ti-44           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tl-204          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tm-170          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-232           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-233          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-234          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-235          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      V-50           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Zr-93          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-20          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-21          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-23          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE CONCENTRATIONS IN STREAM (Ci/m**3)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Pu-236         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-242         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-244         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-228         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Re-187         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    4.9E-20    2.3E-19    9.9E-19    3.9E-18    1.5E-17    5.2E-17    1.7E-16    5.3E-16
1.6E-15    4.5E-15    1.2E-14    3.1E-14    7.8E-14    1.9E-13    4.3E-13    9.6E-13    2.1E-12    4.4E-12
9.0E-12    1.8E-11    3.5E-11    6.6E-11    1.2E-10    3.9E-10    1.2E-09    3.2E-09    8.4E-09    2.0E-08
4.7E-08    1.0E-07    2.2E-07    4.4E-07    8.4E-07    1.6E-06    2.8E-06    4.9E-06    8.4E-06    1.4E-05
2.2E-05    3.5E-05    5.3E-05    8.0E-05    1.2E-04    1.7E-04    2.4E-04    3.3E-04    4.6E-04    6.2E-04
8.3E-04    1.1E-03    1.4E-03    1.8E-03    2.3E-03    2.9E-03    3.6E-03    4.5E-03    5.4E-03    6.6E-03
7.9E-03    9.4E-03    1.1E-02    1.3E-02    1.5E-02    2.0E-02    2.6E-02    3.3E-02    4.1E-02    4.9E-02
6.1E-02   7.3E-02   8.6E-02   9.8E-02   1.1E-01   1.2E-01   1.3E-01   1.3E-01
      Se-79          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Si-32          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-20    1.2E-19    6.5E-19
3.3E-18    1.5E-17    6.8E-17    2.8E-16    1.1E-15    4.0E-15    1.4E-14    4.6E-14    1.4E-13    4.4E-13
1.3E-12    3.5E-12    9.4E-12    2.4E-11    6.1E-11    1.5E-10    3.5E-10    7.9E-10    1.8E-09    3.8E-09
8.0E-09    1.6E-08    3.3E-08    6.4E-08    1.2E-07    4.3E-07    1.4E-06    4.1E-06    1.2E-05    3.1E-05
9.8E-05    2.8E-04    7.7E-04    2.0E-03    4.7E-03    1.1E-02    2.3E-02    4.6E-02
      Sm-151         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sn-121m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sn-126         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.3E-20    1.1E-19    4.5E-19
1.7E-18    6.1E-18    2.0E-17    6.2E-17    1.8E-16    4.8E-16    1.2E-15    3.0E-15    7.0E-15    1.5E-14
3.3E-14    6.7E-14    1.3E-13    2.5E-13    4.6E-13    8.2E-13    1.4E-12    2.4E-12    3.9E-12    6.3E-12
9.8E-12    1.5E-11    2.2E-11    3.3E-11    4.8E-11    9.4E-11    1.7E-10    3.0E-10    5.0E-10    7.9E-10
1.2E-09    1.7E-09    2.4E-09    3.2E-09    4.2E-09    5.3E-09    6.4E-09    7.7E-09    9.0E-09    1.0E-08
1.1E-08    1.3E-08    1.4E-08    1.4E-08    1.5E-08    1.5E-08    1.5E-08    1.5E-08    1.5E-08    1.5E-08
1.4E-08    1.3E-08    1.3E-08    1.2E-08    1.1E-08    9.9E-09    8.9E-09    8.0E-09    7.1E-09    6.3E-09
5.5E-09    4.8E-09    4.2E-09    3.6E-09    3.1E-09    2.2E-09    1.5E-09    1.0E-09    7.0E-10    4.6E-10
2.6E-10    1.5E-10    8.2E-11    4.4E-11    2.3E-11    1.2E-11    6.2E-12    3.1E-12
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Tb-158          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tc-99           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
2.3E-20    8.8E-20    3.1E-19    1.0E-18    3.3E-18    1.0E-17    3.0E-17    8.3E-17    2.2E-16    5.8E-16
1.5E-15    3.5E-15    8.3E-15    1.9E-14    4.2E-14    1.9E-13    7.6E-13    2.9E-12    9.8E-12    3.1E-11
9.3E-11    2.6E-10    6.9E-10    1.7E-09    4.1E-09    9.3E-09    2.0E-08    4.2E-08    8.5E-08    1.7E-07
3.1E-07    5.8E-07    1.0E-06    1.8E-06    3.0E-06    4.9E-06    8.0E-06    1.3E-05    2.0E-05    3.0E-05
4.5E-05    6.5E-05    9.5E-05    1.3E-04    1.9E-04    2.6E-04    3.6E-04    4.9E-04    6.5E-04    8.6E-04
1.1E-03    1.5E-03    1.9E-03    2.4E-03    3.0E-03    4.6E-03    6.9E-03    1.0E-02    1.4E-02    2.0E-02
2.9E-02    4.0E-02    5.5E-02    7.3E-02    9.5E-02    1.2E-01    1.5E-01    1.8E-01
      Te-123          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-229          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ti-44           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tl-204          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tm-170          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-232           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-233           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-234           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-235           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      V-50            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Zr-93           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-20          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-21          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-23          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

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0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE FLUXES AT OUTCROP (Ci/yr)
  NUCLIDE/TIME           6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Pu-236         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-242         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-244         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-228         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Re-187          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    4.4E-23    2.1E-22    8.9E-22    3.5E-21    1.3E-20    4.6E-20    1.5E-19    4.8E-19
1.4E-18    4.0E-18    1.1E-17    2.8E-17    7.0E-17    1.7E-16    3.9E-16    8.7E-16    1.9E-15    4.0E-15
8.1E-15    1.6E-14    3.1E-14    5.9E-14    1.1E-13    3.5E-13    1.0E-12    2.9E-12    7.5E-12    1.8E-11
4.2E-11    9.3E-11    2.0E-10    3.9E-10    7.6E-10    1.4E-09    2.5E-09    4.4E-09    7.5E-09    1.2E-08
2.0E-08    3.1E-08    4.8E-08    7.2E-08    1.1E-07    1.5E-07    2.2E-07    3.0E-07    4.1E-07    5.6E-07
7.5E-07    9.8E-07    1.3E-06    1.6E-06    2.1E-06    2.6E-06    3.3E-06    4.0E-06    4.9E-06    5.9E-06
7.1E-06    8.5E-06    1.0E-05    1.2E-05    1.4E-05    1.8E-05    2.3E-05    3.0E-05    3.7E-05    4.4E-05
5.5E-05    6.6E-05    7.7E-05    8.8E-05    9.8E-05    1.1E-04    1.2E-04    1.2E-04
      Se-79           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Si-32           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.8E-23    1.1E-22    5.9E-22
3.0E-21    1.4E-20    6.1E-20    2.5E-19    9.7E-19    3.6E-18    1.2E-17    4.1E-17    1.3E-16    3.9E-16
1.1E-15    3.2E-15    8.5E-15    2.2E-14    5.5E-14    1.3E-13    3.1E-13    7.1E-13    1.6E-12    3.4E-12
7.2E-12    1.5E-11    2.9E-11    5.8E-11    1.1E-10    3.9E-10    1.2E-09    3.7E-09    1.1E-08    2.8E-08
8.8E-08    2.6E-07    6.9E-07    1.8E-06    4.2E-06    9.5E-06    2.0E-05    4.2E-05
      Sm-151          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-121m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-126          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-23    9.5E-23    4.0E-22
1.5E-21    5.5E-21    1.8E-20    5.6E-20    1.6E-19    4.3E-19    1.1E-18    2.7E-18    6.3E-18    1.4E-17
3.0E-17    6.0E-17    1.2E-16    2.2E-16    4.1E-16    7.4E-16    1.3E-15    2.1E-15    3.5E-15    5.6E-15
8.8E-15    1.3E-14    2.0E-14    3.0E-14    4.3E-14    8.5E-14    1.6E-13    2.7E-13    4.5E-13    7.1E-13
1.1E-12    1.5E-12    2.1E-12    2.9E-12    3.7E-12    4.7E-12    5.8E-12    6.9E-12    8.1E-12    9.2E-12
1.0E-11    1.1E-11    1.2E-11    1.3E-11    1.3E-11    1.4E-11    1.4E-11    1.4E-11    1.4E-11    1.3E-11
1.3E-11    1.2E-11    1.1E-11    1.1E-11    9.7E-12    8.9E-12    8.0E-12    7.2E-12    6.4E-12    5.7E-12
5.0E-12    4.3E-12    3.7E-12    3.2E-12    2.7E-12    2.0E-12    1.4E-12    9.4E-13    6.3E-13    4.1E-13
2.4E-13    1.3E-13    7.4E-14    4.0E-14    2.1E-14    1.1E-14    5.6E-15    2.8E-15
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-158         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tc-99          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
2.1E-23    7.9E-23    2.8E-22    9.4E-22    3.0E-21    9.2E-21    2.7E-20    7.5E-20    2.0E-19    5.2E-19
1.3E-18    3.2E-18    7.4E-18    1.7E-17    3.7E-17    1.7E-16    6.9E-16    2.6E-15    8.8E-15    2.8E-14
8.4E-14    2.3E-13    6.2E-13    1.5E-12    3.7E-12    8.4E-12    1.8E-11    3.8E-11    7.7E-11    1.5E-10
2.8E-10    5.2E-10    9.2E-10    1.6E-09    2.7E-09    4.5E-09    7.2E-09    1.1E-08    1.8E-08    2.7E-08
4.0E-08    5.9E-08    8.5E-08    1.2E-07    1.7E-07    2.4E-07    3.2E-07    4.4E-07    5.9E-07    7.7E-07
1.0E-06    1.3E-06    1.7E-06    2.1E-06    2.7E-06    4.1E-06    6.2E-06    9.0E-06    1.3E-05    1.8E-05
2.6E-05    3.6E-05    5.0E-05    6.6E-05    8.6E-05    1.1E-04    1.3E-04    1.6E-04
      Te-123         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-229         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-232         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ti-44          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tl-204         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tm-170         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-233          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-234          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-235          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      V-50            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Zr-93           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-20           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-21           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-22           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-23           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
*********** CUMULATIVE TOTAL DOSES PER YEAR FOR GIVEN TIMES **********
      1              0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
*********** CUMULATIVE TOTAL RISKS PER YEAR FOR GIVEN TIMES **********
      1              0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
        NUCLIDE HALFLIFE AND INVENTORY (CI) ASSUMING NO TRANSPORT FROM THE FACILITY
 (TIMES IN YEARS) HALFLIFE         6.         9.        12.        15.        18.        21.        24.
27.        30.        35.        40.        45.        50.        55.        60.        65.        70.
75.        80.        85.        90.        95.       100.       105.       110.       115.       120.
125.       130.       135.       140.       145.       150.       155.       160.       165.       170.
175.       180.       185.       190.       195.       200.       205.       210.       215.       220.
225.       230.       235.       240.       245.       250.       255.       260.       265.       270.
275.       280.       285.       290.       295.       300.       310.       320.       330.       340.
350.       360.       370.       380.       390.       400.       410.       420.       430.       440.
450.       460.       470.       480.       490.       500.       510.       520.       530.       540.
550.       560.       570.       580.       590.       600.       610.       620.       630.       640.
650.       660.       670.       680.       690.       700.       720.       740.       760.       780.
800.       825.       850.       875.       900.       925.       950.       975.      1000.
   Pu-236             2.86E+00   9.00E-04   1.02E-04   4.91E-05   2.37E-05   1.15E-05   5.54E-06   2.68E-06
1.30E-06   6.26E-07   1.86E-07   5.55E-08   1.65E-08   4.91E-09   1.46E-09   4.35E-10   1.30E-10   3.86E-11
1.15E-11   3.42E-12   1.02E-12   3.03E-13   9.02E-14   2.68E-14   7.99E-15   2.38E-15   7.08E-16   2.11E-16
6.27E-17   1.87E-17   5.56E-18   1.65E-18   4.92E-19   1.47E-19   4.36E-20   1.30E-20   3.86E-21   1.15E-21
3.42E-22   1.02E-22   3.03E-23   9.03E-24   2.69E-24   8.00E-25   2.38E-25   7.09E-26   2.11E-26   6.28E-27
1.87E-27   5.57E-28   1.66E-28   4.93E-29   1.47E-29   4.37E-30   1.30E-30   3.87E-31   1.15E-31   3.43E-32
1.02E-32   3.04E-33   9.05E-34   2.69E-34   8.02E-35   2.39E-35   2.11E-36   1.87E-37   1.66E-38   1.47E-39
1.30E-40   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
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0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pu-238           8.77E+01  1.80E-02  1.68E-02  1.64E-02  1.60E-02  1.56E-02  1.52E-02  1.49E-02
1.45E-02  1.42E-02  1.37E-02  1.31E-02  1.26E-02  1.21E-02  1.17E-02  1.12E-02  1.08E-02  1.04E-02
9.95E-03  9.56E-03  9.19E-03  8.84E-03  8.50E-03  8.17E-03  7.85E-03  7.55E-03  7.25E-03  6.97E-03
6.70E-03  6.44E-03  6.19E-03  5.95E-03  5.72E-03  5.50E-03  5.29E-03  5.08E-03  4.89E-03  4.70E-03
4.51E-03  4.34E-03  4.17E-03  4.01E-03  3.85E-03  3.70E-03  3.56E-03  3.42E-03  3.29E-03  3.16E-03
3.04E-03  2.92E-03  2.81E-03  2.70E-03  2.60E-03  2.50E-03  2.40E-03  2.31E-03  2.22E-03  2.13E-03
2.05E-03  1.97E-03  1.89E-03  1.82E-03  1.75E-03  1.68E-03  1.55E-03  1.44E-03  1.33E-03  1.23E-03
1.13E-03  1.05E-03  9.67E-04  8.93E-04  8.25E-04  7.63E-04  7.05E-04  6.51E-04  6.02E-04  5.56E-04
5.14E-04  4.75E-04  4.39E-04  4.05E-04  3.74E-04  3.46E-04  3.20E-04  2.95E-04  2.73E-04  2.52E-04
2.33E-04  2.15E-04  1.99E-04  1.84E-04  1.70E-04  1.57E-04  1.45E-04  1.34E-04  1.24E-04  1.14E-04
1.06E-04  9.77E-05  9.03E-05  8.34E-05  7.71E-05  7.12E-05  6.08E-05  5.19E-05  4.43E-05  3.78E-05
3.23E-05  2.65E-05  2.18E-05  1.79E-05  1.47E-05  1.20E-05  9.87E-06  8.10E-06  6.65E-06
   Pu-239           2.41E+04  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
   Pu-242           3.73E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
   Pu-244           8.08E+07  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
   Ra-228           5.75E+00  4.90E+08  1.66E+08  1.15E+08  8.03E+07  5.60E+07  3.90E+07  2.71E+07
1.89E+07  1.32E+07  7.21E+06  3.95E+06  2.16E+06  1.18E+06  6.47E+05  3.54E+05  1.94E+05  1.06E+05
5.80E+04  3.18E+04  1.74E+04  9.52E+03  5.21E+03  2.85E+03  1.56E+03  8.54E+02  4.67E+02  2.56E+02
1.40E+02  7.66E+01  4.19E+01  2.29E+01  1.26E+01  6.87E+00  3.76E+00  2.06E+00  1.13E+00  6.17E-01
3.38E-01  1.85E-01  1.01E-01  5.54E-02  3.03E-02  1.66E-02  9.07E-03  4.97E-03  2.72E-03  1.49E-03
8.14E-04  4.46E-04  2.44E-04  1.33E-04  7.31E-05  4.00E-05  2.19E-05  1.20E-05  6.56E-06  3.59E-06
1.96E-06  1.07E-06  5.88E-07  3.22E-07  1.76E-07  9.64E-08  2.89E-08  8.65E-09  2.59E-09  7.77E-10
2.33E-10  6.97E-11  2.09E-11  6.25E-12  1.87E-12  5.61E-13  1.68E-13  5.03E-14  1.51E-14  4.52E-15
1.35E-15  4.05E-16  1.21E-16  3.64E-17  1.09E-17  3.26E-18  9.78E-19  2.93E-19  8.77E-20  2.63E-20
7.87E-21  2.36E-21  7.06E-22  2.12E-22  6.34E-23  1.90E-23  5.69E-24  1.70E-24  5.10E-25  1.53E-25
4.58E-26  1.37E-26  4.11E-27  1.23E-27  3.69E-28  1.10E-28  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Re-187           4.35E+10  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
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6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
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6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02  6.84E-02
   Se-79            6.50E+04  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
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1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
   Si-32            1.72E+02  1.17E+08  1.13E+08  1.11E+08  1.10E+08  1.09E+08  1.08E+08  1.06E+08
1.05E+08  1.04E+08  1.02E+08  9.96E+07  9.76E+07  9.56E+07  9.37E+07  9.19E+07  9.00E+07  8.82E+07
8.65E+07  8.48E+07  8.31E+07  8.14E+07  7.98E+07  7.82E+07  7.66E+07  7.51E+07  7.36E+07  7.21E+07
7.07E+07  6.93E+07  6.79E+07  6.66E+07  6.52E+07  6.39E+07  6.26E+07  6.14E+07  6.02E+07  5.90E+07
5.78E+07  5.66E+07  5.55E+07  5.44E+07  5.33E+07  5.23E+07  5.12E+07  5.02E+07  4.92E+07  4.82E+07
4.72E+07  4.63E+07  4.54E+07  4.45E+07  4.36E+07  4.27E+07  4.19E+07  4.10E+07  4.02E+07  3.94E+07
3.86E+07  3.79E+07  3.71E+07  3.64E+07  3.56E+07  3.49E+07  3.35E+07  3.22E+07  3.09E+07  2.97E+07
2.86E+07  2.74E+07  2.63E+07  2.53E+07  2.43E+07  2.33E+07  2.24E+07  2.15E+07  2.07E+07  1.99E+07
1.91E+07  1.83E+07  1.76E+07  1.69E+07  1.62E+07  1.56E+07  1.50E+07  1.44E+07  1.38E+07  1.33E+07
1.28E+07  1.22E+07  1.18E+07  1.13E+07  1.09E+07  1.04E+07  1.00E+07  9.62E+06  9.24E+06  8.87E+06
8.52E+06  8.19E+06  7.86E+06  7.55E+06  7.25E+06  6.97E+06  6.43E+06  5.93E+06  5.47E+06  5.05E+06
4.66E+06  4.21E+06  3.81E+06  3.44E+06  3.11E+06  2.81E+06  2.54E+06  2.30E+06  2.08E+06
   Sm-151           9.00E+01  4.74E+07  4.42E+07  4.32E+07  4.22E+07  4.13E+07  4.03E+07  3.94E+07
3.85E+07  3.76E+07  3.62E+07  3.48E+07  3.35E+07  3.23E+07  3.10E+07  2.99E+07  2.87E+07  2.76E+07
2.66E+07  2.56E+07  2.46E+07  2.37E+07  2.28E+07  2.19E+07  2.11E+07  2.03E+07  1.95E+07  1.88E+07
1.81E+07  1.74E+07  1.68E+07  1.61E+07  1.55E+07  1.49E+07  1.44E+07  1.38E+07  1.33E+07  1.28E+07
1.23E+07  1.19E+07  1.14E+07  1.10E+07  1.06E+07  1.02E+07  9.77E+06  9.41E+06  9.05E+06  8.71E+06
8.38E+06  8.06E+06  7.76E+06  7.47E+06  7.18E+06  6.91E+06  6.65E+06  6.40E+06  6.16E+06  5.93E+06
5.70E+06  5.49E+06  5.28E+06  5.08E+06  4.89E+06  4.70E+06  4.35E+06  4.03E+06  3.73E+06  3.46E+06
3.20E+06  2.96E+06  2.74E+06  2.54E+06  2.35E+06  2.18E+06  2.02E+06  1.87E+06  1.73E+06  1.60E+06
1.48E+06  1.37E+06  1.27E+06  1.18E+06  1.09E+06  1.01E+06  9.33E+05  8.64E+05  8.00E+05  7.41E+05
6.86E+05  6.35E+05  5.88E+05  5.44E+05  5.04E+05  4.67E+05  4.32E+05  4.00E+05  3.70E+05  3.43E+05
3.17E+05  2.94E+05  2.72E+05  2.52E+05  2.33E+05  2.16E+05  1.85E+05  1.59E+05  1.36E+05  1.17E+05
1.00E+05  8.25E+04  6.80E+04  5.61E+04  4.63E+04  3.82E+04  3.15E+04  2.60E+04  2.14E+04
   Sn-121m          5.50E+01  9.68E+07  8.64E+07  8.32E+07  8.01E+07  7.72E+07  7.43E+07  7.15E+07
6.89E+07  6.63E+07  6.23E+07  5.85E+07  5.49E+07  5.15E+07  4.84E+07  4.54E+07  4.27E+07  4.01E+07
3.76E+07  3.53E+07  3.32E+07  3.11E+07  2.92E+07  2.75E+07  2.58E+07  2.42E+07  2.27E+07  2.13E+07
2.00E+07  1.88E+07  1.77E+07  1.66E+07  1.56E+07  1.46E+07  1.37E+07  1.29E+07  1.21E+07  1.14E+07
1.07E+07  1.00E+07  9.40E+06  8.83E+06  8.29E+06  7.78E+06  7.31E+06  6.86E+06  6.44E+06  6.05E+06
5.68E+06  5.33E+06  5.01E+06  4.70E+06  4.41E+06  4.15E+06  3.89E+06  3.65E+06  3.43E+06  3.22E+06
3.03E+06  2.84E+06  2.67E+06  2.50E+06  2.35E+06  2.21E+06  1.95E+06  1.72E+06  1.51E+06  1.33E+06
1.18E+06  1.04E+06  9.14E+05  8.05E+05  7.10E+05  6.26E+05  5.52E+05  4.87E+05  4.29E+05  3.78E+05
3.33E+05  2.94E+05  2.59E+05  2.28E+05  2.01E+05  1.78E+05  1.56E+05  1.38E+05  1.22E+05  1.07E+05
9.45E+04  8.33E+04  7.35E+04  6.48E+04  5.71E+04  5.03E+04  4.44E+04  3.91E+04  3.45E+04  3.04E+04
2.68E+04  2.36E+04  2.08E+04  1.84E+04  1.62E+04  1.43E+04  1.11E+04  8.62E+03  6.70E+03  5.21E+03
4.05E+03  2.95E+03  2.16E+03  1.57E+03  1.15E+03  8.38E+02  6.11E+02  4.46E+02  3.26E+02
   Sn-126           1.00E+05  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04
5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04
5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04
5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.09E+04  5.09E+04
5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04
5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04
5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04
5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.07E+04
   Sr-90            2.88E+01  4.50E-02  3.62E-02  3.37E-02  3.14E-02  2.92E-02  2.71E-02  2.53E-02
2.35E-02  2.19E-02  1.94E-02  1.72E-02  1.52E-02  1.35E-02  1.20E-02  1.06E-02  9.41E-03  8.35E-03
7.40E-03  6.56E-03  5.82E-03  5.16E-03  4.57E-03  4.05E-03  3.60E-03  3.19E-03  2.83E-03  2.51E-03
2.22E-03  1.97E-03  1.75E-03  1.55E-03  1.37E-03  1.22E-03  1.08E-03  9.57E-04  8.48E-04  7.52E-04
6.67E-04  5.91E-04  5.24E-04  4.65E-04  4.12E-04  3.65E-04  3.24E-04  2.87E-04  2.55E-04  2.26E-04
2.00E-04  1.77E-04  1.57E-04  1.40E-04  1.24E-04  1.10E-04  9.72E-05  8.62E-05  7.64E-05  6.78E-05
6.01E-05  5.33E-05  4.72E-05  4.19E-05  3.71E-05  3.29E-05  2.59E-05  2.03E-05  1.60E-05  1.26E-05
9.88E-06  7.77E-06  6.11E-06  4.80E-06  3.77E-06  2.97E-06  2.33E-06  1.83E-06  1.44E-06  1.13E-06
8.90E-07  7.00E-07  5.50E-07  4.33E-07  3.40E-07  2.67E-07  2.10E-07  1.65E-07  1.30E-07  1.02E-07
8.02E-08  6.31E-08  4.96E-08  3.90E-08  3.06E-08  2.41E-08  1.89E-08  1.49E-08  1.17E-08  9.20E-09
7.23E-09  5.68E-09  4.47E-09  3.51E-09  2.76E-09  2.17E-09  1.34E-09  8.29E-10  5.12E-10  3.16E-10
1.96E-10  1.07E-10  5.87E-11  3.22E-11  1.76E-11  9.65E-12  5.29E-12  2.90E-12  1.59E-12
   Tb-157           7.10E+01  2.70E+07  2.47E+07  2.40E+07  2.33E+07  2.26E+07  2.20E+07  2.14E+07
2.07E+07  2.01E+07  1.92E+07  1.83E+07  1.74E+07  1.66E+07  1.58E+07  1.50E+07  1.43E+07  1.36E+07
1.30E+07  1.24E+07  1.18E+07  1.12E+07  1.07E+07  1.02E+07  9.69E+06  9.23E+06  8.79E+06  8.37E+06
7.97E+06  7.59E+06  7.23E+06  6.88E+06  6.56E+06  6.24E+06  5.95E+06  5.66E+06  5.39E+06  5.14E+06
4.89E+06  4.66E+06  4.44E+06  4.22E+06  4.02E+06  3.83E+06  3.65E+06  3.48E+06  3.31E+06  3.15E+06
3.00E+06  2.86E+06  2.72E+06  2.59E+06  2.47E+06  2.35E+06  2.24E+06  2.13E+06  2.03E+06  1.93E+06
1.84E+06  1.75E+06  1.67E+06  1.59E+06  1.52E+06  1.44E+06  1.31E+06  1.19E+06  1.08E+06  9.77E+05
8.86E+05  8.04E+05  7.29E+05  6.61E+05  6.00E+05  5.44E+05  4.93E+05  4.47E+05  4.06E+05  3.68E+05
3.34E+05  3.03E+05  2.75E+05  2.49E+05  2.26E+05  2.05E+05  1.86E+05  1.69E+05  1.53E+05  1.39E+05
1.26E+05  1.14E+05  1.03E+05  9.38E+04  8.51E+04  7.72E+04  7.00E+04  6.35E+04  5.76E+04  5.22E+04
4.74E+04  4.30E+04  3.90E+04  3.53E+04  3.21E+04  2.91E+04  2.39E+04  1.97E+04  1.62E+04  1.33E+04
1.10E+04  8.58E+03  6.72E+03  5.27E+03  4.13E+03  3.23E+03  2.53E+03  1.98E+03  1.55E+03
   Tb-158           1.80E+02  2.70E+07  2.61E+07  2.58E+07  2.55E+07  2.52E+07  2.49E+07  2.46E+07
2.43E+07  2.41E+07  2.36E+07  2.31E+07  2.27E+07  2.23E+07  2.18E+07  2.14E+07  2.10E+07  2.06E+07
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2.02E+07  1.98E+07  1.95E+07  1.91E+07  1.87E+07  1.84E+07  1.80E+07  1.77E+07  1.73E+07  1.70E+07
1.67E+07  1.64E+07  1.61E+07  1.57E+07  1.54E+07  1.52E+07  1.49E+07  1.46E+07  1.43E+07  1.40E+07
1.38E+07  1.35E+07  1.32E+07  1.30E+07  1.27E+07  1.25E+07  1.23E+07  1.20E+07  1.18E+07  1.16E+07
1.14E+07  1.11E+07  1.09E+07  1.07E+07  1.05E+07  1.03E+07  1.01E+07  9.92E+06  9.73E+06  9.55E+06
9.36E+06  9.19E+06  9.01E+06  8.84E+06  8.67E+06  8.50E+06  8.18E+06  7.87E+06  7.58E+06  7.29E+06
7.01E+06  6.75E+06  6.50E+06  6.25E+06  6.01E+06  5.79E+06  5.57E+06  5.36E+06  5.16E+06  4.96E+06
4.77E+06  4.59E+06  4.42E+06  4.25E+06  4.09E+06  3.94E+06  3.79E+06  3.65E+06  3.51E+06  3.38E+06
3.25E+06  3.12E+06  3.01E+06  2.89E+06  2.78E+06  2.68E+06  2.58E+06  2.48E+06  2.39E+06  2.30E+06
2.21E+06  2.13E+06  2.05E+06  1.97E+06  1.89E+06  1.82E+06  1.69E+06  1.56E+06  1.45E+06  1.34E+06
1.24E+06  1.13E+06  1.02E+06  9.29E+05  8.44E+05  7.66E+05  6.96E+05  6.32E+05  5.74E+05
   Tc-99            2.11E+05  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01  3.38E-01
3.38E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01
3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01
3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01
3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01  3.37E-01
   Te-123           1.00E+13  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04  5.24E-04
   Th-229           7.88E+03  3.83E+05  3.83E+05  3.83E+05  3.82E+05  3.82E+05  3.82E+05  3.82E+05
3.82E+05  3.82E+05  3.82E+05  3.82E+05  3.81E+05  3.81E+05  3.81E+05  3.81E+05  3.81E+05  3.81E+05
3.80E+05  3.80E+05  3.80E+05  3.80E+05  3.80E+05  3.80E+05  3.79E+05  3.79E+05  3.79E+05  3.79E+05
3.79E+05  3.79E+05  3.78E+05  3.78E+05  3.78E+05  3.78E+05  3.78E+05  3.78E+05  3.77E+05  3.77E+05
3.77E+05  3.77E+05  3.77E+05  3.77E+05  3.76E+05  3.76E+05  3.76E+05  3.76E+05  3.76E+05  3.76E+05
3.75E+05  3.75E+05  3.75E+05  3.75E+05  3.75E+05  3.75E+05  3.75E+05  3.74E+05  3.74E+05  3.74E+05
3.74E+05  3.74E+05  3.74E+05  3.73E+05  3.73E+05  3.73E+05  3.73E+05  3.72E+05  3.72E+05  3.72E+05
3.71E+05  3.71E+05  3.71E+05  3.70E+05  3.70E+05  3.70E+05  3.69E+05  3.69E+05  3.69E+05  3.68E+05
3.68E+05  3.68E+05  3.67E+05  3.67E+05  3.67E+05  3.67E+05  3.66E+05  3.66E+05  3.66E+05  3.65E+05
3.65E+05  3.65E+05  3.64E+05  3.64E+05  3.64E+05  3.63E+05  3.63E+05  3.63E+05  3.62E+05  3.62E+05
3.62E+05  3.61E+05  3.61E+05  3.61E+05  3.60E+05  3.60E+05  3.59E+05  3.59E+05  3.58E+05  3.58E+05
3.57E+05  3.56E+05  3.55E+05  3.55E+05  3.54E+05  3.53E+05  3.52E+05  3.52E+05  3.51E+05
   Th-232           1.41E+10  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
   Ti-44            6.30E+01  2.81E+08  2.55E+08  2.46E+08  2.38E+08  2.31E+08  2.23E+08  2.16E+08
2.09E+08  2.02E+08  1.91E+08  1.81E+08  1.71E+08  1.62E+08  1.53E+08  1.45E+08  1.37E+08  1.30E+08
1.23E+08  1.17E+08  1.10E+08  1.04E+08  9.88E+07  9.35E+07  8.85E+07  8.38E+07  7.93E+07  7.50E+07
7.10E+07  6.72E+07  6.36E+07  6.02E+07  5.70E+07  5.39E+07  5.11E+07  4.83E+07  4.57E+07  4.33E+07
4.10E+07  3.88E+07  3.67E+07  3.47E+07  3.29E+07  3.11E+07  2.95E+07  2.79E+07  2.64E+07  2.50E+07
2.36E+07  2.24E+07  2.12E+07  2.00E+07  1.90E+07  1.80E+07  1.70E+07  1.61E+07  1.52E+07  1.44E+07
1.36E+07  1.29E+07  1.22E+07  1.16E+07  1.09E+07  1.04E+07  9.28E+06  8.31E+06  7.45E+06  6.67E+06
5.97E+06  5.35E+06  4.79E+06  4.30E+06  3.85E+06  3.45E+06  3.09E+06  2.77E+06  2.48E+06  2.22E+06
1.99E+06  1.78E+06  1.60E+06  1.43E+06  1.28E+06  1.15E+06  1.03E+06  9.20E+05  8.25E+05  7.39E+05
6.62E+05  5.93E+05  5.31E+05  4.76E+05  4.26E+05  3.82E+05  3.42E+05  3.06E+05  2.74E+05  2.46E+05
2.20E+05  1.97E+05  1.77E+05  1.58E+05  1.42E+05  1.27E+05  1.02E+05  8.18E+04  6.56E+04  5.27E+04
4.23E+04  3.21E+04  2.44E+04  1.85E+04  1.41E+04  1.07E+04  8.12E+03  6.16E+03  4.68E+03
   Tl-204           3.78E+00  7.92E+02  1.52E+02  8.77E+01  5.06E+01  2.92E+01  1.68E+01  9.71E+00
5.60E+00  3.23E+00  1.29E+00  5.17E-01  2.07E-01  8.26E-02  3.30E-02  1.32E-02  5.28E-03  2.11E-03
8.43E-04  3.37E-04  1.35E-04  5.39E-05  2.15E-05  8.61E-06  3.44E-06  1.38E-06  5.50E-07  2.20E-07
8.79E-08  3.51E-08  1.40E-08  5.62E-09  2.25E-09  8.98E-10  3.59E-10  1.43E-10  5.73E-11  2.29E-11
9.17E-12  3.66E-12  1.46E-12  5.86E-13  2.34E-13  9.36E-14  3.74E-14  1.50E-14  5.98E-15  2.39E-15
9.56E-16  3.82E-16  1.53E-16  6.11E-17  2.44E-17  9.76E-18  3.90E-18  1.56E-18  6.23E-19  2.49E-19
9.96E-20  3.98E-20  1.59E-20  6.37E-21  2.54E-21  1.02E-21  1.63E-22  2.60E-23  4.15E-24  6.64E-25
1.06E-25  1.70E-26  2.71E-27  4.33E-28  6.92E-29  1.11E-29  1.77E-30  2.82E-31  4.51E-32  7.21E-33
1.15E-33  1.84E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
```

```
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Tm-170           3.52E-01  7.92E+02  1.59E-05  4.33E-08  1.18E-10  3.20E-13  8.70E-16  2.37E-18
6.43E-21  1.75E-23  9.26E-28  4.91E-32  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   U-232            6.89E+01  3.97E+07  3.63E+07  3.52E+07  3.41E+07  3.31E+07  3.21E+07  3.12E+07
3.03E+07  2.94E+07  2.79E+07  2.65E+07  2.52E+07  2.40E+07  2.28E+07  2.17E+07  2.06E+07  1.96E+07
1.87E+07  1.78E+07  1.69E+07  1.61E+07  1.53E+07  1.45E+07  1.38E+07  1.31E+07  1.25E+07  1.19E+07
1.13E+07  1.07E+07  1.02E+07  9.71E+06  9.23E+06  8.78E+06  8.35E+06  7.94E+06  7.55E+06  7.18E+06
6.83E+06  6.49E+06  6.17E+06  5.87E+06  5.58E+06  5.31E+06  5.05E+06  4.80E+06  4.56E+06  4.34E+06
4.13E+06  3.93E+06  3.73E+06  3.55E+06  3.38E+06  3.21E+06  3.05E+06  2.90E+06  2.76E+06  2.63E+06
2.50E+06  2.37E+06  2.26E+06  2.15E+06  2.04E+06  1.94E+06  1.76E+06  1.59E+06  1.44E+06  1.30E+06
1.17E+06  1.06E+06  9.60E+05  8.68E+05  7.85E+05  7.10E+05  6.42E+05  5.80E+05  5.25E+05  4.75E+05
4.29E+05  3.88E+05  3.51E+05  3.17E+05  2.87E+05  2.60E+05  2.35E+05  2.12E+05  1.92E+05  1.74E+05
1.57E+05  1.42E+05  1.28E+05  1.16E+05  1.05E+05  9.49E+04  8.58E+04  7.76E+04  7.02E+04  6.35E+04
5.74E+04  5.19E+04  4.69E+04  4.24E+04  3.84E+04  3.47E+04  2.84E+04  2.32E+04  1.90E+04  1.55E+04
1.27E+04  9.87E+03  7.67E+03  5.97E+03  4.64E+03  3.61E+03  2.81E+03  2.18E+03  1.70E+03
   U-233            1.59E+05  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01
   U-234            2.46E+05  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
   U-235            7.04E+08  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
   V-50             1.40E+17  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
   Zr-93            1.53E+06  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
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4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
   Ks-20            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-21            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-22            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-23            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-24            4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.38E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.18E-04  1.34E-04  5.61E-05  2.36E-05  9.92E-06  4.17E-06  1.75E-06  7.38E-07
3.10E-07  1.30E-07  5.48E-08  2.31E-08  9.69E-09  4.07E-09  1.71E-09  7.20E-10  3.03E-10  1.27E-10
5.35E-11  2.25E-11  9.46E-12  3.98E-12  1.67E-12  7.03E-13  2.96E-13  1.24E-13  5.23E-14  2.20E-14
9.24E-15  3.89E-15  1.63E-15  6.87E-16  2.89E-16  1.21E-16  5.11E-17  2.15E-17  9.03E-18  3.79E-18
1.60E-18  6.71E-19  2.82E-19  1.19E-19  4.99E-20  2.10E-20  3.71E-21  6.55E-22  1.16E-22  2.05E-23
3.62E-24  6.40E-25  1.13E-25  2.00E-26  3.53E-27  6.25E-28  1.10E-28  1.95E-29  3.45E-30  6.10E-31
1.08E-31  1.91E-32  3.37E-33  5.96E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-25            4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.38E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.18E-04  1.34E-04  5.61E-05  2.36E-05  9.92E-06  4.17E-06  1.75E-06  7.38E-07
3.10E-07  1.30E-07  5.48E-08  2.31E-08  9.69E-09  4.07E-09  1.71E-09  7.20E-10  3.03E-10  1.27E-10
5.35E-11  2.25E-11  9.46E-12  3.98E-12  1.67E-12  7.03E-13  2.96E-13  1.24E-13  5.23E-14  2.20E-14
9.24E-15  3.89E-15  1.63E-15  6.87E-16  2.89E-16  1.21E-16  5.11E-17  2.15E-17  9.03E-18  3.79E-18
1.60E-18  6.71E-19  2.82E-19  1.19E-19  4.99E-20  2.10E-20  3.71E-21  6.55E-22  1.16E-22  2.05E-23
3.62E-24  6.40E-25  1.13E-25  2.00E-26  3.53E-27  6.25E-28  1.10E-28  1.95E-29  3.45E-30  6.10E-31
1.08E-31  1.91E-32  3.37E-33  5.96E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-26            2.00E+00  7.92E+02  3.50E+01  1.24E+01  4.38E+00  1.55E+00  5.47E-01  1.93E-01
6.84E-02  2.42E-02  4.27E-03  7.55E-04  1.34E-04  2.36E-05  4.17E-06  7.38E-07  1.30E-07  2.31E-08
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4.07E-09  7.20E-10  1.27E-10  2.25E-11  3.98E-12  7.03E-13  1.24E-13  2.20E-14  3.89E-15  6.87E-16
1.21E-16  2.15E-17  3.79E-18  6.71E-19  1.19E-19  2.10E-20  3.71E-21  6.55E-22  1.16E-22  2.05E-23
3.62E-24  6.40E-25  1.13E-25  2.00E-26  3.53E-27  6.25E-28  1.10E-28  1.95E-29  3.45E-30  6.10E-31
1.08E-31  1.91E-32  3.37E-33  5.96E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Th-230           7.54E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04
3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04
3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04
3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
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3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04
3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04
3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.68E+04  3.68E+04  3.68E+04
3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04
   U-236            2.34E+07  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
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1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
   U-238            4.47E+09  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01
6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01
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6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01
   Pu-240           6.56E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02
1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02
1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02
1.68E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02
1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.63E-02  1.63E-02  1.62E-02  1.62E-02
   Pu-241           1.44E+01  6.30E-01  4.09E-01  3.54E-01  3.06E-01  2.65E-01  2.29E-01  1.98E-01
1.72E-01  1.49E-01  1.17E-01  9.19E-02  7.22E-02  5.68E-02  4.46E-02  3.51E-02  2.76E-02  2.17E-02
1.70E-02  1.34E-02  1.05E-02  8.28E-03  6.51E-03  5.12E-03  4.02E-03  3.16E-03  2.48E-03  1.95E-03
1.54E-03  1.21E-03  9.49E-04  7.46E-04  5.86E-04  4.61E-04  3.62E-04  2.85E-04  2.24E-04  1.76E-04
1.38E-04  1.09E-04  8.55E-05  6.72E-05  5.28E-05  4.15E-05  3.26E-05  2.57E-05  2.02E-05  1.59E-05
1.25E-05  9.80E-06  7.70E-06  6.06E-06  4.76E-06  3.74E-06  2.94E-06  2.31E-06  1.82E-06  1.43E-06
1.12E-06  8.83E-07  6.94E-07  5.46E-07  4.29E-07  3.37E-07  2.08E-07  1.29E-07  7.96E-08  4.92E-08
3.04E-08  1.88E-08  1.16E-08  7.17E-09  4.43E-09  2.74E-09  1.69E-09  1.05E-09  6.46E-10  3.99E-10
2.47E-10  1.52E-10  9.42E-11  5.82E-11  3.60E-11  2.22E-11  1.37E-11  8.49E-12  5.25E-12  3.24E-12
2.00E-12  1.24E-12  7.65E-13  4.73E-13  2.92E-13  1.80E-13  1.12E-13  6.89E-14  4.26E-14  2.63E-14
1.63E-14  1.00E-14  6.21E-15  3.84E-15  2.37E-15  1.47E-15  5.60E-16  2.14E-16  8.16E-17  3.12E-17
1.19E-17  3.57E-18  1.07E-18  3.22E-19  9.66E-20  2.90E-20  8.70E-21  2.61E-21  7.84E-22
   Ra-226           1.60E+03  1.80E-02  1.44E+02  1.92E+02  2.40E+02  2.88E+02  3.36E+02  3.84E+02
4.31E+02  4.79E+02  5.58E+02  6.37E+02  7.16E+02  7.95E+02  8.73E+02  9.52E+02  1.03E+03  1.11E+03
1.19E+03  1.26E+03  1.34E+03  1.42E+03  1.50E+03  1.57E+03  1.65E+03  1.73E+03  1.80E+03  1.88E+03
1.95E+03  2.03E+03  2.11E+03  2.18E+03  2.26E+03  2.33E+03  2.41E+03  2.48E+03  2.56E+03  2.63E+03
2.71E+03  2.78E+03  2.85E+03  2.93E+03  3.00E+03  3.08E+03  3.15E+03  3.22E+03  3.30E+03  3.37E+03
3.44E+03  3.51E+03  3.59E+03  3.66E+03  3.73E+03  3.80E+03  3.88E+03  3.95E+03  4.02E+03  4.09E+03
4.16E+03  4.23E+03  4.30E+03  4.37E+03  4.44E+03  4.52E+03  4.66E+03  4.80E+03  4.93E+03  5.07E+03
5.21E+03  5.35E+03  5.49E+03  5.62E+03  5.76E+03  5.89E+03  6.03E+03  6.16E+03  6.29E+03  6.43E+03
6.56E+03  6.69E+03  6.82E+03  6.95E+03  7.08E+03  7.21E+03  7.34E+03  7.46E+03  7.59E+03  7.72E+03
7.84E+03  7.97E+03  8.10E+03  8.22E+03  8.34E+03  8.47E+03  8.59E+03  8.71E+03  8.83E+03  8.96E+03
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9.08E+03  9.20E+03  9.32E+03  9.44E+03  9.55E+03  9.67E+03  9.91E+03  1.01E+04  1.04E+04  1.06E+04
1.08E+04  1.11E+04  1.14E+04  1.17E+04  1.19E+04  1.22E+04  1.25E+04  1.27E+04  1.30E+04
        NUCLIDE HALFLIFE AND INVENTORY (CI) REMAINING IN THE FACILITY
 (TIMES IN YEARS) HALFLIFE        6.        9.       12.       15.       18.       21.       24.
27.       30.       35.       40.       45.       50.       55.       60.       65.       70.
75.       80.       85.       90.       95.      100.      105.      110.      115.      120.
125.      130.      135.      140.      145.      150.      155.      160.      165.      170.
175.      180.      185.      190.      195.      200.      205.      210.      215.      220.
225.      230.      235.      240.      245.      250.      255.      260.      265.      270.
275.      280.      285.      290.      295.      300.      310.      320.      330.      340.
350.      360.      370.      380.      390.      400.      410.      420.      430.      440.
450.      460.      470.      480.      490.      500.      510.      520.      530.      540.
550.      560.      570.      580.      590.      600.      610.      620.      630.      640.
650.      660.      670.      680.      690.      700.      720.      740.      760.      780.
800.      825.      850.      875.      900.      925.      950.      975.     1000.
   Pu-236          2.86E+00  9.00E-04  1.02E-04  4.91E-05  2.37E-05  1.15E-05  5.54E-06  2.68E-06
1.29E-06  6.25E-07  1.86E-07  5.54E-08  1.65E-08  4.90E-09  1.46E-09  4.34E-10  1.29E-10  3.84E-11
1.14E-11  3.40E-12  1.01E-12  3.02E-13  8.97E-14  2.67E-14  7.95E-15  2.36E-15  7.04E-16  2.09E-16
6.23E-17  1.85E-17  5.52E-18  1.64E-18  4.89E-19  1.45E-19  4.33E-20  1.29E-20  3.83E-21  1.14E-21
3.39E-22  1.01E-22  3.01E-23  8.95E-24  2.66E-24  7.92E-25  2.36E-25  7.02E-26  2.09E-26  6.21E-27
1.85E-27  5.50E-28  1.64E-28  4.87E-29  1.45E-29  4.32E-30  1.28E-30  3.82E-31  1.14E-31  3.38E-32
1.01E-32  3.00E-33  8.92E-34  2.65E-34  7.90E-35  2.35E-35  2.08E-36  1.84E-37  1.63E-38  1.45E-39
1.28E-40  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pu-238          8.77E+01  1.80E-02  1.68E-02  1.64E-02  1.60E-02  1.56E-02  1.52E-02  1.49E-02
1.45E-02  1.42E-02  1.36E-02  1.31E-02  1.26E-02  1.21E-02  1.16E-02  1.12E-02  1.07E-02  1.03E-02
9.91E-03  9.53E-03  9.16E-03  8.80E-03  8.46E-03  8.13E-03  7.81E-03  7.50E-03  7.21E-03  6.93E-03
6.66E-03  6.40E-03  6.15E-03  5.91E-03  5.68E-03  5.46E-03  5.25E-03  5.04E-03  4.85E-03  4.66E-03
4.47E-03  4.30E-03  4.13E-03  3.97E-03  3.82E-03  3.67E-03  3.53E-03  3.39E-03  3.26E-03  3.13E-03
3.01E-03  2.89E-03  2.78E-03  2.67E-03  2.56E-03  2.46E-03  2.37E-03  2.28E-03  2.19E-03  2.10E-03
2.02E-03  1.94E-03  1.87E-03  1.79E-03  1.72E-03  1.66E-03  1.53E-03  1.41E-03  1.30E-03  1.20E-03
1.11E-03  1.03E-03  9.49E-04  8.76E-04  8.09E-04  7.47E-04  6.90E-04  6.38E-04  5.89E-04  5.44E-04
5.02E-04  4.64E-04  4.28E-04  3.96E-04  3.65E-04  3.37E-04  3.12E-04  2.88E-04  2.66E-04  2.45E-04
2.27E-04  2.09E-04  1.93E-04  1.79E-04  1.65E-04  1.52E-04  1.41E-04  1.30E-04  1.20E-04  1.11E-04
1.02E-04  9.45E-05  8.73E-05  8.06E-05  7.45E-05  6.88E-05  5.87E-05  5.00E-05  4.27E-05  3.64E-05
3.10E-05  2.54E-05  2.09E-05  1.71E-05  1.40E-05  1.15E-05  9.41E-06  7.72E-06  6.33E-06
   Pu-239          2.41E+04  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02
1.69E-02  1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02
   Pu-242          3.73E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
   Pu-244          8.08E+07  9.00E-04  9.00E-04  8.99E-04  8.99E-04  8.99E-04  8.99E-04  8.99E-04
8.99E-04  8.99E-04  8.98E-04  8.98E-04  8.98E-04  8.98E-04  8.98E-04  8.97E-04  8.97E-04  8.97E-04
8.97E-04  8.96E-04  8.96E-04  8.96E-04  8.96E-04  8.96E-04  8.95E-04  8.95E-04  8.95E-04  8.95E-04
8.94E-04  8.94E-04  8.94E-04  8.94E-04  8.94E-04  8.93E-04  8.93E-04  8.93E-04  8.93E-04  8.92E-04
8.92E-04  8.92E-04  8.92E-04  8.92E-04  8.91E-04  8.91E-04  8.91E-04  8.91E-04  8.90E-04  8.90E-04
8.90E-04  8.90E-04  8.90E-04  8.89E-04  8.89E-04  8.89E-04  8.89E-04  8.88E-04  8.88E-04  8.88E-04
8.88E-04  8.88E-04  8.87E-04  8.87E-04  8.87E-04  8.87E-04  8.86E-04  8.86E-04  8.85E-04  8.85E-04
8.84E-04  8.84E-04  8.84E-04  8.83E-04  8.83E-04  8.82E-04  8.82E-04  8.81E-04  8.81E-04  8.80E-04
8.80E-04  8.80E-04  8.79E-04  8.79E-04  8.78E-04  8.78E-04  8.77E-04  8.77E-04  8.77E-04  8.76E-04
8.76E-04  8.75E-04  8.75E-04  8.74E-04  8.74E-04  8.73E-04  8.73E-04  8.73E-04  8.72E-04  8.72E-04
8.71E-04  8.71E-04  8.70E-04  8.70E-04  8.70E-04  8.69E-04  8.68E-04  8.67E-04  8.67E-04  8.66E-04
8.65E-04  8.64E-04  8.63E-04  8.62E-04  8.60E-04  8.59E-04  8.58E-04  8.57E-04  8.56E-04
   Ra-228          5.75E+00  4.90E+08  1.66E+08  1.15E+08  8.03E+07  5.59E+07  3.89E+07  2.71E+07
1.89E+07  1.32E+07  7.20E+06  3.94E+06  2.15E+06  1.18E+06  6.45E+05  3.53E+05  1.93E+05  1.06E+05
5.78E+04  3.16E+04  1.73E+04  9.47E+03  5.18E+03  2.84E+03  1.55E+03  8.49E+02  4.65E+02  2.54E+02
1.39E+02  7.61E+01  4.16E+01  2.28E+01  1.25E+01  6.82E+00  3.73E+00  2.04E+00  1.12E+00  6.12E-01
3.35E-01  1.83E-01  1.00E-01  5.48E-02  3.00E-02  1.64E-02  8.98E-03  4.91E-03  2.69E-03  1.47E-03
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8.05E-04   4.41E-04   2.41E-04   1.32E-04   7.22E-05   3.95E-05   2.16E-05   1.18E-05   6.47E-06   3.54E-06
1.94E-06   1.06E-06   5.80E-07   3.17E-07   1.74E-07   9.50E-08   2.84E-08   8.52E-09   2.55E-09   7.63E-10
2.29E-10   6.84E-11   2.05E-11   6.13E-12   1.84E-12   5.50E-13   1.65E-13   4.93E-14   1.48E-14   4.42E-15
1.32E-15   3.96E-16   1.19E-16   3.55E-17   1.06E-17   3.18E-18   9.53E-19   2.85E-19   8.54E-20   2.56E-20
7.66E-21   2.29E-21   6.86E-22   2.06E-22   6.15E-23   1.84E-23   5.52E-24   1.65E-24   4.94E-25   1.48E-25
4.43E-26   1.33E-26   3.97E-27   1.19E-27   3.56E-28   1.07E-28   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
   Re-187             4.35E+10   6.84E-02   6.55E-02   6.45E-02   6.36E-02   6.27E-02   6.18E-02   6.09E-02
6.00E-02   5.91E-02   5.77E-02   5.63E-02   5.50E-02   5.36E-02   5.24E-02   5.11E-02   4.99E-02   4.87E-02
4.75E-02   4.64E-02   4.53E-02   4.42E-02   4.31E-02   4.21E-02   4.11E-02   4.01E-02   3.91E-02   3.82E-02
3.73E-02   3.64E-02   3.55E-02   3.46E-02   3.38E-02   3.30E-02   3.22E-02   3.14E-02   3.07E-02   2.99E-02
2.92E-02   2.85E-02   2.78E-02   2.72E-02   2.65E-02   2.59E-02   2.53E-02   2.46E-02   2.41E-02   2.35E-02
2.29E-02   2.24E-02   2.18E-02   2.13E-02   2.08E-02   2.03E-02   1.98E-02   1.93E-02   1.89E-02   1.84E-02
1.80E-02   1.75E-02   1.71E-02   1.67E-02   1.63E-02   1.59E-02   1.52E-02   1.44E-02   1.38E-02   1.31E-02
1.25E-02   1.19E-02   1.13E-02   1.08E-02   1.03E-02   9.79E-03   9.33E-03   8.88E-03   8.46E-03   8.06E-03
7.68E-03   7.31E-03   6.97E-03   6.64E-03   6.32E-03   6.02E-03   5.74E-03   5.46E-03   5.20E-03   4.96E-03
4.72E-03   4.50E-03   4.29E-03   4.08E-03   3.89E-03   3.70E-03   3.53E-03   3.36E-03   3.20E-03   3.05E-03
2.90E-03   2.77E-03   2.64E-03   2.51E-03   2.39E-03   2.28E-03   2.07E-03   1.88E-03   1.70E-03   1.54E-03
1.40E-03   1.24E-03   1.10E-03   9.73E-04   8.62E-04   7.63E-04   6.76E-04   5.99E-04   5.30E-04
   Se-79              6.50E+04   1.25E+05   1.24E+05   1.24E+05   1.24E+05   1.24E+05   1.24E+05   1.24E+05
1.23E+05   1.23E+05   1.23E+05   1.23E+05   1.22E+05   1.22E+05   1.22E+05   1.21E+05   1.21E+05   1.21E+05
1.20E+05   1.20E+05   1.20E+05   1.20E+05   1.19E+05   1.19E+05   1.19E+05   1.18E+05   1.18E+05   1.18E+05
1.17E+05   1.17E+05   1.17E+05   1.17E+05   1.16E+05   1.16E+05   1.16E+05   1.15E+05   1.15E+05   1.15E+05
1.15E+05   1.14E+05   1.14E+05   1.14E+05   1.13E+05   1.13E+05   1.13E+05   1.13E+05   1.12E+05   1.12E+05
1.12E+05   1.12E+05   1.11E+05   1.11E+05   1.11E+05   1.10E+05   1.10E+05   1.10E+05   1.10E+05   1.09E+05
1.09E+05   1.09E+05   1.09E+05   1.08E+05   1.08E+05   1.08E+05   1.07E+05   1.07E+05   1.06E+05   1.06E+05
1.05E+05   1.05E+05   1.04E+05   1.04E+05   1.03E+05   1.02E+05   1.02E+05   1.01E+05   1.01E+05   1.00E+05
1.00E+05   9.95E+04   9.90E+04   9.85E+04   9.80E+04   9.75E+04   9.70E+04   9.65E+04   9.61E+04   9.56E+04
9.51E+04   9.46E+04   9.42E+04   9.37E+04   9.32E+04   9.28E+04   9.23E+04   9.19E+04   9.14E+04   9.10E+04
9.05E+04   9.01E+04   8.96E+04   8.92E+04   8.87E+04   8.83E+04   8.74E+04   8.66E+04   8.57E+04   8.49E+04
8.40E+04   8.30E+04   8.20E+04   8.09E+04   7.99E+04   7.90E+04   7.80E+04   7.70E+04   7.61E+04
   Si-32              1.72E+02   1.17E+08   1.12E+08   1.10E+08   1.08E+08   1.06E+08   1.05E+08   1.03E+08
1.01E+08   9.97E+07   9.70E+07   9.45E+07   9.20E+07   8.95E+07   8.72E+07   8.49E+07   8.26E+07   8.05E+07
7.83E+07   7.63E+07   7.42E+07   7.23E+07   7.04E+07   6.85E+07   6.67E+07   6.50E+07   6.32E+07   6.16E+07
5.99E+07   5.84E+07   5.68E+07   5.53E+07   5.39E+07   5.24E+07   5.11E+07   4.97E+07   4.84E+07   4.71E+07
4.59E+07   4.47E+07   4.35E+07   4.23E+07   4.12E+07   4.01E+07   3.91E+07   3.80E+07   3.70E+07   3.61E+07
3.51E+07   3.42E+07   3.33E+07   3.24E+07   3.15E+07   3.07E+07   2.99E+07   2.91E+07   2.83E+07   2.76E+07
2.69E+07   2.62E+07   2.55E+07   2.48E+07   2.41E+07   2.35E+07   2.23E+07   2.11E+07   2.00E+07   1.90E+07
1.80E+07   1.71E+07   1.62E+07   1.53E+07   1.45E+07   1.38E+07   1.30E+07   1.24E+07   1.17E+07   1.11E+07
1.05E+07   9.99E+06   9.47E+06   8.97E+06   8.51E+06   8.06E+06   7.64E+06   7.24E+06   6.87E+06   6.51E+06
6.17E+06   5.85E+06   5.54E+06   5.26E+06   4.98E+06   4.72E+06   4.48E+06   4.24E+06   4.02E+06   3.81E+06
3.61E+06   3.43E+06   3.25E+06   3.08E+06   2.92E+06   2.77E+06   2.48E+06   2.23E+06   2.01E+06   1.80E+06
1.62E+06   1.42E+06   1.24E+06   1.08E+06   9.49E+05   8.30E+05   7.26E+05   6.35E+05   5.56E+05
   Sm-151             9.00E+01   4.74E+07   4.41E+07   4.31E+07   4.21E+07   4.11E+07   4.02E+07   3.92E+07
3.83E+07   3.74E+07   3.59E+07   3.46E+07   3.32E+07   3.19E+07   3.07E+07   2.95E+07   2.84E+07   2.73E+07
2.62E+07   2.52E+07   2.42E+07   2.33E+07   2.24E+07   2.15E+07   2.07E+07   1.99E+07   1.91E+07   1.84E+07
1.76E+07   1.70E+07   1.63E+07   1.57E+07   1.51E+07   1.45E+07   1.39E+07   1.34E+07   1.29E+07   1.24E+07
1.19E+07   1.14E+07   1.10E+07   1.06E+07   1.01E+07   9.76E+06   9.38E+06   9.01E+06   8.67E+06   8.33E+06
8.01E+06   7.70E+06   7.40E+06   7.11E+06   6.84E+06   6.57E+06   6.32E+06   6.07E+06   5.84E+06   5.61E+06
5.39E+06   5.18E+06   4.98E+06   4.79E+06   4.60E+06   4.43E+06   4.09E+06   3.78E+06   3.49E+06   3.23E+06
2.98E+06   2.75E+06   2.55E+06   2.35E+06   2.17E+06   2.01E+06   1.86E+06   1.71E+06   1.58E+06   1.46E+06
1.35E+06   1.25E+06   1.15E+06   1.07E+06   9.86E+05   9.11E+05   8.42E+05   7.78E+05   7.19E+05   6.64E+05
6.14E+05   5.67E+05   5.24E+05   4.84E+05   4.47E+05   4.13E+05   3.82E+05   3.53E+05   3.26E+05   3.01E+05
2.78E+05   2.57E+05   2.38E+05   2.20E+05   2.03E+05   1.88E+05   1.60E+05   1.37E+05   1.17E+05   9.96E+04
8.51E+04   6.98E+04   5.73E+04   4.70E+04   3.86E+04   3.17E+04   2.60E+04   2.13E+04   1.75E+04
   Sn-121m            5.50E+01   9.68E+07   8.64E+07   8.32E+07   8.01E+07   7.71E+07   7.43E+07   7.15E+07
6.89E+07   6.63E+07   6.23E+07   5.84E+07   5.49E+07   5.15E+07   4.84E+07   4.54E+07   4.26E+07   4.00E+07
3.76E+07   3.53E+07   3.31E+07   3.11E+07   2.92E+07   2.74E+07   2.57E+07   2.42E+07   2.27E+07   2.13E+07
2.00E+07   1.88E+07   1.76E+07   1.66E+07   1.55E+07   1.46E+07   1.37E+07   1.29E+07   1.21E+07   1.13E+07
1.06E+07   1.00E+07   9.39E+06   8.81E+06   8.27E+06   7.77E+06   7.29E+06   6.85E+06   6.43E+06   6.04E+06
5.67E+06   5.32E+06   5.00E+06   4.69E+06   4.40E+06   4.13E+06   3.88E+06   3.64E+06   3.42E+06   3.21E+06
3.02E+06   2.83E+06   2.66E+06   2.50E+06   2.34E+06   2.20E+06   1.94E+06   1.71E+06   1.51E+06   1.33E+06
1.17E+06   1.03E+06   9.10E+05   8.02E+05   7.07E+05   6.23E+05   5.50E+05   4.84E+05   4.27E+05   3.76E+05
3.32E+05   2.93E+05   2.58E+05   2.27E+05   2.00E+05   1.77E+05   1.56E+05   1.37E+05   1.21E+05   1.07E+05
9.40E+04   8.29E+04   7.31E+04   6.44E+04   5.68E+04   5.00E+04   4.41E+04   3.89E+04   3.43E+04   3.02E+04
2.66E+04   2.35E+04   2.07E+04   1.82E+04   1.61E+04   1.42E+04   1.10E+04   8.56E+03   6.65E+03   5.17E+03
4.02E+03   2.93E+03   2.14E+03   1.56E+03   1.14E+03   8.30E+02   6.06E+02   4.42E+02   3.22E+02
   Sn-126             1.00E+05   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04
5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.10E+04   5.10E+04   5.10E+04
5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04
5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04
5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04
5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04
5.09E+04   5.09E+04   5.09E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04
5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04
5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.06E+04   5.06E+04
5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.05E+04
5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.04E+04   5.04E+04
5.04E+04   5.04E+04   5.04E+04   5.03E+04   5.03E+04   5.03E+04   5.03E+04   5.03E+04   5.02E+04
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   Sr-90            2.88E+01  4.50E-02  3.42E-02  3.12E-02  2.85E-02  2.60E-02  2.37E-02  2.16E-02
1.98E-02  1.80E-02  1.55E-02  1.33E-02  1.14E-02  9.80E-03  8.41E-03  7.22E-03  6.20E-03  5.33E-03
4.57E-03  3.93E-03  3.37E-03  2.89E-03  2.49E-03  2.13E-03  1.83E-03  1.57E-03  1.35E-03  1.16E-03
9.96E-04  8.55E-04  7.34E-04  6.30E-04  5.41E-04  4.65E-04  3.99E-04  3.43E-04  2.94E-04  2.53E-04
2.17E-04  1.86E-04  1.60E-04  1.37E-04  1.18E-04  1.01E-04  8.69E-05  7.46E-05  6.40E-05  5.50E-05
4.72E-05  4.05E-05  3.48E-05  2.99E-05  2.57E-05  2.20E-05  1.89E-05  1.62E-05  1.39E-05  1.20E-05
1.03E-05  8.83E-06  7.58E-06  6.51E-06  5.59E-06  4.80E-06  3.54E-06  2.61E-06  1.92E-06  1.42E-06
1.04E-06  7.70E-07  5.68E-07  4.19E-07  3.09E-07  2.27E-07  1.68E-07  1.24E-07  9.11E-08  6.72E-08
4.95E-08  3.65E-08  2.69E-08  1.98E-08  1.46E-08  1.08E-08  7.95E-09  5.86E-09  4.32E-09  3.19E-09
2.35E-09  1.73E-09  1.28E-09  9.41E-10  6.94E-10  5.12E-10  3.77E-10  2.78E-10  2.05E-10  1.51E-10
1.11E-10  8.21E-11  6.05E-11  4.46E-11  3.29E-11  2.43E-11  1.32E-11  7.16E-12  3.89E-12  2.12E-12
1.15E-12  5.37E-13  2.50E-13  1.17E-13  5.45E-14  2.54E-14  1.19E-14  5.54E-15  2.59E-15
   Tb-157           7.10E+01  2.70E+07  2.47E+07  2.40E+07  2.33E+07  2.26E+07  2.20E+07  2.13E+07
2.07E+07  2.01E+07  1.91E+07  1.82E+07  1.73E+07  1.65E+07  1.57E+07  1.50E+07  1.42E+07  1.36E+07
1.29E+07  1.23E+07  1.17E+07  1.11E+07  1.06E+07  1.01E+07  9.61E+06  9.15E+06  8.71E+06  8.29E+06
7.89E+06  7.51E+06  7.15E+06  6.81E+06  6.48E+06  6.17E+06  5.88E+06  5.59E+06  5.32E+06  5.07E+06
4.83E+06  4.59E+06  4.37E+06  4.16E+06  3.96E+06  3.77E+06  3.59E+06  3.42E+06  3.26E+06  3.10E+06
2.95E+06  2.81E+06  2.67E+06  2.55E+06  2.42E+06  2.31E+06  2.20E+06  2.09E+06  1.99E+06  1.90E+06
1.80E+06  1.72E+06  1.64E+06  1.56E+06  1.48E+06  1.41E+06  1.28E+06  1.16E+06  1.05E+06  9.52E+05
8.63E+05  7.82E+05  7.08E+05  6.42E+05  5.82E+05  5.27E+05  4.78E+05  4.33E+05  3.93E+05  3.56E+05
3.22E+05  2.92E+05  2.65E+05  2.40E+05  2.18E+05  1.97E+05  1.79E+05  1.62E+05  1.47E+05  1.33E+05
1.21E+05  1.09E+05  9.90E+04  8.97E+04  8.13E+04  7.37E+04  6.68E+04  6.05E+04  5.49E+04  4.97E+04
4.51E+04  4.08E+04  3.70E+04  3.35E+04  3.04E+04  2.76E+04  2.26E+04  1.86E+04  1.53E+04  1.25E+04
1.03E+04  8.05E+03  6.30E+03  4.92E+03  3.85E+03  3.01E+03  2.35E+03  1.84E+03  1.44E+03
   Tb-158           1.80E+02  2.70E+07  2.61E+07  2.58E+07  2.55E+07  2.52E+07  2.49E+07  2.46E+07
2.43E+07  2.40E+07  2.35E+07  2.31E+07  2.26E+07  2.22E+07  2.18E+07  2.13E+07  2.09E+07  2.05E+07
2.01E+07  1.97E+07  1.93E+07  1.90E+07  1.86E+07  1.82E+07  1.79E+07  1.75E+07  1.72E+07  1.69E+07
1.65E+07  1.62E+07  1.59E+07  1.56E+07  1.53E+07  1.50E+07  1.47E+07  1.44E+07  1.41E+07  1.38E+07
1.36E+07  1.33E+07  1.31E+07  1.28E+07  1.26E+07  1.23E+07  1.21E+07  1.18E+07  1.16E+07  1.14E+07
1.12E+07  1.09E+07  1.07E+07  1.05E+07  1.03E+07  1.01E+07  9.92E+06  9.73E+06  9.54E+06  9.35E+06
9.17E+06  8.99E+06  8.82E+06  8.64E+06  8.48E+06  8.31E+06  7.99E+06  7.68E+06  7.39E+06  7.10E+06
6.83E+06  6.57E+06  6.31E+06  6.07E+06  5.84E+06  5.61E+06  5.40E+06  5.19E+06  4.99E+06  4.80E+06
4.61E+06  4.43E+06  4.26E+06  4.10E+06  3.94E+06  3.79E+06  3.64E+06  3.50E+06  3.37E+06  3.24E+06
3.11E+06  2.99E+06  2.88E+06  2.77E+06  2.66E+06  2.56E+06  2.46E+06  2.37E+06  2.27E+06  2.19E+06
2.10E+06  2.02E+06  1.94E+06  1.87E+06  1.80E+06  1.73E+06  1.60E+06  1.48E+06  1.36E+06  1.26E+06
1.17E+06  1.06E+06  9.58E+05  8.69E+05  7.88E+05  7.14E+05  6.47E+05  5.87E+05  5.32E+05
   Tc-99            2.11E+05  3.38E-01  3.27E-01  3.24E-01  3.20E-01  3.17E-01  3.13E-01  3.10E-01
3.06E-01  3.03E-01  2.98E-01  2.92E-01  2.87E-01  2.82E-01  2.77E-01  2.72E-01  2.67E-01  2.62E-01
2.57E-01  2.53E-01  2.48E-01  2.44E-01  2.39E-01  2.35E-01  2.31E-01  2.27E-01  2.23E-01  2.19E-01
2.15E-01  2.11E-01  2.07E-01  2.03E-01  2.00E-01  1.96E-01  1.92E-01  1.89E-01  1.86E-01  1.82E-01
1.79E-01  1.76E-01  1.73E-01  1.69E-01  1.66E-01  1.63E-01  1.60E-01  1.58E-01  1.55E-01  1.52E-01
1.49E-01  1.47E-01  1.44E-01  1.41E-01  1.39E-01  1.36E-01  1.34E-01  1.31E-01  1.29E-01  1.27E-01
1.24E-01  1.22E-01  1.20E-01  1.18E-01  1.16E-01  1.14E-01  1.10E-01  1.06E-01  1.02E-01  9.83E-02
9.48E-02  9.14E-02  8.81E-02  8.50E-02  8.19E-02  7.90E-02  7.62E-02  7.35E-02  7.09E-02  6.83E-02
6.59E-02  6.35E-02  6.13E-02  5.91E-02  5.70E-02  5.49E-02  5.30E-02  5.11E-02  4.93E-02  4.75E-02
4.58E-02  4.42E-02  4.26E-02  4.11E-02  3.96E-02  3.82E-02  3.68E-02  3.55E-02  3.43E-02  3.30E-02
3.19E-02  3.07E-02  2.96E-02  2.86E-02  2.76E-02  2.66E-02  2.47E-02  2.30E-02  2.14E-02  1.99E-02
1.85E-02  1.69E-02  1.54E-02  1.41E-02  1.28E-02  1.17E-02  1.07E-02  9.78E-03  8.93E-03
   Te-123           1.00E+13  5.24E-04  5.22E-04  5.22E-04  5.21E-04  5.20E-04  5.20E-04  5.19E-04
5.18E-04  5.18E-04  5.17E-04  5.16E-04  5.15E-04  5.14E-04  5.13E-04  5.12E-04  5.11E-04  5.10E-04
5.09E-04  5.08E-04  5.07E-04  5.06E-04  5.05E-04  5.04E-04  5.03E-04  5.02E-04  5.01E-04  5.00E-04
4.99E-04  4.98E-04  4.97E-04  4.96E-04  4.95E-04  4.94E-04  4.93E-04  4.92E-04  4.91E-04  4.90E-04
4.89E-04  4.88E-04  4.87E-04  4.86E-04  4.86E-04  4.85E-04  4.84E-04  4.83E-04  4.82E-04  4.81E-04
4.80E-04  4.79E-04  4.78E-04  4.77E-04  4.76E-04  4.75E-04  4.74E-04  4.73E-04  4.72E-04  4.72E-04
4.71E-04  4.70E-04  4.69E-04  4.68E-04  4.67E-04  4.66E-04  4.64E-04  4.62E-04  4.61E-04  4.59E-04
4.57E-04  4.55E-04  4.53E-04  4.52E-04  4.50E-04  4.48E-04  4.46E-04  4.45E-04  4.43E-04  4.41E-04
4.39E-04  4.38E-04  4.36E-04  4.34E-04  4.33E-04  4.31E-04  4.29E-04  4.28E-04  4.26E-04  4.24E-04
4.23E-04  4.21E-04  4.19E-04  4.18E-04  4.16E-04  4.14E-04  4.13E-04  4.11E-04  4.10E-04  4.08E-04
4.06E-04  4.05E-04  4.03E-04  4.02E-04  4.00E-04  3.99E-04  3.95E-04  3.92E-04  3.89E-04  3.86E-04
3.83E-04  3.80E-04  3.76E-04  3.72E-04  3.69E-04  3.65E-04  3.61E-04  3.58E-04  3.54E-04
   Th-229           7.88E+03  3.83E+05  3.83E+05  3.82E+05  3.82E+05  3.82E+05  3.82E+05  3.82E+05
3.82E+05  3.81E+05  3.81E+05  3.81E+05  3.81E+05  3.80E+05  3.80E+05  3.80E+05  3.80E+05  3.79E+05
3.79E+05  3.79E+05  3.79E+05  3.78E+05  3.78E+05  3.78E+05  3.77E+05  3.77E+05  3.77E+05  3.77E+05
3.76E+05  3.76E+05  3.76E+05  3.76E+05  3.75E+05  3.75E+05  3.75E+05  3.75E+05  3.74E+05  3.74E+05
3.74E+05  3.74E+05  3.73E+05  3.73E+05  3.73E+05  3.73E+05  3.72E+05  3.72E+05  3.72E+05  3.72E+05
3.71E+05  3.71E+05  3.71E+05  3.71E+05  3.70E+05  3.70E+05  3.70E+05  3.70E+05  3.69E+05  3.69E+05
3.69E+05  3.68E+05  3.68E+05  3.68E+05  3.68E+05  3.67E+05  3.67E+05  3.66E+05  3.66E+05  3.65E+05
3.65E+05  3.64E+05  3.64E+05  3.63E+05  3.63E+05  3.62E+05  3.62E+05  3.61E+05  3.61E+05  3.60E+05
3.60E+05  3.59E+05  3.59E+05  3.58E+05  3.58E+05  3.57E+05  3.57E+05  3.57E+05  3.56E+05  3.56E+05
3.55E+05  3.55E+05  3.54E+05  3.54E+05  3.53E+05  3.53E+05  3.52E+05  3.52E+05  3.51E+05  3.51E+05
3.50E+05  3.50E+05  3.49E+05  3.49E+05  3.48E+05  3.48E+05  3.47E+05  3.46E+05  3.45E+05  3.44E+05
3.43E+05  3.42E+05  3.41E+05  3.39E+05  3.38E+05  3.37E+05  3.36E+05  3.35E+05  3.34E+05
   Th-232           1.41E+10  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01
1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01
1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01
1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01
1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01
1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01
1.95E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01
```

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1.94E-01  1.94E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01
1.93E-01  1.93E-01  1.92E-01  1.92E-01  1.92E-01  1.92E-01  1.92E-01  1.92E-01  1.92E-01  1.92E-01
1.92E-01  1.92E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.90E-01
1.90E-01  1.90E-01  1.90E-01  1.90E-01  1.89E-01  1.89E-01  1.89E-01  1.89E-01  1.88E-01
   Ti-44            6.30E+01  2.81E+08  2.54E+08  2.46E+08  2.38E+08  2.30E+08  2.23E+08  2.16E+08
2.09E+08  2.02E+08  1.91E+08  1.81E+08  1.71E+08  1.62E+08  1.53E+08  1.45E+08  1.37E+08  1.30E+08
1.23E+08  1.16E+08  1.10E+08  1.04E+08  9.83E+07  9.30E+07  8.80E+07  8.33E+07  7.88E+07  7.46E+07
7.06E+07  6.68E+07  6.32E+07  5.98E+07  5.66E+07  5.35E+07  5.07E+07  4.79E+07  4.54E+07  4.29E+07
4.06E+07  3.84E+07  3.64E+07  3.44E+07  3.26E+07  3.08E+07  2.92E+07  2.76E+07  2.61E+07  2.47E+07
2.34E+07  2.21E+07  2.09E+07  1.98E+07  1.87E+07  1.77E+07  1.68E+07  1.59E+07  1.50E+07  1.42E+07
1.35E+07  1.27E+07  1.20E+07  1.14E+07  1.08E+07  1.02E+07  9.14E+06  8.18E+06  7.32E+06  6.56E+06
5.87E+06  5.26E+06  4.71E+06  4.21E+06  3.77E+06  3.38E+06  3.03E+06  2.71E+06  2.43E+06  2.17E+06
1.94E+06  1.74E+06  1.56E+06  1.40E+06  1.25E+06  1.12E+06  1.00E+06  8.97E+05  8.03E+05  7.19E+05
6.44E+05  5.76E+05  5.16E+05  4.62E+05  4.14E+05  3.70E+05  3.32E+05  2.97E+05  2.66E+05  2.38E+05
2.13E+05  1.91E+05  1.71E+05  1.53E+05  1.37E+05  1.23E+05  9.83E+04  7.88E+04  6.32E+04  5.07E+04
4.06E+04  3.08E+04  2.34E+04  1.77E+04  1.35E+04  1.02E+04  7.74E+03  5.87E+03  4.45E+03
   Tl-204           3.78E+00  7.92E+02  1.48E+02  8.48E+01  4.85E+01  2.78E+01  1.59E+01  9.08E+00
5.19E+00  2.97E+00  1.17E+00  4.62E-01  1.82E-01  7.18E-02  2.83E-02  1.11E-02  4.40E-03  1.73E-03
6.83E-04  2.69E-04  1.06E-04  4.18E-05  1.65E-05  6.50E-06  2.56E-06  1.01E-06  3.98E-07  1.57E-07
6.19E-08  2.44E-08  9.61E-09  3.79E-09  1.49E-09  5.89E-10  2.32E-10  9.15E-11  3.61E-11  1.42E-11
5.61E-12  2.21E-12  8.71E-13  3.43E-13  1.35E-13  5.34E-14  2.10E-14  8.29E-15  3.27E-15  1.29E-15
5.08E-16  2.00E-16  7.89E-17  3.11E-17  1.23E-17  4.83E-18  1.91E-18  7.51E-19  2.96E-19  1.17E-19
4.60E-20  1.81E-20  7.15E-21  2.82E-21  1.11E-21  4.38E-22  6.80E-23  1.06E-23  1.64E-24  2.55E-25
3.97E-26  6.16E-27  9.58E-28  1.49E-28  2.31E-29  3.59E-30  5.58E-31  8.68E-32  1.35E-32  2.10E-33
3.26E-34  5.06E-35  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Tm-170           3.52E-01  7.92E+02  1.59E-05  4.32E-08  1.18E-10  3.20E-13  8.69E-16  2.36E-18
6.42E-21  1.74E-23  9.24E-28  4.89E-32  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   U-232            6.89E+01  3.97E+07  3.62E+07  3.52E+07  3.41E+07  3.31E+07  3.21E+07  3.11E+07
3.02E+07  2.93E+07  2.78E+07  2.65E+07  2.52E+07  2.39E+07  2.27E+07  2.16E+07  2.05E+07  1.95E+07
1.86E+07  1.76E+07  1.68E+07  1.59E+07  1.51E+07  1.44E+07  1.37E+07  1.30E+07  1.24E+07  1.18E+07
1.12E+07  1.06E+07  1.01E+07  9.60E+06  9.12E+06  8.67E+06  8.24E+06  7.83E+06  7.45E+06  7.08E+06
6.73E+06  6.40E+06  6.08E+06  5.78E+06  5.49E+06  5.22E+06  4.96E+06  4.72E+06  4.48E+06  4.26E+06
4.05E+06  3.85E+06  3.66E+06  3.48E+06  3.31E+06  3.14E+06  2.99E+06  2.84E+06  2.70E+06  2.57E+06
2.44E+06  2.32E+06  2.20E+06  2.10E+06  1.99E+06  1.89E+06  1.71E+06  1.55E+06  1.40E+06  1.26E+06
1.14E+06  1.03E+06  9.31E+05  8.41E+05  7.60E+05  6.87E+05  6.20E+05  5.61E+05  5.07E+05  4.58E+05
4.14E+05  3.74E+05  3.38E+05  3.05E+05  2.76E+05  2.49E+05  2.25E+05  2.03E+05  1.84E+05  1.66E+05
1.50E+05  1.36E+05  1.22E+05  1.11E+05  1.00E+05  9.03E+04  8.16E+04  7.37E+04  6.66E+04  6.02E+04
5.44E+04  4.91E+04  4.44E+04  4.01E+04  3.62E+04  3.28E+04  2.67E+04  2.18E+04  1.78E+04  1.45E+04
1.19E+04  9.22E+03  7.15E+03  5.55E+03  4.31E+03  3.34E+03  2.59E+03  2.01E+03  1.56E+03
   U-233            1.59E+05  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01
1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01
1.34E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01
1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.32E-01  1.32E-01
1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01
1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.31E-01  1.31E-01  1.31E-01  1.31E-01
1.31E-01  1.31E-01  1.31E-01  1.31E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01
1.30E-01  1.30E-01  1.30E-01  1.29E-01  1.29E-01  1.29E-01  1.29E-01  1.29E-01  1.29E-01  1.29E-01
1.29E-01  1.29E-01  1.28E-01  1.28E-01  1.28E-01  1.28E-01  1.28E-01  1.28E-01  1.28E-01  1.28E-01
1.28E-01  1.27E-01  1.27E-01  1.27E-01  1.27E-01  1.27E-01  1.27E-01  1.27E-01  1.26E-01  1.26E-01
1.26E-01  1.26E-01  1.25E-01  1.25E-01  1.25E-01  1.25E-01  1.24E-01  1.24E-01  1.24E-01
   U-234            2.46E+05  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04
1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04
1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.10E+04  1.10E+04  1.10E+04
1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04
1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.09E+04  1.09E+04
1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04
1.09E+04  1.09E+04  1.09E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04
1.08E+04  1.08E+04  1.08E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04
1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.06E+04  1.06E+04  1.06E+04  1.06E+04  1.06E+04  1.06E+04
1.06E+04  1.06E+04  1.06E+04  1.06E+04  1.06E+04  1.05E+04  1.05E+04  1.05E+04  1.05E+04  1.05E+04
1.05E+04  1.04E+04  1.04E+04  1.04E+04  1.04E+04  1.03E+04  1.03E+04  1.03E+04  1.03E+04
   U-235            7.04E+08  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.78E-02
2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.77E-02
2.77E-02  2.77E-02  2.77E-02  2.77E-02  2.77E-02  2.77E-02  2.77E-02  2.76E-02  2.76E-02  2.76E-02
2.76E-02  2.76E-02  2.76E-02  2.76E-02  2.76E-02  2.76E-02  2.75E-02  2.75E-02  2.75E-02  2.75E-02
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2.75E-02  2.75E-02  2.75E-02  2.75E-02  2.75E-02  2.74E-02  2.74E-02  2.74E-02  2.74E-02  2.74E-02
2.74E-02  2.74E-02  2.74E-02  2.74E-02  2.73E-02  2.73E-02  2.73E-02  2.73E-02  2.73E-02  2.73E-02
2.73E-02  2.73E-02  2.72E-02  2.72E-02  2.72E-02  2.72E-02  2.72E-02  2.72E-02  2.71E-02  2.71E-02
2.71E-02  2.71E-02  2.71E-02  2.70E-02  2.70E-02  2.70E-02  2.70E-02  2.69E-02  2.69E-02  2.69E-02
2.69E-02  2.69E-02  2.68E-02  2.68E-02  2.68E-02  2.68E-02  2.67E-02  2.67E-02  2.67E-02  2.67E-02
2.67E-02  2.66E-02  2.66E-02  2.66E-02  2.66E-02  2.65E-02  2.65E-02  2.65E-02  2.65E-02  2.65E-02
2.64E-02  2.64E-02  2.64E-02  2.64E-02  2.63E-02  2.63E-02  2.63E-02  2.62E-02  2.62E-02  2.62E-02
2.61E-02  2.61E-02  2.60E-02  2.59E-02  2.59E-02  2.58E-02  2.58E-02  2.57E-02  2.57E-02
   V-50             1.40E+17  9.20E-08  9.20E-08  9.19E-08  9.19E-08  9.19E-08  9.19E-08  9.19E-08
9.19E-08  9.19E-08  9.18E-08  9.18E-08  9.18E-08  9.18E-08  9.17E-08  9.17E-08  9.17E-08  9.17E-08
9.17E-08  9.16E-08  9.16E-08  9.16E-08  9.16E-08  9.15E-08  9.15E-08  9.15E-08  9.15E-08  9.15E-08
9.14E-08  9.14E-08  9.14E-08  9.14E-08  9.13E-08  9.13E-08  9.13E-08  9.13E-08  9.12E-08  9.12E-08
9.12E-08  9.12E-08  9.12E-08  9.11E-08  9.11E-08  9.11E-08  9.11E-08  9.10E-08  9.10E-08  9.10E-08
9.10E-08  9.10E-08  9.09E-08  9.09E-08  9.09E-08  9.09E-08  9.08E-08  9.08E-08  9.08E-08  9.08E-08
9.07E-08  9.07E-08  9.07E-08  9.07E-08  9.07E-08  9.06E-08  9.06E-08  9.05E-08  9.05E-08  9.05E-08
9.04E-08  9.04E-08  9.03E-08  9.03E-08  9.02E-08  9.02E-08  9.01E-08  9.01E-08  9.00E-08  9.00E-08
9.00E-08  8.99E-08  8.99E-08  8.98E-08  8.98E-08  8.97E-08  8.97E-08  8.96E-08  8.96E-08  8.96E-08
8.95E-08  8.95E-08  8.94E-08  8.94E-08  8.93E-08  8.93E-08  8.92E-08  8.92E-08  8.92E-08  8.91E-08
8.91E-08  8.90E-08  8.90E-08  8.89E-08  8.89E-08  8.88E-08  8.88E-08  8.87E-08  8.86E-08  8.85E-08
8.84E-08  8.83E-08  8.82E-08  8.81E-08  8.80E-08  8.79E-08  8.77E-08  8.76E-08  8.75E-08
   Zr-93            1.53E+06  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.52E+03
4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.51E+03
4.51E+03  4.51E+03  4.51E+03  4.51E+03  4.51E+03  4.51E+03  4.51E+03  4.50E+03  4.50E+03  4.50E+03
4.50E+03  4.50E+03  4.50E+03  4.50E+03  4.50E+03  4.50E+03  4.49E+03  4.49E+03  4.49E+03  4.49E+03
4.49E+03  4.49E+03  4.49E+03  4.49E+03  4.49E+03  4.48E+03  4.48E+03  4.48E+03  4.48E+03  4.48E+03
4.48E+03  4.48E+03  4.48E+03  4.48E+03  4.47E+03  4.47E+03  4.47E+03  4.47E+03  4.47E+03  4.47E+03
4.47E+03  4.47E+03  4.47E+03  4.46E+03  4.46E+03  4.46E+03  4.46E+03  4.46E+03  4.46E+03  4.45E+03
4.45E+03  4.45E+03  4.45E+03  4.44E+03  4.44E+03  4.44E+03  4.44E+03  4.44E+03  4.43E+03  4.43E+03
4.43E+03  4.43E+03  4.42E+03  4.42E+03  4.42E+03  4.42E+03  4.42E+03  4.41E+03  4.41E+03  4.41E+03
4.41E+03  4.40E+03  4.40E+03  4.40E+03  4.40E+03  4.40E+03  4.39E+03  4.39E+03  4.39E+03  4.39E+03
4.38E+03  4.38E+03  4.38E+03  4.38E+03  4.38E+03  4.37E+03  4.37E+03  4.36E+03  4.36E+03  4.36E+03
4.35E+03  4.35E+03  4.34E+03  4.33E+03  4.33E+03  4.32E+03  4.32E+03  4.31E+03  4.31E+03
   Ks-20            1.00E+00  7.92E+02  1.32E+00  1.57E-01  1.86E-02  2.21E-03  2.63E-04  3.12E-05
3.70E-06  4.39E-07  1.26E-08  3.61E-10  1.03E-11  2.96E-13  8.49E-15  2.43E-16  6.97E-18  2.00E-19
5.73E-21  1.64E-22  4.70E-24  1.35E-25  3.86E-27  1.11E-28  3.17E-30  9.10E-32  2.61E-33  7.47E-35
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-21            1.00E+00  7.92E+02  1.37E+00  1.65E-01  1.98E-02  2.38E-03  2.86E-04  3.44E-05
4.13E-06  4.96E-07  1.45E-08  4.25E-10  1.24E-11  3.64E-13  1.06E-14  3.11E-16  9.10E-18  2.66E-19
7.79E-21  2.28E-22  6.67E-24  1.95E-25  5.71E-27  1.67E-28  4.88E-30  1.43E-31  4.18E-33  1.22E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-22            1.00E+00  7.92E+02  1.49E+00  1.84E-01  2.28E-02  2.82E-03  3.48E-04  4.30E-05
5.31E-06  6.56E-07  2.01E-08  6.16E-10  1.89E-11  5.79E-13  1.77E-14  5.43E-16  1.66E-17  5.10E-19
1.56E-20  4.79E-22  1.47E-23  4.50E-25  1.38E-26  4.23E-28  1.30E-29  3.97E-31  1.22E-32  3.73E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-23            1.00E+00  7.92E+02  1.54E+00  1.92E-01  2.40E-02  2.99E-03  3.74E-04  4.67E-05
5.82E-06  7.27E-07  2.27E-08  7.06E-10  2.20E-11  6.87E-13  2.14E-14  6.67E-16  2.08E-17  6.48E-19
2.02E-20  6.30E-22  1.96E-23  6.12E-25  1.91E-26  5.95E-28  1.86E-29  5.78E-31  1.80E-32  5.62E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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   Ks-24             4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.37E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.17E-04  1.33E-04  5.61E-05  2.36E-05  9.91E-06  4.17E-06  1.75E-06  7.37E-07
3.10E-07  1.30E-07  5.47E-08  2.30E-08  9.68E-09  4.07E-09  1.71E-09  7.19E-10  3.02E-10  1.27E-10
5.34E-11  2.25E-11  9.45E-12  3.97E-12  1.67E-12  7.02E-13  2.95E-13  1.24E-13  5.22E-14  2.19E-14
9.22E-15  3.88E-15  1.63E-15  6.85E-16  2.88E-16  1.21E-16  5.09E-17  2.14E-17  9.00E-18  3.78E-18
1.59E-18  6.69E-19  2.81E-19  1.18E-19  4.97E-20  2.09E-20  3.69E-21  6.53E-22  1.15E-22  2.04E-23
3.61E-24  6.37E-25  1.13E-25  1.99E-26  3.52E-27  6.22E-28  1.10E-28  1.94E-29  3.44E-30  6.07E-31
1.07E-31  1.90E-32  3.35E-33  5.93E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-25             4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.37E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.17E-04  1.33E-04  5.61E-05  2.36E-05  9.92E-06  4.17E-06  1.75E-06  7.37E-07
3.10E-07  1.30E-07  5.48E-08  2.30E-08  9.68E-09  4.07E-09  1.71E-09  7.20E-10  3.03E-10  1.27E-10
5.35E-11  2.25E-11  9.46E-12  3.98E-12  1.67E-12  7.03E-13  2.95E-13  1.24E-13  5.22E-14  2.20E-14
9.23E-15  3.88E-15  1.63E-15  6.86E-16  2.88E-16  1.21E-16  5.10E-17  2.14E-17  9.01E-18  3.79E-18
1.59E-18  6.70E-19  2.82E-19  1.18E-19  4.98E-20  2.09E-20  3.70E-21  6.54E-22  1.16E-22  2.04E-23
3.61E-24  6.39E-25  1.13E-25  2.00E-26  3.53E-27  6.24E-28  1.10E-28  1.95E-29  3.44E-30  6.09E-31
1.08E-31  1.90E-32  3.36E-33  5.94E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-26             2.00E+00  7.92E+02  3.48E+01  1.23E+01  4.34E+00  1.53E+00  5.41E-01  1.91E-01
6.75E-02  2.38E-02  4.20E-03  7.41E-04  1.31E-04  2.30E-05  4.06E-06  7.16E-07  1.26E-07  2.23E-08
3.93E-09  6.93E-10  1.22E-10  2.15E-11  3.80E-12  6.70E-13  1.18E-13  2.08E-14  3.67E-15  6.48E-16
1.14E-16  2.02E-17  3.55E-18  6.27E-19  1.11E-19  1.95E-20  3.44E-21  6.06E-22  1.07E-22  1.88E-23
3.32E-24  5.86E-25  1.03E-25  1.82E-26  3.21E-27  5.67E-28  1.00E-28  1.76E-29  3.11E-30  5.48E-31
9.67E-32  1.71E-32  3.01E-33  5.30E-34  9.35E-35  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Th-230            7.54E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.70E+04
3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.69E+04
3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.68E+04  3.68E+04
3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.67E+04  3.67E+04
3.67E+04  3.67E+04  3.67E+04  3.67E+04  3.67E+04  3.67E+04  3.67E+04  3.66E+04  3.66E+04  3.66E+04
3.66E+04  3.66E+04  3.66E+04  3.66E+04  3.66E+04  3.66E+04  3.65E+04  3.65E+04  3.65E+04  3.65E+04
3.65E+04  3.65E+04  3.65E+04  3.65E+04  3.65E+04  3.64E+04  3.64E+04  3.64E+04  3.64E+04  3.64E+04
3.63E+04  3.63E+04  3.63E+04  3.63E+04  3.63E+04  3.62E+04  3.62E+04  3.62E+04  3.62E+04  3.61E+04
3.61E+04  3.61E+04  3.61E+04  3.61E+04  3.60E+04  3.60E+04  3.60E+04  3.60E+04  3.60E+04  3.59E+04
3.59E+04  3.59E+04  3.59E+04  3.58E+04  3.58E+04  3.58E+04  3.58E+04  3.58E+04  3.57E+04  3.57E+04
3.57E+04  3.57E+04  3.57E+04  3.56E+04  3.56E+04  3.56E+04  3.56E+04  3.55E+04  3.55E+04  3.54E+04
3.54E+04  3.53E+04  3.53E+04  3.52E+04  3.52E+04  3.51E+04  3.51E+04  3.50E+04  3.50E+04
   U-236             2.34E+07  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02
1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02
1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.15E+02  1.14E+02  1.14E+02  1.14E+02
1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02
1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.14E+02  1.13E+02  1.13E+02
1.13E+02  1.13E+02  1.13E+02  1.13E+02  1.13E+02  1.13E+02  1.13E+02  1.13E+02  1.13E+02  1.13E+02
1.13E+02  1.13E+02  1.12E+02  1.12E+02  1.12E+02  1.12E+02  1.12E+02  1.12E+02  1.12E+02  1.12E+02
1.12E+02  1.12E+02  1.12E+02  1.11E+02  1.11E+02  1.11E+02  1.11E+02  1.11E+02  1.11E+02  1.11E+02
1.11E+02  1.11E+02  1.11E+02  1.11E+02  1.10E+02  1.10E+02  1.10E+02  1.10E+02  1.10E+02  1.10E+02
1.10E+02  1.10E+02  1.10E+02  1.10E+02  1.10E+02  1.09E+02  1.09E+02  1.09E+02  1.09E+02  1.09E+02
1.09E+02  1.08E+02  1.08E+02  1.08E+02  1.08E+02  1.07E+02  1.07E+02  1.07E+02  1.07E+02
   U-238             4.47E+09  6.05E-01  6.05E-01  6.04E-01  6.04E-01  6.04E-01  6.04E-01  6.04E-01
6.04E-01  6.03E-01  6.03E-01  6.03E-01  6.03E-01  6.02E-01  6.02E-01  6.02E-01  6.02E-01  6.01E-01
6.01E-01  6.01E-01  6.01E-01  6.01E-01  6.00E-01  6.00E-01  6.00E-01  6.00E-01  5.99E-01  5.99E-01
5.99E-01  5.99E-01  5.98E-01  5.98E-01  5.98E-01  5.98E-01  5.97E-01  5.97E-01  5.97E-01  5.97E-01
5.96E-01  5.96E-01  5.96E-01  5.96E-01  5.95E-01  5.95E-01  5.95E-01  5.95E-01  5.94E-01  5.94E-01
5.94E-01  5.94E-01  5.93E-01  5.93E-01  5.93E-01  5.93E-01  5.92E-01  5.92E-01  5.92E-01  5.92E-01
5.91E-01  5.91E-01  5.91E-01  5.91E-01  5.90E-01  5.90E-01  5.90E-01  5.89E-01  5.89E-01  5.88E-01
5.88E-01  5.87E-01  5.87E-01  5.86E-01  5.86E-01  5.85E-01  5.85E-01  5.84E-01  5.84E-01  5.83E-01
5.83E-01  5.82E-01  5.82E-01  5.81E-01  5.81E-01  5.80E-01  5.80E-01  5.79E-01  5.79E-01  5.79E-01
5.78E-01  5.78E-01  5.77E-01  5.77E-01  5.76E-01  5.76E-01  5.75E-01  5.75E-01  5.74E-01  5.74E-01
5.73E-01  5.73E-01  5.72E-01  5.72E-01  5.71E-01  5.71E-01  5.70E-01  5.69E-01  5.68E-01  5.67E-01
5.66E-01  5.65E-01  5.64E-01  5.63E-01  5.62E-01  5.60E-01  5.59E-01  5.58E-01  5.57E-01
   Pu-240            6.56E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02
```

```
1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02  1.65E-02
1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.64E-02  1.64E-02  1.63E-02  1.63E-02  1.63E-02
1.63E-02  1.62E-02  1.62E-02  1.62E-02  1.62E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02
1.59E-02  1.58E-02  1.58E-02  1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.55E-02  1.54E-02
   Pu-241           1.44E+01  6.30E-01  4.08E-01  3.53E-01  3.06E-01  2.65E-01  2.29E-01  1.98E-01
1.72E-01  1.48E-01  1.17E-01  9.17E-02  7.21E-02  5.66E-02  4.45E-02  3.50E-02  2.75E-02  2.16E-02
1.70E-02  1.33E-02  1.05E-02  8.24E-03  6.48E-03  5.09E-03  4.00E-03  3.14E-03  2.47E-03  1.94E-03
1.53E-03  1.20E-03  9.42E-04  7.41E-04  5.82E-04  4.57E-04  3.60E-04  2.83E-04  2.22E-04  1.75E-04
1.37E-04  1.08E-04  8.47E-05  6.66E-05  5.23E-05  4.11E-05  3.23E-05  2.54E-05  2.00E-05  1.57E-05
1.23E-05  9.69E-06  7.61E-06  5.98E-06  4.70E-06  3.70E-06  2.90E-06  2.28E-06  1.79E-06  1.41E-06
1.11E-06  8.71E-07  6.84E-07  5.38E-07  4.23E-07  3.32E-07  2.05E-07  1.27E-07  7.83E-08  4.83E-08
2.99E-08  1.84E-08  1.14E-08  7.03E-09  4.35E-09  2.68E-09  1.66E-09  1.02E-09  6.32E-10  3.91E-10
2.41E-10  1.49E-10  9.20E-11  5.68E-11  3.51E-11  2.17E-11  1.34E-11  8.27E-12  5.11E-12  3.16E-12
1.95E-12  1.20E-12  7.43E-13  4.59E-13  2.84E-13  1.75E-13  1.08E-13  6.68E-14  4.13E-14  2.55E-14
1.57E-14  9.72E-15  6.01E-15  3.71E-15  2.29E-15  1.42E-15  5.40E-16  2.06E-16  7.86E-17  3.00E-17
1.14E-17  3.43E-18  1.03E-18  3.08E-19  9.24E-20  2.77E-20  8.30E-21  2.49E-21  7.46E-22
   Ra-226           1.60E+03  1.80E-02  1.44E+02  1.92E+02  2.40E+02  2.88E+02  3.36E+02  3.83E+02
4.31E+02  4.78E+02  5.57E+02  6.36E+02  7.15E+02  7.93E+02  8.71E+02  9.49E+02  1.03E+03  1.10E+03
1.18E+03  1.26E+03  1.34E+03  1.41E+03  1.49E+03  1.56E+03  1.64E+03  1.72E+03  1.79E+03  1.87E+03
1.94E+03  2.02E+03  2.09E+03  2.17E+03  2.24E+03  2.32E+03  2.39E+03  2.46E+03  2.54E+03  2.61E+03
2.68E+03  2.76E+03  2.83E+03  2.90E+03  2.97E+03  3.05E+03  3.12E+03  3.19E+03  3.26E+03  3.33E+03
3.40E+03  3.47E+03  3.55E+03  3.62E+03  3.69E+03  3.76E+03  3.83E+03  3.90E+03  3.97E+03  4.04E+03
4.10E+03  4.17E+03  4.24E+03  4.31E+03  4.38E+03  4.45E+03  4.58E+03  4.72E+03  4.85E+03  4.99E+03
5.12E+03  5.25E+03  5.38E+03  5.52E+03  5.65E+03  5.78E+03  5.90E+03  6.03E+03  6.16E+03  6.29E+03
6.41E+03  6.54E+03  6.66E+03  6.79E+03  6.91E+03  7.03E+03  7.15E+03  7.27E+03  7.39E+03  7.51E+03
7.63E+03  7.75E+03  7.87E+03  7.99E+03  8.10E+03  8.22E+03  8.33E+03  8.45E+03  8.56E+03  8.67E+03
8.79E+03  8.90E+03  9.01E+03  9.12E+03  9.23E+03  9.34E+03  9.56E+03  9.77E+03  9.98E+03  1.02E+04
1.04E+04  1.07E+04  1.09E+04  1.12E+04  1.14E+04  1.16E+04  1.19E+04  1.21E+04  1.23E+04
*********** MAXIMUM DOSES & DOMINANT NUCLIDES BY PATHWAY **********
 EnergySolns LARW, run VS238bw, vert., 0.238 cm/yr, 10 cm d.
            PATHWAY       DUST         ATMOSPHERIC         GAMMA             WELL             FOOD
        ANNUAL DOSE     0.00E+00         0.00E+00         0.00E+00         0.00E+00         0.00E+00
               YEAR        0                0                0                0                0
   DOMINANT NUCLIDE
```

# PATHRAE MODEL VERTICAL OUTPUT FILE FILE --168Wa.OUT.docx 0.168 CM/YR CASE -PART 1

```
 PATHRAE-RAD(PC)  Version 2.2d  February 1995
   Date: 11- 2-2011
   Time: 14:24:35
 EnergySolns CAW, run VS168W, vert., 0.168 cm/yr inf.
 *****  Mirror Image of Input Files  *****
 -- Input File:  ABCDEF.DAT
 EnergySolns CAW, run VS168W, vert., 0.168 cm/yr inf.

116,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,11
0.,115.,120.,125.,130.,135.,14
 58,0,1
 1,2
 0,1.,1.,1.68E-03,1.68E-03,4.072,0
 1563.,0.100,0,0,0.250,3.20E-02,2.09,0
 1,0,0,0,0,0
 0,1.,1.,4.072,0,1800.,1.,0,0,0
 0,0,0,0.0,1.
 0,0,0,0,0,0,0
 0,0,0,0,0,0,0,0,0,0,0
 4,7
 1,0,1,0
 0.00168,0.0171,0.098,0,0,1.,0,1.,0,0.354

 -- Input File:  BRCDCF.DAT
 101,Ac-227  0,0,0,0,0,0,0
 102,Ag-108m 0,0,0,0,0,0,0
 103,Al-26   0,0,0,0,0,0,0
 48,Am-241   0,0,0,0,0,0,0
 104,Am-242m 0,0,0,0,0,0,0
 105,Am-243  0,0,0,0,0,0,0
 106,Ba-133  0,0,0,0,0,0,0
 107,Be-10   0,0,0,0,0,0,0
 108,Bi-207  0,0,0,0,0,0,0
 109,Bi-210m 0,0,0,0,0,0,0
 110,Bk-247  0,0,0,0,0,0,0
 111,C-14    0,0,0,0,0,0,0
 112,Ca-41   0,0,0,0,0,0,0
 113,Cd-113  0,0,0,0,0,0,0
 114,Cd-113m 0,0,0,0,0,0,0
 115,Cf-249  0,0,0,0,0,0,0
 116,Cf-250  0,0,0,0,0,0,0
 117,Cf-251  0,0,0,0,0,0,0
 118,Cf-252  0,0,0,0,0,0,0
 119,Cl-36   0,0,0,0,0,0,0
 120,Cm-243  0,0,0,0,0,0,0
 50,Cm-244   0,0,0,0,0,0,0
 121,Cm-245  0,0,0,0,0,0,0
 122,Cm-246  0,0,0,0,0,0,0
 123,Cm-247  0,0,0,0,0,0,0
 124,Cm-248  0,0,0,0,0,0,0
 125,Co-60   0,0,0,0,0,0,0
 126,Cs-135  0,0,0,0,0,0,0
 127,Cs-137  0,0,0,0,0,0,0
 128,Eu-152  0,0,0,0,0,0,0
 129,Eu-154  0,0,0,0,0,0,0
 130,Eu-155  0,0,0,0,0,0,0
 131,Fe-55   0,0,0,0,0,0,0
 132,Fe-60   0,0,0,0,0,0,0
 133,Gd-148  0,0,0,0,0,0,0
 134,H-3     0,0,0,0,0,0,0
 135,Hg-194  0,0,0,0,0,0,0
 136,Ho-166m 0,0,0,0,0,0,0
 137,I-129   0,0,0,0,0,0,0
 138,K-40    0,0,0,0,0,0,0
 139,Mn-53   0,0,0,0,0,0,0
 140,Na-22   0,0,0,0,0,0,0
 141,Nb-91   0,0,0,0,0,0,0
 142,Nb-92   0,0,0,0,0,0,0
 143,Nb-93m  0,0,0,0,0,0,0
 144,Nb-94   0,0,0,0,0,0,0
 146,Ni-59   0,0,0,0,0,0,0
 147,Ni-63   0,0,0,0,0,0,0
 42,Np-237   0,0,0,0,0,0,0
 148,Os-194  0,0,0,0,0,0,0
 149,Pa-231  0,0,0,0,0,0,0
 150,Pb-202  0,0,0,0,0,0,0
 151,Pb-210  0,0,0,0,0,0,0
 152,Pd-107  0,0,0,0,0,0,0
 153,Pm-145  0,0,0,0,0,0,0
 154,Pm-147  0,0,0,0,0,0,0
 155,Po-208  0,0,0,0,0,0,0
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156,Po-209  0,0,0,0,0,0,0
157,Pt-193  0,0,0,0,0,0,0
-- Input File:  INVNTRY.DAT
101,2.18E+01,1.30E+08,0,0,0,0,0
102,4.18E+02,4.69E+07,0,0,0,0,0
103,7.40E+05,3.35E+04,0,0,0,0,0
48,4.32E+02,1.80E-02,0,0,0,0,0
104,1.41E+02,1.80E-02,0,0,0,0,0
105,7.37E+03,1.80E-02,0,0,0,0,0
106,1.05E+01,4.61E+08,0,0,0,0,0
107,1.51E+06,3.96E+04,0,0,0,0,0
108,3.16E+01,9.66E+07,0,0,0,0,0
109,3.04E+06,1.02E+03,0,0,0,0,0
110,1.40E+03,6.98E-09,0,0,0,0,0
111,5.73E+03,9.00E+00,0,0,0,0,0
112,1.03E+05,6.14E-05,0,0,0,0,0
113,9.30E+15,7.75E-07,0,0,0,0,0
114,1.41E+01,4.04E+08,0,0,0,0,0
115,3.51E+02,1.80E-02,0,0,0,0,0
116,1.31E+01,1.80E-02,0,0,0,0,0
117,8.98E+02,1.80E-02,0,0,0,0,0
118,2.65E+00,7.92E+02,0,0,0,0,0
119,3.01E+05,1.75E-05,0,0,0,0,0
120,2.91E+01,1.80E-02,0,0,0,0,0
50,1.81E+01,1.80E-02,0,0,0,0,0
121,8.50E+03,1.80E-02,0,0,0,0,0
122,4.73E+03,1.80E-02,0,0,0,0,0
123,1.56E+07,1.80E-02,0,0,0,0,0
124,3.40E+05,1.80E-02,0,0,0,0,0
125,5.27E+00,7.92E+02,0,0,0,0,0
126,2.30E+06,2.07E+03,0,0,0,0,0
127,3.01E+01,1.13E+00,0,0,0,0,0
128,1.35E+01,3.11E+08,0,0,0,0,0
129,8.59E+00,4.87E+08,0,0,0,0,0
130,4.76E+00,7.92E+02,0,0,0,0,0
131,2.73E+00,7.92E+02,0,0,0,0,0
132,1.50E+06,7.15E+03,0,0,0,0,0
133,7.46E+01,5.80E+07,0,0,0,0,0
134,1.23E+01,4.50E+01,0,0,0,0,0
135,4.44E+02,6.38E+06,0,0,0,0,0
136,1.20E+03,3.24E+06,0,0,0,0,0
137,1.57E+07,3.94E-05,0,0,0,0,0
139,3.74E+06,3.24E+03,0,0,0,0,0
140,2.60E+00,7.92E+02,0,0,0,0,0
141,6.80E+02,1.04E+07,0,0,0,0,0
142,3.47E+07,2.02E+02,0,0,0,0,0
143,1.61E+01,4.74E+08,0,0,0,0,0
144,2.03E+04,2.34E-02,0,0,0,0,0
146,7.60E+04,2.52E+01,0,0,0,0,0
147,1.00E+02,3.96E+00,0,0,0,0,0
42,2.14E+06,1.80E-02,0,0,0,0,0
148,6.00E+00,5.53E+08,0,0,0,0,0
149,3.28E+04,8.46E+04,0,0,0,0,0
150,5.25E+04,6.12E+03,0,0,0,0,0
151,2.23E+01,1.37E+08,0,0,0,0,0
152,6.50E+06,9.18E+02,0,0,0,0,0
153,1.77E+01,2.52E+08,0,0,0,0,0
154,2.62E+00,7.92E+02,0,0,0,0,0
155,2.90E+00,7.92E+02,0,0,0,0,0
156,1.02E+02,3.02E+07,0,0,0,0,0
157,5.00E+01,6.66E+07,0,0,0,0,0
-- Input File:  RQSITE.DAT
101,2.06E-04,4.5,4.5
102,3.42E-04,2.7,2.7
103,6.21E-05,15.,15.
48,9.06E-04,1.,1.
104,9.06E-04,1.,1.
105,9.06E-04,1.,1.
106,9.31E-05,10.,10.
107,3.69E-04,2.5,2.5
108,9.06E-04,1.,1.
109,9.06E-04,1.,1.
110,3.00E-02,0.001,0.001
111,1.09E-04,8.52,8.52
112,1.17E-02,0.05,0.05
113,9.06E-04,1.,1.
114,9.06E-04,1.,1.
115,4.60E-04,2.,2.
116,4.60E-04,2.,2.
117,4.60E-04,2.,2.
118,4.60E-04,2.,2.
```

```
119,2.86E-02,0.0025,0.0025
120,1.00E-05,93.3,93.3
50,1.00E-05,93.3,93.3
121,1.00E-05,93.3,93.3
122,1.00E-05,93.3,93.3
123,1.00E-05,93.3,93.3
124,1.00E-05,93.3,93.3
125,2.52E-06,370.,370.
126,7.02E-06,133.,133.
127,7.02E-06,133.,133.
128,1.43E-04,6.5,6.5
129,1.43E-04,6.5,6.5
130,1.43E-04,6.5,6.5
131,6.53E-04,1.4,1.4
132,6.53E-04,1.4,1.4
133,1.43E-04,6.5,6.5
134,1.33E-02,0.04,0.04
135,9.31E-05,10.,10.
136,3.69E-04,2.5,2.5
137,6.22E-03,0.12,0.12
139,1.45E-04,6.4,6.4
140,9.06E-04,1.,1.
141,5.73E-04,1.6,1.6
142,5.73E-04,1.6,1.6
143,5.73E-04,1.6,1.6
144,5.73E-04,1.6,1.6
146,9.31E-05,10.,10.
147,9.31E-05,10.,10.
42,3.08E-04,3.,3.
148,2.06E-04,4.5,4.5
149,1.69E-04,5.5,5.5
150,4.90E-05,19.,19.
151,4.90E-05,19.,19.
152,1.61E-03,0.55,0.55
153,1.43E-04,6.5,6.5
154,1.43E-04,6.5,6.5
155,1.03E-04,9.,9.
156,1.03E-04,9.,9.
157,1.00E-03,0.9,0.9
158,9.31E-05,10.,10.
159,9.31E-05,10.,10.
160,9.31E-05,10.,10.
45,9.31E-05,10.,10.
46,9.31E-05,10.,10.
161,9.31E-05,10.,10.
162,9.31E-05,10,10.
55,9.31E-05,10.,10.
163,9.31E-05,10.,10.
164,8.88E-03,0.075,0.075
165,9.06E-04,1.,1.
166,2.46E-03,0.35,0.35
167,3.76E-04,2.45,2.45
168,1.87E-05,50.,50.
169,1.87E-05,50.,50.
170,1.17E-02,0.05,0.05
171,1.43E-04,6.5,6.5
172,1.43E-04,6.5,6.5
173,6.66E-03,0.11,0.11
174,7.29E-04,1.25,1.25
175,9.31E-05,10.,10.
36,9.31E-05,10.,10.
176,9.31E-05,10.,10.
177,9.31E-05,10.,10.
178,5.18E-03,0.15,0.15
179,1.43E-04,6.5,6.5
180,1.55E-04,6.,6.
181,1.55E-04,6.,6.
182,1.55E-04,6.,6.
183,1.55E-04,6.,6.
40,1.55E-04,6.,6.
41,1.55E-04,6.,6.
184,9.31E-05,10.,10.
185,9.31E-05,10.,10.
186,3.00E-02,0.001,0.001
187,2.33E-02,0.01,0.01
188,7.18E-03,0.1,0.1
189,9.06E-04,1.,1.
190,1.87E-05,50.,50.
191,9.33E-06,100.,100.
192,9.06E-04,1.,1.
-- Input File:  UPTAKE.DAT
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 156,0.00E+00,0.0,0.0,0,0,0,0
 157,0.00E+00,0.0,0.0,0,0,0,0
1
                        TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
                 UT(J,1)   UT(J,2)   UT(J,3)   UT(J,4)   UT(J,5)   UT(J,6)
                  RIVER     WELL     EROSION   BATHTUB  SPILLAGE    FOOD
 NUCLIDE          L/YR      L/YR      L/YR      L/YR      L/YR      KG/YR
   Ac-227      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ag-108m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Al-26       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Am-242m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Am-243      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ba-133      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Be-10       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Bi-207      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Bi-210m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Bk-247      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   C-14        0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
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  Ca-41       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cd-113      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cd-113m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-249      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-250      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-251      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cf-252      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cl-36       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-243      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-245      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-246      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-247      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-248      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Co-60       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cs-135      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cs-137      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Eu-152      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Eu-154      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Eu-155      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Fe-55       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Fe-60       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Gd-148      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  H-3         0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Hg-194      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Np-237      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Am-241      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Cm-244      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ho-166m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  I-129       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Mn-53       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Na-22       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-91       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-92       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-93m      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Nb-94       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ni-59       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Ni-63       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Os-194      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pa-231      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pb-202      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pb-210      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pd-107      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pm-145      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pm-147      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Po-208      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Po-209      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
  Pt-193      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS116
YEARS TO BE CALCULATED ARE ...
     6.00     9.00    12.00    15.00    18.00
    21.00    24.00    27.00    30.00    35.00
    40.00    45.00    50.00    55.00    60.00
    65.00    70.00    75.00    80.00    85.00
    90.00    95.00   100.00   105.00   110.00
   115.00   120.00   125.00   130.00   135.00
   140.00   145.00   150.00   155.00   160.00
   165.00   170.00   175.00   180.00   185.00
   190.00   195.00   200.00   205.00   210.00
   215.00   220.00   225.00   230.00   235.00
   240.00   245.00   250.00   255.00   260.00
   265.00   270.00   275.00   280.00   285.00
   290.00   295.00   300.00   310.00   320.00
   330.00   340.00   350.00   360.00   370.00
   380.00   390.00   400.00   410.00   420.00
   430.00   440.00   450.00   460.00   470.00
   480.00   490.00   500.00   510.00   520.00
   530.00   540.00   550.00   560.00   570.00
   580.00   590.00   600.00   610.00   620.00
   630.00   640.00   650.00   660.00   670.00
   680.00   690.00   700.00   720.00   740.00
   760.00   780.00   800.00   825.00   850.00
   875.00   900.00   925.00   950.00   975.00
  1000.00
THERE ARE  58 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
           PATHWAY           TYPE OF USAGE
                            FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER         2
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| | |
|---|---|
| TIME OF OPERATION OF WASTE FACILITY IN YEARS | 0. |
| LENGTH OF REPOSITORY (M) | 1. |
| WIDTH OF REPOSITORY (M) | 1. |
| RIVER FLOW RATE (M**3/YR) | 1.68E-03 |
| STREAM FLOW RATE (M**3/YR) | 1.68E-03 |
| DISTANCE TO RIVER (M) | 4. |
| OPERATIONAL SPILLAGE FRACTION | 0.00E+00 |
| DENSITY OF AQUIFER (KG/M**3) | 1563. |
| LONGITUDINAL DISPERSIVITY (M) | 1.00E-01 |
| LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR) | 0.00E+00 |
| NUMBER OF MESH POINTS FOR DISPERSION CALCULATION | 1 |
| FLAG FOR GAMMA PATHWAY OPTIONS | 0 |
| FLAG FOR GAMMA BUILDUP CALCULATION | 0 |
| FLAG FOR ATMOSPHERIC PATHWAY | 0 |
| COVER THICKNESS OVER WASTE (M) | .00 |
| THICKNESS OF WASTE IN PITS (M) | 1.00 |
| TOTAL WASTE VOLUME (M**3) | 1.000E+00 |
| DISTANCE TO WELL -- X COORDINATE (M) | 4. |
| DISTANCE TO WELL -- Y COORDINATE (M) | 0. |
| DENSITY OF WASTE (KG/M**3) | 1800. |
| FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE | 1.000 |
| FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD | .000 |
| DEPTH OF PLANT ROOT ZONE (M) | .000 |
| AREAL DENSITY OF PLANTS (KG/M**2) | .000 |
| AVERAGE DUST LOADING IN AIR (KG/M**3) | 0.00E+00 |
| ANNUAL ADULT BREATHING RATE (M**3/YR) | 0. |
| FRACTION OF YEAR EXPOSED TO DUST | .000 |
| CANISTER LIFETIME (YEARS) | 0. |
| INVENTORY SCALING FACTOR | 1.00E+00 |
| HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM) | 0. |
| AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC) | 0.00E+00 |
| RADON EMANATING POWER OF THE WASTE | 0.00E+00 |
| DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC) | 0.00E+00 |
| DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC) | 0.00E+00 |
| THICKNESS OF CONCRETE SLAB FLOOR (CM) | .0 |
| DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC) | 0.00E+00 |
| ATMOSPHERIC STABILITY CLASS | 0 |
| AVERAGE WIND SPEED (M/S) | .00 |
| FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR | .0000 |
| RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M) | .0 |
| DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S) | 0.00E+00 |
| DEPOSITION VELOCITY (M/S) | .0000 |
| STACK HEIGHT (M) | .0 |
| STACK INSIDE DIAMETER (M) | .00 |
| STACK GAS VELOCITY (M/S) | .0 |
| HEAT EMISSION RATE FROM BURNING (CAL/S) | 0.00E+00 |
| DECAY CHAIN FLAGS 4 7 0 0 0 0 | 0 |
| FLAG FOR INPUT SUMMARY PRINTOUT | 1 |
| FLAG FOR DIRECTION OF TRENCH FILLING | 1 |
| FLAG FOR GROUNDWATER PATHWAY OPTIONS | 0 |
| AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M) | 1.68E-03 |
| DEGREE OF SOIL SATURATION | .250 |
| RESIDUAL SOIL SATURATION | .032 |
| PERMEABILITY OF VERTICAL ZONE (M/YR) | 2.09 |
| SOIL NUMBER | .000 |
| POROSITY OF AQUIFER | .10 |
| POROSITY OF UNSATURATED ZONE | .35 |
| DISTANCE FROM AQUIFER TO WASTE (M) | .0 |
| AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR) | 1.90E-02 |
| HORIZONTAL VELOCITY OF AQUIFER (M/YR) | .0 |
| LENGTH OF PERFORATED WELL CASING (M) | 1.000 |
| SURFACE EROSION RATE (M/YR) | 0.000E+00 |
| LEACH RATE SCALING FACTOR | 1.000E+00 |
| ANNUAL RUNOFF OF PRECIPITATION (M) | 0.00E+00 |

| NUCLIDE | INGESTION DOSE FACTORS (MREM/PCI) | INHALATION DOSE FACTORS (MREM/PCI) | DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR) | HALF LIFE (YR) |
|---|---|---|---|---|
| Ac-227 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.180E+01 |
| Ag-108m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.180E+02 |
| Al-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.400E+05 |
| Am-242m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.410E+02 |
| Am-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.370E+03 |
| Ba-133 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.050E+01 |
| Be-10 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.510E+06 |
| Bi-207 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.160E+01 |
| Bi-210m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.040E+06 |
| Bk-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.400E+03 |
| C-14 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.730E+03 |
| Ca-41 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.030E+05 |
| Cd-113 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 9.300E+15 |
| Cd-113m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.410E+01 |

| | | | | |
|---|---|---|---|---|
| Cf-249 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.510E+02 |
| Cf-250 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.310E+01 |
| Cf-251 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.980E+02 |
| Cf-252 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.650E+00 |
| Cl-36 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.010E+05 |
| Cm-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.910E+01 |
| Cm-245 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.500E+03 |
| Cm-246 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.730E+03 |
| Cm-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.560E+07 |
| Cm-248 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.400E+05 |
| Co-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.270E+00 |
| Cs-135 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.300E+06 |
| Cs-137 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.010E+01 |
| Eu-152 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.350E+01 |
| Eu-154 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.590E+00 |
| Eu-155 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.760E+00 |
| Fe-55 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.730E+00 |
| Fe-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.500E+06 |
| Gd-148 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.460E+01 |
| H-3 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.230E+01 |
| Hg-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.440E+02 |
| Np-237 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.140E+06 |
| Am-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.320E+02 |
| Cm-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.810E+01 |
| Ho-166m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.200E+03 |
| I-129 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.570E+07 |
| Mn-53 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.740E+06 |
| Na-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.600E+00 |
| Nb-91 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.800E+02 |
| Nb-92 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.470E+07 |
| Nb-93m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.610E+01 |
| Nb-94 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.030E+04 |
| Ni-59 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.600E+04 |
| Ni-63 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+02 |
| Os-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.000E+00 |
| Pa-231 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.280E+04 |
| Pb-202 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.250E+04 |
| Pb-210 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.230E+01 |
| Pd-107 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.500E+06 |
| Pm-145 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.770E+01 |
| Pm-147 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.620E+00 |
| Po-208 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.900E+00 |
| Po-209 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.020E+02 |
| Pt-193 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.000E+01 |

| NUCLIDE | VOLATILITY FRACTION | GAMMA ENERGY (MEV) | GAMMA ATTENUATION (1/M) |
|---|---|---|---|
| Ac-227 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ag-108m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Al-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-242m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ba-133 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Be-10 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bi-207 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bi-210m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bk-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| C-14 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ca-41 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cd-113 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cd-113m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-249 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-250 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-251 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-252 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cl-36 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-245 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-246 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-248 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Co-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cs-135 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cs-137 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Eu-152 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Eu-154 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Eu-155 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Fe-55 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Fe-60 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Gd-148 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| H-3 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| | | | |
|---|---|---|---|
| Hg-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Np-237 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cm-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ho-166m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| I-129 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Mn-53 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Na-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-91 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-92 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-93m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Nb-94 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ni-59 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ni-63 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Os-194 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pa-231 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pb-202 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pb-210 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pd-107 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pm-145 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pm-147 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Po-208 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Po-209 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pt-193 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| NUCLIDE | INPUT LEACH RATE (1/YR) | FINAL LEACH RATE (1/YR) | SOLUBILITY (MOLE/L) | INPUT INVENTORY (CI) |
|---|---|---|---|---|
| Ac-227 | 2.060E-04 | 2.060E-04 | 0.000E+00 | 1.300E+08 |
| Ag-108m | 3.420E-04 | 3.420E-04 | 0.000E+00 | 4.690E+07 |
| Al-26 | 6.210E-05 | 6.210E-05 | 0.000E+00 | 3.350E+04 |
| Am-242m | 9.060E-04 | 9.060E-04 | 0.000E+00 | 1.800E-02 |
| Am-243 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 1.800E-02 |
| Ba-133 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 4.610E+08 |
| Be-10 | 3.690E-04 | 3.690E-04 | 0.000E+00 | 3.960E+04 |
| Bi-207 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 9.660E+07 |
| Bi-210m | 9.060E-04 | 9.060E-04 | 0.000E+00 | 1.020E+03 |
| Bk-247 | 3.000E-02 | 3.000E-02 | 0.000E+00 | 6.980E-09 |
| C-14 | 1.090E-04 | 1.090E-04 | 0.000E+00 | 9.000E+00 |
| Ca-41 | 1.170E-02 | 1.170E-02 | 0.000E+00 | 6.140E-05 |
| Cd-113 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 7.750E-07 |
| Cd-113m | 9.060E-04 | 9.060E-04 | 0.000E+00 | 4.040E+08 |
| Cf-249 | 4.600E-04 | 4.600E-04 | 0.000E+00 | 1.800E-02 |
| Cf-250 | 4.600E-04 | 4.600E-04 | 0.000E+00 | 1.800E-02 |
| Cf-251 | 4.600E-04 | 4.600E-04 | 0.000E+00 | 1.800E-02 |
| Cf-252 | 4.600E-04 | 4.600E-04 | 0.000E+00 | 7.920E+02 |
| Cl-36 | 2.860E-02 | 2.860E-02 | 0.000E+00 | 1.750E-05 |
| Cm-243 | 1.000E-05 | 1.000E-05 | 0.000E+00 | 1.800E-02 |
| Cm-245 | 1.000E-05 | 1.000E-05 | 0.000E+00 | 1.800E-02 |
| Cm-246 | 1.000E-05 | 1.000E-05 | 0.000E+00 | 1.800E-02 |
| Cm-247 | 1.000E-05 | 1.000E-05 | 0.000E+00 | 1.800E-02 |
| Cm-248 | 1.000E-05 | 1.000E-05 | 0.000E+00 | 1.800E-02 |
| Co-60 | 2.520E-06 | 2.520E-06 | 0.000E+00 | 7.920E+02 |
| Cs-135 | 7.020E-06 | 7.020E-06 | 0.000E+00 | 2.070E+03 |
| Cs-137 | 7.020E-06 | 7.020E-06 | 0.000E+00 | 1.130E+00 |
| Eu-152 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 3.110E+08 |
| Eu-154 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 4.870E+08 |
| Eu-155 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 7.920E+02 |
| Fe-55 | 6.530E-04 | 6.530E-04 | 0.000E+00 | 7.920E+02 |
| Fe-60 | 6.530E-04 | 6.530E-04 | 0.000E+00 | 7.150E+03 |
| Gd-148 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 5.800E+07 |
| H-3 | 1.330E-02 | 1.330E-02 | 0.000E+00 | 4.500E+01 |
| Hg-194 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 6.380E+06 |
| Np-237 | 3.080E-04 | 3.080E-04 | 0.000E+00 | 1.800E-02 |
| Am-241 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 1.800E-02 |
| Cm-244 | 1.000E-05 | 1.000E-05 | 0.000E+00 | 1.800E-02 |
| Ho-166m | 3.690E-04 | 3.690E-04 | 0.000E+00 | 3.240E+06 |
| I-129 | 6.220E-03 | 6.220E-03 | 0.000E+00 | 3.940E-05 |
| Mn-53 | 1.450E-04 | 1.450E-04 | 0.000E+00 | 3.240E+03 |
| Na-22 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 7.920E+02 |
| Nb-91 | 5.730E-04 | 5.730E-04 | 0.000E+00 | 1.040E+07 |
| Nb-92 | 5.730E-04 | 5.730E-04 | 0.000E+00 | 2.020E+02 |
| Nb-93m | 5.730E-04 | 5.730E-04 | 0.000E+00 | 4.740E+08 |
| Nb-94 | 5.730E-04 | 5.730E-04 | 0.000E+00 | 2.340E-02 |
| Ni-59 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 2.520E+01 |
| Ni-63 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 3.960E+00 |
| Os-194 | 2.060E-04 | 2.060E-04 | 0.000E+00 | 5.530E+08 |
| Pa-231 | 1.690E-04 | 1.690E-04 | 0.000E+00 | 8.460E+04 |
| Pb-202 | 4.900E-05 | 4.900E-05 | 0.000E+00 | 6.120E+03 |
| Pb-210 | 4.900E-05 | 4.900E-05 | 0.000E+00 | 1.370E+08 |
| Pd-107 | 1.610E-03 | 1.610E-03 | 0.000E+00 | 9.180E+02 |
| Pm-145 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 2.520E+08 |
| Pm-147 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 7.920E+02 |

| | | | | |
|---|---|---|---|---|
| Po-208 | 1.030E-04 | 1.030E-04 | 0.000E+00 | 7.920E+02 |
| Po-209 | 1.030E-04 | 1.030E-04 | 0.000E+00 | 3.020E+07 |
| Pt-193 | 1.000E-03 | 1.000E-03 | 0.000E+00 | 6.660E+07 |

| NUCLIDE | AQUIFER SORPTION | AQUIFER RETARDATION | VERTICAL SORPTION | VERTICAL RETARDATION |
|---|---|---|---|---|
| Ac-227 | 4.500E+00 | 7.277E+01 | 4.500E+00 | 8.047E+01 |
| Ag-108m | 2.700E+00 | 4.406E+01 | 2.700E+00 | 4.868E+01 |
| Al-26 | 1.500E+01 | 2.402E+02 | 1.500E+01 | 2.659E+02 |
| Am-242m | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Am-243 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Ba-133 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Be-10 | 2.500E+00 | 4.087E+01 | 2.500E+00 | 4.515E+01 |
| Bi-207 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Bi-210m | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Bk-247 | 1.000E-03 | 1.016E+00 | 1.000E-03 | 1.018E+00 |
| C-14 | 8.520E+00 | 1.369E+02 | 8.520E+00 | 1.515E+02 |
| Ca-41 | 5.000E-02 | 1.797E+00 | 5.000E-02 | 1.883E+00 |
| Cd-113 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Cd-113m | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Cf-249 | 2.000E+00 | 3.290E+01 | 2.000E+00 | 3.632E+01 |
| Cf-250 | 2.000E+00 | 3.290E+01 | 2.000E+00 | 3.632E+01 |
| Cf-251 | 2.000E+00 | 3.290E+01 | 2.000E+00 | 3.632E+01 |
| Cf-252 | 2.000E+00 | 3.290E+01 | 2.000E+00 | 3.632E+01 |
| Cl-36 | 2.500E-03 | 1.040E+00 | 2.500E-03 | 1.044E+00 |
| Cm-243 | 9.330E+01 | 1.489E+03 | 9.330E+01 | 1.649E+03 |
| Cm-245 | 9.330E+01 | 1.489E+03 | 9.330E+01 | 1.649E+03 |
| Cm-246 | 9.330E+01 | 1.489E+03 | 9.330E+01 | 1.649E+03 |
| Cm-247 | 9.330E+01 | 1.489E+03 | 9.330E+01 | 1.649E+03 |
| Cm-248 | 9.330E+01 | 1.489E+03 | 9.330E+01 | 1.649E+03 |
| Co-60 | 3.700E+02 | 5.902E+03 | 3.700E+02 | 6.536E+03 |
| Cs-135 | 1.330E+02 | 2.122E+03 | 1.330E+02 | 2.350E+03 |
| Cs-137 | 1.330E+02 | 2.122E+03 | 1.330E+02 | 2.350E+03 |
| Eu-152 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Eu-154 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Eu-155 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Fe-55 | 1.400E+00 | 2.333E+01 | 1.400E+00 | 2.573E+01 |
| Fe-60 | 1.400E+00 | 2.333E+01 | 1.400E+00 | 2.573E+01 |
| Gd-148 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| H-3 | 4.000E-02 | 1.638E+00 | 4.000E-02 | 1.706E+00 |
| Hg-194 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Np-237 | 3.000E+00 | 4.885E+01 | 3.000E+00 | 5.398E+01 |
| Am-241 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Cm-244 | 9.330E+01 | 1.489E+03 | 9.330E+01 | 1.649E+03 |
| Ho-166m | 2.500E+00 | 4.087E+01 | 2.500E+00 | 4.515E+01 |
| I-129 | 1.200E-01 | 2.914E+00 | 1.200E-01 | 3.119E+00 |
| Mn-53 | 6.400E+00 | 1.031E+02 | 6.400E+00 | 1.140E+02 |
| Na-22 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Nb-91 | 1.600E+00 | 2.652E+01 | 1.600E+00 | 2.926E+01 |
| Nb-92 | 1.600E+00 | 2.652E+01 | 1.600E+00 | 2.926E+01 |
| Nb-93m | 1.600E+00 | 2.652E+01 | 1.600E+00 | 2.926E+01 |
| Nb-94 | 1.600E+00 | 2.652E+01 | 1.600E+00 | 2.926E+01 |
| Ni-59 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Ni-63 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Os-194 | 4.500E+00 | 7.277E+01 | 4.500E+00 | 8.047E+01 |
| Pa-231 | 5.500E+00 | 8.872E+01 | 5.500E+00 | 9.814E+01 |
| Pb-202 | 1.900E+01 | 3.040E+02 | 1.900E+01 | 3.366E+02 |
| Pb-210 | 1.900E+01 | 3.040E+02 | 1.900E+01 | 3.366E+02 |
| Pd-107 | 5.500E-01 | 9.772E+00 | 5.500E-01 | 1.071E+01 |
| Pm-145 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Pm-147 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Po-208 | 9.000E+00 | 1.445E+02 | 9.000E+00 | 1.599E+02 |
| Po-209 | 9.000E+00 | 1.445E+02 | 9.000E+00 | 1.599E+02 |
| Pt-193 | 9.000E-01 | 1.535E+01 | 9.000E-01 | 1.689E+01 |

BIOACCUMULATION FACTORS

| NUCLIDE | SOIL-PLANT Bv | SOIL-PLANT Br | FORAGE-MILK Fm (D/L) | FORAGE-MEAT Ff (D/KG) |
|---|---|---|---|---|
| Ac-227 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ag-108m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Al-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-242m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Am-243 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ba-133 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Be-10 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bi-207 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bi-210m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Bk-247 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| C-14 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ca-41 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cd-113 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cd-113m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Cf-249 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

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    Cf-250            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cf-251            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cf-252            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cl-36             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-243            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-245            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-246            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-247            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-248            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Co-60             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cs-135            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cs-137            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Eu-152            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Eu-154            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Eu-155            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Fe-55             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Fe-60             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Gd-148            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    H-3               0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Hg-194            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Np-237            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Am-241            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Cm-244            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ho-166m           0.000E+00       0.000E+00       0.000E+00       0.000E+00
    I-129             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Mn-53             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Na-22             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-91             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-92             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-93m            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Nb-94             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ni-59             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Ni-63             0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Os-194            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pa-231            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pb-202            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pb-210            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pd-107            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pm-145            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pm-147            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Po-208            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Po-209            0.000E+00       0.000E+00       0.000E+00       0.000E+00
    Pt-193            0.000E+00       0.000E+00       0.000E+00       0.000E+00
                                                        PATHWAY  1
                                                  GROUNDWATER TO RIVER
********* NUCLIDE DOSES (mrem/yr) ********
  NUCLIDE/TIME            6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.      850.      875.      900.      925.      950.      975.      1000.
      Ac-227         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ag-108m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Al-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Am-242m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Am-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ba-133         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Be-10          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Bi-207         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Bi-210m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

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0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Bk-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      C-14            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ca-41           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cd-113          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cd-113m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-249          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-250          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-251          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-252          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cl-36           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Cm-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cm-248          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Co-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cs-135          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cs-137          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Hg-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Np-237          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-244         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ho-166m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      I-129          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Mn-53          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Na-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Os-194         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Pa-231          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pb-202          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pb-210          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pd-107          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pm-145          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pm-147          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-208          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-209          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pt-193          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE DOSES FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE RISKS FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE CONCENTRATIONS IN RIVER  (Ci/m**3)
  NUCLIDE/TIME            6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.      850.      875.      900.      925.      950.      975.     1000.
      Ac-227          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ag-108m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.2E-20   4.0E-20   1.3E-19
      Am-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   1.2E-20   6.1E-20   2.7E-19   1.1E-18   4.4E-18   1.6E-17
      Ba-133         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
3.0E-20    1.1E-19    3.3E-19    9.4E-19    2.5E-18    5.9E-18    1.3E-17    2.7E-17
```

```
      Bi-210m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-20    1.2E-19    6.7E-19    3.4E-18
2.3E-17   1.4E-16   7.6E-16   3.7E-15   1.7E-14   7.0E-14   2.7E-13   9.7E-13
      Bk-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.0E-20    2.6E-19    4.3E-18
4.8E-17    3.9E-16    2.5E-15    1.3E-14    5.6E-14    2.1E-13    6.6E-13    1.9E-12    4.9E-12    1.2E-11
2.5E-11    5.1E-11    9.7E-11    1.7E-10    3.0E-10    4.9E-10    7.6E-10    1.1E-09    1.7E-09    2.3E-09
3.2E-09    4.2E-09    5.4E-09    6.7E-09    8.2E-09    9.9E-09    1.2E-08    1.4E-08    1.5E-08    1.7E-08
1.9E-08    2.1E-08    2.2E-08    2.3E-08    2.4E-08    2.5E-08    2.6E-08    2.6E-08    2.6E-08    2.6E-08
2.6E-08    2.5E-08    2.5E-08    2.4E-08    2.3E-08    2.1E-08    1.8E-08    1.6E-08    1.3E-08    1.1E-08
9.3E-09    7.5E-09    6.0E-09    4.8E-09    3.7E-09    2.9E-09    2.2E-09    1.7E-09    1.3E-09    9.5E-10
7.0E-10    5.2E-10    3.8E-10    2.8E-10    2.0E-10    1.5E-10    1.1E-10    7.5E-11    5.4E-11    3.8E-11
2.7E-11    1.9E-11    1.3E-11    9.4E-12    6.6E-12    4.6E-12    3.2E-12    2.2E-12    1.5E-12    1.1E-12
7.3E-13    5.0E-13    3.4E-13    2.4E-13    1.6E-13    7.5E-14    3.5E-14    1.6E-14    7.3E-15    3.3E-15
1.2E-15   4.6E-16   1.7E-16   6.2E-17   2.3E-17   8.2E-18   3.0E-18   1.1E-18
      C-14            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ca-41           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.7E-20    4.6E-19    4.5E-18    3.6E-17    2.4E-16    1.4E-15
6.8E-15    2.9E-14    1.1E-13    4.0E-13    1.3E-12    3.8E-12    1.0E-11    2.7E-11    6.5E-11    1.5E-10
3.2E-10    6.7E-10    1.3E-09    2.5E-09    4.6E-09    8.2E-09    1.4E-08    2.3E-08    3.8E-08    6.0E-08
9.2E-08    1.4E-07    2.0E-07    3.0E-07    4.2E-07    5.9E-07    8.0E-07    1.1E-06    1.4E-06    1.9E-06
2.5E-06    3.2E-06    4.0E-06    5.0E-06    6.2E-06    9.2E-06    1.3E-05    1.8E-05    2.4E-05    3.2E-05
4.0E-05    5.0E-05    6.0E-05    7.1E-05    8.2E-05    9.3E-05    1.0E-04    1.1E-04    1.2E-04    1.3E-04
1.4E-04    1.4E-04    1.5E-04    1.5E-04    1.5E-04    1.5E-04    1.4E-04    1.4E-04    1.3E-04    1.3E-04
1.2E-04    1.1E-04    1.1E-04    9.8E-05    9.0E-05    8.3E-05    7.6E-05    6.9E-05    6.2E-05    5.6E-05
5.0E-05    4.4E-05    3.9E-05    3.5E-05    3.0E-05    2.3E-05    1.8E-05    1.3E-05    9.7E-06    7.1E-06
4.7E-06   3.1E-06   2.0E-06   1.3E-06   8.2E-07   5.2E-07   3.3E-07   2.0E-07
      Cd-113          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cd-113m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-249          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-250          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-251          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-252          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cl-36           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.7E-19    8.6E-18    2.4E-16    4.2E-15
5.1E-14    4.4E-13    3.0E-12    1.6E-11    7.3E-11    2.8E-10    9.4E-10    2.8E-09    7.4E-09    1.8E-08
4.1E-08    8.5E-08    1.7E-07    3.1E-07    5.3E-07    8.9E-07    1.4E-06    2.2E-06    3.2E-06    4.6E-06
6.4E-06    8.6E-06    1.1E-05    1.5E-05    1.8E-05    2.2E-05    2.7E-05    3.1E-05    3.6E-05    4.1E-05
4.6E-05    5.1E-05    5.6E-05    6.0E-05    6.4E-05    6.7E-05    6.9E-05    7.1E-05    7.3E-05    7.4E-05
7.4E-05    7.3E-05    7.2E-05    7.1E-05    6.9E-05    6.4E-05    5.8E-05    5.1E-05    4.5E-05    3.8E-05
3.2E-05    2.7E-05    2.2E-05    1.8E-05    1.4E-05    1.1E-05    8.7E-06    6.7E-06    5.2E-06    3.9E-06
3.0E-06    2.2E-06    1.7E-06    1.3E-06    9.3E-07    6.8E-07    5.0E-07    3.6E-07    2.6E-07    1.9E-07
1.4E-07    9.9E-08    7.1E-08    5.0E-08    3.6E-08    2.5E-08    1.8E-08    1.3E-08    8.9E-09    6.3E-09
4.4E-09    3.1E-09    2.1E-09    1.5E-09    1.0E-09    5.0E-10    2.4E-10    1.1E-10    5.4E-11    2.5E-11
9.8E-12    3.8E-12    1.4E-12    5.5E-13    2.1E-13    7.9E-14    3.0E-14    1.1E-14
      Cm-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-248          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Co-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-135          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-137          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   2.8E-20
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
2.0E-19    5.5E-18    9.9E-17    1.3E-15    1.2E-14    8.9E-14    5.3E-13    2.6E-12    1.1E-11    3.9E-11
1.2E-10    3.5E-10    8.9E-10    2.1E-09    4.5E-09    8.9E-09    1.6E-08    2.9E-08    4.8E-08    7.5E-08
1.1E-07    1.6E-07    2.2E-07    3.0E-07    3.8E-07    4.8E-07    5.8E-07    6.8E-07    7.8E-07    8.8E-07
9.7E-07    1.0E-06    1.1E-06    1.1E-06    1.2E-06    1.2E-06    1.2E-06    1.1E-06    1.1E-06    1.0E-06
9.7E-07    9.0E-07    8.2E-07    7.5E-07    6.7E-07    5.3E-07    4.0E-07    2.9E-07    2.1E-07    1.4E-07
9.7E-08    6.4E-08    4.1E-08    2.6E-08    1.6E-08    9.8E-09    5.9E-09    3.5E-09    2.0E-09    1.2E-09
6.5E-10    3.6E-10    2.0E-10    1.1E-10    5.9E-11    3.2E-11    1.7E-11    8.9E-12    4.7E-12    2.4E-12
1.2E-12    6.4E-13    3.3E-13    1.6E-13    8.3E-14    4.2E-14    2.1E-14    1.0E-14    5.1E-15    2.5E-15
1.2E-15    5.9E-16    2.9E-16    1.4E-16    6.7E-17    1.6E-17    3.5E-18    8.0E-19    1.8E-19    4.0E-20
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Hg-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Np-237          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Am-241          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.6E-20    6.8E-20    2.7E-19    1.0E-18    3.5E-18
      Cm-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ho-166m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      I-129           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.2E-20    1.5E-19    6.2E-19
2.4E-18    8.7E-18    2.9E-17    9.1E-17    2.7E-16    7.5E-16    2.0E-15    5.1E-15    1.2E-14    2.8E-14
6.3E-14    1.4E-13    2.8E-13    5.7E-13    1.1E-12    2.1E-12    3.9E-12    6.9E-12    1.2E-11    2.1E-11
3.5E-11    5.8E-11    9.3E-11    1.5E-10    2.3E-10    5.3E-10    1.2E-09    2.4E-09    4.7E-09    8.7E-09
1.6E-08    2.7E-08    4.5E-08    7.3E-08    1.1E-07    1.7E-07    2.6E-07    3.8E-07    5.4E-07    7.4E-07
1.0E-06    1.4E-06    1.8E-06    2.3E-06    3.0E-06    3.7E-06    4.6E-06    5.7E-06    6.9E-06    8.3E-06
9.8E-06    1.2E-05    1.3E-05    1.5E-05    1.8E-05    2.0E-05    2.2E-05    2.5E-05    2.7E-05    3.0E-05
3.3E-05    3.5E-05    3.8E-05    4.0E-05    4.3E-05    4.7E-05    5.1E-05    5.4E-05    5.6E-05    5.7E-05
5.8E-05    5.6E-05    5.4E-05    5.1E-05    4.7E-05    4.2E-05    3.8E-05    3.3E-05
      Mn-53           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Na-22           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Os-194         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pa-231         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-202         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-210         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pd-107         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.1E-20    5.4E-20    2.5E-19    1.1E-18
4.6E-18    1.8E-17    6.4E-17    2.2E-16    7.2E-16    2.3E-15    6.7E-15    1.9E-14    5.3E-14    1.4E-13
3.6E-13    8.8E-13    2.1E-12    4.9E-12    1.1E-11    2.4E-11    5.1E-11    1.1E-10    2.1E-10    4.2E-10
8.2E-10    1.6E-09    2.9E-09    5.3E-09    9.5E-09    2.9E-08    8.3E-08    2.2E-07    5.7E-07    1.4E-06
3.9E-06   1.0E-05   2.6E-05   6.1E-05   1.4E-04   2.9E-04   6.0E-04   1.2E-03
      Pm-145         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pm-147         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-208         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-209          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pt-193          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-20
5.2E-20    1.3E-19    3.0E-19    7.0E-19    1.6E-18    7.4E-18    3.2E-17    1.2E-16    4.3E-16    1.4E-15
5.6E-15    2.0E-14    6.5E-14    1.9E-13    5.3E-13    1.3E-12    3.2E-12    7.2E-12
 NUCLIDE CONCENTRATIONS IN STREAM (Ci/m**3)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Ac-227          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ag-108m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   1.2E-20   4.0E-20   1.3E-19
      Am-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   1.2E-20   6.1E-20   2.7E-19   1.1E-18   4.4E-18   1.6E-17
      Ba-133         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
3.0E-20   1.1E-19   3.3E-19   9.4E-19   2.5E-18   5.9E-18   1.3E-17   2.7E-17
      Bi-210m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-20    1.2E-19    6.7E-19    3.4E-18
2.3E-17   1.4E-16   7.6E-16   3.7E-15   1.7E-14   7.0E-14   2.7E-13   9.7E-13
      Bk-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.0E-20    2.6E-19    4.3E-18
4.8E-17    3.9E-16    2.5E-15    1.3E-14    5.6E-14    2.1E-13    6.6E-13    1.9E-12    4.9E-12    1.2E-11
2.5E-11    5.1E-11    9.7E-11    1.7E-10    3.0E-10    4.9E-10    7.6E-10    1.1E-09    1.7E-09    2.3E-09
3.2E-09    4.2E-09    5.4E-09    6.7E-09    8.2E-09    9.9E-09    1.2E-08    1.4E-08    1.5E-08    1.7E-08
1.9E-08    2.1E-08    2.2E-08    2.3E-08    2.4E-08    2.5E-08    2.6E-08    2.6E-08    2.6E-08    2.6E-08
2.6E-08    2.5E-08    2.5E-08    2.4E-08    2.3E-08    2.1E-08    1.8E-08    1.6E-08    1.3E-08    1.1E-08
```

```
9.3E-09    7.5E-09    6.0E-09    4.8E-09    3.7E-09    2.9E-09    2.2E-09    1.7E-09    1.3E-09    9.5E-10
7.0E-10    5.2E-10    3.8E-10    2.8E-10    2.0E-10    1.5E-10    1.1E-10    7.5E-11    5.4E-11    3.8E-11
2.7E-11    1.9E-11    1.3E-11    9.4E-12    6.6E-12    4.6E-12    3.2E-12    2.2E-12    1.5E-12    1.1E-12
7.3E-13    5.0E-13    3.4E-13    2.4E-13    1.6E-13    7.5E-14    3.5E-14    1.6E-14    7.3E-15    3.3E-15
1.2E-15   4.6E-16   1.7E-16   6.2E-17   2.3E-17   8.2E-18   3.0E-18   1.1E-18
      C-14            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ca-41           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.7E-20    4.6E-19    4.5E-18    3.6E-17    2.4E-16    1.4E-15
6.8E-15    2.9E-14    1.1E-13    4.0E-13    1.3E-12    3.8E-12    1.0E-11    2.7E-11    6.5E-11    1.5E-10
3.2E-10    6.7E-10    1.3E-09    2.5E-09    4.6E-09    8.2E-09    1.4E-08    2.3E-08    3.8E-08    6.0E-08
9.2E-08    1.4E-07    2.0E-07    3.0E-07    4.2E-07    5.9E-07    8.0E-07    1.1E-06    1.4E-06    1.9E-06
2.5E-06    3.2E-06    4.0E-06    5.0E-06    6.2E-06    9.2E-06    1.3E-05    1.8E-05    2.4E-05    3.2E-05
4.0E-05    5.0E-05    6.0E-05    7.1E-05    8.2E-05    9.3E-05    1.0E-04    1.1E-04    1.2E-04    1.3E-04
1.4E-04    1.4E-04    1.5E-04    1.5E-04    1.5E-04    1.5E-04    1.4E-04    1.4E-04    1.3E-04    1.3E-04
1.2E-04    1.1E-04    1.1E-04    9.8E-05    9.0E-05    8.3E-05    7.6E-05    6.9E-05    6.2E-05    5.6E-05
5.0E-05    4.4E-05    3.9E-05    3.5E-05    3.0E-05    2.3E-05    1.8E-05    1.3E-05    9.7E-06    7.1E-06
4.7E-06   3.1E-06   2.0E-06   1.3E-06   8.2E-07   5.2E-07   3.3E-07   2.0E-07
      Cd-113          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cd-113m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-249          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-250          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-251          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cf-252          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cl-36           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.7E-19    8.6E-18    2.4E-16    4.2E-15
5.1E-14    4.4E-13    3.0E-12    1.6E-11    7.3E-11    2.8E-10    9.4E-10    2.8E-09    7.4E-09    1.8E-08
4.1E-08    8.5E-08    1.7E-07    3.1E-07    5.3E-07    8.9E-07    1.4E-06    2.2E-06    3.2E-06    4.6E-06
6.4E-06    8.6E-06    1.1E-05    1.5E-05    1.8E-05    2.2E-05    2.7E-05    3.1E-05    3.6E-05    4.1E-05
4.6E-05    5.1E-05    5.6E-05    6.0E-05    6.4E-05    6.7E-05    6.9E-05    7.1E-05    7.3E-05    7.4E-05
7.4E-05    7.3E-05    7.2E-05    7.1E-05    6.9E-05    6.4E-05    5.8E-05    5.1E-05    4.5E-05    3.8E-05
3.2E-05    2.7E-05    2.2E-05    1.8E-05    1.4E-05    1.1E-05    8.7E-06    6.7E-06    5.2E-06    3.9E-06
3.0E-06    2.2E-06    1.7E-06    1.3E-06    9.3E-07    6.8E-07    5.0E-07    3.6E-07    2.6E-07    1.9E-07
1.4E-07    9.9E-08    7.1E-08    5.0E-08    3.6E-08    2.5E-08    1.8E-08    1.3E-08    8.9E-09    6.3E-09
4.4E-09    3.1E-09    2.1E-09    1.5E-09    1.0E-09    5.0E-10    2.4E-10    1.1E-10    5.4E-11    2.5E-11
9.8E-12   3.8E-12   1.4E-12   5.5E-13   2.1E-13   7.9E-14   3.0E-14   1.1E-14
      Cm-243          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Cm-248          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Co-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cs-135          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cs-137          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Fe-55          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Fe-60          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.8E-20
      Gd-148         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      H-3            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
2.0E-19    5.5E-18    9.9E-17    1.3E-15    1.2E-14    8.9E-14    5.3E-13    2.6E-12    1.1E-11    3.9E-11
1.2E-10    3.5E-10    8.9E-10    2.1E-09    4.5E-09    8.9E-09    1.6E-08    2.9E-08    4.8E-08    7.5E-08
1.1E-07    1.6E-07    2.2E-07    3.0E-07    3.8E-07    4.8E-07    5.8E-07    6.8E-07    7.8E-07    8.8E-07
9.7E-07    1.0E-06    1.1E-06    1.1E-06    1.2E-06    1.2E-06    1.2E-06    1.1E-06    1.1E-06    1.0E-06
9.7E-07    9.0E-07    8.2E-07    7.5E-07    6.7E-07    5.3E-07    4.0E-07    2.9E-07    2.1E-07    1.4E-07
9.7E-08    6.4E-08    4.1E-08    2.6E-08    1.6E-08    9.8E-09    5.9E-09    3.5E-09    2.0E-09    1.2E-09
6.5E-10    3.6E-10    2.0E-10    1.1E-10    5.9E-11    3.2E-11    1.7E-11    8.9E-12    4.7E-12    2.4E-12
1.2E-12    6.4E-13    3.3E-13    1.6E-13    8.3E-14    4.2E-14    2.1E-14    1.0E-14    5.1E-15    2.5E-15
1.2E-15    5.9E-16    2.9E-16    1.4E-16    6.7E-17    1.6E-17    3.5E-18    8.0E-19    1.8E-19    4.0E-20
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Hg-194         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Np-237         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Am-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   1.6E-20   6.8E-20   2.7E-19   1.0E-18   3.5E-18
      Cm-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ho-166m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      I-129           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.2E-20    1.5E-19    6.2E-19
2.4E-18    8.7E-18    2.9E-17    9.1E-17    2.7E-16    7.5E-16    2.0E-15    5.1E-15    1.2E-14    2.8E-14
6.3E-14    1.4E-13    2.8E-13    5.7E-13    1.1E-12    2.1E-12    3.9E-12    6.9E-12    1.2E-11    2.1E-11
3.5E-11    5.8E-11    9.3E-11    1.5E-10    2.3E-10    5.3E-10    1.2E-09    2.4E-09    4.7E-09    8.7E-09
1.6E-08    2.7E-08    4.5E-08    7.3E-08    1.1E-07    1.7E-07    2.6E-07    3.8E-07    5.4E-07    7.4E-07
1.0E-06    1.4E-06    1.8E-06    2.3E-06    3.0E-06    3.7E-06    4.6E-06    5.7E-06    6.9E-06    8.3E-06
9.8E-06    1.2E-05    1.3E-05    1.5E-05    1.8E-05    2.0E-05    2.2E-05    2.5E-05    2.7E-05    3.0E-05
3.3E-05    3.5E-05    3.8E-05    4.0E-05    4.3E-05    4.7E-05    5.1E-05    5.4E-05    5.6E-05    5.7E-05
5.8E-05   5.6E-05   5.4E-05   5.1E-05   4.7E-05   4.2E-05   3.8E-05   3.3E-05
      Mn-53           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Na-22           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-91           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-92           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-93m          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Os-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pa-231          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Pb-202          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pb-210          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pd-107          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.1E-20    5.4E-20    2.5E-19    1.1E-18
4.6E-18    1.8E-17    6.4E-17    2.2E-16    7.2E-16    2.3E-15    6.7E-15    1.9E-14    5.3E-14    1.4E-13
3.6E-13    8.8E-13    2.1E-12    4.9E-12    1.1E-11    2.4E-11    5.1E-11    1.1E-10    2.1E-10    4.2E-10
8.2E-10    1.6E-09    2.9E-09    5.3E-09    9.5E-09    2.9E-08    8.3E-08    2.2E-07    5.7E-07    1.4E-06
3.9E-06    1.0E-05    2.6E-05    6.1E-05    1.4E-04    2.9E-04    6.0E-04    1.2E-03
      Pm-145          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pm-147          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-208          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Po-209          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pt-193         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-20
5.2E-20    1.3E-19    3.0E-19    7.0E-19    1.6E-18    7.4E-18    3.2E-17    1.2E-16    4.3E-16    1.4E-15
5.6E-15    2.0E-14    6.5E-14    1.9E-13    5.3E-13    1.3E-12    3.2E-12    7.2E-12
 NUCLIDE FLUXES AT OUTCROP (Ci/yr)
  NUCLIDE/TIME            6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Ac-227         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ag-108m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Al-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-242m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   2.0E-23   6.7E-23   2.1E-22
      Am-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   2.1E-23   1.0E-22   4.6E-22   1.9E-21   7.3E-21   2.6E-20
      Ba-133          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Be-10           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Bi-207          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
5.1E-23   1.8E-22   5.6E-22   1.6E-21   4.1E-21   1.0E-20   2.2E-20   4.6E-20
      Bi-210m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.3E-23    2.0E-22    1.1E-21    5.7E-21
3.9E-20   2.3E-19   1.3E-18   6.3E-18   2.8E-17   1.2E-16   4.6E-16   1.6E-15
      Bk-247          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.7E-23    4.4E-22    7.1E-21
8.0E-20    6.6E-19    4.2E-18    2.2E-17    9.4E-17    3.5E-16    1.1E-15    3.2E-15    8.2E-15    1.9E-14
4.2E-14    8.6E-14    1.6E-13    2.9E-13    5.0E-13    8.2E-13    1.3E-12    1.9E-12    2.8E-12    3.9E-12
5.3E-12    7.0E-12    9.0E-12    1.1E-11    1.4E-11    1.7E-11    2.0E-11    2.3E-11    2.6E-11    2.9E-11
3.2E-11    3.5E-11    3.7E-11    3.9E-11    4.1E-11    4.2E-11    4.3E-11    4.4E-11    4.4E-11    4.4E-11
4.4E-11    4.3E-11    4.2E-11    4.0E-11    3.9E-11    3.5E-11    3.1E-11    2.7E-11    2.3E-11    1.9E-11
1.6E-11    1.3E-11    1.0E-11    8.0E-12    6.2E-12    4.8E-12    3.7E-12    2.8E-12    2.1E-12    1.6E-12
1.2E-12    8.7E-13    6.4E-13    4.7E-13    3.4E-13    2.5E-13    1.8E-13    1.3E-13    9.0E-14    6.4E-14
4.6E-14    3.2E-14    2.3E-14    1.6E-14    1.1E-14    7.7E-15    5.4E-15    3.7E-15    2.6E-15    1.8E-15
1.2E-15    8.4E-16    5.8E-16    4.0E-16    2.7E-16    1.3E-16    5.8E-17    2.7E-17    1.2E-17    5.6E-18
2.1E-18   7.7E-19   2.9E-19   1.0E-19   3.8E-20   1.4E-20   5.0E-21   1.8E-21
      C-14            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ca-41           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    6.2E-23    7.7E-22    7.6E-21    6.1E-20    4.0E-19    2.3E-18
1.1E-17    4.9E-17    1.9E-16    6.7E-16    2.2E-15    6.4E-15    1.8E-14    4.5E-14    1.1E-13    2.5E-13
5.4E-13    1.1E-12    2.2E-12    4.2E-12    7.7E-12    1.4E-11    2.4E-11    3.9E-11    6.4E-11    1.0E-10
1.5E-10    2.3E-10    3.4E-10    5.0E-10    7.1E-10    9.8E-10    1.4E-09    1.8E-09    2.4E-09    3.2E-09
4.1E-09    5.3E-09    6.7E-09    8.4E-09    1.0E-08    1.5E-08    2.2E-08    3.1E-08    4.1E-08    5.3E-08
6.7E-08    8.3E-08    1.0E-07    1.2E-07    1.4E-07    1.6E-07    1.7E-07    1.9E-07    2.1E-07    2.2E-07
2.3E-07    2.4E-07    2.4E-07    2.5E-07    2.5E-07    2.4E-07    2.4E-07    2.3E-07    2.2E-07    2.1E-07
2.0E-07    1.9E-07    1.8E-07    1.6E-07    1.5E-07    1.4E-07    1.3E-07    1.2E-07    1.0E-07    9.3E-08
8.3E-08    7.4E-08    6.6E-08    5.8E-08    5.1E-08    3.9E-08    3.0E-08    2.2E-08    1.6E-08    1.2E-08
7.9E-09    5.2E-09    3.4E-09    2.2E-09    1.4E-09    8.7E-10    5.5E-10    3.4E-10
      Cd-113          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cd-113m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-249          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-250          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-251          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Cf-252          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cl-36          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.9E-22    1.4E-20    4.0E-19    7.1E-18
8.5E-17    7.4E-16    5.0E-15    2.7E-14    1.2E-13    4.7E-13    1.6E-12    4.7E-12    1.2E-11    3.0E-11
6.8E-11    1.4E-10    2.8E-10    5.1E-10    9.0E-10    1.5E-09    2.4E-09    3.7E-09    5.4E-09    7.8E-09
1.1E-08    1.5E-08    1.9E-08    2.4E-08    3.1E-08    3.7E-08    4.5E-08    5.3E-08    6.1E-08    6.9E-08
7.8E-08    8.6E-08    9.4E-08    1.0E-07    1.1E-07    1.1E-07    1.2E-07    1.2E-07    1.2E-07    1.2E-07
1.2E-07    1.2E-07    1.2E-07    1.2E-07    1.2E-07    1.1E-07    9.7E-08    8.6E-08    7.5E-08    6.4E-08
5.4E-08    4.5E-08    3.6E-08    2.9E-08    2.4E-08    1.9E-08    1.5E-08    1.1E-08    8.7E-09    6.6E-09
5.0E-09    3.8E-09    2.8E-09    2.1E-09    1.6E-09    1.1E-09    8.4E-10    6.1E-10    4.4E-10    3.2E-10
2.3E-10    1.7E-10    1.2E-10    8.5E-11    6.0E-11    4.3E-11    3.0E-11    2.1E-11    1.5E-11    1.1E-11
7.4E-12    5.2E-12    3.6E-12    2.5E-12    1.7E-12    8.4E-13    4.0E-13    1.9E-13    9.0E-14    4.3E-14
1.6E-14   6.3E-15   2.4E-15   9.2E-16   3.5E-16   1.3E-16   5.0E-17   1.9E-17
      Cm-243         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-245         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-246         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-247         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cm-248         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Co-60          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-135          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Cs-137          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-152          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-154          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Eu-155          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-55           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Fe-60           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   4.7E-23
      Gd-148          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      H-3             0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
3.4E-22    9.2E-21    1.7E-19    2.1E-18    2.0E-17    1.5E-16    8.9E-16    4.4E-15    1.8E-14    6.6E-14
2.1E-13    5.9E-13    1.5E-12    3.5E-12    7.5E-12    1.5E-11    2.8E-11    4.8E-11    8.0E-11    1.3E-10
1.9E-10    2.7E-10    3.7E-10    5.0E-10    6.4E-10    8.0E-10    9.7E-10    1.1E-09    1.3E-09    1.5E-09
1.6E-09    1.8E-09    1.9E-09    1.9E-09    2.0E-09    2.0E-09    1.9E-09    1.9E-09    1.8E-09    1.7E-09
1.6E-09    1.5E-09    1.4E-09    1.3E-09    1.1E-09    8.8E-10    6.7E-10    4.9E-10    3.5E-10    2.4E-10
1.6E-10    1.1E-10    6.9E-11    4.4E-11    2.7E-11    1.7E-11    9.9E-12    5.8E-12    3.4E-12    1.9E-12
1.1E-12    6.1E-13    3.4E-13    1.8E-13    1.0E-13    5.3E-14    2.8E-14    1.5E-14    7.8E-15    4.1E-15
2.1E-15    1.1E-15    5.5E-16    2.8E-16    1.4E-16    7.0E-17    3.5E-17    1.7E-17    8.5E-18    4.2E-18
2.0E-18    1.0E-18    4.9E-19    2.3E-19    1.1E-19    2.6E-20    6.0E-21    1.3E-21    3.0E-22    6.6E-23
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Hg-194          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Np-237          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Am-241          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   2.6E-23   1.1E-22   4.5E-22   1.7E-21   5.8E-21
      Cm-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Ho-166m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      I-129           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    5.3E-23    2.5E-22    1.0E-21
4.1E-21    1.5E-20    4.9E-20    1.5E-19    4.5E-19    1.3E-18    3.4E-18    8.5E-18    2.1E-17    4.8E-17
1.1E-16    2.3E-16    4.7E-16    9.5E-16    1.9E-15    3.5E-15    6.5E-15    1.2E-14    2.0E-14    3.5E-14
5.9E-14    9.7E-14    1.6E-13    2.5E-13    3.9E-13    8.9E-13    1.9E-12    4.0E-12    7.8E-12    1.5E-11
2.6E-11    4.5E-11    7.6E-11    1.2E-10    1.9E-10    2.9E-10    4.4E-10    6.3E-10    9.0E-10    1.3E-09
1.7E-09    2.3E-09    3.0E-09    3.9E-09    5.0E-09    6.3E-09    7.8E-09    9.6E-09    1.2E-08    1.4E-08
1.6E-08    1.9E-08    2.2E-08    2.6E-08    2.9E-08    3.3E-08    3.7E-08    4.2E-08    4.6E-08    5.0E-08
5.5E-08    5.9E-08    6.4E-08    6.8E-08    7.2E-08    7.9E-08    8.6E-08    9.1E-08    9.4E-08    9.6E-08
9.7E-08    9.5E-08    9.1E-08    8.5E-08    7.8E-08    7.1E-08    6.3E-08    5.6E-08
      Mn-53           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Na-22           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Nb-91           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Nb-92           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Nb-93m          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Nb-94          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-59          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ni-63          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Os-194         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pa-231         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-202         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pb-210         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pd-107          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    1.8E-23    9.1E-23    4.3E-22    1.9E-21
7.7E-21    3.0E-20    1.1E-19    3.7E-19    1.2E-18    3.8E-18    1.1E-17    3.2E-17    8.9E-17    2.3E-16
6.0E-16    1.5E-15    3.5E-15    8.2E-15    1.8E-14    4.0E-14    8.5E-14    1.8E-13    3.6E-13    7.1E-13
1.4E-12    2.6E-12    4.9E-12    8.9E-12    1.6E-11    4.9E-11    1.4E-10    3.7E-10    9.6E-10    2.3E-09
6.6E-09   1.7E-08   4.4E-08   1.0E-07   2.3E-07   4.9E-07   1.0E-06   2.0E-06
      Pm-145          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pm-147          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-208          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Po-209          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pt-193          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.4E-23
8.7E-23    2.1E-22    5.1E-22    1.2E-21    2.7E-21    1.3E-20    5.3E-20    2.0E-19    7.2E-19    2.4E-18
9.4E-18    3.4E-17    1.1E-16    3.2E-16    8.9E-16    2.3E-15    5.4E-15    1.2E-14
*********** CUMULATIVE TOTAL DOSES PER YEAR FOR GIVEN TIMES **********
      1               0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
```

```
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
*********** CUMULATIVE TOTAL RISKS PER YEAR FOR GIVEN TIMES **********
      1             0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
        NUCLIDE HALFLIFE AND INVENTORY (CI) ASSUMING NO TRANSPORT FROM THE FACILITY
 (TIMES IN YEARS) HALFLIFE        6.        9.       12.       15.       18.       21.       24.
27.       30.       35.       40.       45.       50.       55.       60.       65.       70.
75.       80.       85.       90.       95.      100.      105.      110.      115.      120.
125.      130.      135.      140.      145.      150.      155.      160.      165.      170.
175.      180.      185.      190.      195.      200.      205.      210.      215.      220.
225.      230.      235.      240.      245.      250.      255.      260.      265.      270.
275.      280.      285.      290.      295.      300.      310.      320.      330.      340.
350.      360.      370.      380.      390.      400.      410.      420.      430.      440.
450.      460.      470.      480.      490.      500.      510.      520.      530.      540.
550.      560.      570.      580.      590.      600.      610.      620.      630.      640.
650.      660.      670.      680.      690.      700.      720.      740.      760.      780.
800.      825.      850.      875.      900.      925.      950.      975.     1000.
   Ac-227            2.18E+01  1.30E+08  9.76E+07  8.88E+07  8.07E+07  7.33E+07  6.67E+07  6.06E+07
5.51E+07  5.01E+07  4.27E+07  3.64E+07  3.11E+07  2.65E+07  2.26E+07  1.93E+07  1.65E+07  1.40E+07
1.20E+07  1.02E+07  8.71E+06  7.43E+06  6.34E+06  5.41E+06  4.61E+06  3.94E+06  3.36E+06  2.86E+06
2.44E+06  2.08E+06  1.78E+06  1.52E+06  1.29E+06  1.10E+06  9.41E+05  8.03E+05  6.85E+05  5.84E+05
4.98E+05  4.25E+05  3.63E+05  3.09E+05  2.64E+05  2.25E+05  1.92E+05  1.64E+05  1.40E+05  1.19E+05
1.02E+05  8.67E+04  7.39E+04  6.31E+04  5.38E+04  4.59E+04  3.91E+04  3.34E+04  2.85E+04  2.43E+04
2.07E+04  1.77E+04  1.51E+04  1.29E+04  1.10E+04  9.36E+03  6.81E+03  4.96E+03  3.61E+03  2.62E+03
1.91E+03  1.39E+03  1.01E+03  7.36E+02  5.35E+02  3.89E+02  2.83E+02  2.06E+02  1.50E+02  1.09E+02
7.94E+01  5.78E+01  4.21E+01  3.06E+01  2.23E+01  1.62E+01  1.18E+01  8.58E+00  6.24E+00  4.54E+00
3.30E+00  2.40E+00  1.75E+00  1.27E+00  9.26E-01  6.74E-01  4.90E-01  3.57E-01  2.60E-01  1.89E-01
1.37E-01  1.00E-01  7.28E-02  5.30E-02  3.85E-02  2.80E-02  1.48E-02  7.86E-03  4.16E-03  2.20E-03
1.17E-03  5.27E-04  2.38E-04  1.07E-04  4.85E-05  2.19E-05  9.90E-06  4.47E-06  2.02E-06
   Ag-108m           4.18E+02  4.69E+07  4.62E+07  4.60E+07  4.57E+07  4.55E+07  4.53E+07  4.51E+07
4.48E+07  4.46E+07  4.43E+07  4.39E+07  4.35E+07  4.32E+07  4.28E+07  4.25E+07  4.21E+07  4.18E+07
4.14E+07  4.11E+07  4.07E+07  4.04E+07  4.01E+07  3.97E+07  3.94E+07  3.91E+07  3.88E+07  3.84E+07
3.81E+07  3.78E+07  3.75E+07  3.72E+07  3.69E+07  3.66E+07  3.63E+07  3.60E+07  3.57E+07  3.54E+07
3.51E+07  3.48E+07  3.45E+07  3.42E+07  3.39E+07  3.37E+07  3.34E+07  3.31E+07  3.28E+07  3.26E+07
3.23E+07  3.20E+07  3.18E+07  3.15E+07  3.12E+07  3.10E+07  3.07E+07  3.05E+07  3.02E+07  3.00E+07
2.97E+07  2.95E+07  2.92E+07  2.90E+07  2.88E+07  2.85E+07  2.80E+07  2.76E+07  2.71E+07  2.67E+07
2.62E+07  2.58E+07  2.54E+07  2.50E+07  2.46E+07  2.42E+07  2.38E+07  2.34E+07  2.30E+07  2.26E+07
2.22E+07  2.19E+07  2.15E+07  2.12E+07  2.08E+07  2.05E+07  2.01E+07  1.98E+07  1.95E+07  1.92E+07
1.88E+07  1.85E+07  1.82E+07  1.79E+07  1.76E+07  1.73E+07  1.71E+07  1.68E+07  1.65E+07  1.62E+07
1.60E+07  1.57E+07  1.54E+07  1.52E+07  1.49E+07  1.47E+07  1.42E+07  1.37E+07  1.33E+07  1.29E+07
1.24E+07  1.19E+07  1.15E+07  1.10E+07  1.05E+07  1.01E+07  9.71E+06  9.31E+06  8.93E+06
   Al-26             7.40E+05  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04
   Am-242m           1.41E+02  1.80E-02  1.72E-02  1.70E-02  1.67E-02  1.65E-02  1.62E-02  1.60E-02
1.58E-02  1.55E-02  1.52E-02  1.48E-02  1.44E-02  1.41E-02  1.37E-02  1.34E-02  1.31E-02  1.28E-02
1.24E-02  1.21E-02  1.19E-02  1.16E-02  1.13E-02  1.10E-02  1.07E-02  1.05E-02  1.02E-02  9.98E-03
9.74E-03  9.50E-03  9.27E-03  9.04E-03  8.82E-03  8.61E-03  8.40E-03  8.20E-03  8.00E-03  7.80E-03
7.61E-03  7.43E-03  7.25E-03  7.07E-03  6.90E-03  6.73E-03  6.57E-03  6.41E-03  6.26E-03  6.10E-03
5.96E-03  5.81E-03  5.67E-03  5.53E-03  5.40E-03  5.27E-03  5.14E-03  5.01E-03  4.89E-03  4.77E-03
4.66E-03  4.54E-03  4.43E-03  4.33E-03  4.22E-03  4.12E-03  3.92E-03  3.73E-03  3.55E-03  3.38E-03
3.22E-03  3.07E-03  2.92E-03  2.78E-03  2.65E-03  2.52E-03  2.40E-03  2.28E-03  2.17E-03  2.07E-03
1.97E-03  1.88E-03  1.79E-03  1.70E-03  1.62E-03  1.54E-03  1.47E-03  1.40E-03  1.33E-03  1.27E-03
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1.21E-03  1.15E-03  1.09E-03  1.04E-03  9.90E-04  9.43E-04  8.97E-04  8.54E-04  8.13E-04  7.74E-04
7.37E-04  7.02E-04  6.68E-04  6.36E-04  6.06E-04  5.76E-04  5.23E-04  4.74E-04  4.29E-04  3.89E-04
3.53E-04  3.12E-04  2.76E-04  2.44E-04  2.16E-04  1.91E-04  1.69E-04  1.49E-04  1.32E-04
   Am-243           7.37E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02
1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02
1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02
   Ba-133           1.05E+01  4.61E+08  2.54E+08  2.09E+08  1.71E+08  1.40E+08  1.15E+08  9.45E+07
7.76E+07  6.36E+07  4.57E+07  3.29E+07  2.36E+07  1.70E+07  1.22E+07  8.78E+06  6.31E+06  4.54E+06
3.26E+06  2.34E+06  1.69E+06  1.21E+06  8.71E+05  6.26E+05  4.50E+05  3.24E+05  2.33E+05  1.67E+05
1.20E+05  8.64E+04  6.21E+04  4.47E+04  3.21E+04  2.31E+04  1.66E+04  1.19E+04  8.57E+03  6.16E+03
4.43E+03  3.19E+03  2.29E+03  1.65E+03  1.18E+03  8.51E+02  6.12E+02  4.40E+02  3.16E+02  2.27E+02
1.63E+02  1.17E+02  8.44E+01  6.07E+01  4.36E+01  3.14E+01  2.25E+01  1.62E+01  1.16E+01  8.37E+00
6.02E+00  4.33E+00  3.11E+00  2.24E+00  1.61E+00  1.16E+00  5.97E-01  3.09E-01  1.59E-01  8.24E-02
4.26E-02  2.20E-02  1.14E-02  5.88E-03  3.04E-03  1.57E-03  8.11E-04  4.19E-04  2.17E-04  1.12E-04
5.79E-05  2.99E-05  1.55E-05  7.99E-06  4.13E-06  2.13E-06  1.10E-06  5.70E-07  2.94E-07  1.52E-07
7.86E-08  4.06E-08  2.10E-08  1.08E-08  5.61E-09  2.90E-09  1.50E-09  7.74E-10  4.00E-10  2.07E-10
1.07E-10  5.52E-11  2.85E-11  1.47E-11  7.62E-12  3.94E-12  1.05E-12  2.81E-13  7.50E-14  2.00E-14
5.35E-15  1.03E-15  1.97E-16  3.78E-17  7.26E-18  1.39E-18  2.68E-19  5.14E-20  9.87E-21
   Be-10            1.51E+06  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04  3.96E+04
   Bi-207           3.16E+01  9.66E+07  7.93E+07  7.42E+07  6.95E+07  6.51E+07  6.09E+07  5.71E+07
5.34E+07  5.00E+07  4.48E+07  4.02E+07  3.60E+07  3.23E+07  2.89E+07  2.59E+07  2.32E+07  2.08E+07
1.86E+07  1.67E+07  1.50E+07  1.34E+07  1.20E+07  1.08E+07  9.65E+06  8.65E+06  7.75E+06  6.95E+06
6.23E+06  5.58E+06  5.00E+06  4.48E+06  4.01E+06  3.60E+06  3.22E+06  2.89E+06  2.59E+06  2.32E+06
2.08E+06  1.86E+06  1.67E+06  1.50E+06  1.34E+06  1.20E+06  1.08E+06  9.65E+05  8.65E+05  7.75E+05
6.94E+05  6.22E+05  5.58E+05  5.00E+05  4.48E+05  4.01E+05  3.60E+05  3.22E+05  2.89E+05  2.59E+05
2.32E+05  2.08E+05  1.86E+05  1.67E+05  1.50E+05  1.34E+05  1.08E+05  8.64E+04  6.94E+04  5.57E+04
4.47E+04  3.59E+04  2.89E+04  2.32E+04  1.86E+04  1.49E+04  1.20E+04  9.64E+03  7.74E+03  6.21E+03
4.99E+03  4.01E+03  3.22E+03  2.58E+03  2.08E+03  1.67E+03  1.34E+03  1.07E+03  8.63E+02  6.93E+02
5.57E+02  4.47E+02  3.59E+02  2.88E+02  2.31E+02  1.86E+02  1.49E+02  1.20E+02  9.63E+01  7.73E+01
6.21E+01  4.98E+01  4.00E+01  3.21E+01  2.58E+01  2.07E+01  1.34E+01  8.62E+00  5.56E+00  3.59E+00
2.31E+00  1.34E+00  7.72E-01  4.46E-01  2.58E-01  1.49E-01  8.61E-02  4.98E-02  2.88E-02
   Bi-210m          3.04E+06  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03  1.02E+03
   Bk-247           1.40E+03  6.98E-09  6.95E-09  6.94E-09  6.93E-09  6.92E-09  6.91E-09  6.90E-09
6.89E-09  6.88E-09  6.86E-09  6.84E-09  6.83E-09  6.81E-09  6.79E-09  6.78E-09  6.76E-09  6.74E-09
6.73E-09  6.71E-09  6.69E-09  6.68E-09  6.66E-09  6.64E-09  6.63E-09  6.61E-09  6.59E-09  6.58E-09
6.56E-09  6.54E-09  6.53E-09  6.51E-09  6.50E-09  6.48E-09  6.46E-09  6.45E-09  6.43E-09  6.42E-09
6.40E-09  6.38E-09  6.37E-09  6.35E-09  6.34E-09  6.32E-09  6.31E-09  6.29E-09  6.28E-09  6.26E-09
6.24E-09  6.23E-09  6.21E-09  6.20E-09  6.18E-09  6.17E-09  6.15E-09  6.14E-09  6.12E-09  6.11E-09
6.09E-09  6.08E-09  6.06E-09  6.05E-09  6.03E-09  6.02E-09  5.99E-09  5.96E-09  5.93E-09  5.90E-09
5.87E-09  5.84E-09  5.81E-09  5.78E-09  5.75E-09  5.73E-09  5.70E-09  5.67E-09  5.64E-09  5.61E-09
5.59E-09  5.56E-09  5.53E-09  5.50E-09  5.48E-09  5.45E-09  5.42E-09  5.40E-09  5.37E-09  5.34E-09
5.32E-09  5.29E-09  5.26E-09  5.24E-09  5.21E-09  5.19E-09  5.16E-09  5.14E-09  5.11E-09  5.08E-09
5.06E-09  5.03E-09  5.01E-09  4.98E-09  4.96E-09  4.94E-09  4.89E-09  4.84E-09  4.79E-09  4.74E-09
4.70E-09  4.64E-09  4.58E-09  4.53E-09  4.47E-09  4.42E-09  4.36E-09  4.31E-09  4.25E-09
   C-14             5.73E+03  9.00E+00  8.99E+00  8.99E+00  8.98E+00  8.98E+00  8.98E+00  8.97E+00
8.97E+00  8.97E+00  8.96E+00  8.96E+00  8.95E+00  8.95E+00  8.94E+00  8.93E+00  8.93E+00  8.92E+00
8.92E+00  8.91E+00  8.91E+00  8.90E+00  8.90E+00  8.89E+00  8.89E+00  8.88E+00  8.88E+00  8.87E+00
8.86E+00  8.86E+00  8.85E+00  8.85E+00  8.84E+00  8.84E+00  8.83E+00  8.83E+00  8.82E+00  8.82E+00
8.81E+00  8.81E+00  8.80E+00  8.80E+00  8.79E+00  8.78E+00  8.78E+00  8.77E+00  8.77E+00  8.76E+00
8.76E+00  8.75E+00  8.75E+00  8.74E+00  8.74E+00  8.73E+00  8.73E+00  8.72E+00  8.72E+00  8.71E+00
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8.71E+00  8.70E+00  8.70E+00  8.69E+00  8.68E+00  8.68E+00  8.67E+00  8.66E+00  8.65E+00  8.64E+00
8.63E+00  8.62E+00  8.61E+00  8.60E+00  8.59E+00  8.57E+00  8.56E+00  8.55E+00  8.54E+00  8.53E+00
8.52E+00  8.51E+00  8.50E+00  8.49E+00  8.48E+00  8.47E+00  8.46E+00  8.45E+00  8.44E+00  8.43E+00
8.42E+00  8.41E+00  8.40E+00  8.39E+00  8.38E+00  8.37E+00  8.36E+00  8.35E+00  8.34E+00  8.33E+00
8.32E+00  8.31E+00  8.30E+00  8.29E+00  8.28E+00  8.27E+00  8.25E+00  8.23E+00  8.21E+00  8.19E+00
8.17E+00  8.15E+00  8.12E+00  8.10E+00  8.07E+00  8.05E+00  8.02E+00  8.00E+00  7.97E+00
   Ca-41            1.03E+05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05
6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05
6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05  6.14E-05
6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05
6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05
6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05
6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05  6.13E-05
6.13E-05  6.13E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05
6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05
6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.12E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05
6.11E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05  6.11E-05
6.11E-05  6.11E-05  6.10E-05  6.10E-05  6.10E-05  6.10E-05  6.10E-05  6.10E-05  6.10E-05
   Cd-113           9.30E+15  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07  7.75E-07
   Cd-113m          1.41E+01  4.04E+08  2.60E+08  2.24E+08  1.93E+08  1.67E+08  1.44E+08  1.24E+08
1.07E+08  9.24E+07  7.23E+07  5.65E+07  4.42E+07  3.46E+07  2.70E+07  2.12E+07  1.65E+07  1.29E+07
1.01E+07  7.91E+06  6.19E+06  4.84E+06  3.79E+06  2.96E+06  2.32E+06  1.81E+06  1.42E+06  1.11E+06
8.66E+05  6.78E+05  5.30E+05  4.14E+05  3.24E+05  2.53E+05  1.98E+05  1.55E+05  1.21E+05  9.48E+04
7.42E+04  5.80E+04  4.54E+04  3.55E+04  2.77E+04  2.17E+04  1.70E+04  1.33E+04  1.04E+04  8.12E+03
6.35E+03  4.97E+03  3.88E+03  3.04E+03  2.38E+03  1.86E+03  1.45E+03  1.14E+03  8.89E+02  6.95E+02
5.44E+02  4.25E+02  3.32E+02  2.60E+02  2.03E+02  1.59E+02  9.73E+01  5.95E+01  3.64E+01  2.23E+01
1.36E+01  8.33E+00  5.09E+00  3.12E+00  1.91E+00  1.17E+00  7.13E-01  4.36E-01  2.67E-01  1.63E-01
9.98E-02  6.10E-02  3.73E-02  2.28E-02  1.40E-02  8.54E-03  5.22E-03  3.20E-03  1.95E-03  1.20E-03
7.31E-04  4.47E-04  2.74E-04  1.67E-04  1.02E-04  6.26E-05  3.83E-05  2.34E-05  1.43E-05  8.76E-06
5.36E-06  3.28E-06  2.01E-06  1.23E-06  7.50E-07  4.59E-07  1.72E-07  6.42E-08  2.40E-08  8.99E-09
3.36E-09  9.84E-10  2.88E-10  8.42E-11  2.46E-11  7.21E-12  2.11E-12  6.17E-13  1.81E-13
   Cf-249           3.51E+02  1.80E-02  1.77E-02  1.76E-02  1.75E-02  1.74E-02  1.73E-02  1.72E-02
1.71E-02  1.70E-02  1.68E-02  1.66E-02  1.65E-02  1.63E-02  1.61E-02  1.60E-02  1.58E-02  1.57E-02
1.55E-02  1.54E-02  1.52E-02  1.51E-02  1.49E-02  1.48E-02  1.46E-02  1.45E-02  1.43E-02  1.42E-02
1.41E-02  1.39E-02  1.38E-02  1.37E-02  1.35E-02  1.34E-02  1.33E-02  1.31E-02  1.30E-02  1.29E-02
1.27E-02  1.26E-02  1.25E-02  1.24E-02  1.22E-02  1.21E-02  1.20E-02  1.19E-02  1.18E-02  1.17E-02
1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.11E-02  1.10E-02  1.09E-02  1.08E-02  1.07E-02  1.06E-02
1.05E-02  1.04E-02  1.03E-02  1.02E-02  1.01E-02  9.95E-03  9.76E-03  9.57E-03  9.38E-03  9.20E-03
9.02E-03  8.84E-03  8.67E-03  8.50E-03  8.33E-03  8.17E-03  8.01E-03  7.85E-03  7.70E-03  7.55E-03
7.40E-03  7.26E-03  7.12E-03  6.98E-03  6.84E-03  6.71E-03  6.57E-03  6.45E-03  6.32E-03  6.20E-03
6.08E-03  5.96E-03  5.84E-03  5.73E-03  5.61E-03  5.50E-03  5.40E-03  5.29E-03  5.19E-03  5.09E-03
4.99E-03  4.89E-03  4.79E-03  4.70E-03  4.61E-03  4.52E-03  4.34E-03  4.17E-03  4.01E-03  3.86E-03
3.71E-03  3.53E-03  3.36E-03  3.20E-03  3.04E-03  2.90E-03  2.76E-03  2.62E-03  2.50E-03
   Cf-250           1.31E+01  1.80E-02  1.12E-02  9.54E-03  8.14E-03  6.94E-03  5.93E-03  5.06E-03
4.31E-03  3.68E-03  2.82E-03  2.17E-03  1.66E-03  1.28E-03  9.80E-04  7.53E-04  5.78E-04  4.43E-04
3.40E-04  2.61E-04  2.00E-04  1.54E-04  1.18E-04  9.06E-05  6.96E-05  5.34E-05  4.10E-05  3.15E-05
2.41E-05  1.85E-05  1.42E-05  1.09E-05  8.38E-06  6.43E-06  4.94E-06  3.79E-06  2.91E-06  2.23E-06
1.71E-06  1.32E-06  1.01E-06  7.75E-07  5.95E-07  4.56E-07  3.50E-07  2.69E-07  2.06E-07  1.58E-07
1.22E-07  9.33E-08  7.16E-08  5.50E-08  4.22E-08  3.24E-08  2.49E-08  1.91E-08  1.46E-08  1.12E-08
8.63E-09  6.62E-09  5.08E-09  3.90E-09  2.99E-09  2.30E-09  1.35E-09  7.98E-10  4.70E-10  2.77E-10
1.63E-10  9.61E-11  5.66E-11  3.34E-11  1.96E-11  1.16E-11  6.82E-12  4.02E-12  2.37E-12  1.39E-12
8.21E-13  4.84E-13  2.85E-13  1.68E-13  9.89E-14  5.83E-14  3.43E-14  2.02E-14  1.19E-14  7.02E-15
4.14E-15  2.44E-15  1.44E-15  8.46E-16  4.98E-16  2.94E-16  1.73E-16  1.02E-16  6.00E-17  3.54E-17
2.08E-17  1.23E-17  7.23E-18  4.26E-18  2.51E-18  1.48E-18  5.13E-19  1.78E-19  6.18E-20  2.14E-20
7.44E-21  1.98E-21  5.28E-22  1.41E-22  3.75E-23  9.98E-24  2.66E-24  7.09E-25  1.89E-25
   Cf-251           8.98E+02  1.80E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02
1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.74E-02  1.73E-02  1.73E-02  1.72E-02  1.71E-02  1.71E-02
1.70E-02  1.69E-02  1.69E-02  1.68E-02  1.67E-02  1.67E-02  1.66E-02  1.65E-02  1.65E-02  1.64E-02
1.63E-02  1.63E-02  1.62E-02  1.62E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02  1.58E-02  1.58E-02
1.57E-02  1.57E-02  1.56E-02  1.55E-02  1.55E-02  1.54E-02  1.54E-02  1.53E-02  1.52E-02  1.52E-02
1.51E-02  1.51E-02  1.50E-02  1.50E-02  1.49E-02  1.48E-02  1.48E-02  1.47E-02  1.47E-02  1.46E-02
1.46E-02  1.45E-02  1.44E-02  1.44E-02  1.43E-02  1.43E-02  1.42E-02  1.41E-02  1.40E-02  1.38E-02
1.37E-02  1.36E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.31E-02  1.30E-02  1.29E-02  1.28E-02
1.27E-02  1.26E-02  1.25E-02  1.24E-02  1.23E-02  1.22E-02  1.21E-02  1.20E-02  1.20E-02  1.19E-02
1.18E-02  1.17E-02  1.16E-02  1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.12E-02  1.11E-02  1.10E-02
1.09E-02  1.08E-02  1.07E-02  1.06E-02  1.06E-02  1.05E-02  1.03E-02  1.02E-02  1.00E-02  9.86E-03
9.71E-03  9.52E-03  9.34E-03  9.16E-03  8.99E-03  8.81E-03  8.65E-03  8.48E-03  8.32E-03
   Cf-252           2.65E+00  7.92E+02  7.52E+01  3.43E+01  1.57E+01  7.14E+00  3.26E+00  1.49E+00
6.79E-01  3.10E-01  8.37E-02  2.26E-02  6.12E-03  1.66E-03  4.48E-04  1.21E-04  3.27E-05  8.85E-06
2.39E-06  6.47E-07  1.75E-07  4.73E-08  1.28E-08  3.46E-09  9.36E-10  2.53E-10  6.84E-11  1.85E-11
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5.00E-12  1.35E-12  3.66E-13  9.89E-14  2.67E-14  7.23E-15  1.96E-15  5.29E-16  1.43E-16  3.87E-17
1.05E-17  2.83E-18  7.65E-19  2.07E-19  5.59E-20  1.51E-20  4.09E-21  1.11E-21  2.99E-22  8.08E-23
2.19E-23  5.91E-24  1.60E-24  4.32E-25  1.17E-25  3.16E-26  8.54E-27  2.31E-27  6.25E-28  1.69E-28
4.57E-29  1.24E-29  3.34E-30  9.03E-31  2.44E-31  6.60E-32  4.83E-33  3.53E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cl-36            3.01E+05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05  1.75E-05
   Cm-243           2.91E+01  1.80E-02  1.45E-02  1.35E-02  1.26E-02  1.17E-02  1.09E-02  1.02E-02
9.46E-03  8.81E-03  7.82E-03  6.94E-03  6.16E-03  5.47E-03  4.86E-03  4.31E-03  3.83E-03  3.40E-03
3.02E-03  2.68E-03  2.38E-03  2.11E-03  1.87E-03  1.66E-03  1.48E-03  1.31E-03  1.16E-03  1.03E-03
9.17E-04  8.14E-04  7.22E-04  6.41E-04  5.69E-04  5.05E-04  4.49E-04  3.98E-04  3.54E-04  3.14E-04
2.79E-04  2.47E-04  2.20E-04  1.95E-04  1.73E-04  1.54E-04  1.36E-04  1.21E-04  1.07E-04  9.54E-05
8.47E-05  7.52E-05  6.67E-05  5.92E-05  5.26E-05  4.67E-05  4.14E-05  3.68E-05  3.27E-05  2.90E-05
2.57E-05  2.28E-05  2.03E-05  1.80E-05  1.60E-05  1.42E-05  1.12E-05  8.81E-06  6.94E-06  5.47E-06
4.31E-06  3.40E-06  2.68E-06  2.11E-06  1.66E-06  1.31E-06  1.03E-06  8.14E-07  6.41E-07  5.05E-07
3.98E-07  3.14E-07  2.47E-07  1.95E-07  1.54E-07  1.21E-07  9.54E-08  7.52E-08  5.92E-08  4.67E-08
3.68E-08  2.90E-08  2.28E-08  1.80E-08  1.42E-08  1.12E-08  8.81E-09  6.94E-09  5.47E-09  4.31E-09
3.40E-09  2.68E-09  2.11E-09  1.66E-09  1.31E-09  1.03E-09  6.41E-10  3.98E-10  2.47E-10  1.54E-10
9.54E-11  5.26E-11  2.90E-11  1.60E-11  8.81E-12  4.86E-12  2.68E-12  1.48E-12  8.14E-13
   Cm-245           8.50E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02
1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02
1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02
   Cm-246           4.73E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02
1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02
1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02
1.66E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.64E-02
1.64E-02  1.63E-02  1.63E-02  1.63E-02  1.63E-02  1.62E-02  1.62E-02  1.62E-02  1.61E-02  1.61E-02
1.60E-02  1.60E-02  1.59E-02  1.58E-02  1.58E-02  1.57E-02  1.57E-02  1.56E-02  1.55E-02
   Cm-247           1.56E+07  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
   Cm-248           3.40E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
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   Co-60             5.27E+00  7.92E+02  2.42E+02  1.63E+02  1.10E+02  7.42E+01  5.00E+01  3.37E+01
2.27E+01  1.53E+01  7.93E+00  4.11E+00  2.13E+00  1.10E+00  5.72E-01  2.96E-01  1.53E-01  7.95E-02
4.12E-02  2.13E-02  1.11E-02  5.73E-03  2.97E-03  1.54E-03  7.96E-04  4.12E-04  2.14E-04  1.11E-04
5.74E-05  2.97E-05  1.54E-05  7.97E-06  4.13E-06  2.14E-06  1.11E-06  5.75E-07  2.98E-07  1.54E-07
7.99E-08  4.14E-08  2.14E-08  1.11E-08  5.75E-09  2.98E-09  1.54E-09  8.00E-10  4.15E-10  2.15E-10
1.11E-10  5.76E-11  2.99E-11  1.55E-11  8.02E-12  4.15E-12  2.15E-12  1.11E-12  5.77E-13  2.99E-13
1.55E-13  8.03E-14  4.16E-14  2.16E-14  1.12E-14  5.78E-15  1.55E-15  4.17E-16  1.12E-16  3.00E-17
8.06E-18  2.16E-18  5.80E-19  1.56E-19  4.18E-20  1.12E-20  3.01E-21  8.09E-22  2.17E-22  5.82E-23
1.56E-23  4.20E-24  1.13E-24  3.02E-25  8.11E-26  2.18E-26  5.85E-27  1.57E-27  4.21E-28  1.13E-28
3.03E-29  8.14E-30  2.19E-30  5.87E-31  1.57E-31  4.23E-32  1.13E-32  3.04E-33  8.17E-34  2.19E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cs-135            2.30E+06  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
   Cs-137            3.01E+01  1.13E+00  9.18E-01  8.57E-01  8.00E-01  7.47E-01  6.97E-01  6.50E-01
6.07E-01  5.66E-01  5.05E-01  4.50E-01  4.01E-01  3.57E-01  3.18E-01  2.84E-01  2.53E-01  2.25E-01
2.01E-01  1.79E-01  1.60E-01  1.42E-01  1.27E-01  1.13E-01  1.01E-01  8.97E-02  8.00E-02  7.13E-02
6.35E-02  5.66E-02  5.05E-02  4.50E-02  4.01E-02  3.57E-02  3.18E-02  2.84E-02  2.53E-02  2.25E-02
2.01E-02  1.79E-02  1.60E-02  1.42E-02  1.27E-02  1.13E-02  1.01E-02  8.97E-03  8.00E-03  7.13E-03
6.35E-03  5.66E-03  5.04E-03  4.50E-03  4.01E-03  3.57E-03  3.18E-03  2.84E-03  2.53E-03  2.25E-03
2.01E-03  1.79E-03  1.60E-03  1.42E-03  1.27E-03  1.13E-03  8.97E-04  7.12E-04  5.66E-04  4.50E-04
3.57E-04  2.84E-04  2.25E-04  1.79E-04  1.42E-04  1.13E-04  8.97E-05  7.12E-05  5.66E-05  4.49E-05
3.57E-05  2.84E-05  2.25E-05  1.79E-05  1.42E-05  1.13E-05  8.97E-06  7.12E-06  5.66E-06  4.49E-06
3.57E-06  2.83E-06  2.25E-06  1.79E-06  1.42E-06  1.13E-06  8.96E-07  7.12E-07  5.66E-07  4.49E-07
3.57E-07  2.83E-07  2.25E-07  1.79E-07  1.42E-07  1.13E-07  7.12E-08  4.49E-08  2.83E-08  1.79E-08
1.13E-08  6.34E-09  3.57E-09  2.01E-09  1.13E-09  6.34E-10  3.57E-10  2.00E-10  1.13E-10
   Eu-152            1.35E+01  3.11E+08  1.96E+08  1.68E+08  1.44E+08  1.23E+08  1.06E+08  9.07E+07
7.78E+07  6.67E+07  5.16E+07  3.99E+07  3.09E+07  2.39E+07  1.85E+07  1.43E+07  1.10E+07  8.55E+06
6.61E+06  5.12E+06  3.96E+06  3.06E+06  2.37E+06  1.83E+06  1.42E+06  1.10E+06  8.48E+05  6.56E+05
5.08E+05  3.93E+05  3.04E+05  2.35E+05  1.82E+05  1.41E+05  1.09E+05  8.41E+04  6.51E+04  5.04E+04
3.90E+04  3.01E+04  2.33E+04  1.80E+04  1.39E+04  1.08E+04  8.35E+03  6.46E+03  5.00E+03  3.86E+03
2.99E+03  2.31E+03  1.79E+03  1.38E+03  1.07E+03  8.28E+02  6.41E+02  4.96E+02  3.83E+02  2.97E+02
2.29E+02  1.77E+02  1.37E+02  1.06E+02  8.22E+01  6.36E+01  3.80E+01  2.28E+01  1.36E+01  8.15E+00
4.88E+00  2.92E+00  1.75E+00  1.05E+00  6.26E-01  3.74E-01  2.24E-01  1.34E-01  8.02E-02  4.80E-02
2.87E-02  1.72E-02  1.03E-02  6.16E-03  3.69E-03  2.21E-03  1.32E-03  7.90E-04  4.73E-04  2.83E-04
1.69E-04  1.01E-04  6.06E-05  3.63E-05  2.17E-05  1.30E-05  7.77E-06  4.65E-06  2.78E-06  1.67E-06
9.97E-07  5.97E-07  3.57E-07  2.14E-07  1.28E-07  7.65E-08  2.74E-08  9.81E-09  3.51E-09  1.26E-09
4.51E-10  1.25E-10  3.46E-11  9.58E-12  2.66E-12  7.36E-13  2.04E-13  5.65E-14  1.56E-14
   Eu-154            8.59E+00  4.87E+08  2.36E+08  1.85E+08  1.45E+08  1.14E+08  8.95E+07  7.02E+07
5.51E+07  4.33E+07  2.89E+07  1.93E+07  1.29E+07  8.62E+06  5.76E+06  3.84E+06  2.57E+06  1.72E+06
1.15E+06  7.66E+05  5.11E+05  3.42E+05  2.28E+05  1.52E+05  1.02E+05  6.80E+04  4.54E+04  3.04E+04
2.03E+04  1.35E+04  9.05E+03  6.04E+03  4.04E+03  2.70E+03  1.80E+03  1.20E+03  8.04E+02  5.37E+02
3.59E+02  2.40E+02  1.60E+02  1.07E+02  7.14E+01  4.77E+01  3.19E+01  2.13E+01  1.42E+01  9.50E+00
6.35E+00  4.24E+00  2.83E+00  1.89E+00  1.26E+00  8.44E-01  5.64E-01  3.77E-01  2.52E-01  1.68E-01
1.12E-01  7.50E-02  5.01E-02  3.35E-02  2.24E-02  1.49E-02  6.67E-03  2.97E-03  1.33E-03  5.92E-04
2.64E-04  1.18E-04  5.26E-05  2.35E-05  1.05E-05  4.68E-06  2.09E-06  9.31E-07  4.15E-07  1.85E-07
8.27E-08  3.69E-08  1.65E-08  7.35E-09  3.28E-09  1.46E-09  6.53E-10  2.91E-10  1.30E-10  5.80E-11
2.59E-11  1.16E-11  5.16E-12  2.30E-12  1.03E-12  4.58E-13  2.04E-13  9.12E-14  4.07E-14  1.82E-14
8.11E-15  3.62E-15  1.61E-15  7.20E-16  3.21E-16  1.43E-16  2.86E-17  5.69E-18  1.13E-18  2.25E-19
4.49E-20  5.97E-21  7.94E-22  1.06E-22  1.41E-23  1.87E-24  2.49E-25  3.31E-26  4.40E-27
   Eu-155            4.76E+00  7.92E+02  2.14E+02  1.38E+02  8.91E+01  5.76E+01  3.72E+01  2.40E+01
1.55E+01  1.00E+01  4.84E+00  2.34E+00  1.13E+00  5.45E-01  2.63E-01  1.27E-01  6.14E-02  2.96E-02
1.43E-02  6.91E-03  3.34E-03  1.61E-03  7.78E-04  3.75E-04  1.81E-04  8.75E-05  4.23E-05  2.04E-05
9.85E-06  4.76E-06  2.30E-06  1.11E-06  5.35E-07  2.59E-07  1.25E-07  6.03E-08  2.91E-08  1.40E-08
6.78E-09  3.28E-09  1.58E-09  7.64E-10  3.69E-10  1.78E-10  8.59E-11  4.15E-11  2.00E-11  9.67E-12
4.67E-12  2.26E-12  1.09E-12  5.26E-13  2.54E-13  1.23E-13  5.92E-14  2.86E-14  1.38E-14  6.66E-15
3.22E-15  1.55E-15  7.50E-16  3.62E-16  1.75E-16  8.44E-17  1.97E-17  4.59E-18  1.07E-18  2.49E-19
5.81E-20  1.35E-20  3.16E-21  7.36E-22  1.72E-22  4.00E-23  9.33E-24  2.17E-24  5.07E-25  1.18E-25
2.75E-26  6.42E-27  1.50E-27  3.49E-28  8.13E-29  1.90E-29  4.42E-30  1.03E-30  2.40E-31  5.60E-32
1.31E-32  3.04E-33  7.10E-34  1.65E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-55             2.73E+00  7.92E+02  8.06E+01  3.76E+01  1.76E+01  8.20E+00  3.83E+00  1.79E+00
8.35E-01  3.90E-01  1.09E-01  3.08E-02  8.64E-03  2.43E-03  6.82E-04  1.92E-04  5.39E-05  1.51E-05
4.25E-06  1.19E-06  3.36E-07  9.43E-08  2.65E-08  7.45E-09  2.09E-09  5.88E-10  1.65E-10  4.64E-11
1.30E-11  3.66E-12  1.03E-12  2.89E-13  8.13E-14  2.28E-14  6.42E-15  1.80E-15  5.07E-16  1.42E-16
4.00E-17  1.12E-17  3.16E-18  8.87E-19  2.49E-19  7.00E-20  1.97E-20  5.53E-21  1.55E-21  4.36E-22
1.23E-22  3.45E-23  9.68E-24  2.72E-24  7.64E-25  2.15E-25  6.03E-26  1.70E-26  4.76E-27  1.34E-27
3.76E-28  1.06E-28  2.97E-29  8.34E-30  2.34E-30  6.58E-31  5.20E-32  4.10E-33  3.24E-34  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
```

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0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-60            1.50E+06  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03  7.15E+03
   Gd-148           7.46E+01  5.80E+07  5.33E+07  5.19E+07  5.05E+07  4.91E+07  4.77E+07  4.64E+07
4.51E+07  4.39E+07  4.19E+07  4.00E+07  3.82E+07  3.64E+07  3.48E+07  3.32E+07  3.17E+07  3.03E+07
2.89E+07  2.76E+07  2.63E+07  2.51E+07  2.40E+07  2.29E+07  2.19E+07  2.09E+07  1.99E+07  1.90E+07
1.82E+07  1.73E+07  1.65E+07  1.58E+07  1.51E+07  1.44E+07  1.37E+07  1.31E+07  1.25E+07  1.20E+07
1.14E+07  1.09E+07  1.04E+07  9.92E+06  9.47E+06  9.04E+06  8.63E+06  8.24E+06  7.87E+06  7.51E+06
7.17E+06  6.84E+06  6.53E+06  6.24E+06  5.95E+06  5.68E+06  5.43E+06  5.18E+06  4.94E+06  4.72E+06
4.51E+06  4.30E+06  4.11E+06  3.92E+06  3.74E+06  3.57E+06  3.25E+06  2.97E+06  2.70E+06  2.46E+06
2.24E+06  2.05E+06  1.86E+06  1.70E+06  1.55E+06  1.41E+06  1.29E+06  1.17E+06  1.07E+06  9.73E+05
8.86E+05  8.08E+05  7.36E+05  6.71E+05  6.11E+05  5.57E+05  5.08E+05  4.62E+05  4.21E+05  3.84E+05
3.50E+05  3.19E+05  2.91E+05  2.65E+05  2.41E+05  2.20E+05  2.00E+05  1.83E+05  1.66E+05  1.52E+05
1.38E+05  1.26E+05  1.15E+05  1.05E+05  9.53E+04  8.68E+04  7.21E+04  5.99E+04  4.97E+04  4.13E+04
3.43E+04  2.72E+04  2.16E+04  1.71E+04  1.35E+04  1.07E+04  8.51E+03  6.75E+03  5.35E+03
   H-3              1.23E+01  4.50E+01  2.71E+01  2.29E+01  1.93E+01  1.63E+01  1.38E+01  1.16E+01
9.83E+00  8.30E+00  6.26E+00  4.72E+00  3.56E+00  2.69E+00  2.03E+00  1.53E+00  1.15E+00  8.71E-01
6.57E-01  4.96E-01  3.74E-01  2.82E-01  2.13E-01  1.61E-01  1.21E-01  9.14E-02  6.90E-02  5.20E-02
3.93E-02  2.96E-02  2.23E-02  1.69E-02  1.27E-02  9.60E-03  7.24E-03  5.46E-03  4.12E-03  3.11E-03
2.35E-03  1.77E-03  1.34E-03  1.01E-03  7.60E-04  5.73E-04  4.33E-04  3.26E-04  2.46E-04  1.86E-04
1.40E-04  1.06E-04  7.98E-05  6.02E-05  4.54E-05  3.43E-05  2.58E-05  1.95E-05  1.47E-05  1.11E-05
8.37E-06  6.32E-06  4.77E-06  3.60E-06  2.71E-06  2.05E-06  1.16E-06  6.63E-07  3.77E-07  2.15E-07
1.22E-07  6.96E-08  3.96E-08  2.25E-08  1.28E-08  7.30E-09  4.16E-09  2.37E-09  1.35E-09  7.67E-10
4.36E-10  2.48E-10  1.41E-10  8.05E-11  4.58E-11  2.61E-11  1.48E-11  8.45E-12  4.81E-12  2.74E-12
1.56E-12  8.87E-13  5.05E-13  2.87E-13  1.64E-13  9.31E-14  5.30E-14  3.02E-14  1.72E-14  9.77E-15
5.56E-15  3.17E-15  1.80E-15  1.03E-15  5.84E-16  3.32E-16  1.08E-16  3.49E-17  1.13E-17  3.66E-18
1.19E-18  2.90E-19  7.08E-20  1.73E-20  4.23E-21  1.03E-21  2.53E-22  6.18E-23  1.51E-23
   Hg-194           4.44E+02  6.38E+06  6.29E+06  6.26E+06  6.23E+06  6.20E+06  6.17E+06  6.15E+06
6.12E+06  6.09E+06  6.04E+06  5.99E+06  5.95E+06  5.90E+06  5.86E+06  5.81E+06  5.76E+06  5.72E+06
5.68E+06  5.63E+06  5.59E+06  5.54E+06  5.50E+06  5.46E+06  5.42E+06  5.37E+06  5.33E+06  5.29E+06
5.25E+06  5.21E+06  5.17E+06  5.13E+06  5.09E+06  5.05E+06  5.01E+06  4.97E+06  4.93E+06  4.89E+06
4.85E+06  4.82E+06  4.78E+06  4.74E+06  4.71E+06  4.67E+06  4.63E+06  4.60E+06  4.56E+06  4.53E+06
4.49E+06  4.46E+06  4.42E+06  4.39E+06  4.35E+06  4.32E+06  4.28E+06  4.25E+06  4.22E+06  4.19E+06
4.15E+06  4.12E+06  4.09E+06  4.06E+06  4.03E+06  3.99E+06  3.93E+06  3.87E+06  3.81E+06  3.75E+06
3.69E+06  3.64E+06  3.58E+06  3.53E+06  3.47E+06  3.42E+06  3.36E+06  3.31E+06  3.26E+06  3.21E+06
3.16E+06  3.11E+06  3.06E+06  3.02E+06  2.97E+06  2.92E+06  2.88E+06  2.83E+06  2.79E+06  2.75E+06
2.70E+06  2.66E+06  2.62E+06  2.58E+06  2.54E+06  2.50E+06  2.46E+06  2.42E+06  2.39E+06  2.35E+06
2.31E+06  2.28E+06  2.24E+06  2.21E+06  2.17E+06  2.14E+06  2.07E+06  2.01E+06  1.95E+06  1.89E+06
1.83E+06  1.76E+06  1.69E+06  1.63E+06  1.57E+06  1.51E+06  1.45E+06  1.39E+06  1.34E+06
   Np-237           2.14E+06  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
   Am-241           4.32E+02  1.80E-02  1.77E-02  1.77E-02  1.76E-02  1.75E-02  1.74E-02  1.73E-02
1.72E-02  1.72E-02  1.70E-02  1.69E-02  1.67E-02  1.66E-02  1.65E-02  1.63E-02  1.62E-02  1.61E-02
1.60E-02  1.58E-02  1.57E-02  1.56E-02  1.55E-02  1.53E-02  1.52E-02  1.51E-02  1.50E-02  1.48E-02
1.47E-02  1.46E-02  1.45E-02  1.44E-02  1.43E-02  1.41E-02  1.40E-02  1.39E-02  1.38E-02  1.37E-02
1.36E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.31E-02  1.30E-02  1.29E-02  1.27E-02  1.26E-02
1.25E-02  1.24E-02  1.23E-02  1.22E-02  1.21E-02  1.21E-02  1.20E-02  1.19E-02  1.18E-02  1.17E-02
1.16E-02  1.15E-02  1.14E-02  1.13E-02  1.12E-02  1.11E-02  1.09E-02  1.08E-02  1.06E-02  1.04E-02
1.03E-02  1.01E-02  9.94E-03  9.78E-03  9.63E-03  9.47E-03  9.32E-03  9.17E-03  9.03E-03  8.89E-03
8.74E-03  8.60E-03  8.47E-03  8.33E-03  8.20E-03  8.07E-03  7.94E-03  7.81E-03  7.69E-03  7.57E-03
7.45E-03  7.33E-03  7.21E-03  7.10E-03  6.98E-03  6.87E-03  6.76E-03  6.66E-03  6.55E-03  6.45E-03
6.34E-03  6.24E-03  6.14E-03  6.05E-03  5.95E-03  5.85E-03  5.67E-03  5.49E-03  5.32E-03  5.15E-03
4.99E-03  4.79E-03  4.60E-03  4.42E-03  4.25E-03  4.08E-03  3.92E-03  3.77E-03  3.62E-03
   Cm-244           1.81E+01  1.80E-02  1.28E-02  1.14E-02  1.01E-02  9.03E-03  8.05E-03  7.18E-03
6.40E-03  5.71E-03  4.71E-03  3.89E-03  3.21E-03  2.65E-03  2.19E-03  1.81E-03  1.49E-03  1.23E-03
1.02E-03  8.41E-04  6.94E-04  5.73E-04  4.73E-04  3.91E-04  3.23E-04  2.67E-04  2.20E-04  1.82E-04
1.50E-04  1.24E-04  1.02E-04  8.45E-05  6.98E-05  5.76E-05  4.76E-05  3.93E-05  3.24E-05  2.68E-05
2.21E-05  1.83E-05  1.51E-05  1.25E-05  1.03E-05  8.49E-06  7.01E-06  5.79E-06  4.78E-06  3.95E-06
3.26E-06  2.69E-06  2.22E-06  1.84E-06  1.52E-06  1.25E-06  1.03E-06  8.53E-07  7.05E-07  5.82E-07
```

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4.80E-07  3.97E-07  3.28E-07  2.70E-07  2.23E-07  1.84E-07  1.26E-07  8.57E-08  5.85E-08  3.99E-08
2.72E-08  1.85E-08  1.26E-08  8.62E-09  5.87E-09  4.01E-09  2.73E-09  1.86E-09  1.27E-09  8.66E-10
5.90E-10  4.03E-10  2.74E-10  1.87E-10  1.28E-10  8.70E-11  5.93E-11  4.04E-11  2.76E-11  1.88E-11
1.28E-11  8.74E-12  5.96E-12  4.06E-12  2.77E-12  1.89E-12  1.29E-12  8.79E-13  5.99E-13  4.08E-13
2.78E-13  1.90E-13  1.29E-13  8.83E-14  6.02E-14  4.10E-14  1.91E-14  8.87E-15  4.12E-15  1.92E-15
8.91E-16  3.42E-16  1.31E-16  5.04E-17  1.94E-17  7.43E-18  2.85E-18  1.10E-18  4.21E-19
   Ho-166m          1.20E+03  3.24E+06  3.22E+06  3.22E+06  3.21E+06  3.21E+06  3.20E+06  3.20E+06
3.19E+06  3.18E+06  3.18E+06  3.17E+06  3.16E+06  3.15E+06  3.14E+06  3.13E+06  3.12E+06  3.11E+06
3.10E+06  3.09E+06  3.08E+06  3.08E+06  3.07E+06  3.06E+06  3.05E+06  3.04E+06  3.03E+06  3.02E+06
3.01E+06  3.01E+06  3.00E+06  2.99E+06  2.98E+06  2.97E+06  2.96E+06  2.95E+06  2.95E+06  2.94E+06
2.93E+06  2.92E+06  2.91E+06  2.90E+06  2.89E+06  2.89E+06  2.88E+06  2.87E+06  2.86E+06  2.85E+06
2.85E+06  2.84E+06  2.83E+06  2.82E+06  2.81E+06  2.80E+06  2.80E+06  2.79E+06  2.78E+06  2.77E+06
2.76E+06  2.76E+06  2.75E+06  2.74E+06  2.73E+06  2.72E+06  2.71E+06  2.69E+06  2.68E+06  2.66E+06
2.65E+06  2.63E+06  2.62E+06  2.60E+06  2.59E+06  2.57E+06  2.56E+06  2.54E+06  2.53E+06  2.51E+06
2.50E+06  2.48E+06  2.47E+06  2.46E+06  2.44E+06  2.43E+06  2.41E+06  2.40E+06  2.39E+06  2.37E+06
2.36E+06  2.34E+06  2.33E+06  2.32E+06  2.30E+06  2.29E+06  2.28E+06  2.26E+06  2.25E+06  2.24E+06
2.23E+06  2.21E+06  2.20E+06  2.19E+06  2.17E+06  2.16E+06  2.14E+06  2.11E+06  2.09E+06  2.06E+06
2.04E+06  2.01E+06  1.98E+06  1.95E+06  1.93E+06  1.90E+06  1.87E+06  1.84E+06  1.82E+06
   I-129            1.57E+07  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
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3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
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3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05  3.94E-05
   Mn-53            3.74E+06  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
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3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03  3.24E+03
   Na-22            2.60E+00  7.92E+02  7.19E+01  3.23E+01  1.45E+01  6.53E+00  2.93E+00  1.32E+00
5.92E-01  2.66E-01  7.02E-02  1.85E-02  4.88E-03  1.29E-03  3.39E-04  8.95E-05  2.36E-05  6.22E-06
1.64E-06  4.33E-07  1.14E-07  3.01E-08  7.94E-09  2.09E-09  5.52E-10  1.45E-10  3.84E-11  1.01E-11
2.67E-12  7.03E-13  1.85E-13  4.89E-14  1.29E-14  3.40E-15  8.97E-16  2.36E-16  6.24E-17  1.64E-17
4.34E-18  1.14E-18  3.01E-19  7.95E-20  2.10E-20  5.53E-21  1.46E-21  3.84E-22  1.01E-22  2.67E-23
7.05E-24  1.86E-24  4.90E-25  1.29E-25  3.41E-26  8.99E-27  2.37E-27  6.25E-28  1.65E-28  4.34E-29
1.15E-29  3.02E-30  7.97E-31  2.10E-31  5.54E-32  1.46E-32  1.02E-33  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Nb-91            6.80E+02  1.04E+07  1.03E+07  1.03E+07  1.02E+07  1.02E+07  1.02E+07  1.01E+07
1.01E+07  1.01E+07  1.00E+07  9.98E+06  9.93E+06  9.88E+06  9.83E+06  9.78E+06  9.73E+06  9.68E+06
9.63E+06  9.59E+06  9.54E+06  9.49E+06  9.44E+06  9.39E+06  9.34E+06  9.30E+06  9.25E+06  9.20E+06
9.16E+06  9.11E+06  9.06E+06  9.02E+06  8.97E+06  8.93E+06  8.88E+06  8.83E+06  8.79E+06  8.75E+06
8.70E+06  8.66E+06  8.61E+06  8.57E+06  8.53E+06  8.48E+06  8.44E+06  8.40E+06  8.35E+06  8.31E+06
8.27E+06  8.23E+06  8.18E+06  8.14E+06  8.10E+06  8.06E+06  8.02E+06  7.98E+06  7.94E+06  7.90E+06
7.86E+06  7.82E+06  7.78E+06  7.74E+06  7.70E+06  7.66E+06  7.58E+06  7.51E+06  7.43E+06  7.35E+06
7.28E+06  7.21E+06  7.13E+06  7.06E+06  6.99E+06  6.92E+06  6.85E+06  6.78E+06  6.71E+06  6.64E+06
6.57E+06  6.51E+06  6.44E+06  6.38E+06  6.31E+06  6.25E+06  6.18E+06  6.12E+06  6.06E+06  6.00E+06
5.94E+06  5.88E+06  5.82E+06  5.76E+06  5.70E+06  5.64E+06  5.58E+06  5.53E+06  5.47E+06  5.42E+06
5.36E+06  5.31E+06  5.25E+06  5.20E+06  5.15E+06  5.10E+06  4.99E+06  4.89E+06  4.79E+06  4.70E+06
4.60E+06  4.49E+06  4.37E+06  4.26E+06  4.16E+06  4.05E+06  3.95E+06  3.85E+06  3.75E+06
   Nb-92            3.47E+07  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
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2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02  2.02E+02
   Nb-93m           1.61E+01  4.74E+08  3.22E+08  2.83E+08  2.48E+08  2.18E+08  1.92E+08  1.69E+08
1.48E+08  1.30E+08  1.05E+08  8.47E+07  6.83E+07  5.51E+07  4.44E+07  3.58E+07  2.89E+07  2.33E+07
1.88E+07  1.51E+07  1.22E+07  9.84E+06  7.93E+06  6.40E+06  5.16E+06  4.16E+06  3.35E+06  2.70E+06
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2.18E+06  1.76E+06  1.42E+06  1.14E+06  9.22E+05  7.43E+05  5.99E+05  4.83E+05  3.90E+05  3.14E+05
2.53E+05  2.04E+05  1.65E+05  1.33E+05  1.07E+05  8.64E+04  6.96E+04  5.61E+04  4.53E+04  3.65E+04
2.94E+04  2.37E+04  1.91E+04  1.54E+04  1.24E+04  1.00E+04  8.09E+03  6.52E+03  5.26E+03  4.24E+03
3.42E+03  2.76E+03  2.22E+03  1.79E+03  1.45E+03  1.17E+03  7.58E+02  4.93E+02  3.20E+02  2.08E+02
1.35E+02  8.80E+01  5.72E+01  3.72E+01  2.42E+01  1.57E+01  1.02E+01  6.65E+00  4.32E+00  2.81E+00
1.83E+00  1.19E+00  7.73E-01  5.02E-01  3.27E-01  2.12E-01  1.38E-01  8.98E-02  5.84E-02  3.79E-02
2.47E-02  1.60E-02  1.04E-02  6.78E-03  4.41E-03  2.87E-03  1.86E-03  1.21E-03  7.88E-04  5.12E-04
3.33E-04  2.16E-04  1.41E-04  9.15E-05  5.95E-05  3.87E-05  1.64E-05  6.91E-06  2.92E-06  1.24E-06
5.22E-07  1.78E-07  6.07E-08  2.07E-08  7.05E-09  2.40E-09  8.19E-10  2.79E-10  9.51E-11
   Nb-94            2.03E+04  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02
2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.34E-02  2.33E-02  2.33E-02
2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02
2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02  2.33E-02
2.33E-02  2.33E-02  2.33E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02
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2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.32E-02  2.31E-02  2.31E-02  2.31E-02
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2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02  2.30E-02
2.30E-02  2.30E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02
2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.29E-02  2.28E-02  2.28E-02  2.28E-02  2.28E-02  2.28E-02
2.28E-02  2.28E-02  2.27E-02  2.27E-02  2.27E-02  2.27E-02  2.27E-02  2.26E-02  2.26E-02
   Ni-59            7.60E+04  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01
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2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01
2.51E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01
2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01
   Ni-63            1.00E+02  3.96E+00  3.72E+00  3.64E+00  3.57E+00  3.50E+00  3.42E+00  3.35E+00
3.28E+00  3.22E+00  3.11E+00  3.00E+00  2.90E+00  2.80E+00  2.70E+00  2.61E+00  2.52E+00  2.44E+00
2.35E+00  2.27E+00  2.20E+00  2.12E+00  2.05E+00  1.98E+00  1.91E+00  1.85E+00  1.78E+00  1.72E+00
1.66E+00  1.61E+00  1.55E+00  1.50E+00  1.45E+00  1.40E+00  1.35E+00  1.31E+00  1.26E+00  1.22E+00
1.18E+00  1.14E+00  1.10E+00  1.06E+00  1.02E+00  9.90E-01  9.56E-01  9.24E-01  8.92E-01  8.62E-01
8.32E-01  8.04E-01  7.77E-01  7.50E-01  7.25E-01  7.00E-01  6.76E-01  6.53E-01  6.31E-01  6.09E-01
5.89E-01  5.69E-01  5.49E-01  5.31E-01  5.12E-01  4.95E-01  4.62E-01  4.31E-01  4.02E-01  3.75E-01
3.50E-01  3.27E-01  3.05E-01  2.84E-01  2.65E-01  2.48E-01  2.31E-01  2.15E-01  2.01E-01  1.88E-01
1.75E-01  1.63E-01  1.52E-01  1.42E-01  1.33E-01  1.24E-01  1.15E-01  1.08E-01  1.01E-01  9.38E-02
8.75E-02  8.16E-02  7.62E-02  7.11E-02  6.63E-02  6.19E-02  5.77E-02  5.39E-02  5.03E-02  4.69E-02
4.38E-02  4.08E-02  3.81E-02  3.55E-02  3.32E-02  3.09E-02  2.69E-02  2.34E-02  2.04E-02  1.78E-02
1.55E-02  1.30E-02  1.09E-02  9.20E-03  7.73E-03  6.50E-03  5.47E-03  4.60E-03  3.87E-03
   Os-194           6.00E+00  5.53E+08  1.96E+08  1.38E+08  9.78E+07  6.91E+07  4.89E+07  3.46E+07
2.44E+07  1.73E+07  9.70E+06  5.44E+06  3.05E+06  1.71E+06  9.62E+05  5.40E+05  3.03E+05  1.70E+05
9.55E+04  5.36E+04  3.01E+04  1.69E+04  9.47E+03  5.32E+03  2.98E+03  1.67E+03  9.40E+02  5.27E+02
2.96E+02  1.66E+02  9.32E+01  5.23E+01  2.94E+01  1.65E+01  9.25E+00  5.19E+00  2.91E+00  1.64E+00
9.18E-01  5.15E-01  2.89E-01  1.62E-01  9.10E-02  5.11E-02  2.87E-02  1.61E-02  9.03E-03  5.07E-03
2.85E-03  1.60E-03  8.96E-04  5.03E-04  2.82E-04  1.58E-04  8.89E-05  4.99E-05  2.80E-05  1.57E-05
8.82E-06  4.95E-06  2.78E-06  1.56E-06  8.75E-07  4.91E-07  1.55E-07  4.87E-08  1.53E-08  4.83E-09
1.52E-09  4.80E-10  1.51E-10  4.76E-11  1.50E-11  4.72E-12  1.49E-12  4.68E-13  1.48E-13  4.65E-14
1.46E-14  4.61E-15  1.45E-15  4.57E-16  1.44E-16  4.54E-17  1.43E-17  4.50E-18  1.42E-18  4.47E-19
1.41E-19  4.43E-20  1.40E-20  4.40E-21  1.38E-21  4.36E-22  1.37E-22  4.33E-23  1.36E-23  4.29E-24
1.35E-24  4.26E-25  1.34E-25  4.23E-26  1.33E-26  4.19E-27  4.16E-28  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pa-231           3.28E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04  8.46E+04
8.46E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04  8.45E+04
8.45E+04  8.45E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.44E+04
8.44E+04  8.44E+04  8.44E+04  8.44E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04
8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.43E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04
8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.42E+04  8.41E+04  8.41E+04  8.41E+04  8.41E+04
8.41E+04  8.41E+04  8.41E+04  8.41E+04  8.41E+04  8.41E+04  8.40E+04  8.40E+04  8.40E+04  8.40E+04
8.40E+04  8.40E+04  8.39E+04  8.39E+04  8.39E+04  8.39E+04  8.39E+04  8.39E+04  8.38E+04  8.38E+04
8.38E+04  8.38E+04  8.38E+04  8.37E+04  8.37E+04  8.37E+04  8.37E+04  8.37E+04  8.37E+04  8.36E+04
8.36E+04  8.36E+04  8.36E+04  8.36E+04  8.36E+04  8.35E+04  8.35E+04  8.35E+04  8.35E+04  8.35E+04
8.34E+04  8.34E+04  8.34E+04  8.34E+04  8.34E+04  8.34E+04  8.33E+04  8.33E+04  8.33E+04  8.32E+04
8.32E+04  8.31E+04  8.31E+04  8.31E+04  8.30E+04  8.30E+04  8.29E+04  8.29E+04  8.28E+04
   Pb-202           5.25E+04  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03
6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.12E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03
6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03
6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.09E+03  6.09E+03  6.09E+03
6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.08E+03
6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03
6.08E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03
6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03
6.06E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.04E+03  6.04E+03  6.04E+03
```

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   Pb-210            2.23E+01  1.37E+08  1.04E+08  9.43E+07  8.59E+07  7.83E+07  7.13E+07  6.50E+07
5.92E+07  5.39E+07  4.62E+07  3.95E+07  3.38E+07  2.90E+07  2.48E+07  2.12E+07  1.82E+07  1.56E+07
1.33E+07  1.14E+07  9.76E+06  8.35E+06  7.15E+06  6.12E+06  5.24E+06  4.49E+06  3.84E+06  3.29E+06
2.81E+06  2.41E+06  2.06E+06  1.77E+06  1.51E+06  1.29E+06  1.11E+06  9.48E+05  8.12E+05  6.95E+05
5.95E+05  5.09E+05  4.36E+05  3.73E+05  3.19E+05  2.73E+05  2.34E+05  2.00E+05  1.72E+05  1.47E+05
1.26E+05  1.08E+05  9.21E+04  7.89E+04  6.75E+04  5.78E+04  4.95E+04  4.24E+04  3.63E+04  3.10E+04
2.66E+04  2.27E+04  1.95E+04  1.67E+04  1.43E+04  1.22E+04  8.95E+03  6.56E+03  4.81E+03  3.52E+03
2.58E+03  1.89E+03  1.39E+03  1.02E+03  7.45E+02  5.46E+02  4.00E+02  2.93E+02  2.15E+02  1.57E+02
1.15E+02  8.46E+01  6.20E+01  4.54E+01  3.33E+01  2.44E+01  1.79E+01  1.31E+01  9.60E+00  7.03E+00
5.15E+00  3.78E+00  2.77E+00  2.03E+00  1.49E+00  1.09E+00  7.98E-01  5.85E-01  4.29E-01  3.14E-01
2.30E-01  1.69E-01  1.24E-01  9.06E-02  6.64E-02  4.87E-02  2.61E-02  1.40E-02  7.54E-03  4.05E-03
2.17E-03  1.00E-03  4.60E-04  2.11E-04  9.72E-05  4.47E-05  2.05E-05  9.44E-06  4.34E-06
   Pd-107            6.50E+06  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02  9.18E+02
   Pm-145            1.77E+01  2.52E+08  1.77E+08  1.58E+08  1.40E+08  1.25E+08  1.11E+08  9.85E+07
8.75E+07  7.78E+07  6.40E+07  5.26E+07  4.33E+07  3.56E+07  2.92E+07  2.40E+07  1.98E+07  1.63E+07
1.34E+07  1.10E+07  9.03E+06  7.43E+06  6.11E+06  5.02E+06  4.13E+06  3.39E+06  2.79E+06  2.29E+06
1.89E+06  1.55E+06  1.27E+06  1.05E+06  8.62E+05  7.08E+05  5.82E+05  4.79E+05  3.94E+05  3.24E+05
2.66E+05  2.19E+05  1.80E+05  1.48E+05  1.22E+05  1.00E+05  8.22E+04  6.76E+04  5.56E+04  4.57E+04
3.76E+04  3.09E+04  2.54E+04  2.09E+04  1.72E+04  1.41E+04  1.16E+04  9.54E+03  7.84E+03  6.45E+03
5.30E+03  4.36E+03  3.58E+03  2.95E+03  2.42E+03  1.99E+03  1.35E+03  9.10E+02  6.15E+02  4.16E+02
2.81E+02  1.90E+02  1.28E+02  8.68E+01  5.87E+01  3.97E+01  2.68E+01  1.81E+01  1.23E+01  8.28E+00
5.60E+00  3.78E+00  2.56E+00  1.73E+00  1.17E+00  7.90E-01  5.34E-01  3.61E-01  2.44E-01  1.65E-01
1.12E-01  7.54E-02  5.10E-02  3.44E-02  2.33E-02  1.57E-02  1.06E-02  7.19E-03  4.86E-03  3.29E-03
2.22E-03  1.50E-03  1.02E-03  6.86E-04  4.64E-04  3.14E-04  1.43E-04  6.55E-05  2.99E-05  1.37E-05
6.24E-06  2.35E-06  8.81E-07  3.31E-07  1.24E-07  4.67E-08  1.76E-08  6.60E-09  2.48E-09
   Pm-147            2.62E+00  7.92E+02  7.32E+01  3.31E+01  1.50E+01  6.77E+00  3.06E+00  1.38E+00
6.26E-01  2.83E-01  7.54E-02  2.01E-02  5.35E-03  1.43E-03  3.80E-04  1.01E-04  2.69E-05  7.18E-06
1.91E-06  5.09E-07  1.36E-07  3.61E-08  9.63E-09  2.56E-09  6.83E-10  1.82E-10  4.85E-11  1.29E-11
3.44E-12  9.16E-13  2.44E-13  6.50E-14  1.73E-14  4.62E-15  1.23E-15  3.28E-16  8.72E-17  2.32E-17
6.19E-18  1.65E-18  4.39E-19  1.17E-19  3.12E-20  8.30E-21  2.21E-21  5.89E-22  1.57E-22  4.18E-23
1.11E-23  2.97E-24  7.91E-25  2.11E-25  5.61E-26  1.49E-26  3.98E-27  1.06E-27  2.83E-28  7.53E-29
2.00E-29  5.34E-30  1.42E-30  3.79E-31  1.01E-31  2.69E-32  1.91E-33  1.35E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-208            2.90E+00  7.92E+02  9.21E+01  4.50E+01  2.20E+01  1.07E+01  5.23E+00  2.56E+00
1.25E+00  6.09E-01  1.84E-01  5.58E-02  1.69E-02  5.11E-03  1.55E-03  4.68E-04  1.42E-04  4.29E-05
1.30E-05  3.93E-06  1.19E-06  3.60E-07  1.09E-07  3.30E-08  9.99E-09  3.02E-09  9.15E-10  2.77E-10
8.38E-11  2.54E-11  7.68E-12  2.32E-12  7.03E-13  2.13E-13  6.44E-14  1.95E-14  5.90E-15  1.79E-15
5.41E-16  1.64E-16  4.96E-17  1.50E-17  4.54E-18  1.37E-18  4.16E-19  1.26E-19  3.81E-20  1.15E-20
3.49E-21  1.06E-21  3.20E-22  9.68E-23  2.93E-23  8.87E-24  2.68E-24  8.13E-25  2.46E-25  7.44E-26
2.25E-26  6.82E-27  2.06E-27  6.25E-28  1.89E-28  5.72E-29  5.24E-30  4.80E-31  4.40E-32  4.03E-33
3.69E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-209            1.02E+02  3.02E+07  2.84E+07  2.78E+07  2.73E+07  2.67E+07  2.62E+07  2.57E+07
2.51E+07  2.46E+07  2.38E+07  2.30E+07  2.22E+07  2.15E+07  2.08E+07  2.01E+07  1.94E+07  1.88E+07
1.81E+07  1.75E+07  1.69E+07  1.64E+07  1.58E+07  1.53E+07  1.48E+07  1.43E+07  1.38E+07  1.34E+07
1.29E+07  1.25E+07  1.21E+07  1.17E+07  1.13E+07  1.09E+07  1.05E+07  1.02E+07  9.84E+06  9.51E+06
9.19E+06  8.89E+06  8.59E+06  8.30E+06  8.03E+06  7.76E+06  7.50E+06  7.25E+06  7.01E+06  6.77E+06
6.55E+06  6.33E+06  6.12E+06  5.91E+06  5.71E+06  5.52E+06  5.34E+06  5.16E+06  4.99E+06  4.82E+06
4.66E+06  4.50E+06  4.35E+06  4.21E+06  4.07E+06  3.93E+06  3.67E+06  3.43E+06  3.21E+06  3.00E+06
2.80E+06  2.62E+06  2.44E+06  2.28E+06  2.13E+06  1.99E+06  1.86E+06  1.74E+06  1.63E+06  1.52E+06
1.42E+06  1.33E+06  1.24E+06  1.16E+06  1.08E+06  1.01E+06  9.44E+05  8.82E+05  8.24E+05  7.70E+05
7.19E+05  6.72E+05  6.28E+05  5.86E+05  5.48E+05  5.12E+05  4.78E+05  4.47E+05  4.18E+05  3.90E+05
3.64E+05  3.41E+05  3.18E+05  2.97E+05  2.78E+05  2.59E+05  2.27E+05  1.98E+05  1.73E+05  1.51E+05
1.32E+05  1.11E+05  9.36E+04  7.90E+04  6.67E+04  5.62E+04  4.75E+04  4.00E+04  3.38E+04
   Pt-193            5.00E+01  6.66E+07  5.88E+07  5.64E+07  5.41E+07  5.19E+07  4.98E+07  4.78E+07
4.58E+07  4.39E+07  4.10E+07  3.83E+07  3.57E+07  3.33E+07  3.11E+07  2.90E+07  2.70E+07  2.52E+07
2.35E+07  2.20E+07  2.05E+07  1.91E+07  1.78E+07  1.67E+07  1.55E+07  1.45E+07  1.35E+07  1.26E+07
1.18E+07  1.10E+07  1.02E+07  9.56E+06  8.92E+06  8.33E+06  7.77E+06  7.25E+06  6.76E+06  6.31E+06
5.89E+06  5.49E+06  5.12E+06  4.78E+06  4.46E+06  4.16E+06  3.88E+06  3.62E+06  3.38E+06  3.15E+06
2.94E+06  2.75E+06  2.56E+06  2.39E+06  2.23E+06  2.08E+06  1.94E+06  1.81E+06  1.69E+06  1.58E+06
1.47E+06  1.37E+06  1.28E+06  1.20E+06  1.12E+06  1.04E+06  9.06E+05  7.89E+05  6.87E+05  5.98E+05
5.20E+05  4.53E+05  3.94E+05  3.43E+05  2.99E+05  2.60E+05  2.26E+05  1.97E+05  1.72E+05  1.49E+05
1.30E+05  1.13E+05  9.86E+04  8.58E+04  7.47E+04  6.50E+04  5.66E+04  4.93E+04  4.29E+04  3.74E+04
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3.25E+04  2.83E+04  2.46E+04  2.15E+04  1.87E+04  1.63E+04  1.42E+04  1.23E+04  1.07E+04  9.34E+03
8.13E+03  7.08E+03  6.16E+03  5.36E+03  4.67E+03  4.06E+03  3.08E+03  2.33E+03  1.77E+03  1.34E+03
1.02E+03  7.19E+02  5.08E+02  3.59E+02  2.54E+02  1.80E+02  1.27E+02  8.98E+01  6.35E+01
        NUCLIDE HALFLIFE AND INVENTORY (CI) REMAINING IN THE FACILITY
 (TIMES IN YEARS) HALFLIFE        6.        9.       12.       15.       18.       21.       24.
27.       30.       35.       40.       45.       50.       55.       60.       65.       70.
75.       80.       85.       90.       95.      100.      105.      110.      115.      120.
125.      130.      135.      140.      145.      150.      155.      160.      165.      170.
175.      180.      185.      190.      195.      200.      205.      210.      215.      220.
225.      230.      235.      240.      245.      250.      255.      260.      265.      270.
275.      280.      285.      290.      295.      300.      310.      320.      330.      340.
350.      360.      370.      380.      390.      400.      410.      420.      430.      440.
450.      460.      470.      480.      490.      500.      510.      520.      530.      540.
550.      560.      570.      580.      590.      600.      610.      620.      630.      640.
650.      660.      670.      680.      690.      700.      720.      740.      760.      780.
800.      825.      850.      875.      900.      925.      950.      975.     1000.
   Ac-227          2.18E+01  1.30E+08  9.75E+07  8.85E+07  8.04E+07  7.31E+07  6.64E+07  6.03E+07
5.48E+07  4.98E+07  4.24E+07  3.61E+07  3.08E+07  2.62E+07  2.24E+07  1.91E+07  1.62E+07  1.38E+07
1.18E+07  1.00E+07  8.56E+06  7.30E+06  6.22E+06  5.30E+06  4.51E+06  3.85E+06  3.28E+06  2.79E+06
2.38E+06  2.03E+06  1.73E+06  1.47E+06  1.26E+06  1.07E+06  9.11E+05  7.77E+05  6.62E+05  5.64E+05
4.81E+05  4.10E+05  3.49E+05  2.97E+05  2.53E+05  2.16E+05  1.84E+05  1.57E+05  1.34E+05  1.14E+05
9.70E+04  8.27E+04  7.04E+04  6.00E+04  5.12E+04  4.36E+04  3.71E+04  3.17E+04  2.70E+04  2.30E+04
1.96E+04  1.67E+04  1.42E+04  1.21E+04  1.03E+04  8.80E+03  6.39E+03  4.64E+03  3.37E+03  2.45E+03
1.78E+03  1.29E+03  9.37E+02  6.80E+02  4.94E+02  3.59E+02  2.60E+02  1.89E+02  1.37E+02  9.97E+01
7.24E+01  5.26E+01  3.82E+01  2.77E+01  2.01E+01  1.46E+01  1.06E+01  7.71E+00  5.60E+00  4.06E+00
2.95E+00  2.14E+00  1.56E+00  1.13E+00  8.20E-01  5.96E-01  4.33E-01  3.14E-01  2.28E-01  1.66E-01
1.20E-01  8.73E-02  6.34E-02  4.60E-02  3.34E-02  2.43E-02  1.28E-02  6.75E-03  3.56E-03  1.88E-03
9.89E-04  4.45E-04  2.00E-04  8.98E-05  4.03E-05  1.81E-05  8.14E-06  3.66E-06  1.64E-06
   Ag-108m         4.18E+02  4.69E+07  4.61E+07  4.58E+07  4.55E+07  4.52E+07  4.50E+07  4.47E+07
4.44E+07  4.42E+07  4.37E+07  4.33E+07  4.29E+07  4.24E+07  4.20E+07  4.16E+07  4.12E+07  4.08E+07
4.04E+07  4.00E+07  3.96E+07  3.92E+07  3.88E+07  3.84E+07  3.80E+07  3.76E+07  3.73E+07  3.69E+07
3.65E+07  3.62E+07  3.58E+07  3.54E+07  3.51E+07  3.47E+07  3.44E+07  3.41E+07  3.37E+07  3.34E+07
3.30E+07  3.27E+07  3.24E+07  3.21E+07  3.18E+07  3.14E+07  3.11E+07  3.08E+07  3.05E+07  3.02E+07
2.99E+07  2.96E+07  2.93E+07  2.90E+07  2.87E+07  2.84E+07  2.82E+07  2.79E+07  2.76E+07  2.73E+07
2.71E+07  2.68E+07  2.65E+07  2.63E+07  2.60E+07  2.57E+07  2.52E+07  2.47E+07  2.42E+07  2.38E+07
2.33E+07  2.28E+07  2.24E+07  2.19E+07  2.15E+07  2.11E+07  2.07E+07  2.02E+07  1.98E+07  1.95E+07
1.91E+07  1.87E+07  1.83E+07  1.80E+07  1.76E+07  1.73E+07  1.69E+07  1.66E+07  1.62E+07  1.59E+07
1.56E+07  1.53E+07  1.50E+07  1.47E+07  1.44E+07  1.41E+07  1.38E+07  1.36E+07  1.33E+07  1.30E+07
1.28E+07  1.25E+07  1.23E+07  1.20E+07  1.18E+07  1.16E+07  1.11E+07  1.07E+07  1.03E+07  9.85E+06
9.47E+06  9.01E+06  8.57E+06  8.15E+06  7.75E+06  7.37E+06  7.01E+06  6.67E+06  6.35E+06
   Al-26           7.40E+05  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.35E+04  3.34E+04
3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04  3.34E+04
3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.33E+04  3.32E+04
3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.32E+04  3.31E+04
3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.31E+04  3.30E+04  3.30E+04
3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.30E+04  3.29E+04  3.29E+04
3.29E+04  3.29E+04  3.29E+04  3.29E+04  3.29E+04  3.29E+04  3.29E+04  3.28E+04  3.28E+04  3.28E+04
3.28E+04  3.27E+04  3.27E+04  3.27E+04  3.27E+04  3.27E+04  3.26E+04  3.26E+04  3.26E+04  3.26E+04
3.26E+04  3.25E+04  3.25E+04  3.25E+04  3.25E+04  3.25E+04  3.24E+04  3.24E+04  3.24E+04  3.24E+04
3.24E+04  3.23E+04  3.23E+04  3.23E+04  3.23E+04  3.23E+04  3.22E+04  3.22E+04  3.22E+04  3.22E+04
3.22E+04  3.21E+04  3.21E+04  3.21E+04  3.21E+04  3.21E+04  3.20E+04  3.20E+04  3.19E+04  3.19E+04
3.19E+04  3.18E+04  3.18E+04  3.17E+04  3.17E+04  3.16E+04  3.16E+04  3.15E+04  3.15E+04
   Am-242m         1.41E+02  1.80E-02  1.71E-02  1.68E-02  1.65E-02  1.62E-02  1.59E-02  1.57E-02
1.54E-02  1.51E-02  1.47E-02  1.43E-02  1.39E-02  1.35E-02  1.31E-02  1.27E-02  1.23E-02  1.20E-02
1.16E-02  1.13E-02  1.10E-02  1.07E-02  1.04E-02  1.01E-02  9.77E-03  9.49E-03  9.22E-03  8.95E-03
8.69E-03  8.44E-03  8.20E-03  7.97E-03  7.74E-03  7.52E-03  7.30E-03  7.09E-03  6.89E-03  6.69E-03
6.50E-03  6.31E-03  6.13E-03  5.95E-03  5.78E-03  5.62E-03  5.46E-03  5.30E-03  5.15E-03  5.00E-03
4.86E-03  4.72E-03  4.58E-03  4.45E-03  4.32E-03  4.20E-03  4.08E-03  3.96E-03  3.85E-03  3.74E-03
3.63E-03  3.53E-03  3.43E-03  3.33E-03  3.23E-03  3.14E-03  2.96E-03  2.79E-03  2.64E-03  2.49E-03
2.35E-03  2.21E-03  2.09E-03  1.97E-03  1.86E-03  1.75E-03  1.65E-03  1.56E-03  1.47E-03  1.39E-03
1.31E-03  1.24E-03  1.17E-03  1.10E-03  1.04E-03  9.80E-04  9.24E-04  8.72E-04  8.23E-04  7.76E-04
7.32E-04  6.91E-04  6.52E-04  6.15E-04  5.80E-04  5.47E-04  5.16E-04  4.87E-04  4.60E-04  4.34E-04
4.09E-04  3.86E-04  3.64E-04  3.44E-04  3.24E-04  3.06E-04  2.72E-04  2.42E-04  2.16E-04  1.92E-04
1.71E-04  1.48E-04  1.28E-04  1.10E-04  9.54E-05  8.25E-05  7.13E-05  6.17E-05  5.33E-05
   Am-243          7.37E+03  1.80E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02
1.75E-02  1.75E-02  1.74E-02  1.73E-02  1.72E-02  1.71E-02  1.70E-02  1.70E-02  1.69E-02  1.68E-02
1.67E-02  1.66E-02  1.65E-02  1.65E-02  1.64E-02  1.63E-02  1.62E-02  1.61E-02  1.60E-02  1.60E-02
1.59E-02  1.58E-02  1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.54E-02  1.53E-02  1.53E-02  1.52E-02
1.51E-02  1.50E-02  1.50E-02  1.49E-02  1.48E-02  1.47E-02  1.47E-02  1.46E-02  1.45E-02  1.44E-02
1.44E-02  1.43E-02  1.42E-02  1.42E-02  1.41E-02  1.40E-02  1.39E-02  1.39E-02  1.38E-02  1.37E-02
1.37E-02  1.36E-02  1.35E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.31E-02  1.29E-02  1.28E-02
1.27E-02  1.26E-02  1.24E-02  1.23E-02  1.22E-02  1.21E-02  1.19E-02  1.18E-02  1.17E-02  1.16E-02
1.15E-02  1.14E-02  1.12E-02  1.11E-02  1.10E-02  1.09E-02  1.08E-02  1.07E-02  1.06E-02  1.05E-02
1.04E-02  1.03E-02  1.02E-02  1.01E-02  9.98E-03  9.88E-03  9.78E-03  9.68E-03  9.59E-03  9.49E-03
9.40E-03  9.30E-03  9.21E-03  9.12E-03  9.03E-03  8.94E-03  8.76E-03  8.59E-03  8.42E-03  8.25E-03
8.09E-03  7.89E-03  7.69E-03  7.50E-03  7.32E-03  7.14E-03  6.96E-03  6.79E-03  6.62E-03
   Ba-133          1.05E+01  4.61E+08  2.54E+08  2.09E+08  1.71E+08  1.40E+08  1.15E+08  9.43E+07
7.74E+07  6.34E+07  4.56E+07  3.28E+07  2.35E+07  1.69E+07  1.22E+07  8.73E+06  6.27E+06  4.51E+06
3.24E+06  2.33E+06  1.67E+06  1.20E+06  8.63E+05  6.20E+05  4.46E+05  3.20E+05  2.30E+05  1.65E+05
1.19E+05  8.54E+04  6.14E+04  4.41E+04  3.17E+04  2.28E+04  1.64E+04  1.18E+04  8.44E+03  6.07E+03
4.36E+03  3.13E+03  2.25E+03  1.62E+03  1.16E+03  8.35E+02  6.00E+02  4.31E+02  3.10E+02  2.23E+02
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1.60E+02  1.15E+02  8.26E+01  5.93E+01  4.26E+01  3.06E+01  2.20E+01  1.58E+01  1.14E+01  8.17E+00
5.87E+00  4.22E+00  3.03E+00  2.18E+00  1.56E+00  1.12E+00  5.80E-01  3.00E-01  1.55E-01  7.99E-02
4.12E-02  2.13E-02  1.10E-02  5.67E-03  2.93E-03  1.51E-03  7.81E-04  4.03E-04  2.08E-04  1.07E-04
5.55E-05  2.86E-05  1.48E-05  7.64E-06  3.94E-06  2.04E-06  1.05E-06  5.43E-07  2.80E-07  1.45E-07
7.47E-08  3.86E-08  1.99E-08  1.03E-08  5.31E-09  2.74E-09  1.41E-09  7.30E-10  3.77E-10  1.95E-10
1.01E-10  5.19E-11  2.68E-11  1.38E-11  7.14E-12  3.69E-12  9.83E-13  2.62E-13  6.98E-14  1.86E-14
4.96E-15  9.51E-16  1.82E-16  3.49E-17  6.68E-18  1.28E-18  2.45E-19  4.69E-20  8.99E-21
   Be-10            1.51E+06  3.96E+04  3.95E+04  3.94E+04  3.94E+04  3.93E+04  3.93E+04  3.93E+04
3.92E+04  3.92E+04  3.91E+04  3.90E+04  3.89E+04  3.89E+04  3.88E+04  3.87E+04  3.87E+04  3.86E+04
3.85E+04  3.84E+04  3.84E+04  3.83E+04  3.82E+04  3.82E+04  3.81E+04  3.80E+04  3.80E+04  3.79E+04
3.78E+04  3.77E+04  3.77E+04  3.76E+04  3.75E+04  3.75E+04  3.74E+04  3.73E+04  3.73E+04  3.72E+04
3.71E+04  3.71E+04  3.70E+04  3.69E+04  3.68E+04  3.68E+04  3.67E+04  3.66E+04  3.66E+04  3.65E+04
3.64E+04  3.64E+04  3.63E+04  3.62E+04  3.62E+04  3.61E+04  3.60E+04  3.60E+04  3.59E+04  3.58E+04
3.58E+04  3.57E+04  3.56E+04  3.56E+04  3.55E+04  3.54E+04  3.53E+04  3.52E+04  3.51E+04  3.49E+04
3.48E+04  3.47E+04  3.45E+04  3.44E+04  3.43E+04  3.42E+04  3.40E+04  3.39E+04  3.38E+04  3.37E+04
3.35E+04  3.34E+04  3.33E+04  3.32E+04  3.30E+04  3.29E+04  3.28E+04  3.27E+04  3.26E+04  3.24E+04
3.23E+04  3.22E+04  3.21E+04  3.20E+04  3.18E+04  3.17E+04  3.16E+04  3.15E+04  3.14E+04  3.13E+04
3.11E+04  3.10E+04  3.09E+04  3.08E+04  3.07E+04  3.06E+04  3.04E+04  3.01E+04  2.99E+04  2.97E+04
2.95E+04  2.92E+04  2.89E+04  2.87E+04  2.84E+04  2.81E+04  2.79E+04  2.76E+04  2.74E+04
   Bi-207           3.16E+01  9.66E+07  7.87E+07  7.34E+07  6.86E+07  6.40E+07  5.98E+07  5.58E+07
5.21E+07  4.87E+07  4.34E+07  3.87E+07  3.46E+07  3.08E+07  2.75E+07  2.45E+07  2.19E+07  1.95E+07
1.74E+07  1.55E+07  1.39E+07  1.24E+07  1.10E+07  9.84E+06  8.78E+06  7.83E+06  6.99E+06  6.23E+06
5.56E+06  4.96E+06  4.42E+06  3.95E+06  3.52E+06  3.14E+06  2.80E+06  2.50E+06  2.23E+06  1.99E+06
1.77E+06  1.58E+06  1.41E+06  1.26E+06  1.12E+06  1.00E+06  8.94E+05  7.98E+05  7.12E+05  6.35E+05
5.66E+05  5.05E+05  4.51E+05  4.02E+05  3.59E+05  3.20E+05  2.85E+05  2.55E+05  2.27E+05  2.03E+05
1.81E+05  1.61E+05  1.44E+05  1.28E+05  1.14E+05  1.02E+05  8.13E+04  6.47E+04  5.15E+04  4.10E+04
3.26E+04  2.59E+04  2.06E+04  1.64E+04  1.31E+04  1.04E+04  8.28E+03  6.59E+03  5.24E+03  4.17E+03
3.32E+03  2.64E+03  2.10E+03  1.67E+03  1.33E+03  1.06E+03  8.43E+02  6.71E+02  5.34E+02  4.25E+02
3.38E+02  2.69E+02  2.14E+02  1.70E+02  1.36E+02  1.08E+02  8.59E+01  6.84E+01  5.44E+01  4.33E+01
3.44E+01  2.74E+01  2.18E+01  1.74E+01  1.38E+01  1.10E+01  6.96E+00  4.41E+00  2.79E+00  1.77E+00
1.12E+00  6.33E-01  3.57E-01  2.02E-01  1.14E-01  6.44E-02  3.64E-02  2.06E-02  1.16E-02
   Bi-210m          3.04E+06  1.02E+03  1.01E+03  1.01E+03  1.01E+03  1.00E+03  1.00E+03  9.98E+02
9.95E+02  9.93E+02  9.88E+02  9.84E+02  9.79E+02  9.75E+02  9.70E+02  9.66E+02  9.62E+02  9.57E+02
9.53E+02  9.49E+02  9.44E+02  9.40E+02  9.36E+02  9.32E+02  9.27E+02  9.23E+02  9.19E+02  9.15E+02
9.11E+02  9.07E+02  9.03E+02  8.98E+02  8.94E+02  8.90E+02  8.86E+02  8.82E+02  8.78E+02  8.74E+02
8.70E+02  8.66E+02  8.63E+02  8.59E+02  8.55E+02  8.51E+02  8.47E+02  8.43E+02  8.39E+02  8.36E+02
8.32E+02  8.28E+02  8.24E+02  8.21E+02  8.17E+02  8.13E+02  8.10E+02  8.06E+02  8.02E+02  7.99E+02
7.95E+02  7.91E+02  7.88E+02  7.84E+02  7.81E+02  7.77E+02  7.70E+02  7.63E+02  7.56E+02  7.50E+02
7.43E+02  7.36E+02  7.29E+02  7.23E+02  7.16E+02  7.10E+02  7.03E+02  6.97E+02  6.91E+02  6.85E+02
6.78E+02  6.72E+02  6.66E+02  6.60E+02  6.54E+02  6.48E+02  6.43E+02  6.37E+02  6.31E+02  6.25E+02
6.20E+02  6.14E+02  6.09E+02  6.03E+02  5.98E+02  5.92E+02  5.87E+02  5.82E+02  5.76E+02  5.71E+02
5.66E+02  5.61E+02  5.56E+02  5.51E+02  5.46E+02  5.41E+02  5.31E+02  5.22E+02  5.12E+02  5.03E+02
4.94E+02  4.83E+02  4.72E+02  4.62E+02  4.51E+02  4.41E+02  4.31E+02  4.22E+02  4.12E+02
   Bk-247           1.40E+03  6.98E-09  5.30E-09  4.84E-09  4.42E-09  4.03E-09  3.68E-09  3.36E-09
3.06E-09  2.80E-09  2.40E-09  2.06E-09  1.77E-09  1.52E-09  1.30E-09  1.12E-09  9.62E-10  8.26E-10
7.09E-10  6.09E-10  5.23E-10  4.49E-10  3.85E-10  3.31E-10  2.84E-10  2.44E-10  2.09E-10  1.80E-10
1.54E-10  1.32E-10  1.14E-10  9.77E-11  8.38E-11  7.20E-11  6.18E-11  5.31E-11  4.56E-11  3.91E-11
3.36E-11  2.88E-11  2.48E-11  2.13E-11  1.83E-11  1.57E-11  1.35E-11  1.16E-11  9.92E-12  8.52E-12
7.31E-12  6.28E-12  5.39E-12  4.63E-12  3.97E-12  3.41E-12  2.93E-12  2.51E-12  2.16E-12  1.85E-12
1.59E-12  1.37E-12  1.17E-12  1.01E-12  8.65E-13  7.43E-13  5.47E-13  4.03E-13  2.97E-13  2.19E-13
1.62E-13  1.19E-13  8.78E-14  6.47E-14  4.77E-14  3.52E-14  2.59E-14  1.91E-14  1.41E-14  1.04E-14
7.66E-15  5.65E-15  4.16E-15  3.07E-15  2.26E-15  1.67E-15  1.23E-15  9.06E-16  6.68E-16  4.92E-16
3.63E-16  2.67E-16  1.97E-16  1.45E-16  1.07E-16  7.90E-17  5.82E-17  4.29E-17  3.16E-17  2.33E-17
1.72E-17  1.27E-17  9.34E-18  6.89E-18  5.08E-18  3.74E-18  2.03E-18  1.11E-18  6.01E-19  3.26E-19
1.77E-19  8.27E-20  3.86E-20  1.80E-20  8.40E-21  3.92E-21  1.83E-21  8.53E-22  3.98E-22
   C-14             5.73E+03  9.00E+00  8.98E+00  8.98E+00  8.97E+00  8.96E+00  8.96E+00  8.95E+00
8.94E+00  8.94E+00  8.93E+00  8.92E+00  8.91E+00  8.90E+00  8.89E+00  8.88E+00  8.87E+00  8.86E+00
8.85E+00  8.84E+00  8.83E+00  8.82E+00  8.81E+00  8.80E+00  8.79E+00  8.78E+00  8.77E+00  8.76E+00
8.74E+00  8.73E+00  8.72E+00  8.71E+00  8.70E+00  8.69E+00  8.68E+00  8.67E+00  8.66E+00  8.65E+00
8.64E+00  8.64E+00  8.63E+00  8.62E+00  8.61E+00  8.60E+00  8.59E+00  8.58E+00  8.57E+00  8.56E+00
8.55E+00  8.54E+00  8.53E+00  8.52E+00  8.51E+00  8.50E+00  8.49E+00  8.48E+00  8.47E+00  8.46E+00
8.45E+00  8.44E+00  8.43E+00  8.42E+00  8.41E+00  8.40E+00  8.38E+00  8.36E+00  8.34E+00  8.32E+00
8.30E+00  8.28E+00  8.27E+00  8.25E+00  8.23E+00  8.21E+00  8.19E+00  8.17E+00  8.15E+00  8.13E+00
8.12E+00  8.10E+00  8.08E+00  8.06E+00  8.04E+00  8.02E+00  8.00E+00  7.99E+00  7.97E+00  7.95E+00
7.93E+00  7.91E+00  7.89E+00  7.88E+00  7.86E+00  7.84E+00  7.82E+00  7.80E+00  7.79E+00  7.77E+00
7.75E+00  7.73E+00  7.71E+00  7.70E+00  7.68E+00  7.66E+00  7.63E+00  7.59E+00  7.56E+00  7.52E+00
7.49E+00  7.44E+00  7.40E+00  7.36E+00  7.32E+00  7.28E+00  7.23E+00  7.19E+00  7.15E+00
   Ca-41            1.03E+05  6.14E-05  5.53E-05  5.34E-05  5.15E-05  4.97E-05  4.80E-05  4.64E-05
4.48E-05  4.32E-05  4.08E-05  3.84E-05  3.63E-05  3.42E-05  3.23E-05  3.04E-05  2.87E-05  2.71E-05
2.55E-05  2.41E-05  2.27E-05  2.14E-05  2.02E-05  1.90E-05  1.80E-05  1.69E-05  1.60E-05  1.51E-05
1.42E-05  1.34E-05  1.26E-05  1.19E-05  1.12E-05  1.06E-05  1.00E-05  9.43E-06  8.90E-06  8.39E-06
7.91E-06  7.46E-06  7.04E-06  6.64E-06  6.26E-06  5.91E-06  5.57E-06  5.25E-06  4.96E-06  4.67E-06
4.41E-06  4.16E-06  3.92E-06  3.70E-06  3.49E-06  3.29E-06  3.10E-06  2.93E-06  2.76E-06  2.60E-06
2.45E-06  2.32E-06  2.18E-06  2.06E-06  1.94E-06  1.83E-06  1.63E-06  1.45E-06  1.29E-06  1.15E-06
1.02E-06  9.08E-07  8.07E-07  7.18E-07  6.39E-07  5.68E-07  5.05E-07  4.50E-07  4.00E-07  3.56E-07
3.16E-07  2.81E-07  2.50E-07  2.23E-07  1.98E-07  1.76E-07  1.57E-07  1.39E-07  1.24E-07  1.10E-07
9.81E-08  8.73E-08  7.77E-08  6.91E-08  6.14E-08  5.47E-08  4.86E-08  4.32E-08  3.85E-08  3.42E-08
3.04E-08  2.71E-08  2.41E-08  2.14E-08  1.91E-08  1.70E-08  1.34E-08  1.06E-08  8.40E-09  6.65E-09
5.26E-09  3.92E-09  2.93E-09  2.19E-09  1.63E-09  1.22E-09  9.08E-10  6.78E-10  5.06E-10
   Cd-113           9.30E+15  7.75E-07  7.69E-07  7.67E-07  7.65E-07  7.62E-07  7.60E-07  7.58E-07
7.56E-07  7.54E-07  7.51E-07  7.47E-07  7.44E-07  7.41E-07  7.37E-07  7.34E-07  7.31E-07  7.27E-07
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7.24E-07  7.21E-07  7.18E-07  7.14E-07  7.11E-07  7.08E-07  7.05E-07  7.01E-07  6.98E-07  6.95E-07
6.92E-07  6.89E-07  6.86E-07  6.83E-07  6.80E-07  6.77E-07  6.73E-07  6.70E-07  6.67E-07  6.64E-07
6.61E-07  6.58E-07  6.55E-07  6.52E-07  6.49E-07  6.47E-07  6.44E-07  6.41E-07  6.38E-07  6.35E-07
6.32E-07  6.29E-07  6.26E-07  6.24E-07  6.21E-07  6.18E-07  6.15E-07  6.12E-07  6.10E-07  6.07E-07
6.04E-07  6.01E-07  5.99E-07  5.96E-07  5.93E-07  5.91E-07  5.85E-07  5.80E-07  5.75E-07  5.70E-07
5.64E-07  5.59E-07  5.54E-07  5.49E-07  5.44E-07  5.39E-07  5.35E-07  5.30E-07  5.25E-07  5.20E-07
5.16E-07  5.11E-07  5.06E-07  5.02E-07  4.97E-07  4.93E-07  4.88E-07  4.84E-07  4.79E-07  4.75E-07
4.71E-07  4.67E-07  4.62E-07  4.58E-07  4.54E-07  4.50E-07  4.46E-07  4.42E-07  4.38E-07  4.34E-07
4.30E-07  4.26E-07  4.22E-07  4.19E-07  4.15E-07  4.11E-07  4.04E-07  3.96E-07  3.89E-07  3.82E-07
3.75E-07  3.67E-07  3.59E-07  3.51E-07  3.43E-07  3.35E-07  3.28E-07  3.20E-07  3.13E-07
   Cd-113m          1.41E+01  4.04E+08  2.57E+08  2.22E+08  1.91E+08  1.64E+08  1.41E+08  1.21E+08
1.05E+08  9.00E+07  7.00E+07  5.45E+07  4.25E+07  3.31E+07  2.57E+07  2.00E+07  1.56E+07  1.21E+07
9.45E+06  7.36E+06  5.73E+06  4.46E+06  3.47E+06  2.70E+06  2.11E+06  1.64E+06  1.28E+06  9.94E+05
7.74E+05  6.02E+05  4.69E+05  3.65E+05  2.84E+05  2.21E+05  1.72E+05  1.34E+05  1.04E+05  8.13E+04
6.33E+04  4.93E+04  3.84E+04  2.99E+04  2.33E+04  1.81E+04  1.41E+04  1.10E+04  8.54E+03  6.65E+03
5.18E+03  4.03E+03  3.14E+03  2.44E+03  1.90E+03  1.48E+03  1.15E+03  8.98E+02  6.99E+02  5.44E+02
4.24E+02  3.30E+02  2.57E+02  2.00E+02  1.56E+02  1.21E+02  7.35E+01  4.45E+01  2.70E+01  1.64E+01
9.91E+00  6.01E+00  3.64E+00  2.21E+00  1.34E+00  8.11E-01  4.92E-01  2.98E-01  1.81E-01  1.09E-01
6.64E-02  4.02E-02  2.44E-02  1.48E-02  8.96E-03  5.43E-03  3.29E-03  2.00E-03  1.21E-03  7.33E-04
4.44E-04  2.69E-04  1.63E-04  9.89E-05  6.00E-05  3.64E-05  2.20E-05  1.34E-05  8.10E-06  4.91E-06
2.97E-06  1.80E-06  1.09E-06  6.62E-07  4.01E-07  2.43E-07  8.94E-08  3.28E-08  1.21E-08  4.43E-09
1.63E-09  4.66E-10  1.33E-10  3.81E-11  1.09E-11  3.12E-12  8.92E-13  2.55E-13  7.30E-14
   Cf-249           3.51E+02  1.80E-02  1.76E-02  1.75E-02  1.74E-02  1.72E-02  1.71E-02  1.70E-02
1.69E-02  1.67E-02  1.65E-02  1.63E-02  1.61E-02  1.59E-02  1.57E-02  1.56E-02  1.54E-02  1.52E-02
1.50E-02  1.48E-02  1.46E-02  1.45E-02  1.43E-02  1.41E-02  1.39E-02  1.38E-02  1.36E-02  1.34E-02
1.33E-02  1.31E-02  1.30E-02  1.28E-02  1.26E-02  1.25E-02  1.23E-02  1.22E-02  1.20E-02  1.19E-02
1.18E-02  1.16E-02  1.15E-02  1.13E-02  1.12E-02  1.11E-02  1.09E-02  1.08E-02  1.07E-02  1.05E-02
1.04E-02  1.03E-02  1.02E-02  1.00E-02  9.91E-03  9.79E-03  9.67E-03  9.56E-03  9.44E-03  9.33E-03
9.21E-03  9.10E-03  8.99E-03  8.88E-03  8.78E-03  8.67E-03  8.46E-03  8.26E-03  8.06E-03  7.87E-03
7.68E-03  7.49E-03  7.31E-03  7.14E-03  6.96E-03  6.80E-03  6.63E-03  6.47E-03  6.32E-03  6.17E-03
6.02E-03  5.87E-03  5.73E-03  5.59E-03  5.46E-03  5.33E-03  5.20E-03  5.07E-03  4.95E-03  4.83E-03
4.72E-03  4.60E-03  4.49E-03  4.39E-03  4.28E-03  4.18E-03  4.08E-03  3.98E-03  3.88E-03  3.79E-03
3.70E-03  3.61E-03  3.52E-03  3.44E-03  3.35E-03  3.27E-03  3.12E-03  2.97E-03  2.83E-03  2.69E-03
2.57E-03  2.41E-03  2.27E-03  2.14E-03  2.01E-03  1.89E-03  1.78E-03  1.68E-03  1.58E-03
   Cf-250           1.31E+01  1.80E-02  1.11E-02  9.49E-03  8.08E-03  6.89E-03  5.87E-03  5.00E-03
4.26E-03  3.63E-03  2.78E-03  2.13E-03  1.63E-03  1.25E-03  9.56E-04  7.32E-04  5.61E-04  4.29E-04
3.29E-04  2.52E-04  1.93E-04  1.48E-04  1.13E-04  8.66E-05  6.63E-05  5.08E-05  3.89E-05  2.98E-05
2.28E-05  1.75E-05  1.34E-05  1.02E-05  7.84E-06  6.00E-06  4.60E-06  3.52E-06  2.70E-06  2.06E-06
1.58E-06  1.21E-06  9.27E-07  7.10E-07  5.44E-07  4.16E-07  3.19E-07  2.44E-07  1.87E-07  1.43E-07
1.10E-07  8.40E-08  6.43E-08  4.92E-08  3.77E-08  2.89E-08  2.21E-08  1.69E-08  1.30E-08  9.93E-09
7.60E-09  5.82E-09  4.46E-09  3.41E-09  2.61E-09  2.00E-09  1.17E-09  6.89E-10  4.04E-10  2.37E-10
1.39E-10  8.14E-11  4.78E-11  2.80E-11  1.64E-11  9.63E-12  5.65E-12  3.31E-12  1.94E-12  1.14E-12
6.68E-13  3.92E-13  2.30E-13  1.35E-13  7.90E-14  4.63E-14  2.72E-14  1.59E-14  9.34E-15  5.48E-15
3.21E-15  1.88E-15  1.10E-15  6.48E-16  3.80E-16  2.23E-16  1.31E-16  7.66E-17  4.49E-17  2.63E-17
1.54E-17  9.06E-18  5.31E-18  3.11E-18  1.83E-18  1.07E-18  3.68E-19  1.27E-19  4.36E-20  1.50E-20
5.15E-21  1.36E-21  3.57E-22  9.41E-23  2.48E-23  6.52E-24  1.72E-24  4.52E-25  1.19E-25
   Cf-251           8.98E+02  1.80E-02  1.78E-02  1.77E-02  1.77E-02  1.76E-02  1.75E-02  1.75E-02
1.74E-02  1.73E-02  1.72E-02  1.71E-02  1.70E-02  1.69E-02  1.68E-02  1.67E-02  1.66E-02  1.65E-02
1.64E-02  1.63E-02  1.62E-02  1.61E-02  1.60E-02  1.59E-02  1.58E-02  1.57E-02  1.56E-02  1.55E-02
1.54E-02  1.53E-02  1.52E-02  1.51E-02  1.51E-02  1.50E-02  1.49E-02  1.48E-02  1.47E-02  1.46E-02
1.45E-02  1.44E-02  1.43E-02  1.42E-02  1.42E-02  1.41E-02  1.40E-02  1.39E-02  1.38E-02  1.37E-02
1.36E-02  1.36E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02  1.31E-02  1.31E-02  1.30E-02  1.29E-02
1.28E-02  1.27E-02  1.27E-02  1.26E-02  1.25E-02  1.24E-02  1.23E-02  1.21E-02  1.20E-02  1.18E-02
1.17E-02  1.16E-02  1.14E-02  1.13E-02  1.11E-02  1.10E-02  1.09E-02  1.07E-02  1.06E-02  1.05E-02
1.03E-02  1.02E-02  1.01E-02  9.96E-03  9.84E-03  9.72E-03  9.60E-03  9.49E-03  9.37E-03  9.25E-03
9.14E-03  9.03E-03  8.92E-03  8.81E-03  8.70E-03  8.60E-03  8.49E-03  8.39E-03  8.28E-03  8.18E-03
8.08E-03  7.98E-03  7.89E-03  7.79E-03  7.69E-03  7.60E-03  7.41E-03  7.23E-03  7.06E-03  6.89E-03
6.72E-03  6.51E-03  6.32E-03  6.13E-03  5.94E-03  5.76E-03  5.59E-03  5.42E-03  5.25E-03
   Cf-252           2.65E+00  7.92E+02  7.49E+01  3.41E+01  1.56E+01  7.09E+00  3.23E+00  1.47E+00
6.70E-01  3.05E-01  8.24E-02  2.22E-02  6.00E-03  1.62E-03  4.36E-04  1.18E-04  3.18E-05  8.57E-06
2.31E-06  6.24E-07  1.68E-07  4.54E-08  1.22E-08  3.30E-09  8.92E-10  2.41E-10  6.49E-11  1.75E-11
4.72E-12  1.27E-12  3.44E-13  9.27E-14  2.50E-14  6.75E-15  1.82E-15  4.91E-16  1.33E-16  3.58E-17
9.65E-18  2.60E-18  7.02E-19  1.89E-19  5.11E-20  1.38E-20  3.72E-21  1.00E-21  2.71E-22  7.30E-23
1.97E-23  5.32E-24  1.43E-24  3.87E-25  1.04E-25  2.82E-26  7.60E-27  2.05E-27  5.53E-28  1.49E-28
4.03E-29  1.09E-29  2.93E-30  7.90E-31  2.13E-31  5.75E-32  4.19E-33  3.05E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cl-36            3.01E+05  1.75E-05  1.35E-05  1.24E-05  1.14E-05  1.05E-05  9.60E-06  8.81E-06
8.08E-06  7.42E-06  6.43E-06  5.57E-06  4.83E-06  4.19E-06  3.63E-06  3.15E-06  2.73E-06  2.36E-06
2.05E-06  1.78E-06  1.54E-06  1.33E-06  1.16E-06  1.00E-06  8.68E-07  7.53E-07  6.52E-07  5.65E-07
4.90E-07  4.25E-07  3.68E-07  3.19E-07  2.77E-07  2.40E-07  2.08E-07  1.80E-07  1.56E-07  1.35E-07
1.17E-07  1.02E-07  8.81E-08  7.64E-08  6.62E-08  5.74E-08  4.97E-08  4.31E-08  3.74E-08  3.24E-08
2.81E-08  2.43E-08  2.11E-08  1.83E-08  1.58E-08  1.37E-08  1.19E-08  1.03E-08  8.94E-09  7.75E-09
6.71E-09  5.82E-09  5.04E-09  4.37E-09  3.79E-09  3.28E-09  2.47E-09  1.85E-09  1.39E-09  1.05E-09
7.86E-10  5.90E-10  4.44E-10  3.33E-10  2.50E-10  1.88E-10  1.41E-10  1.06E-10  7.97E-11  5.99E-11
4.50E-11  3.38E-11  2.54E-11  1.91E-11  1.43E-11  1.08E-11  8.09E-12  6.08E-12  4.57E-12  3.43E-12
2.58E-12  1.94E-12  1.45E-12  1.09E-12  8.21E-13  6.17E-13  4.63E-13  3.48E-13  2.61E-13  1.96E-13
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1.48E-13  1.11E-13  8.33E-14  6.25E-14  4.70E-14  3.53E-14  1.99E-14  1.12E-14  6.35E-15  3.58E-15
2.02E-15  9.89E-16  4.84E-16  2.37E-16  1.16E-16  5.66E-17  2.77E-17  1.35E-17  6.63E-18
   Cm-243           2.91E+01  1.80E-02  1.45E-02  1.35E-02  1.26E-02  1.17E-02  1.09E-02  1.02E-02
9.46E-03  8.81E-03  7.82E-03  6.94E-03  6.16E-03  5.47E-03  4.85E-03  4.31E-03  3.82E-03  3.40E-03
3.01E-03  2.68E-03  2.37E-03  2.11E-03  1.87E-03  1.66E-03  1.47E-03  1.31E-03  1.16E-03  1.03E-03
9.15E-04  8.13E-04  7.21E-04  6.40E-04  5.68E-04  5.05E-04  4.48E-04  3.98E-04  3.53E-04  3.13E-04
2.78E-04  2.47E-04  2.19E-04  1.95E-04  1.73E-04  1.53E-04  1.36E-04  1.21E-04  1.07E-04  9.52E-05
8.45E-05  7.50E-05  6.66E-05  5.91E-05  5.25E-05  4.66E-05  4.13E-05  3.67E-05  3.26E-05  2.89E-05
2.57E-05  2.28E-05  2.02E-05  1.79E-05  1.59E-05  1.41E-05  1.11E-05  8.78E-06  6.92E-06  5.45E-06
4.30E-06  3.39E-06  2.67E-06  2.10E-06  1.66E-06  1.31E-06  1.03E-06  8.10E-07  6.39E-07  5.03E-07
3.96E-07  3.12E-07  2.46E-07  1.94E-07  1.53E-07  1.20E-07  9.49E-08  7.48E-08  5.89E-08  4.64E-08
3.66E-08  2.88E-08  2.27E-08  1.79E-08  1.41E-08  1.11E-08  8.76E-09  6.90E-09  5.44E-09  4.28E-09
3.38E-09  2.66E-09  2.10E-09  1.65E-09  1.30E-09  1.03E-09  6.37E-10  3.95E-10  2.45E-10  1.52E-10
9.46E-11  5.22E-11  2.87E-11  1.58E-11  8.73E-12  4.81E-12  2.65E-12  1.46E-12  8.06E-13
   Cm-245           8.50E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02
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1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02
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1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02
1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02  1.68E-02
1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02
   Cm-246           4.73E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
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1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02
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1.63E-02  1.62E-02  1.62E-02  1.62E-02  1.62E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02
1.59E-02  1.58E-02  1.58E-02  1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.55E-02  1.54E-02
   Cm-247           1.56E+07  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
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1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
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   Cm-248           3.40E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
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   Co-60            5.27E+00  7.92E+02  2.42E+02  1.63E+02  1.10E+02  7.42E+01  5.00E+01  3.37E+01
2.27E+01  1.53E+01  7.93E+00  4.11E+00  2.13E+00  1.10E+00  5.71E-01  2.96E-01  1.53E-01  7.95E-02
4.12E-02  2.13E-02  1.10E-02  5.72E-03  2.97E-03  1.54E-03  7.96E-04  4.12E-04  2.14E-04  1.11E-04
5.73E-05  2.97E-05  1.54E-05  7.97E-06  4.13E-06  2.14E-06  1.11E-06  5.74E-07  2.98E-07  1.54E-07
7.99E-08  4.14E-08  2.14E-08  1.11E-08  5.75E-09  2.98E-09  1.54E-09  8.00E-10  4.14E-10  2.15E-10
1.11E-10  5.76E-11  2.98E-11  1.55E-11  8.01E-12  4.15E-12  2.15E-12  1.11E-12  5.77E-13  2.99E-13
1.55E-13  8.02E-14  4.16E-14  2.15E-14  1.12E-14  5.78E-15  1.55E-15  4.16E-16  1.12E-16  3.00E-17
8.05E-18  2.16E-18  5.80E-19  1.56E-19  4.18E-20  1.12E-20  3.01E-21  8.08E-22  2.17E-22  5.82E-23
1.56E-23  4.19E-24  1.12E-24  3.02E-25  8.10E-26  2.17E-26  5.84E-27  1.57E-27  4.21E-28  1.13E-28
3.03E-29  8.13E-30  2.18E-30  5.86E-31  1.57E-31  4.22E-32  1.13E-32  3.04E-33  8.16E-34  2.19E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Cs-135           2.30E+06  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03  2.07E+03
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2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.06E+03  2.05E+03
   Cs-137           3.01E+01  1.13E+00  9.18E-01  8.57E-01  8.00E-01  7.46E-01  6.97E-01  6.50E-01
6.07E-01  5.66E-01  5.05E-01  4.50E-01  4.01E-01  3.57E-01  3.18E-01  2.84E-01  2.53E-01  2.25E-01
2.01E-01  1.79E-01  1.59E-01  1.42E-01  1.27E-01  1.13E-01  1.01E-01  8.97E-02  7.99E-02  7.12E-02
6.35E-02  5.66E-02  5.04E-02  4.49E-02  4.00E-02  3.57E-02  3.18E-02  2.83E-02  2.53E-02  2.25E-02
2.01E-02  1.79E-02  1.59E-02  1.42E-02  1.27E-02  1.13E-02  1.01E-02  8.96E-03  7.98E-03  7.12E-03
6.34E-03  5.65E-03  5.04E-03  4.49E-03  4.00E-03  3.57E-03  3.18E-03  2.83E-03  2.52E-03  2.25E-03
2.00E-03  1.79E-03  1.59E-03  1.42E-03  1.26E-03  1.13E-03  8.95E-04  7.11E-04  5.65E-04  4.48E-04
3.56E-04  2.83E-04  2.25E-04  1.78E-04  1.42E-04  1.13E-04  8.94E-05  7.10E-05  5.64E-05  4.48E-05
3.56E-05  2.83E-05  2.24E-05  1.78E-05  1.42E-05  1.12E-05  8.93E-06  7.10E-06  5.64E-06  4.48E-06
3.56E-06  2.82E-06  2.24E-06  1.78E-06  1.41E-06  1.12E-06  8.93E-07  7.09E-07  5.63E-07  4.47E-07
3.55E-07  2.82E-07  2.24E-07  1.78E-07  1.41E-07  1.12E-07  7.08E-08  4.47E-08  2.82E-08  1.78E-08
1.12E-08  6.31E-09  3.55E-09  1.99E-09  1.12E-09  6.30E-10  3.54E-10  1.99E-10  1.12E-10
   Eu-152           1.35E+01  3.11E+08  1.96E+08  1.68E+08  1.44E+08  1.23E+08  1.05E+08  9.04E+07
7.75E+07  6.64E+07  5.13E+07  3.97E+07  3.07E+07  2.37E+07  1.83E+07  1.42E+07  1.09E+07  8.46E+06
6.54E+06  5.06E+06  3.91E+06  3.02E+06  2.34E+06  1.81E+06  1.40E+06  1.08E+06  8.34E+05  6.45E+05
4.99E+05  3.85E+05  2.98E+05  2.30E+05  1.78E+05  1.38E+05  1.06E+05  8.22E+04  6.36E+04  4.91E+04
3.80E+04  2.94E+04  2.27E+04  1.75E+04  1.36E+04  1.05E+04  8.11E+03  6.27E+03  4.84E+03  3.74E+03
2.89E+03  2.24E+03  1.73E+03  1.34E+03  1.03E+03  7.99E+02  6.18E+02  4.78E+02  3.69E+02  2.85E+02
2.21E+02  1.71E+02  1.32E+02  1.02E+02  7.88E+01  6.09E+01  3.64E+01  2.17E+01  1.30E+01  7.77E+00
4.64E+00  2.77E+00  1.66E+00  9.90E-01  5.92E-01  3.54E-01  2.11E-01  1.26E-01  7.55E-02  4.51E-02
2.69E-02  1.61E-02  9.62E-03  5.75E-03  3.44E-03  2.05E-03  1.23E-03  7.33E-04  4.38E-04  2.62E-04
1.56E-04  9.35E-05  5.59E-05  3.34E-05  2.00E-05  1.19E-05  7.12E-06  4.26E-06  2.54E-06  1.52E-06
9.09E-07  5.43E-07  3.24E-07  1.94E-07  1.16E-07  6.92E-08  2.47E-08  8.83E-09  3.15E-09  1.13E-09
4.02E-10  1.11E-10  3.06E-11  8.46E-12  2.33E-12  6.44E-13  1.78E-13  4.91E-14  1.36E-14
   Eu-154           8.59E+00  4.87E+08  2.35E+08  1.85E+08  1.45E+08  1.14E+08  8.92E+07  7.00E+07
5.49E+07  4.31E+07  2.88E+07  1.92E+07  1.28E+07  8.55E+06  5.71E+06  3.81E+06  2.54E+06  1.70E+06
1.13E+06  7.57E+05  5.05E+05  3.37E+05  2.25E+05  1.50E+05  1.00E+05  6.70E+04  4.47E+04  2.98E+04
1.99E+04  1.33E+04  8.88E+03  5.92E+03  3.95E+03  2.64E+03  1.76E+03  1.18E+03  7.85E+02  5.24E+02
3.50E+02  2.34E+02  1.56E+02  1.04E+02  6.95E+01  4.64E+01  3.10E+01  2.07E+01  1.38E+01  9.21E+00
6.15E+00  4.10E+00  2.74E+00  1.83E+00  1.22E+00  8.15E-01  5.44E-01  3.63E-01  2.42E-01  1.62E-01
1.08E-01  7.21E-02  4.81E-02  3.21E-02  2.14E-02  1.43E-02  6.38E-03  2.84E-03  1.27E-03  5.64E-04
2.51E-04  1.12E-04  4.99E-05  2.22E-05  9.91E-06  4.42E-06  1.97E-06  8.77E-07  3.91E-07  1.74E-07
7.76E-08  3.46E-08  1.54E-08  6.86E-09  3.06E-09  1.36E-09  6.07E-10  2.71E-10  1.21E-10  5.37E-11
2.39E-11  1.07E-11  4.75E-12  2.12E-12  9.44E-13  4.20E-13  1.87E-13  8.35E-14  3.72E-14  1.66E-14
7.39E-15  3.29E-15  1.47E-15  6.53E-16  2.91E-16  1.30E-16  2.58E-17  5.11E-18  1.02E-18  2.02E-19
4.00E-20  5.31E-21  7.03E-22  9.32E-23  1.24E-23  1.64E-24  2.17E-25  2.88E-26  3.81E-27
   Eu-155           4.76E+00  7.92E+02  2.13E+02  1.38E+02  8.90E+01  5.74E+01  3.71E+01  2.40E+01
1.55E+01  9.99E+00  4.82E+00  2.33E+00  1.12E+00  5.41E-01  2.61E-01  1.26E-01  6.08E-02  2.93E-02
1.42E-02  6.83E-03  3.30E-03  1.59E-03  7.67E-04  3.70E-04  1.79E-04  8.62E-05  4.16E-05  2.01E-05
9.68E-06  4.67E-06  2.25E-06  1.09E-06  5.24E-07  2.53E-07  1.22E-07  5.89E-08  2.84E-08  1.37E-08
6.62E-09  3.19E-09  1.54E-09  7.43E-10  3.59E-10  1.73E-10  8.35E-11  4.03E-11  1.94E-11  9.37E-12
4.52E-12  2.18E-12  1.05E-12  5.08E-13  2.45E-13  1.18E-13  5.71E-14  2.75E-14  1.33E-14  6.41E-15
3.09E-15  1.49E-15  7.20E-16  3.47E-16  1.68E-16  8.08E-17  1.88E-17  4.38E-18  1.02E-18  2.37E-19
5.53E-20  1.29E-20  2.99E-21  6.97E-22  1.62E-22  3.78E-23  8.79E-24  2.05E-24  4.77E-25  1.11E-25
2.58E-26  6.01E-27  1.40E-27  3.26E-28  7.58E-29  1.77E-29  4.11E-30  9.57E-31  2.23E-31  5.18E-32
1.21E-32  2.81E-33  6.54E-34  1.52E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-55            2.73E+00  7.92E+02  8.01E+01  3.73E+01  1.74E+01  8.11E+00  3.78E+00  1.76E+00
8.20E-01  3.82E-01  1.07E-01  3.00E-02  8.39E-03  2.35E-03  6.58E-04  1.84E-04  5.16E-05  1.45E-05
4.05E-06  1.13E-06  3.18E-07  8.89E-08  2.49E-08  6.98E-09  1.95E-09  5.47E-10  1.53E-10  4.29E-11
1.20E-11  3.37E-12  9.43E-13  2.64E-13  7.39E-14  2.07E-14  5.80E-15  1.62E-15  4.55E-16  1.27E-16
3.57E-17  9.99E-18  2.80E-18  7.83E-19  2.19E-19  6.15E-20  1.72E-20  4.82E-21  1.35E-21  3.78E-22
1.06E-22  2.96E-23  8.30E-24  2.33E-24  6.51E-25  1.82E-25  5.11E-26  1.43E-26  4.01E-27  1.12E-27
3.14E-28  8.80E-29  2.46E-29  6.90E-30  1.93E-30  5.41E-31  4.25E-32  3.33E-33  2.61E-34  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Fe-60            1.50E+06  7.15E+03  7.11E+03  7.09E+03  7.08E+03  7.07E+03  7.05E+03  7.04E+03
7.02E+03  7.01E+03  6.99E+03  6.97E+03  6.94E+03  6.92E+03  6.90E+03  6.88E+03  6.85E+03  6.83E+03
6.81E+03  6.79E+03  6.76E+03  6.74E+03  6.72E+03  6.70E+03  6.68E+03  6.65E+03  6.63E+03  6.61E+03
6.59E+03  6.57E+03  6.55E+03  6.52E+03  6.50E+03  6.48E+03  6.46E+03  6.44E+03  6.42E+03  6.40E+03
6.38E+03  6.36E+03  6.34E+03  6.32E+03  6.29E+03  6.27E+03  6.25E+03  6.23E+03  6.21E+03  6.19E+03
6.17E+03  6.15E+03  6.13E+03  6.11E+03  6.09E+03  6.07E+03  6.05E+03  6.03E+03  6.01E+03  5.99E+03
5.97E+03  5.95E+03  5.94E+03  5.92E+03  5.90E+03  5.88E+03  5.84E+03  5.80E+03  5.76E+03  5.73E+03
5.69E+03  5.65E+03  5.61E+03  5.58E+03  5.54E+03  5.51E+03  5.47E+03  5.43E+03  5.40E+03  5.36E+03
5.33E+03  5.29E+03  5.26E+03  5.22E+03  5.19E+03  5.16E+03  5.12E+03  5.09E+03  5.06E+03  5.02E+03
4.99E+03  4.96E+03  4.93E+03  4.89E+03  4.86E+03  4.83E+03  4.80E+03  4.77E+03  4.74E+03  4.71E+03
4.68E+03  4.65E+03  4.61E+03  4.58E+03  4.55E+03  4.53E+03  4.47E+03  4.41E+03  4.35E+03  4.29E+03
4.24E+03  4.17E+03  4.10E+03  4.04E+03  3.97E+03  3.91E+03  3.84E+03  3.78E+03  3.72E+03
   Gd-148           7.46E+01  5.80E+07  5.33E+07  5.18E+07  5.03E+07  4.89E+07  4.76E+07  4.62E+07
4.50E+07  4.37E+07  4.17E+07  3.98E+07  3.79E+07  3.62E+07  3.45E+07  3.29E+07  3.14E+07  3.00E+07
2.86E+07  2.73E+07  2.60E+07  2.48E+07  2.37E+07  2.26E+07  2.15E+07  2.05E+07  1.96E+07  1.87E+07
1.78E+07  1.70E+07  1.62E+07  1.55E+07  1.48E+07  1.41E+07  1.34E+07  1.28E+07  1.22E+07  1.17E+07
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1.11E+07  1.06E+07  1.01E+07  9.66E+06  9.21E+06  8.79E+06  8.38E+06  8.00E+06  7.63E+06  7.28E+06
6.94E+06  6.62E+06  6.32E+06  6.03E+06  5.75E+06  5.48E+06  5.23E+06  4.99E+06  4.76E+06  4.54E+06
4.33E+06  4.13E+06  3.94E+06  3.76E+06  3.59E+06  3.42E+06  3.11E+06  2.83E+06  2.58E+06  2.35E+06
2.13E+06  1.94E+06  1.77E+06  1.61E+06  1.46E+06  1.33E+06  1.21E+06  1.10E+06  1.00E+06  9.13E+05
8.31E+05  7.56E+05  6.88E+05  6.26E+05  5.70E+05  5.18E+05  4.72E+05  4.29E+05  3.91E+05  3.56E+05
3.24E+05  2.94E+05  2.68E+05  2.44E+05  2.22E+05  2.02E+05  1.84E+05  1.67E+05  1.52E+05  1.38E+05
1.26E+05  1.15E+05  1.04E+05  9.49E+04  8.63E+04  7.86E+04  6.51E+04  5.39E+04  4.46E+04  3.69E+04
3.06E+04  2.42E+04  1.91E+04  1.51E+04  1.19E+04  9.41E+03  7.43E+03  5.87E+03  4.64E+03
   H-3              1.23E+01  4.50E+01  2.40E+01  1.95E+01  1.58E+01  1.28E+01  1.04E+01  8.46E+00
6.86E+00  5.57E+00  3.93E+00  2.77E+00  1.96E+00  1.38E+00  9.76E-01  6.89E-01  4.86E-01  3.43E-01
2.42E-01  1.71E-01  1.21E-01  8.53E-02  6.02E-02  4.25E-02  3.00E-02  2.12E-02  1.49E-02  1.05E-02
7.45E-03  5.26E-03  3.71E-03  2.62E-03  1.85E-03  1.31E-03  9.21E-04  6.50E-04  4.59E-04  3.24E-04
2.29E-04  1.62E-04  1.14E-04  8.05E-05  5.68E-05  4.01E-05  2.83E-05  2.00E-05  1.41E-05  9.96E-06
7.03E-06  4.96E-06  3.50E-06  2.47E-06  1.75E-06  1.23E-06  8.70E-07  6.14E-07  4.33E-07  3.06E-07
2.16E-07  1.52E-07  1.08E-07  7.60E-08  5.36E-08  3.79E-08  1.89E-08  9.40E-09  4.68E-09  2.33E-09
1.16E-09  5.80E-10  2.89E-10  1.44E-10  7.17E-11  3.57E-11  1.78E-11  8.88E-12  4.42E-12  2.20E-12
1.10E-12  5.47E-13  2.73E-13  1.36E-13  6.77E-14  3.37E-14  1.68E-14  8.38E-15  4.18E-15  2.08E-15
1.04E-15  5.17E-16  2.57E-16  1.28E-16  6.39E-17  3.19E-17  1.59E-17  7.91E-18  3.94E-18  1.96E-18
9.79E-19  4.88E-19  2.43E-19  1.21E-19  6.03E-20  3.01E-20  7.47E-21  1.85E-21  4.60E-22  1.14E-22
2.84E-23  4.98E-24  8.72E-25  1.53E-25  2.68E-26  4.70E-27  8.23E-28  1.44E-28  2.53E-29
   Hg-194           4.44E+02  6.38E+06  6.29E+06  6.25E+06  6.22E+06  6.19E+06  6.16E+06  6.13E+06
6.10E+06  6.07E+06  6.02E+06  5.97E+06  5.92E+06  5.87E+06  5.83E+06  5.78E+06  5.73E+06  5.68E+06
5.64E+06  5.59E+06  5.54E+06  5.50E+06  5.45E+06  5.41E+06  5.36E+06  5.32E+06  5.27E+06  5.23E+06
5.19E+06  5.15E+06  5.10E+06  5.06E+06  5.02E+06  4.98E+06  4.94E+06  4.90E+06  4.86E+06  4.82E+06
4.78E+06  4.74E+06  4.70E+06  4.66E+06  4.62E+06  4.58E+06  4.55E+06  4.51E+06  4.47E+06  4.43E+06
4.40E+06  4.36E+06  4.33E+06  4.29E+06  4.25E+06  4.22E+06  4.18E+06  4.15E+06  4.12E+06  4.08E+06
4.05E+06  4.01E+06  3.98E+06  3.95E+06  3.92E+06  3.88E+06  3.82E+06  3.76E+06  3.70E+06  3.64E+06
3.58E+06  3.52E+06  3.46E+06  3.40E+06  3.35E+06  3.29E+06  3.24E+06  3.18E+06  3.13E+06  3.08E+06
3.03E+06  2.98E+06  2.93E+06  2.88E+06  2.84E+06  2.79E+06  2.74E+06  2.70E+06  2.65E+06  2.61E+06
2.57E+06  2.53E+06  2.48E+06  2.44E+06  2.40E+06  2.36E+06  2.33E+06  2.29E+06  2.25E+06  2.21E+06
2.18E+06  2.14E+06  2.11E+06  2.07E+06  2.04E+06  2.00E+06  1.94E+06  1.88E+06  1.81E+06  1.76E+06
1.70E+06  1.63E+06  1.56E+06  1.50E+06  1.44E+06  1.38E+06  1.33E+06  1.27E+06  1.22E+06
   Np-237           2.14E+06  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02
1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02
1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02  1.66E-02
1.65E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.64E-02  1.63E-02  1.63E-02  1.62E-02
1.62E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02  1.59E-02  1.58E-02  1.58E-02  1.57E-02
1.57E-02  1.56E-02  1.56E-02  1.55E-02  1.55E-02  1.54E-02  1.54E-02  1.53E-02  1.53E-02  1.52E-02
1.52E-02  1.51E-02  1.51E-02  1.51E-02  1.50E-02  1.50E-02  1.49E-02  1.49E-02  1.48E-02  1.48E-02
1.47E-02  1.47E-02  1.46E-02  1.46E-02  1.46E-02  1.45E-02  1.44E-02  1.43E-02  1.42E-02  1.42E-02
1.41E-02  1.40E-02  1.39E-02  1.37E-02  1.36E-02  1.35E-02  1.34E-02  1.33E-02  1.32E-02
   Am-241           4.32E+02  1.80E-02  1.76E-02  1.75E-02  1.73E-02  1.72E-02  1.71E-02  1.69E-02
1.68E-02  1.67E-02  1.65E-02  1.63E-02  1.61E-02  1.59E-02  1.57E-02  1.55E-02  1.53E-02  1.51E-02
1.49E-02  1.47E-02  1.45E-02  1.44E-02  1.42E-02  1.40E-02  1.38E-02  1.37E-02  1.35E-02  1.33E-02
1.32E-02  1.30E-02  1.28E-02  1.27E-02  1.25E-02  1.24E-02  1.22E-02  1.20E-02  1.19E-02  1.17E-02
1.16E-02  1.15E-02  1.13E-02  1.12E-02  1.10E-02  1.09E-02  1.08E-02  1.06E-02  1.05E-02  1.04E-02
1.02E-02  1.01E-02  9.98E-03  9.85E-03  9.73E-03  9.61E-03  9.49E-03  9.37E-03  9.25E-03  9.14E-03
9.02E-03  8.91E-03  8.80E-03  8.69E-03  8.58E-03  8.48E-03  8.27E-03  8.06E-03  7.86E-03  7.67E-03
7.48E-03  7.29E-03  7.11E-03  6.93E-03  6.76E-03  6.59E-03  6.43E-03  6.27E-03  6.12E-03  5.96E-03
5.82E-03  5.67E-03  5.53E-03  5.39E-03  5.26E-03  5.13E-03  5.00E-03  4.88E-03  4.76E-03  4.64E-03
4.52E-03  4.41E-03  4.30E-03  4.20E-03  4.09E-03  3.99E-03  3.89E-03  3.80E-03  3.70E-03  3.61E-03
3.52E-03  3.43E-03  3.35E-03  3.26E-03  3.18E-03  3.11E-03  2.95E-03  2.81E-03  2.67E-03  2.54E-03
2.42E-03  2.27E-03  2.13E-03  2.00E-03  1.88E-03  1.77E-03  1.66E-03  1.56E-03  1.46E-03
   Cm-244           1.81E+01  1.80E-02  1.28E-02  1.14E-02  1.01E-02  9.03E-03  8.05E-03  7.18E-03
6.40E-03  5.70E-03  4.71E-03  3.89E-03  3.21E-03  2.65E-03  2.19E-03  1.81E-03  1.49E-03  1.23E-03
1.02E-03  8.40E-04  6.94E-04  5.73E-04  4.73E-04  3.91E-04  3.22E-04  2.66E-04  2.20E-04  1.82E-04
1.50E-04  1.24E-04  1.02E-04  8.44E-05  6.97E-05  5.75E-05  4.75E-05  3.92E-05  3.24E-05  2.67E-05
2.21E-05  1.82E-05  1.51E-05  1.24E-05  1.03E-05  8.47E-06  7.00E-06  5.78E-06  4.77E-06  3.94E-06
3.25E-06  2.69E-06  2.22E-06  1.83E-06  1.51E-06  1.25E-06  1.03E-06  8.51E-07  7.03E-07  5.80E-07
4.79E-07  3.96E-07  3.27E-07  2.70E-07  2.23E-07  1.84E-07  1.25E-07  8.55E-08  5.83E-08  3.97E-08
2.71E-08  1.85E-08  1.26E-08  8.58E-09  5.85E-09  3.99E-09  2.72E-09  1.85E-09  1.26E-09  8.62E-10
5.88E-10  4.01E-10  2.73E-10  1.86E-10  1.27E-10  8.66E-11  5.90E-11  4.02E-11  2.74E-11  1.87E-11
1.28E-11  8.69E-12  5.93E-12  4.04E-12  2.76E-12  1.88E-12  1.28E-12  8.73E-13  5.95E-13  4.06E-13
2.77E-13  1.89E-13  1.29E-13  8.77E-14  5.98E-14  4.08E-14  1.89E-14  8.81E-15  4.09E-15  1.90E-15
8.84E-16  3.39E-16  1.30E-16  5.00E-17  1.92E-17  7.36E-18  2.83E-18  1.08E-18  4.16E-19
   Ho-166m          1.20E+03  3.24E+06  3.21E+06  3.20E+06  3.19E+06  3.19E+06  3.18E+06  3.17E+06
3.16E+06  3.15E+06  3.13E+06  3.12E+06  3.10E+06  3.09E+06  3.08E+06  3.06E+06  3.05E+06  3.03E+06
3.02E+06  3.00E+06  2.99E+06  2.98E+06  2.96E+06  2.95E+06  2.93E+06  2.92E+06  2.91E+06  2.89E+06
2.88E+06  2.86E+06  2.85E+06  2.84E+06  2.82E+06  2.81E+06  2.80E+06  2.78E+06  2.77E+06  2.76E+06
2.75E+06  2.73E+06  2.72E+06  2.71E+06  2.69E+06  2.68E+06  2.67E+06  2.66E+06  2.64E+06  2.63E+06
2.62E+06  2.61E+06  2.59E+06  2.58E+06  2.57E+06  2.56E+06  2.55E+06  2.53E+06  2.52E+06  2.51E+06
2.50E+06  2.49E+06  2.47E+06  2.46E+06  2.45E+06  2.44E+06  2.42E+06  2.39E+06  2.37E+06  2.35E+06
2.33E+06  2.30E+06  2.28E+06  2.26E+06  2.24E+06  2.22E+06  2.20E+06  2.18E+06  2.16E+06  2.14E+06
2.12E+06  2.10E+06  2.08E+06  2.06E+06  2.04E+06  2.02E+06  2.00E+06  1.98E+06  1.96E+06  1.94E+06
1.93E+06  1.91E+06  1.89E+06  1.87E+06  1.85E+06  1.84E+06  1.82E+06  1.80E+06  1.78E+06  1.77E+06
1.75E+06  1.73E+06  1.72E+06  1.70E+06  1.69E+06  1.67E+06  1.64E+06  1.61E+06  1.58E+06  1.55E+06
1.52E+06  1.48E+06  1.45E+06  1.42E+06  1.38E+06  1.35E+06  1.32E+06  1.29E+06  1.26E+06
```

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   I-129            1.57E+07  3.94E-05  3.73E-05  3.66E-05  3.59E-05  3.52E-05  3.46E-05  3.39E-05
3.33E-05  3.27E-05  3.17E-05  3.07E-05  2.98E-05  2.89E-05  2.80E-05  2.71E-05  2.63E-05  2.55E-05
2.47E-05  2.40E-05  2.32E-05  2.25E-05  2.18E-05  2.12E-05  2.05E-05  1.99E-05  1.93E-05  1.87E-05
1.81E-05  1.76E-05  1.70E-05  1.65E-05  1.60E-05  1.55E-05  1.50E-05  1.46E-05  1.41E-05  1.37E-05
1.33E-05  1.29E-05  1.25E-05  1.21E-05  1.17E-05  1.14E-05  1.10E-05  1.07E-05  1.03E-05  1.00E-05
9.72E-06  9.42E-06  9.13E-06  8.85E-06  8.58E-06  8.32E-06  8.07E-06  7.82E-06  7.58E-06  7.35E-06
7.12E-06  6.90E-06  6.69E-06  6.49E-06  6.29E-06  6.10E-06  5.73E-06  5.38E-06  5.06E-06  4.75E-06
4.47E-06  4.20E-06  3.94E-06  3.71E-06  3.48E-06  3.27E-06  3.08E-06  2.89E-06  2.72E-06  2.55E-06
2.40E-06  2.25E-06  2.12E-06  1.99E-06  1.87E-06  1.76E-06  1.65E-06  1.55E-06  1.46E-06  1.37E-06
1.29E-06  1.21E-06  1.14E-06  1.07E-06  1.00E-06  9.43E-07  8.87E-07  8.33E-07  7.83E-07  7.36E-07
6.91E-07  6.50E-07  6.10E-07  5.74E-07  5.39E-07  5.06E-07  4.47E-07  3.95E-07  3.49E-07  3.08E-07
2.72E-07  2.33E-07  1.99E-07  1.71E-07  1.46E-07  1.25E-07  1.07E-07  9.16E-08  7.84E-08
   Mn-53            3.74E+06  3.24E+03  3.24E+03  3.23E+03  3.23E+03  3.23E+03  3.23E+03  3.23E+03
3.23E+03  3.23E+03  3.22E+03  3.22E+03  3.22E+03  3.22E+03  3.21E+03  3.21E+03  3.21E+03  3.21E+03
3.20E+03  3.20E+03  3.20E+03  3.20E+03  3.20E+03  3.19E+03  3.19E+03  3.19E+03  3.19E+03  3.18E+03
3.18E+03  3.18E+03  3.18E+03  3.17E+03  3.17E+03  3.17E+03  3.17E+03  3.17E+03  3.16E+03  3.16E+03
3.16E+03  3.16E+03  3.15E+03  3.15E+03  3.15E+03  3.15E+03  3.14E+03  3.14E+03  3.14E+03  3.14E+03
3.14E+03  3.13E+03  3.13E+03  3.13E+03  3.13E+03  3.12E+03  3.12E+03  3.12E+03  3.12E+03  3.12E+03
3.11E+03  3.11E+03  3.11E+03  3.11E+03  3.10E+03  3.10E+03  3.10E+03  3.09E+03  3.09E+03  3.08E+03
3.08E+03  3.08E+03  3.07E+03  3.07E+03  3.06E+03  3.06E+03  3.05E+03  3.05E+03  3.04E+03  3.04E+03
3.04E+03  3.03E+03  3.03E+03  3.02E+03  3.02E+03  3.01E+03  3.01E+03  3.00E+03  3.00E+03  3.00E+03
2.99E+03  2.99E+03  2.98E+03  2.98E+03  2.97E+03  2.97E+03  2.97E+03  2.96E+03  2.96E+03  2.95E+03
2.95E+03  2.94E+03  2.94E+03  2.94E+03  2.93E+03  2.93E+03  2.92E+03  2.91E+03  2.90E+03  2.89E+03
2.88E+03  2.87E+03  2.86E+03  2.85E+03  2.84E+03  2.83E+03  2.82E+03  2.81E+03  2.80E+03
   Na-22            2.60E+00  7.92E+02  7.13E+01  3.20E+01  1.43E+01  6.42E+00  2.88E+00  1.29E+00
5.78E-01  2.59E-01  6.80E-02  1.79E-02  4.69E-03  1.23E-03  3.23E-04  8.48E-05  2.23E-05  5.84E-06
1.53E-06  4.03E-07  1.06E-07  2.77E-08  7.28E-09  1.91E-09  5.02E-10  1.32E-10  3.46E-11  9.07E-12
2.38E-12  6.25E-13  1.64E-13  4.31E-14  1.13E-14  2.97E-15  7.79E-16  2.05E-16  5.37E-17  1.41E-17
3.70E-18  9.71E-19  2.55E-19  6.69E-20  1.76E-20  4.61E-21  1.21E-21  3.18E-22  8.34E-23  2.19E-23
5.75E-24  1.51E-24  3.96E-25  1.04E-25  2.73E-26  7.16E-27  1.88E-27  4.94E-28  1.30E-28  3.40E-29
8.93E-30  2.34E-30  6.15E-31  1.62E-31  4.24E-32  1.11E-32  7.67E-34  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Nb-91            6.80E+02  1.04E+07  1.03E+07  1.02E+07  1.02E+07  1.01E+07  1.01E+07  1.00E+07
9.96E+06  9.91E+06  9.84E+06  9.76E+06  9.68E+06  9.60E+06  9.53E+06  9.45E+06  9.38E+06  9.30E+06
9.23E+06  9.16E+06  9.08E+06  9.01E+06  8.94E+06  8.87E+06  8.80E+06  8.73E+06  8.66E+06  8.59E+06
8.52E+06  8.46E+06  8.39E+06  8.32E+06  8.26E+06  8.19E+06  8.13E+06  8.06E+06  8.00E+06  7.93E+06
7.87E+06  7.81E+06  7.75E+06  7.68E+06  7.62E+06  7.56E+06  7.50E+06  7.44E+06  7.39E+06  7.33E+06
7.27E+06  7.21E+06  7.15E+06  7.10E+06  7.04E+06  6.98E+06  6.93E+06  6.87E+06  6.82E+06  6.77E+06
6.71E+06  6.66E+06  6.61E+06  6.55E+06  6.50E+06  6.45E+06  6.35E+06  6.25E+06  6.15E+06  6.05E+06
5.96E+06  5.86E+06  5.77E+06  5.68E+06  5.59E+06  5.50E+06  5.41E+06  5.33E+06  5.24E+06  5.16E+06
5.08E+06  5.00E+06  4.92E+06  4.84E+06  4.77E+06  4.69E+06  4.62E+06  4.54E+06  4.47E+06  4.40E+06
4.33E+06  4.26E+06  4.20E+06  4.13E+06  4.06E+06  4.00E+06  3.94E+06  3.88E+06  3.81E+06  3.75E+06
3.69E+06  3.64E+06  3.58E+06  3.52E+06  3.47E+06  3.41E+06  3.30E+06  3.20E+06  3.10E+06  3.00E+06
2.91E+06  2.80E+06  2.69E+06  2.58E+06  2.48E+06  2.38E+06  2.29E+06  2.20E+06  2.12E+06
   Nb-92            3.47E+07  2.02E+02  2.01E+02  2.01E+02  2.00E+02  2.00E+02  2.00E+02  1.99E+02
1.99E+02  1.99E+02  1.98E+02  1.97E+02  1.97E+02  1.96E+02  1.96E+02  1.95E+02  1.95E+02  1.94E+02
1.94E+02  1.93E+02  1.92E+02  1.92E+02  1.91E+02  1.91E+02  1.90E+02  1.90E+02  1.89E+02  1.89E+02
1.88E+02  1.87E+02  1.87E+02  1.86E+02  1.86E+02  1.85E+02  1.85E+02  1.84E+02  1.84E+02  1.83E+02
1.83E+02  1.82E+02  1.82E+02  1.81E+02  1.81E+02  1.80E+02  1.80E+02  1.79E+02  1.79E+02  1.78E+02
1.78E+02  1.77E+02  1.77E+02  1.76E+02  1.76E+02  1.75E+02  1.75E+02  1.74E+02  1.74E+02  1.73E+02
1.73E+02  1.72E+02  1.72E+02  1.71E+02  1.71E+02  1.70E+02  1.69E+02  1.68E+02  1.67E+02  1.66E+02
1.65E+02  1.64E+02  1.63E+02  1.62E+02  1.62E+02  1.61E+02  1.60E+02  1.59E+02  1.58E+02  1.57E+02
1.56E+02  1.55E+02  1.54E+02  1.53E+02  1.53E+02  1.52E+02  1.51E+02  1.50E+02  1.49E+02  1.48E+02
1.47E+02  1.47E+02  1.46E+02  1.45E+02  1.44E+02  1.43E+02  1.42E+02  1.42E+02  1.41E+02  1.40E+02
1.39E+02  1.38E+02  1.38E+02  1.37E+02  1.36E+02  1.35E+02  1.34E+02  1.32E+02  1.31E+02  1.29E+02
1.28E+02  1.26E+02  1.24E+02  1.22E+02  1.21E+02  1.19E+02  1.17E+02  1.16E+02  1.14E+02
   Nb-93m           1.61E+01  4.74E+08  3.20E+08  2.81E+08  2.46E+08  2.16E+08  1.90E+08  1.66E+08
1.46E+08  1.28E+08  1.03E+08  8.28E+07  6.66E+07  5.35E+07  4.30E+07  3.46E+07  2.78E+07  2.24E+07
1.80E+07  1.45E+07  1.16E+07  9.35E+06  7.51E+06  6.04E+06  4.86E+06  3.91E+06  3.14E+06  2.52E+06
2.03E+06  1.63E+06  1.31E+06  1.06E+06  8.48E+05  6.82E+05  5.48E+05  4.41E+05  3.55E+05  2.85E+05
2.29E+05  1.84E+05  1.48E+05  1.19E+05  9.58E+04  7.70E+04  6.19E+04  4.98E+04  4.00E+04  3.22E+04
2.59E+04  2.08E+04  1.67E+04  1.34E+04  1.08E+04  8.69E+03  6.99E+03  5.62E+03  4.52E+03  3.63E+03
2.92E+03  2.35E+03  1.89E+03  1.52E+03  1.22E+03  9.81E+02  6.34E+02  4.10E+02  2.65E+02  1.71E+02
1.11E+02  7.16E+01  4.63E+01  2.99E+01  1.94E+01  1.25E+01  8.09E+00  5.23E+00  3.38E+00  2.18E+00
1.41E+00  9.13E-01  5.90E-01  3.82E-01  2.47E-01  1.59E-01  1.03E-01  6.66E-02  4.31E-02  2.78E-02
1.80E-02  1.16E-02  7.52E-03  4.86E-03  3.14E-03  2.03E-03  1.31E-03  8.49E-04  5.49E-04  3.55E-04
2.29E-04  1.48E-04  9.59E-05  6.20E-05  4.01E-05  2.59E-05  1.08E-05  4.52E-06  1.89E-06  7.90E-07
3.30E-07  1.11E-07  3.73E-08  1.25E-08  4.21E-09  1.41E-09  4.75E-10  1.60E-10  5.36E-11
   Nb-94            2.03E+04  2.34E-02  2.33E-02  2.32E-02  2.32E-02  2.31E-02  2.31E-02  2.31E-02
2.30E-02  2.30E-02  2.29E-02  2.28E-02  2.28E-02  2.27E-02  2.26E-02  2.26E-02  2.25E-02  2.24E-02
2.24E-02  2.23E-02  2.22E-02  2.22E-02  2.21E-02  2.20E-02  2.20E-02  2.19E-02  2.18E-02  2.18E-02
2.17E-02  2.16E-02  2.16E-02  2.15E-02  2.14E-02  2.14E-02  2.13E-02  2.12E-02  2.12E-02  2.11E-02
2.10E-02  2.10E-02  2.09E-02  2.09E-02  2.08E-02  2.07E-02  2.07E-02  2.06E-02  2.05E-02  2.05E-02
2.04E-02  2.04E-02  2.03E-02  2.02E-02  2.02E-02  2.01E-02  2.00E-02  2.00E-02  1.99E-02  1.99E-02
1.98E-02  1.97E-02  1.97E-02  1.96E-02  1.96E-02  1.95E-02  1.94E-02  1.93E-02  1.92E-02  1.90E-02
1.89E-02  1.88E-02  1.87E-02  1.86E-02  1.85E-02  1.84E-02  1.82E-02  1.81E-02  1.80E-02  1.79E-02
1.78E-02  1.77E-02  1.76E-02  1.75E-02  1.74E-02  1.73E-02  1.72E-02  1.71E-02  1.70E-02  1.69E-02
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1.68E-02  1.67E-02  1.66E-02  1.65E-02  1.64E-02  1.63E-02  1.62E-02  1.61E-02  1.60E-02  1.59E-02
1.58E-02  1.57E-02  1.56E-02  1.55E-02  1.54E-02  1.53E-02  1.51E-02  1.49E-02  1.48E-02  1.46E-02
1.44E-02  1.42E-02  1.40E-02  1.38E-02  1.35E-02  1.33E-02  1.31E-02  1.29E-02  1.28E-02
   Ni-59            7.60E+04  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.52E+01  2.51E+01  2.51E+01
2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.51E+01  2.50E+01  2.50E+01  2.50E+01
2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.50E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01  2.49E+01
2.49E+01  2.49E+01  2.49E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01  2.48E+01
2.48E+01  2.47E+01  2.47E+01  2.47E+01  2.47E+01  2.47E+01  2.47E+01  2.47E+01  2.47E+01  2.46E+01
2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.46E+01  2.45E+01  2.45E+01  2.45E+01
2.45E+01  2.45E+01  2.45E+01  2.45E+01  2.45E+01  2.44E+01  2.44E+01  2.44E+01  2.44E+01  2.43E+01
2.43E+01  2.43E+01  2.43E+01  2.42E+01  2.42E+01  2.42E+01  2.42E+01  2.41E+01  2.41E+01  2.41E+01
2.41E+01  2.40E+01  2.40E+01  2.40E+01  2.40E+01  2.39E+01  2.39E+01  2.39E+01  2.39E+01  2.38E+01
2.38E+01  2.38E+01  2.38E+01  2.37E+01  2.37E+01  2.37E+01  2.37E+01  2.37E+01  2.36E+01  2.36E+01
2.36E+01  2.36E+01  2.35E+01  2.35E+01  2.35E+01  2.35E+01  2.34E+01  2.34E+01  2.33E+01  2.33E+01
2.32E+01  2.32E+01  2.31E+01  2.30E+01  2.30E+01  2.29E+01  2.29E+01  2.28E+01  2.28E+01
   Ni-63            1.00E+02  3.96E+00  3.72E+00  3.64E+00  3.56E+00  3.49E+00  3.42E+00  3.35E+00
3.28E+00  3.21E+00  3.10E+00  2.99E+00  2.89E+00  2.79E+00  2.69E+00  2.60E+00  2.51E+00  2.42E+00
2.34E+00  2.26E+00  2.18E+00  2.10E+00  2.03E+00  1.96E+00  1.89E+00  1.83E+00  1.77E+00  1.70E+00
1.65E+00  1.59E+00  1.53E+00  1.48E+00  1.43E+00  1.38E+00  1.33E+00  1.29E+00  1.24E+00  1.20E+00
1.16E+00  1.12E+00  1.08E+00  1.04E+00  1.01E+00  9.72E-01  9.38E-01  9.06E-01  8.75E-01  8.44E-01
8.15E-01  7.87E-01  7.60E-01  7.34E-01  7.08E-01  6.84E-01  6.60E-01  6.38E-01  6.16E-01  5.94E-01
5.74E-01  5.54E-01  5.35E-01  5.16E-01  4.99E-01  4.81E-01  4.49E-01  4.18E-01  3.90E-01  3.63E-01
3.39E-01  3.16E-01  2.94E-01  2.74E-01  2.56E-01  2.38E-01  2.22E-01  2.07E-01  1.93E-01  1.80E-01
1.68E-01  1.56E-01  1.46E-01  1.36E-01  1.27E-01  1.18E-01  1.10E-01  1.03E-01  9.57E-02  8.92E-02
8.31E-02  7.75E-02  7.22E-02  6.73E-02  6.28E-02  5.85E-02  5.45E-02  5.08E-02  4.74E-02  4.42E-02
4.12E-02  3.84E-02  3.58E-02  3.34E-02  3.11E-02  2.90E-02  2.52E-02  2.19E-02  1.90E-02  1.65E-02
1.44E-02  1.20E-02  1.01E-02  8.48E-03  7.11E-03  5.97E-03  5.01E-03  4.20E-03  3.52E-03
   Os-194           6.00E+00  5.53E+08  1.95E+08  1.38E+08  9.75E+07  6.89E+07  4.87E+07  3.44E+07
2.43E+07  1.72E+07  9.63E+06  5.40E+06  3.03E+06  1.70E+06  9.51E+05  5.33E+05  2.99E+05  1.68E+05
9.40E+04  5.27E+04  2.95E+04  1.66E+04  9.29E+03  5.21E+03  2.92E+03  1.64E+03  9.18E+02  5.15E+02
2.88E+02  1.62E+02  9.07E+01  5.08E+01  2.85E+01  1.60E+01  8.96E+00  5.02E+00  2.82E+00  1.58E+00
8.85E-01  4.96E-01  2.78E-01  1.56E-01  8.75E-02  4.90E-02  2.75E-02  1.54E-02  8.64E-03  4.84E-03
2.72E-03  1.52E-03  8.54E-04  4.79E-04  2.68E-04  1.50E-04  8.44E-05  4.73E-05  2.65E-05  1.49E-05
8.34E-06  4.67E-06  2.62E-06  1.47E-06  8.24E-07  4.62E-07  1.45E-07  4.56E-08  1.43E-08  4.51E-09
1.42E-09  4.45E-10  1.40E-10  4.40E-11  1.38E-11  4.35E-12  1.37E-12  4.30E-13  1.35E-13  4.24E-14
1.33E-14  4.19E-15  1.32E-15  4.14E-16  1.30E-16  4.09E-17  1.29E-17  4.05E-18  1.27E-18  4.00E-19
1.26E-19  3.95E-20  1.24E-20  3.90E-21  1.23E-21  3.86E-22  1.21E-22  3.81E-23  1.20E-23  3.76E-24
1.18E-24  3.72E-25  1.17E-25  3.67E-26  1.15E-26  3.63E-27  3.59E-28  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pa-231           3.28E+04  8.46E+04  8.45E+04  8.44E+04  8.44E+04  8.43E+04  8.43E+04  8.42E+04
8.42E+04  8.41E+04  8.40E+04  8.40E+04  8.39E+04  8.38E+04  8.37E+04  8.36E+04  8.36E+04  8.35E+04
8.34E+04  8.33E+04  8.32E+04  8.32E+04  8.31E+04  8.30E+04  8.29E+04  8.28E+04  8.28E+04  8.27E+04
8.26E+04  8.25E+04  8.25E+04  8.24E+04  8.23E+04  8.22E+04  8.21E+04  8.21E+04  8.20E+04  8.19E+04
8.18E+04  8.18E+04  8.17E+04  8.16E+04  8.15E+04  8.14E+04  8.14E+04  8.13E+04  8.12E+04  8.11E+04
8.11E+04  8.10E+04  8.09E+04  8.08E+04  8.07E+04  8.07E+04  8.06E+04  8.05E+04  8.04E+04  8.04E+04
8.03E+04  8.02E+04  8.01E+04  8.01E+04  8.00E+04  7.99E+04  7.98E+04  7.96E+04  7.95E+04  7.93E+04
7.92E+04  7.90E+04  7.89E+04  7.87E+04  7.86E+04  7.84E+04  7.83E+04  7.81E+04  7.80E+04  7.78E+04
7.77E+04  7.75E+04  7.74E+04  7.72E+04  7.71E+04  7.69E+04  7.68E+04  7.66E+04  7.65E+04  7.63E+04
7.62E+04  7.61E+04  7.59E+04  7.58E+04  7.56E+04  7.55E+04  7.53E+04  7.52E+04  7.50E+04  7.49E+04
7.48E+04  7.46E+04  7.45E+04  7.43E+04  7.42E+04  7.41E+04  7.38E+04  7.35E+04  7.32E+04  7.29E+04
7.27E+04  7.23E+04  7.20E+04  7.16E+04  7.13E+04  7.10E+04  7.06E+04  7.03E+04  7.00E+04
   Pb-202           5.25E+04  6.12E+03  6.12E+03  6.12E+03  6.11E+03  6.11E+03  6.11E+03  6.11E+03
6.11E+03  6.11E+03  6.11E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.10E+03  6.09E+03
6.09E+03  6.09E+03  6.09E+03  6.09E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.08E+03  6.07E+03
6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.07E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03  6.06E+03
6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.05E+03  6.04E+03  6.04E+03  6.04E+03  6.04E+03  6.04E+03
6.03E+03  6.03E+03  6.03E+03  6.03E+03  6.03E+03  6.03E+03  6.02E+03  6.02E+03  6.02E+03  6.02E+03
6.02E+03  6.01E+03  6.01E+03  6.01E+03  6.01E+03  6.01E+03  6.00E+03  6.00E+03  6.00E+03  5.99E+03
5.99E+03  5.98E+03  5.98E+03  5.98E+03  5.97E+03  5.97E+03  5.97E+03  5.96E+03  5.96E+03  5.95E+03
5.95E+03  5.95E+03  5.94E+03  5.94E+03  5.94E+03  5.93E+03  5.93E+03  5.93E+03  5.92E+03  5.92E+03
5.91E+03  5.91E+03  5.91E+03  5.90E+03  5.90E+03  5.90E+03  5.89E+03  5.89E+03  5.88E+03  5.88E+03
5.88E+03  5.87E+03  5.87E+03  5.87E+03  5.86E+03  5.86E+03  5.85E+03  5.84E+03  5.84E+03  5.83E+03
5.82E+03  5.81E+03  5.80E+03  5.80E+03  5.79E+03  5.78E+03  5.77E+03  5.76E+03  5.75E+03
   Pb-210           2.23E+01  1.37E+08  1.04E+08  9.43E+07  8.59E+07  7.82E+07  7.13E+07  6.49E+07
5.91E+07  5.38E+07  4.61E+07  3.94E+07  3.38E+07  2.89E+07  2.47E+07  2.12E+07  1.81E+07  1.55E+07
1.33E+07  1.14E+07  9.72E+06  8.32E+06  7.12E+06  6.09E+06  5.21E+06  4.46E+06  3.82E+06  3.27E+06
2.80E+06  2.39E+06  2.05E+06  1.75E+06  1.50E+06  1.28E+06  1.10E+06  9.41E+05  8.05E+05  6.89E+05
5.90E+05  5.05E+05  4.32E+05  3.70E+05  3.16E+05  2.71E+05  2.32E+05  1.98E+05  1.70E+05  1.45E+05
1.24E+05  1.06E+05  9.11E+04  7.80E+04  6.67E+04  5.71E+04  4.89E+04  4.18E+04  3.58E+04  3.06E+04
2.62E+04  2.24E+04  1.92E+04  1.64E+04  1.41E+04  1.20E+04  8.82E+03  6.46E+03  4.73E+03  3.47E+03
2.54E+03  1.86E+03  1.36E+03  9.98E+02  7.31E+02  5.35E+02  3.92E+02  2.87E+02  2.10E+02  1.54E+02
1.13E+02  8.27E+01  6.06E+01  4.44E+01  3.25E+01  2.38E+01  1.74E+01  1.28E+01  9.35E+00  6.85E+00
5.02E+00  3.68E+00  2.69E+00  1.97E+00  1.44E+00  1.06E+00  7.75E-01  5.68E-01  4.16E-01  3.05E-01
2.23E-01  1.63E-01  1.20E-01  8.77E-02  6.42E-02  4.70E-02  2.52E-02  1.35E-02  7.26E-03  3.90E-03
2.09E-03  9.60E-04  4.41E-04  2.02E-04  9.30E-05  4.27E-05  1.96E-05  9.00E-06  4.13E-06
   Pd-107           6.50E+06  9.18E+02  9.05E+02  9.00E+02  8.96E+02  8.92E+02  8.87E+02  8.83E+02
8.79E+02  8.75E+02  8.68E+02  8.61E+02  8.54E+02  8.47E+02  8.40E+02  8.33E+02  8.27E+02  8.20E+02
8.14E+02  8.07E+02  8.01E+02  7.94E+02  7.88E+02  7.81E+02  7.75E+02  7.69E+02  7.63E+02  7.57E+02
7.51E+02  7.45E+02  7.39E+02  7.33E+02  7.27E+02  7.21E+02  7.15E+02  7.10E+02  7.04E+02  6.98E+02
6.93E+02  6.87E+02  6.82E+02  6.76E+02  6.71E+02  6.65E+02  6.60E+02  6.55E+02  6.49E+02  6.44E+02
6.39E+02  6.34E+02  6.29E+02  6.24E+02  6.19E+02  6.14E+02  6.09E+02  6.04E+02  5.99E+02  5.94E+02
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5.90E+02  5.85E+02  5.80E+02  5.76E+02  5.71E+02  5.66E+02  5.57E+02  5.48E+02  5.40E+02  5.31E+02
5.23E+02  5.14E+02  5.06E+02  4.98E+02  4.90E+02  4.82E+02  4.74E+02  4.67E+02  4.59E+02  4.52E+02
4.45E+02  4.38E+02  4.31E+02  4.24E+02  4.17E+02  4.10E+02  4.04E+02  3.97E+02  3.91E+02  3.85E+02
3.79E+02  3.73E+02  3.67E+02  3.61E+02  3.55E+02  3.49E+02  3.44E+02  3.38E+02  3.33E+02  3.28E+02
3.22E+02  3.17E+02  3.12E+02  3.07E+02  3.02E+02  2.97E+02  2.88E+02  2.79E+02  2.70E+02  2.61E+02
2.53E+02  2.43E+02  2.34E+02  2.24E+02  2.16E+02  2.07E+02  1.99E+02  1.91E+02  1.83E+02
   Pm-145           1.77E+01  2.52E+08  1.77E+08  1.57E+08  1.40E+08  1.24E+08  1.10E+08  9.81E+07
8.72E+07  7.75E+07  6.37E+07  5.23E+07  4.30E+07  3.53E+07  2.90E+07  2.38E+07  1.96E+07  1.61E+07
1.32E+07  1.09E+07  8.92E+06  7.33E+06  6.02E+06  4.95E+06  4.07E+06  3.34E+06  2.74E+06  2.25E+06
1.85E+06  1.52E+06  1.25E+06  1.03E+06  8.44E+05  6.93E+05  5.70E+05  4.68E+05  3.85E+05  3.16E+05
2.60E+05  2.13E+05  1.75E+05  1.44E+05  1.18E+05  9.72E+04  7.98E+04  6.56E+04  5.39E+04  4.43E+04
3.64E+04  2.99E+04  2.46E+04  2.02E+04  1.66E+04  1.36E+04  1.12E+04  9.19E+03  7.55E+03  6.20E+03
5.10E+03  4.19E+03  3.44E+03  2.83E+03  2.32E+03  1.91E+03  1.29E+03  8.69E+02  5.87E+02  3.96E+02
2.67E+02  1.80E+02  1.22E+02  8.22E+01  5.55E+01  3.75E+01  2.53E+01  1.71E+01  1.15E+01  7.78E+00
5.25E+00  3.54E+00  2.39E+00  1.61E+00  1.09E+00  7.36E-01  4.97E-01  3.35E-01  2.26E-01  1.53E-01
1.03E-01  6.96E-02  4.70E-02  3.17E-02  2.14E-02  1.44E-02  9.75E-03  6.58E-03  4.44E-03  3.00E-03
2.02E-03  1.37E-03  9.22E-04  6.23E-04  4.20E-04  2.84E-04  1.29E-04  5.89E-05  2.68E-05  1.22E-05
5.57E-06  2.08E-06  7.80E-07  2.92E-07  1.09E-07  4.09E-08  1.53E-08  5.74E-09  2.15E-09
   Pm-147           2.62E+00  7.92E+02  7.31E+01  3.31E+01  1.49E+01  6.75E+00  3.05E+00  1.38E+00
6.23E-01  2.82E-01  7.50E-02  2.00E-02  5.32E-03  1.42E-03  3.77E-04  1.00E-04  2.67E-05  7.11E-06
1.89E-06  5.04E-07  1.34E-07  3.57E-08  9.50E-09  2.53E-09  6.73E-10  1.79E-10  4.77E-11  1.27E-11
3.38E-12  9.00E-13  2.39E-13  6.37E-14  1.70E-14  4.52E-15  1.20E-15  3.20E-16  8.52E-17  2.27E-17
6.04E-18  1.61E-18  4.28E-19  1.14E-19  3.03E-20  8.07E-21  2.15E-21  5.72E-22  1.52E-22  4.05E-23
1.08E-23  2.87E-24  7.64E-25  2.03E-25  5.42E-26  1.44E-26  3.84E-27  1.02E-27  2.72E-28  7.24E-29
1.93E-29  5.13E-30  1.37E-30  3.64E-31  9.68E-32  2.58E-32  1.83E-33  1.29E-34  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-208           2.90E+00  7.92E+02  9.21E+01  4.49E+01  2.19E+01  1.07E+01  5.22E+00  2.55E+00
1.24E+00  6.07E-01  1.84E-01  5.56E-02  1.68E-02  5.09E-03  1.54E-03  4.65E-04  1.41E-04  4.26E-05
1.29E-05  3.90E-06  1.18E-06  3.57E-07  1.08E-07  3.27E-08  9.88E-09  2.99E-09  9.04E-10  2.73E-10
8.27E-11  2.50E-11  7.57E-12  2.29E-12  6.93E-13  2.10E-13  6.34E-14  1.92E-14  5.80E-15  1.76E-15
5.31E-16  1.61E-16  4.86E-17  1.47E-17  4.45E-18  1.35E-18  4.07E-19  1.23E-19  3.73E-20  1.13E-20
3.41E-21  1.03E-21  3.12E-22  9.44E-23  2.86E-23  8.64E-24  2.61E-24  7.91E-25  2.39E-25  7.24E-26
2.19E-26  6.63E-27  2.00E-27  6.06E-28  1.83E-28  5.55E-29  5.08E-30  4.65E-31  4.25E-32  3.89E-33
3.56E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Po-209           1.02E+02  3.02E+07  2.84E+07  2.78E+07  2.72E+07  2.67E+07  2.61E+07  2.56E+07
2.51E+07  2.46E+07  2.37E+07  2.29E+07  2.21E+07  2.14E+07  2.07E+07  2.00E+07  1.93E+07  1.86E+07
1.80E+07  1.74E+07  1.68E+07  1.62E+07  1.57E+07  1.51E+07  1.46E+07  1.41E+07  1.37E+07  1.32E+07
1.27E+07  1.23E+07  1.19E+07  1.15E+07  1.11E+07  1.07E+07  1.04E+07  1.00E+07  9.68E+06  9.35E+06
9.03E+06  8.72E+06  8.43E+06  8.14E+06  7.87E+06  7.60E+06  7.34E+06  7.09E+06  6.85E+06  6.62E+06
6.40E+06  6.18E+06  5.97E+06  5.77E+06  5.57E+06  5.38E+06  5.20E+06  5.02E+06  4.85E+06  4.69E+06
4.53E+06  4.38E+06  4.23E+06  4.08E+06  3.95E+06  3.81E+06  3.56E+06  3.32E+06  3.10E+06  2.89E+06
2.70E+06  2.52E+06  2.35E+06  2.20E+06  2.05E+06  1.91E+06  1.79E+06  1.67E+06  1.55E+06  1.45E+06
1.35E+06  1.26E+06  1.18E+06  1.10E+06  1.03E+06  9.59E+05  8.95E+05  8.36E+05  7.80E+05  7.28E+05
6.80E+05  6.34E+05  5.92E+05  5.52E+05  5.16E+05  4.81E+05  4.49E+05  4.19E+05  3.91E+05  3.65E+05
3.41E+05  3.18E+05  2.97E+05  2.77E+05  2.59E+05  2.41E+05  2.10E+05  1.83E+05  1.60E+05  1.39E+05
1.21E+05  1.02E+05  8.58E+04  7.22E+04  6.08E+04  5.11E+04  4.30E+04  3.62E+04  3.05E+04
   Pt-193           5.00E+01  6.66E+07  5.83E+07  5.57E+07  5.33E+07  5.10E+07  4.87E+07  4.66E+07
4.46E+07  4.26E+07  3.96E+07  3.68E+07  3.41E+07  3.17E+07  2.94E+07  2.73E+07  2.53E+07  2.35E+07
2.18E+07  2.03E+07  1.88E+07  1.75E+07  1.62E+07  1.51E+07  1.40E+07  1.30E+07  1.21E+07  1.12E+07
1.04E+07  9.65E+06  8.95E+06  8.31E+06  7.72E+06  7.17E+06  6.65E+06  6.18E+06  5.73E+06  5.32E+06
4.94E+06  4.59E+06  4.26E+06  3.95E+06  3.67E+06  3.41E+06  3.16E+06  2.94E+06  2.73E+06  2.53E+06
2.35E+06  2.18E+06  2.03E+06  1.88E+06  1.75E+06  1.62E+06  1.50E+06  1.40E+06  1.30E+06  1.20E+06
1.12E+06  1.04E+06  9.63E+05  8.94E+05  8.30E+05  7.71E+05  6.64E+05  5.73E+05  4.94E+05  4.25E+05
3.67E+05  3.16E+05  2.72E+05  2.35E+05  2.02E+05  1.74E+05  1.50E+05  1.30E+05  1.12E+05  9.62E+04
8.29E+04  7.15E+04  6.16E+04  5.31E+04  4.58E+04  3.94E+04  3.40E+04  2.93E+04  2.53E+04  2.18E+04
1.88E+04  1.62E+04  1.39E+04  1.20E+04  1.04E+04  8.92E+03  7.69E+03  6.63E+03  5.71E+03  4.92E+03
4.24E+03  3.66E+03  3.15E+03  2.72E+03  2.34E+03  2.02E+03  1.50E+03  1.11E+03  8.27E+02  6.15E+02
4.57E+02  3.15E+02  2.17E+02  1.50E+02  1.03E+02  7.12E+01  4.91E+01  3.39E+01  2.34E+01
*********** MAXIMUM DOSES & DOMINANT NUCLIDES BY PATHWAY **********
 EnergySolns CAW, run VS168W, vert., 0.168 cm/yr inf.
            PATHWAY        DUST          ATMOSPHERIC          GAMMA              WELL              FOOD
        ANNUAL DOSE      0.00E+00          0.00E+00          0.00E+00          0.00E+00          0.00E+00
               YEAR        0                 0                 0                 0                 0
   DOMINANT NUCLIDE
```

# PATHRAE MODEL VERTICAL OUTPUT FILE FILE --168Wb.OUT.docx 0.168 CM/YR CASE -PART 2

```
 PATHRAE-RAD(PC)  Version 2.2d  February 1995
   Date: 11- 2-2011
   Time: 13:59:16
 EnergySolns CAW, run VS168W, vert., 0.168 cm/yr
 *****  Mirror Image of Input Files  *****
 -- Input File:  ABCDEF.DAT
 EnergySolns CAW, run VS168W, vert., 0.168 cm/yr

116,6.,9.,12.,15.,18.,21.,24.,27.,30.,35.,40.,45.,50.,55.,60.,65.,70.,75.,80.,85.,90.,95.,100.,105.,11
0.,115.,120.,125.,130.,135.,14
 41,0,1
 1,2
 0,1.,1.,1.68E-03,1.68E-03,4.072,0
 1563.,0.100,0,0,0.250,3.20E-02,2.09,0
 1,0,0,0,0,0
 0,1.,1.,4.072,0,1800.,1.,0,0,0
 0,0,0,0.0,1.
 0,0,0,0,0,0,0
 0,0,0,0,0,0,0,0,0,0,0
 4,7
 1,0,1,0
 0.00168,0.0171,0.098,0,0,1.,0,1.,0,0.354
 -- Input File:  BRCDCF.DAT
 158,Pu-236  0,0,0,0,0,0,0
 159,Pu-238  0,0,0,0,0,0,0
 160,Pu-239  0,0,0,0,0,0,0
 45,Pu-240   0,0,0,0,0,0,0
 46,Pu-241   0,0,0,0,0,0,0
 161,Pu-242  0,0,0,0,0,0,0
 162,Pu-244  0,0,0,0,0,0,0
 55,Ra-226   0,0,0,0,0,0,0
 163,Ra-228  0,0,0,0,0,0,0
 164,Re-187  0,0,0,0,0,0,0
 165,Se-79   0,0,0,0,0,0,0
 166,Si-32   0,0,0,0,0,0,0
 167,Sm-151  0,0,0,0,0,0,0
 168,Sn-121m 0,0,0,0,0,0,0
 169,Sn-126  0,0,0,0,0,0,0
 170,Sr-90   0,0,0,0,0,0,0
 171,Tb-157  0,0,0,0,0,0,0
 172,Tb-158  0,0,0,0,0,0,0
 173,Tc-99   0,0,0,0,0,0,0
 174,Te-123  0,0,0,0,0,0,0
 175,Th-229  0,0,0,0,0,0,0
 36,Th-230   0,0,0,0,0,0,0
 176,Th-232  0,0,0,0,0,0,0
 177,Ti-44   0,0,0,0,0,0,0
 178,Tl-204  0,0,0,0,0,0,0
 179,Tm-170  0,0,0,0,0,0,0
 180,U-232   0,0,0,0,0,0,0
 181,U-233   0,0,0,0,0,0,0
 182,U-234   0,0,0,0,0,0,0
 183,U-235   0,0,0,0,0,0,0
 40,U-236    0,0,0,0,0,0,0
 41,U-238    0,0,0,0,0,0,0
 184,V-50    0,0,0,0,0,0,0
 185,Zr-93   0,0,0,0,0,0,0
 186,Ks-20   0,0,0,0,0,0,0
 187,Ks-21   0,0,0,0,0,0,0
 188,Ks-22   0,0,0,0,0,0,0
 189,Ks-23   0,0,0,0,0,0,0
 190,Ks-24   0,0,0,0,0,0,0
 191,Ks-25   0,0,0,0,0,0,0
 192,Ks-26   0,0,0,0,0,0,0
 -- Input File:  INVNTRY.DAT
 55,1.60E+03,1.80E-02,0,0,0,0,0
 45,6.56E+03,1.80E-02,0,0,0,0,0
 46,1.44E+01,6.30E-01,0,0,0,0,0
 36,7.54E+04,3.71E+04,0,0,0,0,0
 40,2.34E+07,1.16E+02,0,0,0,0,0
 41,4.47E+09,6.05E-01,0,0,0,0,0
 158,2.86E+00,9.00E-04,0,0,0,0,0
 159,8.77E+01,1.80E-02,0,0,0,0,0
 160,2.41E+04,1.80E-02,0,0,0,0,0
 161,3.73E+05,1.80E-02,0,0,0,0,0
 162,8.08E+07,9.00E-04,0,0,0,0,0
 163,5.75E+00,4.90E+08,0,0,0,0,0
 164,4.35E+10,3.44E-02,0,0,0,0,0
 165,6.50E+04,1.25E+05,0,0,0,0,0
 166,1.72E+02,1.17E+08,0,0,0,0,0
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167,9.00E+01,4.74E+07,0,0,0,0,0
168,5.50E+01,9.68E+07,0,0,0,0,0
169,1.00E+05,5.11E+04,0,0,0,0,0
170,2.88E+01,4.50E-02,0,0,0,0,0
171,7.10E+01,2.70E+07,0,0,0,0,0
172,1.80E+02,2.70E+07,0,0,0,0,0
173,2.11E+05,3.10E-03,0,0,0,0,0
174,1.00E+13,5.24E-04,0,0,0,0,0
175,7.88E+03,3.83E+05,0,0,0,0,0
176,1.41E+10,1.98E-01,0,0,0,0,0
177,6.30E+01,2.81E+08,0,0,0,0,0
178,3.78E+00,7.92E+02,0,0,0,0,0
179,3.52E-01,7.92E+02,0,0,0,0,0
180,6.89E+01,3.97E+07,0,0,0,0,0
181,1.59E+05,1.35E-01,0,0,0,0,0
182,2.46E+05,1.12E+04,0,0,0,0,0
183,7.04E+08,2.79E-02,0,0,0,0,0
184,1.40E+17,9.20E-08,0,0,0,0,0
185,1.53E+06,4.53E+03,0,0,0,0,0
186,1.00E+00,7.92E+02,0,0,0,0,0
187,1.00E+00,7.92E+02,0,0,0,0,0
188,1.00E+00,7.92E+02,0,0,0,0,0
189,1.00E+00,7.92E+02,0,0,0,0,0
190,4.00E+00,7.92E+02,0,0,0,0,0
191,4.00E+00,7.92E+02,0,0,0,0,0
192,2.00E+00,7.92E+02,0,0,0,0,0

-- Input File:  RQSITE.DAT
101,2.06E-04,4.5,4.5
102,3.42E-04,2.7,2.7
103,6.21E-05,15.,15.
48,9.06E-04,1.,1.
104,9.06E-04,1.,1.
105,9.06E-04,1.,1.
106,9.31E-05,10.,10.
107,3.69E-04,2.5,2.5
108,9.06E-04,1.,1.
109,9.06E-04,1.,1.
110,3.00E-02,0.001,0.001
111,1.09E-04,8.52,8.52
112,1.17E-02,0.05,0.05
113,9.06E-04,1.,1.
114,9.06E-04,1.,1.
115,4.60E-04,2.,2.
116,4.60E-04,2.,2.
117,4.60E-04,2.,2.
118,4.60E-04,2.,2.
119,2.86E-02,0.0025,0.0025
120,1.00E-05,93.3,93.3
50,1.00E-05,93.3,93.3
121,1.00E-05,93.3,93.3
122,1.00E-05,93.3,93.3
123,1.00E-05,93.3,93.3
124,1.00E-05,93.3,93.3
125,2.52E-06,370.,370.
126,7.02E-06,133.,133.
127,7.02E-06,133.,133.
128,1.43E-04,6.5,6.5
129,1.43E-04,6.5,6.5
130,1.43E-04,6.5,6.5
131,6.53E-04,1.4,1.4
132,6.53E-04,1.4,1.4
133,1.43E-04,6.5,6.5
134,1.33E-02,0.04,0.04
135,9.31E-05,10.,10.
136,3.69E-04,2.5,2.5
137,6.22E-03,0.12,0.12
139,1.45E-04,6.4,6.4
140,9.06E-04,1.,1.
141,5.73E-04,1.6,1.6
142,5.73E-04,1.6,1.6
143,5.73E-04,1.6,1.6
144,5.73E-04,1.6,1.6
146,9.31E-05,10.,10.
147,9.31E-05,10.,10.
42,3.08E-04,3.,3.
148,2.06E-04,4.5,4.5
149,1.69E-04,5.5,5.5
150,4.90E-05,19.,19.
151,4.90E-05,19.,19.
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152,1.61E-03,0.55,0.55
153,1.43E-04,6.5,6.5
154,1.43E-04,6.5,6.5
155,1.03E-04,9.,9.
156,1.03E-04,9.,9.
157,1.00E-03,0.9,0.9
158,9.31E-05,10.,10.
159,9.31E-05,10.,10.
160,9.31E-05,10.,10.
45,9.31E-05,10.,10.
46,9.31E-05,10.,10.
161,9.31E-05,10.,10.
162,9.31E-05,10,10.
55,9.31E-05,10.,10.
163,9.31E-05,10.,10.
164,8.88E-03,0.075,0.075
165,9.06E-04,1.,1.
166,2.46E-03,0.35,0.35
167,3.76E-04,2.45,2.45
168,1.87E-05,50.,50.
169,1.87E-05,50.,50.
170,1.17E-02,0.05,0.05
171,1.43E-04,6.5,6.5
172,1.43E-04,6.5,6.5
173,6.66E-03,0.11,0.11
174,7.29E-04,1.25,1.25
175,9.31E-05,10.,10.
36,9.31E-05,10.,10.
176,9.31E-05,10.,10.
177,9.31E-05,10.,10.
178,5.18E-03,0.15,0.15
179,1.43E-04,6.5,6.5
180,1.55E-04,6.,6.
181,1.55E-04,6.,6.
182,1.55E-04,6.,6.
183,1.55E-04,6.,6.
40,1.55E-04,6.,6.
41,1.55E-04,6.,6.
184,9.31E-05,10.,10.
185,9.31E-05,10.,10.
186,3.00E-02,0.001,0.001
187,2.33E-02,0.01,0.01
188,7.18E-03,0.1,0.1
189,9.06E-04,1.,1.
190,1.87E-05,50.,50.
191,9.33E-06,100.,100.
192,9.06E-04,1.,1.
-- Input File:  UPTAKE.DAT
1.68E-03,3.54E-01,1.563
0,0,0,0,0
0,0,0
0,0,0,0
0,0,0,0,0
0,0,0,0,0,730.,0
158,0.00E+00,0.0,0.0,0,0,0,0
159,0.00E+00,0.0,0.0,0,0,0,0
160,0.00E+00,0.0,0.0,0,0,0,0
45,0.00E+00,0.0,0.0,0,0,0,0
46,0.00E+00,0.0,0.0,0,0,0,0
161,0.00E+00,0.0,0.0,0,0,0,0
162,0.00E+00,0.0,0.0,0,0,0,0
55,0.00E+00,0.0,0.0,0,0,0,0
163,0.00E+00,0.0,0.0,0,0,0,0
164,0.00E+00,0.0,0.0,0,0,0,0
165,0.00E+00,0.0,0.0,0,0,0,0
166,0.00E+00,0.0,0.0,0,0,0,0
167,0.00E+00,0.0,0.0,0,0,0,0
168,0.00E+00,0.0,0.0,0,0,0,0
169,0.00E+00,0.0,0.0,0,0,0,0
170,0.00E+00,0.0,0.0,0,0,0,0
171,0.00E+00,0.0,0.0,0,0,0,0
172,0.00E+00,0.0,0.0,0,0,0,0
173,0.00E+00,0.0,0.0,0,0,0,0
174,0.00E+00,0.0,0.0,0,0,0,0
175,0.00E+00,0.0,0.0,0,0,0,0
36,0.00E+00,0.0,0.0,0,0,0,0
176,0.00E+00,0.0,0.0,0,0,0,0
177,0.00E+00,0.0,0.0,0,0,0,0
178,0.00E+00,0.0,0.0,0,0,0,0
179,0.00E+00,0.0,0.0,0,0,0,0
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180,0.00E+00,0.0,0.0,0,0,0,0
181,0.00E+00,0.0,0.0,0,0,0,0
182,0.00E+00,0.0,0.0,0,0,0,0
183,0.00E+00,0.0,0.0,0,0,0,0
40,0.00E+00,0.0,0.0,0,0,0,0
41,0.00E+00,0.0,0.0,0,0,0,0
184,0.00E+00,0.0,0.0,0,0,0,0
185,0.00E+00,0.0,0.0,0,0,0,0
186,0.00E+00,0.0,0.0,0,0,0,0
187,0.00E+00,0.0,0.0,0,0,0,0
188,0.00E+00,0.0,0.0,0,0,0,0
189,0.00E+00,0.0,0.0,0,0,0,0
190,0.00E+00,0.0,0.0,0,0,0,0
191,0.00E+00,0.0,0.0,0,0,0,0
192,0.00E+00,0.0,0.0,0,0,0,0

1
                        TOTAL EQUIVALENT UPTAKE FACTORS FOR PATHRAE
                UT(J,1)   UT(J,2)   UT(J,3)   UT(J,4)   UT(J,5)   UT(J,6)
                 RIVER     WELL     EROSION   BATHTUB  SPILLAGE    FOOD
 NUCLIDE         L/YR      L/YR      L/YR      L/YR      L/YR      KG/YR
   Pu-236      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-238      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-239      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-242      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-244      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ra-228      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Re-187      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Se-79       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Si-32       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Sm-151      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Sn-121m     0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Sn-126      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Sr-90       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Tb-157      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Tb-158      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Tc-99       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Te-123      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Th-229      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Th-232      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ti-44       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Tl-204      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Tm-170      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   U-232       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   U-233       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   U-234       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   U-235       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   V-50        0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Zr-93       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-20       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-21       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-22       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-23       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-24       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-25       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ks-26       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Th-230      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   U-236       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   U-238       0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-240      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Pu-241      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
   Ra-226      0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
**********  PATHRAE INPUT SUMMARY  **********
THERE ARE 80 ISOTOPES IN THE DOSE FACTOR LIBRARY
NUMBER OF TIMES FOR CALCULATION IS116
YEARS TO BE CALCULATED ARE ...
     6.00     9.00    12.00    15.00    18.00
    21.00    24.00    27.00    30.00    35.00
    40.00    45.00    50.00    55.00    60.00
    65.00    70.00    75.00    80.00    85.00
    90.00    95.00   100.00   105.00   110.00
   115.00   120.00   125.00   130.00   135.00
   140.00   145.00   150.00   155.00   160.00
   165.00   170.00   175.00   180.00   185.00
   190.00   195.00   200.00   205.00   210.00
   215.00   220.00   225.00   230.00   235.00
   240.00   245.00   250.00   255.00   260.00
   265.00   270.00   275.00   280.00   285.00
   290.00   295.00   300.00   310.00   320.00
   330.00   340.00   350.00   360.00   370.00
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   380.00   390.00   400.00   410.00   420.00
   430.00   440.00   450.00   460.00   470.00
   480.00   490.00   500.00   510.00   520.00
   530.00   540.00   550.00   560.00   570.00
   580.00   590.00   600.00   610.00   620.00
   630.00   640.00   650.00   660.00   670.00
   680.00   690.00   700.00   720.00   740.00
   760.00   780.00   800.00   825.00   850.00
   875.00   900.00   925.00   950.00   975.00
  1000.00
THERE ARE  41 ISOTOPES IN THE INVENTORY FILE
THE VALUE OF IFLAG IS 0
NUMBER OF PATHWAYS IS  1
           PATHWAY           TYPE OF USAGE
                           FOR UPTAKE FACTORS
   1  GROUNDWATER TO RIVER         2
TIME OF OPERATION OF WASTE FACILITY IN YEARS                      0.
LENGTH OF REPOSITORY (M)                                          1.
WIDTH OF REPOSITORY (M)                                           1.
RIVER FLOW RATE (M**3/YR)                                         1.68E-03
STREAM FLOW RATE (M**3/YR)                                        1.68E-03
DISTANCE TO RIVER (M)                                             4.
OPERATIONAL SPILLAGE FRACTION                                     0.00E+00
DENSITY OF AQUIFER (KG/M**3)                                   1563.
LONGITUDINAL DISPERSIVITY (M)                                     1.00E-01
LATERAL DISPERSION COEFFICIENT -- Y AXIS (M**2/YR)                0.00E+00
NUMBER OF MESH POINTS FOR DISPERSION CALCULATION                  1
FLAG FOR GAMMA PATHWAY OPTIONS                                    0
FLAG FOR GAMMA BUILDUP CALCULATION                                0
FLAG FOR ATMOSPHERIC PATHWAY                                      0
COVER THICKNESS OVER WASTE (M)                                     .00
THICKNESS OF WASTE IN PITS (M)                                    1.00
TOTAL WASTE VOLUME (M**3)                                         1.000E+00
DISTANCE TO WELL -- X COORDINATE (M)                              4.
DISTANCE TO WELL -- Y COORDINATE (M)                              0.
DENSITY OF WASTE (KG/M**3)                                     1800.
FRACTION OF FOOD CONSUMED THAT IS GROWN ON SITE                   1.000
FRACTION OF YEAR SPENT IN DIRECT RADIATION FIELD                   .000
DEPTH OF PLANT ROOT ZONE (M)                                       .000
AREAL DENSITY OF PLANTS (KG/M**2)                                  .000
AVERAGE DUST LOADING IN AIR (KG/M**3)                             0.00E+00
ANNUAL ADULT BREATHING RATE (M**3/YR)                             0.
FRACTION OF YEAR EXPOSED TO DUST                                   .000
CANISTER LIFETIME (YEARS)                                         0.
INVENTORY SCALING FACTOR                                          1.00E+00
HEIGHT OF ROOMS IN RECLAIMER HOUSE (CM)                           0.
AIR CHANGE RATE IN RECLAIMER HOUSE (CHANGES/SEC)                  0.00E+00
RADON EMANATING POWER OF THE WASTE                                0.00E+00
DIFFUSION COEFF. OF RADON IN WASTE (CM**2/SEC)                    0.00E+00
DIFFUSION COEFF. OF RN IN CONCRETE (CM**2/SEC)                    0.00E+00
THICKNESS OF CONCRETE SLAB FLOOR (CM)                              .0
DIFFUSION COEFF. OF RADON IN COVER (CM**2/SEC)                    0.00E+00
ATMOSPHERIC STABILITY CLASS                                       0
AVERAGE WIND SPEED (M/S)                                           .00
FRACTION OF TIME WIND BLOWS TOWARD RECEPTOR                        .0000
RECEPTOR DISTANCE FOR ATMOSPHERIC PATHWAY (M)                      .0
DUST RESUSPENSION RATE FOR OFFSITE TRANSPORT (M**3/S)             0.00E+00
DEPOSITION VELOCITY (M/S)                                          .0000
STACK HEIGHT (M)                                                   .0
STACK INSIDE DIAMETER (M)                                          .00
STACK GAS VELOCITY (M/S)                                           .0
HEAT EMISSION RATE FROM BURNING (CAL/S)                           0.00E+00
DECAY CHAIN FLAGS                        4   7   0   0   0   0    0
FLAG FOR INPUT SUMMARY PRINTOUT                                   1
FLAG FOR DIRECTION OF TRENCH FILLING                              1
FLAG FOR GROUNDWATER PATHWAY OPTIONS                              0
AMOUNT OF WATER PERCOLATING THROUGH WASTE ANNUALLY (M)            1.68E-03
DEGREE OF SOIL SATURATION                                          .250
RESIDUAL SOIL SATURATION                                           .032
PERMEABILITY OF VERTICAL ZONE (M/YR)                              2.09
SOIL NUMBER                                                        .000
POROSITY OF AQUIFER                                                .10
POROSITY OF UNSATURATED ZONE                                       .35
DISTANCE FROM AQUIFER TO WASTE (M)                                 .0
AVERAGE VERTICAL GROUNDWATER VELOCITY (M/YR)                      1.90E-02
HORIZONTAL VELOCITY OF AQUIFER (M/YR)                              .0
LENGTH OF PERFORATED WELL CASING (M)                              1.000
SURFACE EROSION RATE (M/YR)                                       0.000E+00
LEACH RATE SCALING FACTOR                                         1.000E+00
ANNUAL RUNOFF OF PRECIPITATION (M)                                0.00E+00
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| NUCLIDE | INGESTION DOSE FACTORS (MREM/PCI) | INHALATION DOSE FACTORS (MREM/PCI) | DIRECT GAMMA DOSE FACTORS (MREM-M2/PCI-YR) | HALF LIFE (YR) |
|---|---|---|---|---|
| Pu-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.860E+00 |
| Pu-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.770E+01 |
| Pu-239 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.410E+04 |
| Pu-242 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.730E+05 |
| Pu-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 8.080E+07 |
| Ra-228 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.750E+00 |
| Re-187 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.350E+10 |
| Se-79 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.500E+04 |
| Si-32 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.720E+02 |
| Sm-151 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 9.000E+01 |
| Sn-121m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 5.500E+01 |
| Sn-126 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+05 |
| Sr-90 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.880E+01 |
| Tb-157 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.100E+01 |
| Tb-158 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.800E+02 |
| Tc-99 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.110E+05 |
| Te-123 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+13 |
| Th-229 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.880E+03 |
| Th-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.410E+10 |
| Ti-44 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.300E+01 |
| Tl-204 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.780E+00 |
| Tm-170 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 3.520E-01 |
| U-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.890E+01 |
| U-233 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.590E+05 |
| U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.460E+05 |
| U-235 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.040E+08 |
| V-50 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.400E+17 |
| Zr-93 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.530E+06 |
| Ks-20 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-21 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-23 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.000E+00 |
| Ks-24 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.000E+00 |
| Ks-25 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.000E+00 |
| Ks-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.000E+00 |
| Th-230 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 7.540E+04 |
| U-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 2.340E+07 |
| U-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 4.470E+09 |
| Pu-240 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 6.560E+03 |
| Pu-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.440E+01 |
| Ra-226 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 1.600E+03 |

| NUCLIDE | VOLATILITY FRACTION | GAMMA ENERGY (MEV) | GAMMA ATTENUATION (1/M) |
|---|---|---|---|
| Pu-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-239 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-242 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-228 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Re-187 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Se-79 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Si-32 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sm-151 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-121m | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-126 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sr-90 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-157 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-158 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tc-99 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Te-123 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-229 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ti-44 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tl-204 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tm-170 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-233 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-235 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| V-50 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Zr-93 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-20 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-21 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-23 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-24 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| | | | |
|---|---|---|---|
| Ks-25 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-230 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-240 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-226 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

| NUCLIDE | INPUT LEACH RATE (1/YR) | FINAL LEACH RATE (1/YR) | SOLUBILITY (MOLE/L) | INPUT INVENTORY (CI) |
|---|---|---|---|---|
| Pu-236 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 9.000E-04 |
| Pu-238 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 1.800E-02 |
| Pu-239 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 1.800E-02 |
| Pu-242 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 1.800E-02 |
| Pu-244 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 9.000E-04 |
| Ra-228 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 4.900E+08 |
| Re-187 | 8.880E-03 | 8.880E-03 | 0.000E+00 | 3.440E-02 |
| Se-79 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 1.250E+05 |
| Si-32 | 2.460E-03 | 2.460E-03 | 0.000E+00 | 1.170E+08 |
| Sm-151 | 3.760E-04 | 3.760E-04 | 0.000E+00 | 4.740E+07 |
| Sn-121m | 1.870E-05 | 1.870E-05 | 0.000E+00 | 9.680E+07 |
| Sn-126 | 1.870E-05 | 1.870E-05 | 0.000E+00 | 5.110E+04 |
| Sr-90 | 1.170E-02 | 1.170E-02 | 0.000E+00 | 4.500E-02 |
| Tb-157 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 2.700E+07 |
| Tb-158 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 2.700E+07 |
| Tc-99 | 6.660E-03 | 6.660E-03 | 0.000E+00 | 3.100E-03 |
| Te-123 | 7.290E-04 | 7.290E-04 | 0.000E+00 | 5.240E-04 |
| Th-229 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 3.830E+05 |
| Th-232 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 1.980E-01 |
| Ti-44 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 2.810E+08 |
| Tl-204 | 5.180E-03 | 5.180E-03 | 0.000E+00 | 7.920E+02 |
| Tm-170 | 1.430E-04 | 1.430E-04 | 0.000E+00 | 7.920E+02 |
| U-232 | 1.550E-04 | 1.550E-04 | 0.000E+00 | 3.970E+07 |
| U-233 | 1.550E-04 | 1.550E-04 | 0.000E+00 | 1.350E-01 |
| U-234 | 1.550E-04 | 1.550E-04 | 0.000E+00 | 1.120E+04 |
| U-235 | 1.550E-04 | 1.550E-04 | 0.000E+00 | 2.790E-02 |
| V-50 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 9.200E-08 |
| Zr-93 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 4.530E+03 |
| Ks-20 | 3.000E-02 | 3.000E-02 | 0.000E+00 | 7.920E+02 |
| Ks-21 | 2.330E-02 | 2.330E-02 | 0.000E+00 | 7.920E+02 |
| Ks-22 | 7.180E-03 | 7.180E-03 | 0.000E+00 | 7.920E+02 |
| Ks-23 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 7.920E+02 |
| Ks-24 | 1.870E-05 | 1.870E-05 | 0.000E+00 | 7.920E+02 |
| Ks-25 | 9.330E-06 | 9.330E-06 | 0.000E+00 | 7.920E+02 |
| Ks-26 | 9.060E-04 | 9.060E-04 | 0.000E+00 | 7.920E+02 |
| Th-230 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 3.710E+04 |
| U-236 | 1.550E-04 | 1.550E-04 | 0.000E+00 | 1.160E+02 |
| U-238 | 1.550E-04 | 1.550E-04 | 0.000E+00 | 6.050E-01 |
| Pu-240 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 1.800E-02 |
| Pu-241 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 6.300E-01 |
| Ra-226 | 9.310E-05 | 9.310E-05 | 0.000E+00 | 1.800E-02 |

| NUCLIDE | AQUIFER SORPTION | AQUIFER RETARDATION | VERTICAL SORPTION | VERTICAL RETARDATION |
|---|---|---|---|---|
| Pu-236 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Pu-238 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Pu-239 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Pu-242 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Pu-244 | 1.000E-05 | 1.000E+00 | 1.000E+01 | 1.776E+02 |
| Ra-228 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Re-187 | 7.500E-02 | 2.196E+00 | 7.500E-02 | 2.325E+00 |
| Se-79 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Si-32 | 3.500E-01 | 6.582E+00 | 3.500E-01 | 7.181E+00 |
| Sm-151 | 2.450E+00 | 4.008E+01 | 2.450E+00 | 4.427E+01 |
| Sn-121m | 5.000E+01 | 7.984E+02 | 5.000E+01 | 8.841E+02 |
| Sn-126 | 5.000E+01 | 7.984E+02 | 5.000E+01 | 8.841E+02 |
| Sr-90 | 5.000E-02 | 1.797E+00 | 5.000E-02 | 1.883E+00 |
| Tb-157 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Tb-158 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| Tc-99 | 1.100E-01 | 2.754E+00 | 1.100E-01 | 2.943E+00 |
| Te-123 | 1.250E+00 | 2.094E+01 | 1.250E+00 | 2.308E+01 |
| Th-229 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Th-232 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Ti-44 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Tl-204 | 1.500E-01 | 3.392E+00 | 1.500E-01 | 3.649E+00 |
| Tm-170 | 6.500E+00 | 1.047E+02 | 6.500E+00 | 1.158E+02 |
| U-232 | 6.000E+00 | 9.669E+01 | 6.000E+00 | 1.070E+02 |
| U-233 | 6.000E+00 | 9.669E+01 | 6.000E+00 | 1.070E+02 |
| U-234 | 6.000E+00 | 9.669E+01 | 6.000E+00 | 1.070E+02 |
| U-235 | 6.000E+00 | 9.669E+01 | 6.000E+00 | 1.070E+02 |
| V-50 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |

| | | | | |
|---|---|---|---|---|
| Zr-93 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Ks-20 | 1.000E-03 | 1.016E+00 | 1.000E-03 | 1.018E+00 |
| Ks-21 | 1.000E-02 | 1.159E+00 | 1.000E-02 | 1.177E+00 |
| Ks-22 | 1.000E-01 | 2.595E+00 | 1.000E-01 | 2.766E+00 |
| Ks-23 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Ks-24 | 5.000E+01 | 7.984E+02 | 5.000E+01 | 8.841E+02 |
| Ks-25 | 1.000E+02 | 1.596E+03 | 1.000E+02 | 1.767E+03 |
| Ks-26 | 1.000E+00 | 1.695E+01 | 1.000E+00 | 1.866E+01 |
| Th-230 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| U-236 | 6.000E+00 | 9.669E+01 | 6.000E+00 | 1.070E+02 |
| U-238 | 6.000E+00 | 9.669E+01 | 6.000E+00 | 1.070E+02 |
| Pu-240 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Pu-241 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |
| Ra-226 | 1.000E+01 | 1.605E+02 | 1.000E+01 | 1.776E+02 |

BIOACCUMULATION FACTORS

| NUCLIDE | SOIL-PLANT Bv | SOIL-PLANT Br | FORAGE-MILK Fm (D/L) | FORAGE-MEAT Ff (D/KG) |
|---|---|---|---|---|
| Pu-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-239 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-242 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-244 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-228 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Re-187 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Se-79 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Si-32 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sm-151 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-121m | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sn-126 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Sr-90 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-157 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tb-158 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tc-99 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Te-123 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-229 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ti-44 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tl-204 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Tm-170 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-232 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-233 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-234 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-235 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| V-50 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Zr-93 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-20 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-21 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-22 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-23 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-24 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-25 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ks-26 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Th-230 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-236 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| U-238 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-240 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Pu-241 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |
| Ra-226 | 0.000E+00 | 0.000E+00 | 0.000E+00 | 0.000E+00 |

PATHWAY 1
GROUNDWATER TO RIVER

********* NUCLIDE DOSES (mrem/yr) ********

| NUCLIDE/TIME | 6. | 9. | 12. | 15. | 18. | 21. | 24. | 27. |
|---|---|---|---|---|---|---|---|---|
| 30. | 35. | 40. | 45. | 50. | 55. | 60. | 65. | 70. |
| 75. | 80. | 85. | 90. | 95. | 100. | 105. | 110. | 115. |
| 120. | 125. | 130. | 135. | 140. | 145. | 150. | 155. | 160. |
| 165. | 170. | 175. | 180. | 185. | 190. | 195. | 200. | 205. |
| 210. | 215. | 220. | 225. | 230. | 235. | 240. | 245. | 250. |
| 255. | 260. | 265. | 270. | 275. | 280. | 285. | 290. | 295. |
| 300. | 310. | 320. | 330. | 340. | 350. | 360. | 370. | 380. |
| 390. | 400. | 410. | 420. | 430. | 440. | 450. | 460. | 470. |
| 480. | 490. | 500. | 510. | 520. | 530. | 540. | 550. | 560. |
| 570. | 580. | 590. | 600. | 610. | 620. | 630. | 640. | 650. |
| 660. | 670. | 680. | 690. | 700. | 720. | 740. | 760. | 780. |
| 800. | 825. | 850. | 875. | 900. | 925. | 950. | 975. | 1000. |
| Pu-236 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-242          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-228          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Re-187          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Se-79           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Si-32          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sm-151         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-121m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-126         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-158          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tc-99           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Te-123          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-229          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ti-44           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tl-204          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tm-170          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-232           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-233           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-234           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-235           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      V-50            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Zr-93           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-20          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-21          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-23          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE DOSES FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
******* SUM OF NUCLIDE RISKS FOR GIVEN TIMES ******
                   0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE CONCENTRATIONS IN RIVER  (Ci/m**3)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Pu-236         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-242          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-244          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-19    8.6E-18    2.1E-16    3.2E-15
3.5E-14    2.8E-13    1.7E-12    8.6E-12    3.6E-11    1.3E-10    4.1E-10    1.1E-09    2.9E-09    6.8E-09
1.5E-08    2.9E-08    5.5E-08    9.7E-08    1.7E-07    2.7E-07    4.2E-07    6.2E-07    9.1E-07    1.3E-06
1.7E-06    2.3E-06    3.0E-06    3.9E-06    4.8E-06    6.0E-06    7.2E-06    8.6E-06    1.0E-05    1.2E-05
1.3E-05    1.5E-05    1.7E-05    1.9E-05    2.1E-05    2.2E-05    2.4E-05    2.6E-05    2.8E-05    3.0E-05
3.1E-05    3.3E-05    3.4E-05    3.6E-05    3.7E-05    4.0E-05    4.2E-05    4.3E-05    4.5E-05    4.6E-05
4.7E-05    4.8E-05    4.8E-05    4.9E-05    4.9E-05    4.9E-05    4.9E-05    4.9E-05    5.0E-05    5.0E-05
5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05
5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05
5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05
      Ra-228          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Re-187          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    4.3E-20    5.6E-19    6.0E-18    5.2E-17
3.8E-16    2.4E-15    1.3E-14    6.3E-14    2.7E-13    1.1E-12    3.8E-12    1.3E-11    3.9E-11    1.1E-10
3.0E-10    7.5E-10    1.8E-09    4.1E-09    9.0E-09    1.9E-08    3.8E-08    7.4E-08    1.4E-07    2.5E-07
4.4E-07    7.6E-07    1.3E-06    2.1E-06    3.3E-06    5.2E-06    8.0E-06    1.2E-05    1.8E-05    2.6E-05
3.7E-05    5.1E-05    7.1E-05    9.7E-05    1.3E-04    2.3E-04    3.8E-04    6.2E-04    9.6E-04    1.4E-03
2.1E-03    3.0E-03    4.1E-03    5.5E-03    7.2E-03    9.2E-03    1.2E-02    1.4E-02    1.7E-02    2.1E-02
2.4E-02    2.8E-02    3.2E-02    3.6E-02    4.1E-02    4.5E-02    4.9E-02    5.2E-02    5.6E-02    5.9E-02
6.1E-02    6.3E-02    6.5E-02    6.6E-02    6.7E-02    6.7E-02    6.7E-02    6.6E-02    6.5E-02    6.4E-02
6.2E-02    6.0E-02    5.7E-02    5.5E-02    5.2E-02    4.7E-02    4.1E-02    3.5E-02    3.0E-02    2.5E-02
2.0E-02    1.6E-02    1.2E-02    9.0E-03    6.7E-03    4.9E-03    3.6E-03    2.6E-03
      Se-79           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.6E-20    4.7E-20    3.6E-19    2.4E-18    1.5E-17    8.1E-17    4.1E-16
2.8E-15    1.7E-14    9.2E-14    4.5E-13    2.0E-12    8.5E-12    3.3E-11    1.2E-10
      Si-32           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.5E-20    7.6E-20    3.5E-19    1.5E-18    6.4E-18    2.5E-17    9.2E-17
3.3E-16    1.1E-15    3.6E-15    1.1E-14    3.3E-14    2.6E-13    1.8E-12    1.1E-11    6.2E-11    3.1E-10
1.4E-09    5.7E-09    2.2E-08    7.8E-08    2.6E-07    8.0E-07    2.4E-06    6.6E-06    1.7E-05    4.4E-05
1.1E-04    2.4E-04    5.4E-04    1.2E-03    2.4E-03    4.8E-03    9.4E-03    1.8E-02    3.3E-02    5.9E-02
1.0E-01    1.8E-01    3.0E-01    4.8E-01    7.8E-01    1.2E+00    1.9E+00    2.9E+00    4.4E+00    6.4E+00
9.4E+00    1.3E+01    1.9E+01    2.7E+01    3.7E+01    6.8E+01    1.2E+02    2.0E+02    3.3E+02    5.2E+02
8.8E+02    1.4E+03    2.2E+03    3.3E+03    4.8E+03    6.8E+03    9.2E+03    1.2E+04
      Sm-151          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sn-121m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sn-126         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.7E-19    2.4E-18    2.7E-17    2.3E-16    1.7E-15    9.8E-15    5.0E-14
2.2E-13    8.4E-13    2.9E-12    9.0E-12    2.6E-11    6.7E-11    1.6E-10    3.7E-10    8.0E-10    1.6E-09
3.1E-09    5.7E-09    1.0E-08    1.7E-08    2.7E-08    4.3E-08    6.6E-08    9.7E-08    1.4E-07    1.9E-07
2.7E-07    3.6E-07    4.7E-07    6.0E-07    7.5E-07    9.3E-07    1.1E-06    1.4E-06    1.6E-06    1.9E-06
2.1E-06    2.4E-06    2.7E-06    3.0E-06    3.3E-06    3.9E-06    4.4E-06    4.7E-06    5.0E-06    5.1E-06
5.1E-06    4.9E-06    4.7E-06    4.4E-06    4.0E-06    3.5E-06    3.1E-06    2.7E-06    2.3E-06    1.9E-06
1.6E-06    1.3E-06    1.0E-06    8.1E-07    6.4E-07    5.0E-07    3.8E-07    2.9E-07    2.2E-07    1.7E-07
1.2E-07    9.2E-08    6.7E-08    4.9E-08    3.6E-08    2.6E-08    1.8E-08    1.3E-08    9.3E-09    6.6E-09
4.6E-09    3.2E-09    2.3E-09    1.6E-09    1.1E-09    5.1E-10    2.4E-10    1.1E-10    5.0E-11    2.3E-11
8.3E-12   3.0E-12   1.1E-12   3.7E-13   1.3E-13   4.5E-14   1.5E-14   5.3E-15
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tb-158         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tc-99          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    5.1E-20    3.4E-19    1.9E-18    9.9E-18    4.6E-17    1.9E-16    7.6E-16
2.7E-15    9.0E-15    2.8E-14    8.2E-14    2.3E-13    6.0E-13    1.5E-12    3.6E-12    8.1E-12    1.8E-11
3.8E-11    7.7E-11    1.5E-10    2.9E-10    5.5E-10    1.0E-09    1.8E-09    3.1E-09    5.2E-09    8.5E-09
1.4E-08    2.2E-08    3.4E-08    5.3E-08    8.0E-08    1.7E-07    3.6E-07    6.9E-07    1.3E-06    2.3E-06
4.0E-06    6.6E-06    1.1E-05    1.6E-05    2.5E-05    3.6E-05    5.2E-05    7.3E-05    1.0E-04    1.4E-04
1.8E-04    2.3E-04    3.0E-04    3.8E-04    4.7E-04    5.7E-04    7.0E-04    8.3E-04    9.9E-04    1.2E-03
1.3E-03    1.5E-03    1.7E-03    2.0E-03    2.2E-03    2.4E-03    2.6E-03    2.9E-03    3.1E-03    3.3E-03
3.5E-03    3.7E-03    3.9E-03    4.1E-03    4.3E-03    4.5E-03    4.7E-03    4.8E-03    4.8E-03    4.7E-03
4.5E-03    4.2E-03    3.8E-03    3.5E-03    3.1E-03    2.7E-03    2.3E-03    1.9E-03
      Te-123         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-229          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ti-44           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tl-204          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tm-170          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-232           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-233          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-234          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-235          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      V-50           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Zr-93          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-20          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-21          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-23          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
 NUCLIDE CONCENTRATIONS IN STREAM (Ci/m**3)
  NUCLIDE/TIME          6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.       850.       875.       900.       925.       950.       975.      1000.
      Pu-236         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-242         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-244         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    2.0E-19    8.6E-18    2.1E-16    3.2E-15
3.5E-14    2.8E-13    1.7E-12    8.6E-12    3.6E-11    1.3E-10    4.1E-10    1.1E-09    2.9E-09    6.8E-09
1.5E-08    2.9E-08    5.5E-08    9.7E-08    1.7E-07    2.7E-07    4.2E-07    6.2E-07    9.1E-07    1.3E-06
1.7E-06    2.3E-06    3.0E-06    3.9E-06    4.8E-06    6.0E-06    7.2E-06    8.6E-06    1.0E-05    1.2E-05
1.3E-05    1.5E-05    1.7E-05    1.9E-05    2.1E-05    2.2E-05    2.4E-05    2.6E-05    2.8E-05    3.0E-05
3.1E-05    3.3E-05    3.4E-05    3.6E-05    3.7E-05    4.0E-05    4.2E-05    4.3E-05    4.5E-05    4.6E-05
4.7E-05    4.8E-05    4.8E-05    4.9E-05    4.9E-05    4.9E-05    4.9E-05    4.9E-05    5.0E-05    5.0E-05
5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05
5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05
5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05    5.0E-05
5.0E-05   5.0E-05   5.0E-05   5.0E-05   5.0E-05   5.0E-05   5.0E-05   5.0E-05
      Ra-228         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Re-187         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    4.3E-20    5.6E-19    6.0E-18    5.2E-17
3.8E-16    2.4E-15    1.3E-14    6.3E-14    2.7E-13    1.1E-12    3.8E-12    1.3E-11    3.9E-11    1.1E-10
3.0E-10    7.5E-10    1.8E-09    4.1E-09    9.0E-09    1.9E-08    3.8E-08    7.4E-08    1.4E-07    2.5E-07
4.4E-07    7.6E-07    1.3E-06    2.1E-06    3.3E-06    5.2E-06    8.0E-06    1.2E-05    1.8E-05    2.6E-05
3.7E-05    5.1E-05    7.1E-05    9.7E-05    1.3E-04    2.3E-04    3.8E-04    6.2E-04    9.6E-04    1.4E-03
2.1E-03    3.0E-03    4.1E-03    5.5E-03    7.2E-03    9.2E-03    1.2E-02    1.4E-02    1.7E-02    2.1E-02
2.4E-02    2.8E-02    3.2E-02    3.6E-02    4.1E-02    4.5E-02    4.9E-02    5.2E-02    5.6E-02    5.9E-02
6.1E-02    6.3E-02    6.5E-02    6.6E-02    6.7E-02    6.7E-02    6.7E-02    6.6E-02    6.5E-02    6.4E-02
6.2E-02    6.0E-02    5.7E-02    5.5E-02    5.2E-02    4.7E-02    4.1E-02    3.5E-02    3.0E-02    2.5E-02
2.0E-02   1.6E-02   1.2E-02   9.0E-03   6.7E-03   4.9E-03   3.6E-03   2.6E-03
      Se-79          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.6E-20    4.7E-20    3.6E-19    2.4E-18    1.5E-17    8.1E-17    4.1E-16
2.8E-15   1.7E-14   9.2E-14   4.5E-13   2.0E-12   8.5E-12   3.3E-11   1.2E-10
      Si-32          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.5E-20    7.6E-20    3.5E-19    1.5E-18    6.4E-18    2.5E-17    9.2E-17
3.3E-16    1.1E-15    3.6E-15    1.1E-14    3.3E-14    2.6E-13    1.8E-12    1.1E-11    6.2E-11    3.1E-10
1.4E-09    5.7E-09    2.2E-08    7.8E-08    2.6E-07    8.0E-07    2.4E-06    6.6E-06    1.7E-05    4.4E-05
1.1E-04    2.4E-04    5.4E-04    1.2E-03    2.4E-03    4.8E-03    9.4E-03    1.8E-02    3.3E-02    5.9E-02
1.0E-01    1.8E-01    3.0E-01    4.8E-01    7.8E-01    1.2E+00    1.9E+00    2.9E+00    4.4E+00    6.4E+00
9.4E+00    1.3E+01    1.9E+01    2.7E+01    3.7E+01    6.8E+01    1.2E+02    2.0E+02    3.3E+02    5.2E+02
8.8E+02   1.4E+03   2.2E+03   3.3E+03   4.8E+03   6.8E+03   9.2E+03   1.2E+04
      Sm-151         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sn-121m        0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sn-126         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    1.7E-19    2.4E-18    2.7E-17    2.3E-16    1.7E-15    9.8E-15    5.0E-14
2.2E-13    8.4E-13    2.9E-12    9.0E-12    2.6E-11    6.7E-11    1.6E-10    3.7E-10    8.0E-10    1.6E-09
3.1E-09    5.7E-09    1.0E-08    1.7E-08    2.7E-08    4.3E-08    6.6E-08    9.7E-08    1.4E-07    1.9E-07
2.7E-07    3.6E-07    4.7E-07    6.0E-07    7.5E-07    9.3E-07    1.1E-06    1.4E-06    1.6E-06    1.9E-06
2.1E-06    2.4E-06    2.7E-06    3.0E-06    3.3E-06    3.9E-06    4.4E-06    4.7E-06    5.0E-06    5.1E-06
5.1E-06    4.9E-06    4.7E-06    4.4E-06    4.0E-06    3.5E-06    3.1E-06    2.7E-06    2.3E-06    1.9E-06
1.6E-06    1.3E-06    1.0E-06    8.1E-07    6.4E-07    5.0E-07    3.8E-07    2.9E-07    2.2E-07    1.7E-07
1.2E-07    9.2E-08    6.7E-08    4.9E-08    3.6E-08    2.6E-08    1.8E-08    1.3E-08    9.3E-09    6.6E-09
4.6E-09    3.2E-09    2.3E-09    1.6E-09    1.1E-09    5.1E-10    2.4E-10    1.1E-10    5.0E-11    2.3E-11
8.3E-12   3.0E-12   1.1E-12   3.7E-13   1.3E-13   4.5E-14   1.5E-14   5.3E-15
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Tb-158          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tc-99           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    5.1E-20    3.4E-19    1.9E-18    9.9E-18    4.6E-17    1.9E-16    7.6E-16
2.7E-15    9.0E-15    2.8E-14    8.2E-14    2.3E-13    6.0E-13    1.5E-12    3.6E-12    8.1E-12    1.8E-11
3.8E-11    7.7E-11    1.5E-10    2.9E-10    5.5E-10    1.0E-09    1.8E-09    3.1E-09    5.2E-09    8.5E-09
1.4E-08    2.2E-08    3.4E-08    5.3E-08    8.0E-08    1.7E-07    3.6E-07    6.9E-07    1.3E-06    2.3E-06
4.0E-06    6.6E-06    1.1E-05    1.6E-05    2.5E-05    3.6E-05    5.2E-05    7.3E-05    1.0E-04    1.4E-04
1.8E-04    2.3E-04    3.0E-04    3.8E-04    4.7E-04    5.7E-04    7.0E-04    8.3E-04    9.9E-04    1.2E-03
1.3E-03    1.5E-03    1.7E-03    2.0E-03    2.2E-03    2.4E-03    2.6E-03    2.9E-03    3.1E-03    3.3E-03
3.5E-03    3.7E-03    3.9E-03    4.1E-03    4.3E-03    4.5E-03    4.7E-03    4.8E-03    4.8E-03    4.7E-03
4.5E-03    4.2E-03    3.8E-03    3.5E-03    3.1E-03    2.7E-03    2.3E-03    1.9E-03
      Te-123          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-229          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ti-44           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tl-204          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tm-170          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-232           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-233           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-234           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-235           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      V-50            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Zr-93           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-20          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-21          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-22          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-23          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
```

```
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
 NUCLIDE FLUXES AT OUTCROP (Ci/yr)
  NUCLIDE/TIME           6.         9.        12.        15.        18.        21.        24.        27.
30.        35.        40.        45.        50.        55.        60.        65.        70.        75.
80.        85.        90.        95.       100.       105.       110.       115.       120.       125.
130.       135.       140.       145.       150.       155.       160.       165.       170.       175.
180.       185.       190.       195.       200.       205.       210.       215.       220.       225.
230.       235.       240.       245.       250.       255.       260.       265.       270.       275.
280.       285.       290.       295.       300.       310.       320.       330.       340.       350.
360.       370.       380.       390.       400.       410.       420.       430.       440.       450.
460.       470.       480.       490.       500.       510.       520.       530.       540.       550.
560.       570.       580.       590.       600.       610.       620.       630.       640.       650.
660.       670.       680.       690.       700.       720.       740.       760.       780.       800.
825.      850.      875.      900.      925.      950.      975.     1000.
      Pu-236         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-238         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-239         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-242         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-244         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    3.4E-22    1.4E-20    3.5E-19    5.4E-18
5.8E-17    4.6E-16    2.9E-15    1.4E-14    6.1E-14    2.2E-13    6.9E-13    1.9E-12    4.9E-12    1.1E-11
2.4E-11    4.9E-11    9.2E-11    1.6E-10    2.8E-10    4.5E-10    7.0E-10    1.0E-09    1.5E-09    2.1E-09
2.9E-09    3.9E-09    5.1E-09    6.5E-09    8.1E-09    1.0E-08    1.2E-08    1.4E-08    1.7E-08    2.0E-08
2.2E-08    2.5E-08    2.8E-08    3.1E-08    3.5E-08    3.8E-08    4.1E-08    4.4E-08    4.7E-08    5.0E-08
5.3E-08    5.5E-08    5.8E-08    6.0E-08    6.2E-08    6.6E-08    7.0E-08    7.3E-08    7.5E-08    7.7E-08
7.9E-08    8.0E-08    8.1E-08    8.2E-08    8.2E-08    8.3E-08    8.3E-08    8.3E-08    8.3E-08    8.3E-08
8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08
8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08
8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08    8.4E-08
8.4E-08   8.4E-08   8.4E-08   8.4E-08   8.4E-08   8.4E-08   8.4E-08   8.4E-08
      Ra-228         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Re-187          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    7.2E-23    9.5E-22    1.0E-20    8.7E-20
6.4E-19    4.0E-18    2.2E-17    1.1E-16    4.6E-16    1.8E-15    6.4E-15    2.1E-14    6.5E-14    1.9E-13
5.0E-13    1.3E-12    3.0E-12    6.9E-12    1.5E-11    3.2E-11    6.4E-11    1.2E-10    2.3E-10    4.2E-10
7.5E-10    1.3E-09    2.1E-09    3.5E-09    5.6E-09    8.7E-09    1.3E-08    2.0E-08    3.0E-08    4.3E-08
6.1E-08    8.6E-08    1.2E-07    1.6E-07    2.2E-07    3.9E-07    6.5E-07    1.0E-06    1.6E-06    2.4E-06
3.5E-06    5.0E-06    6.8E-06    9.2E-06    1.2E-05    1.5E-05    1.9E-05    2.4E-05    2.9E-05    3.5E-05
4.1E-05    4.8E-05    5.4E-05    6.1E-05    6.8E-05    7.5E-05    8.2E-05    8.8E-05    9.3E-05    9.9E-05
1.0E-04    1.1E-04    1.1E-04    1.1E-04    1.1E-04    1.1E-04    1.1E-04    1.1E-04    1.1E-04    1.1E-04
1.0E-04    1.0E-04    9.6E-05    9.2E-05    8.8E-05    7.8E-05    6.9E-05    5.9E-05    5.1E-05    4.3E-05
3.4E-05    2.6E-05    2.0E-05    1.5E-05    1.1E-05    8.3E-06    6.0E-06    4.3E-06
      Se-79           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    2.8E-23    8.0E-23    6.0E-22    4.0E-21    2.5E-20    1.4E-19    6.9E-19
4.7E-18    2.8E-17    1.5E-16    7.6E-16    3.4E-15    1.4E-14    5.5E-14    2.0E-13
      Si-32           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    2.6E-23    1.3E-22    5.9E-22    2.6E-21    1.1E-20    4.2E-20    1.5E-19
5.5E-19    1.9E-18    6.0E-18    1.9E-17    5.5E-17    4.4E-16    3.1E-15    1.9E-14    1.0E-13    5.2E-13
2.3E-12    9.6E-12    3.7E-11    1.3E-10    4.3E-10    1.4E-09    4.0E-09    1.1E-08    2.9E-08    7.4E-08
1.8E-07    4.1E-07    9.1E-07    2.0E-06    4.1E-06    8.1E-06    1.6E-05    3.0E-05    5.5E-05    9.9E-05
1.7E-04    3.0E-04    5.0E-04    8.1E-04    1.3E-03    2.1E-03    3.2E-03    4.9E-03    7.3E-03    1.1E-02
1.6E-02    2.3E-02    3.2E-02    4.5E-02    6.2E-02    1.1E-01    2.0E-01    3.4E-01    5.6E-01    8.8E-01
1.5E+00    2.4E+00    3.7E+00    5.6E+00    8.1E+00    1.1E+01    1.6E+01    2.1E+01
      Sm-151          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-121m         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sn-126          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Sr-90          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    2.8E-22    4.1E-21    4.5E-20    3.9E-19    2.8E-18    1.7E-17    8.3E-17
3.6E-16    1.4E-15    4.8E-15    1.5E-14    4.3E-14    1.1E-13    2.7E-13    6.3E-13    1.3E-12    2.7E-12
5.2E-12    9.6E-12    1.7E-11    2.8E-11    4.6E-11    7.2E-11    1.1E-10    1.6E-10    2.3E-10    3.3E-10
4.5E-10    6.0E-10    7.8E-10    1.0E-09    1.3E-09    1.6E-09    1.9E-09    2.3E-09    2.7E-09    3.1E-09
3.6E-09    4.1E-09    4.6E-09    5.1E-09    5.6E-09    6.5E-09    7.3E-09    8.0E-09    8.4E-09    8.6E-09
8.6E-09    8.3E-09    7.9E-09    7.3E-09    6.7E-09    6.0E-09    5.2E-09    4.5E-09    3.8E-09    3.2E-09
2.6E-09    2.1E-09    1.7E-09    1.4E-09    1.1E-09    8.4E-10    6.4E-10    4.9E-10    3.7E-10    2.8E-10
2.1E-10    1.5E-10    1.1E-10    8.3E-11    6.0E-11    4.3E-11    3.1E-11    2.2E-11    1.6E-11    1.1E-11
7.8E-12    5.4E-12    3.8E-12    2.6E-12    1.8E-12    8.6E-13    4.0E-13    1.8E-13    8.4E-14    3.8E-14
1.4E-14    5.0E-15    1.8E-15    6.3E-16    2.2E-16    7.6E-17    2.6E-17    8.8E-18
      Tb-157         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tb-158         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Tc-99          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    8.6E-23    5.6E-22    3.2E-21    1.7E-20    7.8E-20    3.3E-19    1.3E-18
4.5E-18    1.5E-17    4.7E-17    1.4E-16    3.8E-16    1.0E-15    2.5E-15    6.0E-15    1.4E-14    3.0E-14
6.4E-14    1.3E-13    2.6E-13    4.9E-13    9.2E-13    1.7E-12    3.0E-12    5.1E-12    8.7E-12    1.4E-11
2.3E-11    3.7E-11    5.8E-11    8.9E-11    1.3E-10    2.9E-10    6.0E-10    1.2E-09    2.2E-09    3.9E-09
6.7E-09    1.1E-08    1.8E-08    2.7E-08    4.1E-08    6.1E-08    8.7E-08    1.2E-07    1.7E-07    2.3E-07
3.0E-07    3.9E-07    5.0E-07    6.3E-07    7.9E-07    9.7E-07    1.2E-06    1.4E-06    1.7E-06    1.9E-06
2.2E-06    2.6E-06    2.9E-06    3.3E-06    3.7E-06    4.0E-06    4.4E-06    4.8E-06    5.2E-06    5.6E-06
6.0E-06    6.3E-06    6.6E-06    6.9E-06    7.2E-06    7.6E-06    7.9E-06    8.0E-06    8.0E-06    7.9E-06
7.5E-06    7.1E-06    6.5E-06    5.8E-06    5.1E-06    4.5E-06    3.8E-06    3.2E-06
      Te-123         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-229         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-232         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ti-44          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tl-204         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Tm-170         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-232          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-233          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-234          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      U-235          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      V-50            0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Zr-93           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-20           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-21           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-22           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-23           0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-24          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-25          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Ks-26          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Th-230         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-236          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      U-238          0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
      Pu-240         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
```

```
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Pu-241         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
      Ra-226         0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00    0.0E+00
0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00   0.0E+00
*********** CUMULATIVE TOTAL DOSES PER YEAR FOR GIVEN TIMES **********
      1              0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
*********** CUMULATIVE TOTAL RISKS PER YEAR FOR GIVEN TIMES **********
      1              0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
        NUCLIDE HALFLIFE AND INVENTORY (CI) ASSUMING NO TRANSPORT FROM THE FACILITY
 (TIMES IN YEARS) HALFLIFE         6.         9.        12.        15.        18.        21.        24.
27.        30.        35.        40.        45.        50.        55.        60.        65.        70.
75.        80.        85.        90.        95.       100.       105.       110.       115.       120.
125.       130.       135.       140.       145.       150.       155.       160.       165.       170.
175.       180.       185.       190.       195.       200.       205.       210.       215.       220.
225.       230.       235.       240.       245.       250.       255.       260.       265.       270.
275.       280.       285.       290.       295.       300.       310.       320.       330.       340.
350.       360.       370.       380.       390.       400.       410.       420.       430.       440.
450.       460.       470.       480.       490.       500.       510.       520.       530.       540.
550.       560.       570.       580.       590.       600.       610.       620.       630.       640.
650.       660.       670.       680.       690.       700.       720.       740.       760.       780.
800.       825.       850.       875.       900.       925.       950.       975.      1000.
   Pu-236             2.86E+00   9.00E-04   1.02E-04   4.91E-05   2.37E-05   1.15E-05   5.54E-06   2.68E-06
1.30E-06   6.26E-07   1.86E-07   5.55E-08   1.65E-08   4.91E-09   1.46E-09   4.35E-10   1.30E-10   3.86E-11
1.15E-11   3.42E-12   1.02E-12   3.03E-13   9.02E-14   2.68E-14   7.99E-15   2.38E-15   7.08E-16   2.11E-16
6.27E-17   1.87E-17   5.56E-18   1.65E-18   4.92E-19   1.47E-19   4.36E-20   1.30E-20   3.86E-21   1.15E-21
3.42E-22   1.02E-22   3.03E-23   9.03E-24   2.69E-24   8.00E-25   2.38E-25   7.09E-26   2.11E-26   6.28E-27
1.87E-27   5.57E-28   1.66E-28   4.93E-29   1.47E-29   4.37E-30   1.30E-30   3.87E-31   1.15E-31   3.43E-32
1.02E-32   3.04E-33   9.05E-34   2.69E-34   8.02E-35   2.39E-35   2.11E-36   1.87E-37   1.66E-38   1.47E-39
1.30E-40   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
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0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pu-238           8.77E+01  1.80E-02  1.68E-02  1.64E-02  1.60E-02  1.56E-02  1.52E-02  1.49E-02
1.45E-02  1.42E-02  1.37E-02  1.31E-02  1.26E-02  1.21E-02  1.17E-02  1.12E-02  1.08E-02  1.04E-02
9.95E-03  9.56E-03  9.19E-03  8.84E-03  8.50E-03  8.17E-03  7.85E-03  7.55E-03  7.25E-03  6.97E-03
6.70E-03  6.44E-03  6.19E-03  5.95E-03  5.72E-03  5.50E-03  5.29E-03  5.08E-03  4.89E-03  4.70E-03
4.51E-03  4.34E-03  4.17E-03  4.01E-03  3.85E-03  3.70E-03  3.56E-03  3.42E-03  3.29E-03  3.16E-03
3.04E-03  2.92E-03  2.81E-03  2.70E-03  2.60E-03  2.50E-03  2.40E-03  2.31E-03  2.22E-03  2.13E-03
2.05E-03  1.97E-03  1.89E-03  1.82E-03  1.75E-03  1.68E-03  1.55E-03  1.44E-03  1.33E-03  1.23E-03
1.13E-03  1.05E-03  9.67E-04  8.93E-04  8.25E-04  7.63E-04  7.05E-04  6.51E-04  6.02E-04  5.56E-04
5.14E-04  4.75E-04  4.39E-04  4.05E-04  3.74E-04  3.46E-04  3.20E-04  2.95E-04  2.73E-04  2.52E-04
2.33E-04  2.15E-04  1.99E-04  1.84E-04  1.70E-04  1.57E-04  1.45E-04  1.34E-04  1.24E-04  1.14E-04
1.06E-04  9.77E-05  9.03E-05  8.34E-05  7.71E-05  7.12E-05  6.08E-05  5.19E-05  4.43E-05  3.78E-05
3.23E-05  2.65E-05  2.18E-05  1.79E-05  1.47E-05  1.20E-05  9.87E-06  8.10E-06  6.65E-06
   Pu-239           2.41E+04  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
   Pu-242           3.73E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
   Pu-244           8.08E+07  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04  9.00E-04
   Ra-228           5.75E+00  4.90E+08  1.66E+08  1.15E+08  8.03E+07  5.60E+07  3.90E+07  2.71E+07
1.89E+07  1.32E+07  7.21E+06  3.95E+06  2.16E+06  1.18E+06  6.47E+05  3.54E+05  1.94E+05  1.06E+05
5.80E+04  3.18E+04  1.74E+04  9.52E+03  5.21E+03  2.85E+03  1.56E+03  8.54E+02  4.67E+02  2.56E+02
1.40E+02  7.66E+01  4.19E+01  2.29E+01  1.26E+01  6.87E+00  3.76E+00  2.06E+00  1.13E+00  6.17E-01
3.38E-01  1.85E-01  1.01E-01  5.54E-02  3.03E-02  1.66E-02  9.07E-03  4.97E-03  2.72E-03  1.49E-03
8.14E-04  4.46E-04  2.44E-04  1.33E-04  7.31E-05  4.00E-05  2.19E-05  1.20E-05  6.56E-06  3.59E-06
1.96E-06  1.07E-06  5.88E-07  3.22E-07  1.76E-07  9.64E-08  2.89E-08  8.65E-09  2.59E-09  7.77E-10
2.33E-10  6.97E-11  2.09E-11  6.25E-12  1.87E-12  5.61E-13  1.68E-13  5.03E-14  1.51E-14  4.52E-15
1.35E-15  4.05E-16  1.21E-16  3.64E-17  1.09E-17  3.26E-18  9.78E-19  2.93E-19  8.77E-20  2.63E-20
7.87E-21  2.36E-21  7.06E-22  2.12E-22  6.34E-23  1.90E-23  5.69E-24  1.70E-24  5.10E-25  1.53E-25
4.58E-26  1.37E-26  4.11E-27  1.23E-27  3.69E-28  1.10E-28  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Re-187           4.35E+10  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02  3.44E-02
   Se-79            6.50E+04  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
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1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05  1.25E+05
1.25E+05  1.25E+05  1.25E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05  1.24E+05
   Si-32            1.72E+02  1.17E+08  1.13E+08  1.11E+08  1.10E+08  1.09E+08  1.08E+08  1.06E+08
1.05E+08  1.04E+08  1.02E+08  9.96E+07  9.76E+07  9.56E+07  9.37E+07  9.19E+07  9.00E+07  8.82E+07
8.65E+07  8.48E+07  8.31E+07  8.14E+07  7.98E+07  7.82E+07  7.66E+07  7.51E+07  7.36E+07  7.21E+07
7.07E+07  6.93E+07  6.79E+07  6.66E+07  6.52E+07  6.39E+07  6.26E+07  6.14E+07  6.02E+07  5.90E+07
5.78E+07  5.66E+07  5.55E+07  5.44E+07  5.33E+07  5.23E+07  5.12E+07  5.02E+07  4.92E+07  4.82E+07
4.72E+07  4.63E+07  4.54E+07  4.45E+07  4.36E+07  4.27E+07  4.19E+07  4.10E+07  4.02E+07  3.94E+07
3.86E+07  3.79E+07  3.71E+07  3.64E+07  3.56E+07  3.49E+07  3.35E+07  3.22E+07  3.09E+07  2.97E+07
2.86E+07  2.74E+07  2.63E+07  2.53E+07  2.43E+07  2.33E+07  2.24E+07  2.15E+07  2.07E+07  1.99E+07
1.91E+07  1.83E+07  1.76E+07  1.69E+07  1.62E+07  1.56E+07  1.50E+07  1.44E+07  1.38E+07  1.33E+07
1.28E+07  1.22E+07  1.18E+07  1.13E+07  1.09E+07  1.04E+07  1.00E+07  9.62E+06  9.24E+06  8.87E+06
8.52E+06  8.19E+06  7.86E+06  7.55E+06  7.25E+06  6.97E+06  6.43E+06  5.93E+06  5.47E+06  5.05E+06
4.66E+06  4.21E+06  3.81E+06  3.44E+06  3.11E+06  2.81E+06  2.54E+06  2.30E+06  2.08E+06
   Sm-151           9.00E+01  4.74E+07  4.42E+07  4.32E+07  4.22E+07  4.13E+07  4.03E+07  3.94E+07
3.85E+07  3.76E+07  3.62E+07  3.48E+07  3.35E+07  3.23E+07  3.10E+07  2.99E+07  2.87E+07  2.76E+07
2.66E+07  2.56E+07  2.46E+07  2.37E+07  2.28E+07  2.19E+07  2.11E+07  2.03E+07  1.95E+07  1.88E+07
1.81E+07  1.74E+07  1.68E+07  1.61E+07  1.55E+07  1.49E+07  1.44E+07  1.38E+07  1.33E+07  1.28E+07
1.23E+07  1.19E+07  1.14E+07  1.10E+07  1.06E+07  1.02E+07  9.77E+06  9.41E+06  9.05E+06  8.71E+06
8.38E+06  8.06E+06  7.76E+06  7.47E+06  7.18E+06  6.91E+06  6.65E+06  6.40E+06  6.16E+06  5.93E+06
5.70E+06  5.49E+06  5.28E+06  5.08E+06  4.89E+06  4.70E+06  4.35E+06  4.03E+06  3.73E+06  3.46E+06
3.20E+06  2.96E+06  2.74E+06  2.54E+06  2.35E+06  2.18E+06  2.02E+06  1.87E+06  1.73E+06  1.60E+06
1.48E+06  1.37E+06  1.27E+06  1.18E+06  1.09E+06  1.01E+06  9.33E+05  8.64E+05  8.00E+05  7.41E+05
6.86E+05  6.35E+05  5.88E+05  5.44E+05  5.04E+05  4.67E+05  4.32E+05  4.00E+05  3.70E+05  3.43E+05
3.17E+05  2.94E+05  2.72E+05  2.52E+05  2.33E+05  2.16E+05  1.85E+05  1.59E+05  1.36E+05  1.17E+05
1.00E+05  8.25E+04  6.80E+04  5.61E+04  4.63E+04  3.82E+04  3.15E+04  2.60E+04  2.14E+04
   Sn-121m          5.50E+01  9.68E+07  8.64E+07  8.32E+07  8.01E+07  7.72E+07  7.43E+07  7.15E+07
6.89E+07  6.63E+07  6.23E+07  5.85E+07  5.49E+07  5.15E+07  4.84E+07  4.54E+07  4.27E+07  4.01E+07
3.76E+07  3.53E+07  3.32E+07  3.11E+07  2.92E+07  2.75E+07  2.58E+07  2.42E+07  2.27E+07  2.13E+07
2.00E+07  1.88E+07  1.77E+07  1.66E+07  1.56E+07  1.46E+07  1.37E+07  1.29E+07  1.21E+07  1.14E+07
1.07E+07  1.00E+07  9.40E+06  8.83E+06  8.29E+06  7.78E+06  7.31E+06  6.86E+06  6.44E+06  6.05E+06
5.68E+06  5.33E+06  5.01E+06  4.70E+06  4.41E+06  4.15E+06  3.89E+06  3.65E+06  3.43E+06  3.22E+06
3.03E+06  2.84E+06  2.67E+06  2.50E+06  2.35E+06  2.21E+06  1.95E+06  1.72E+06  1.51E+06  1.33E+06
1.18E+06  1.04E+06  9.14E+05  8.05E+05  7.10E+05  6.26E+05  5.52E+05  4.87E+05  4.29E+05  3.78E+05
3.33E+05  2.94E+05  2.59E+05  2.28E+05  2.01E+05  1.78E+05  1.56E+05  1.38E+05  1.22E+05  1.07E+05
9.45E+04  8.33E+04  7.35E+04  6.48E+04  5.71E+04  5.03E+04  4.44E+04  3.91E+04  3.45E+04  3.04E+04
2.68E+04  2.36E+04  2.08E+04  1.84E+04  1.62E+04  1.43E+04  1.11E+04  8.62E+03  6.70E+03  5.21E+03
4.05E+03  2.95E+03  2.16E+03  1.57E+03  1.15E+03  8.38E+02  6.11E+02  4.46E+02  3.26E+02
   Sn-126           1.00E+05  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04
5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04
5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.11E+04
5.11E+04  5.11E+04  5.11E+04  5.11E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04
5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.10E+04  5.09E+04  5.09E+04
5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04
5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04
5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.09E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04
5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.08E+04  5.07E+04
   Sr-90            2.88E+01  4.50E-02  3.62E-02  3.37E-02  3.14E-02  2.92E-02  2.71E-02  2.53E-02
2.35E-02  2.19E-02  1.94E-02  1.72E-02  1.52E-02  1.35E-02  1.20E-02  1.06E-02  9.41E-03  8.35E-03
7.40E-03  6.56E-03  5.82E-03  5.16E-03  4.57E-03  4.05E-03  3.60E-03  3.19E-03  2.83E-03  2.51E-03
2.22E-03  1.97E-03  1.75E-03  1.55E-03  1.37E-03  1.22E-03  1.08E-03  9.57E-04  8.48E-04  7.52E-04
6.67E-04  5.91E-04  5.24E-04  4.65E-04  4.12E-04  3.65E-04  3.24E-04  2.87E-04  2.55E-04  2.26E-04
2.00E-04  1.77E-04  1.57E-04  1.40E-04  1.24E-04  1.10E-04  9.72E-05  8.62E-05  7.64E-05  6.78E-05
6.01E-05  5.33E-05  4.72E-05  4.19E-05  3.71E-05  3.29E-05  2.59E-05  2.03E-05  1.60E-05  1.26E-05
9.88E-06  7.77E-06  6.11E-06  4.80E-06  3.77E-06  2.97E-06  2.33E-06  1.83E-06  1.44E-06  1.13E-06
8.90E-07  7.00E-07  5.50E-07  4.33E-07  3.40E-07  2.67E-07  2.10E-07  1.65E-07  1.30E-07  1.02E-07
8.02E-08  6.31E-08  4.96E-08  3.90E-08  3.06E-08  2.41E-08  1.89E-08  1.49E-08  1.17E-08  9.20E-09
7.23E-09  5.68E-09  4.47E-09  3.51E-09  2.76E-09  2.17E-09  1.34E-09  8.29E-10  5.12E-10  3.16E-10
1.96E-10  1.07E-10  5.87E-11  3.22E-11  1.76E-11  9.65E-12  5.29E-12  2.90E-12  1.59E-12
   Tb-157           7.10E+01  2.70E+07  2.47E+07  2.40E+07  2.33E+07  2.26E+07  2.20E+07  2.14E+07
2.07E+07  2.01E+07  1.92E+07  1.83E+07  1.74E+07  1.66E+07  1.58E+07  1.50E+07  1.43E+07  1.36E+07
1.30E+07  1.24E+07  1.18E+07  1.12E+07  1.07E+07  1.02E+07  9.69E+06  9.23E+06  8.79E+06  8.37E+06
7.97E+06  7.59E+06  7.23E+06  6.88E+06  6.56E+06  6.24E+06  5.95E+06  5.66E+06  5.39E+06  5.14E+06
4.89E+06  4.66E+06  4.44E+06  4.22E+06  4.02E+06  3.83E+06  3.65E+06  3.48E+06  3.31E+06  3.15E+06
3.00E+06  2.86E+06  2.72E+06  2.59E+06  2.47E+06  2.35E+06  2.24E+06  2.13E+06  2.03E+06  1.93E+06
1.84E+06  1.75E+06  1.67E+06  1.59E+06  1.52E+06  1.44E+06  1.31E+06  1.19E+06  1.08E+06  9.77E+05
8.86E+05  8.04E+05  7.29E+05  6.61E+05  6.00E+05  5.44E+05  4.93E+05  4.47E+05  4.06E+05  3.68E+05
3.34E+05  3.03E+05  2.75E+05  2.49E+05  2.26E+05  2.05E+05  1.86E+05  1.69E+05  1.53E+05  1.39E+05
1.26E+05  1.14E+05  1.03E+05  9.38E+04  8.51E+04  7.72E+04  7.00E+04  6.35E+04  5.76E+04  5.22E+04
4.74E+04  4.30E+04  3.90E+04  3.53E+04  3.21E+04  2.91E+04  2.39E+04  1.97E+04  1.62E+04  1.33E+04
1.10E+04  8.58E+03  6.72E+03  5.27E+03  4.13E+03  3.23E+03  2.53E+03  1.98E+03  1.55E+03
   Tb-158           1.80E+02  2.70E+07  2.61E+07  2.58E+07  2.55E+07  2.52E+07  2.49E+07  2.46E+07
2.43E+07  2.41E+07  2.36E+07  2.31E+07  2.27E+07  2.23E+07  2.18E+07  2.14E+07  2.10E+07  2.06E+07
```

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.02E+07 | 1.98E+07 | 1.95E+07 | 1.91E+07 | 1.87E+07 | 1.84E+07 | 1.80E+07 | 1.77E+07 | 1.73E+07 | 1.70E+07 |
| 1.67E+07 | 1.64E+07 | 1.61E+07 | 1.57E+07 | 1.54E+07 | 1.52E+07 | 1.49E+07 | 1.46E+07 | 1.43E+07 | 1.40E+07 |
| 1.38E+07 | 1.35E+07 | 1.32E+07 | 1.30E+07 | 1.27E+07 | 1.25E+07 | 1.23E+07 | 1.20E+07 | 1.18E+07 | 1.16E+07 |
| 1.14E+07 | 1.11E+07 | 1.09E+07 | 1.07E+07 | 1.05E+07 | 1.03E+07 | 1.01E+07 | 9.92E+06 | 9.73E+06 | 9.55E+06 |
| 9.36E+06 | 9.19E+06 | 9.01E+06 | 8.84E+06 | 8.67E+06 | 8.50E+06 | 8.18E+06 | 7.87E+06 | 7.58E+06 | 7.29E+06 |
| 7.01E+06 | 6.75E+06 | 6.50E+06 | 6.25E+06 | 6.01E+06 | 5.79E+06 | 5.57E+06 | 5.36E+06 | 5.16E+06 | 4.96E+06 |
| 4.77E+06 | 4.59E+06 | 4.42E+06 | 4.25E+06 | 4.09E+06 | 3.94E+06 | 3.79E+06 | 3.65E+06 | 3.51E+06 | 3.38E+06 |
| 3.25E+06 | 3.12E+06 | 3.01E+06 | 2.89E+06 | 2.78E+06 | 2.68E+06 | 2.58E+06 | 2.48E+06 | 2.39E+06 | 2.30E+06 |
| 2.21E+06 | 2.13E+06 | 2.05E+06 | 1.97E+06 | 1.89E+06 | 1.82E+06 | 1.69E+06 | 1.56E+06 | 1.45E+06 | 1.34E+06 |
| 1.24E+06 | 1.13E+06 | 1.02E+06 | 9.29E+05 | 8.44E+05 | 7.66E+05 | 6.96E+05 | 6.32E+05 | 5.74E+05 | |
| Tc-99 | | 2.11E+05 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 |
| 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.10E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 |
| 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 |
| 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 |
| 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | 3.09E-03 | |
| Te-123 | | 1.00E+13 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 |
| 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | 5.24E-04 | |
| Th-229 | | 7.88E+03 | 3.83E+05 | 3.83E+05 | 3.83E+05 | 3.82E+05 | 3.82E+05 | 3.82E+05 | 3.82E+05 |
| 3.82E+05 | 3.82E+05 | 3.82E+05 | 3.82E+05 | 3.81E+05 | 3.81E+05 | 3.81E+05 | 3.81E+05 | 3.81E+05 | 3.81E+05 |
| 3.80E+05 | 3.80E+05 | 3.80E+05 | 3.80E+05 | 3.80E+05 | 3.80E+05 | 3.79E+05 | 3.79E+05 | 3.79E+05 | 3.79E+05 |
| 3.79E+05 | 3.79E+05 | 3.78E+05 | 3.78E+05 | 3.78E+05 | 3.78E+05 | 3.78E+05 | 3.78E+05 | 3.77E+05 | 3.77E+05 |
| 3.77E+05 | 3.77E+05 | 3.77E+05 | 3.77E+05 | 3.76E+05 | 3.76E+05 | 3.76E+05 | 3.76E+05 | 3.76E+05 | 3.76E+05 |
| 3.75E+05 | 3.75E+05 | 3.75E+05 | 3.75E+05 | 3.75E+05 | 3.75E+05 | 3.75E+05 | 3.74E+05 | 3.74E+05 | 3.74E+05 |
| 3.74E+05 | 3.74E+05 | 3.74E+05 | 3.73E+05 | 3.73E+05 | 3.73E+05 | 3.73E+05 | 3.72E+05 | 3.72E+05 | 3.72E+05 |
| 3.71E+05 | 3.71E+05 | 3.71E+05 | 3.70E+05 | 3.70E+05 | 3.70E+05 | 3.69E+05 | 3.69E+05 | 3.69E+05 | 3.68E+05 |
| 3.68E+05 | 3.68E+05 | 3.67E+05 | 3.67E+05 | 3.67E+05 | 3.67E+05 | 3.66E+05 | 3.66E+05 | 3.66E+05 | 3.65E+05 |
| 3.65E+05 | 3.65E+05 | 3.64E+05 | 3.64E+05 | 3.64E+05 | 3.63E+05 | 3.63E+05 | 3.63E+05 | 3.62E+05 | 3.62E+05 |
| 3.62E+05 | 3.61E+05 | 3.61E+05 | 3.61E+05 | 3.60E+05 | 3.60E+05 | 3.59E+05 | 3.59E+05 | 3.58E+05 | 3.58E+05 |
| 3.57E+05 | 3.56E+05 | 3.55E+05 | 3.55E+05 | 3.54E+05 | 3.53E+05 | 3.52E+05 | 3.52E+05 | 3.51E+05 | |
| Th-232 | | 1.41E+10 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 |
| 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | 1.98E-01 | |
| Ti-44 | | 6.30E+01 | 2.81E+08 | 2.55E+08 | 2.46E+08 | 2.38E+08 | 2.31E+08 | 2.23E+08 | 2.16E+08 |
| 2.09E+08 | 2.02E+08 | 1.91E+08 | 1.81E+08 | 1.71E+08 | 1.62E+08 | 1.53E+08 | 1.45E+08 | 1.37E+08 | 1.30E+08 |
| 1.23E+08 | 1.17E+08 | 1.10E+08 | 1.04E+08 | 9.88E+07 | 9.35E+07 | 8.85E+07 | 8.38E+07 | 7.93E+07 | 7.50E+07 |
| 7.10E+07 | 6.72E+07 | 6.36E+07 | 6.02E+07 | 5.70E+07 | 5.39E+07 | 5.11E+07 | 4.83E+07 | 4.57E+07 | 4.33E+07 |
| 4.10E+07 | 3.88E+07 | 3.67E+07 | 3.47E+07 | 3.29E+07 | 3.11E+07 | 2.95E+07 | 2.79E+07 | 2.64E+07 | 2.50E+07 |
| 2.36E+07 | 2.24E+07 | 2.12E+07 | 2.00E+07 | 1.90E+07 | 1.80E+07 | 1.70E+07 | 1.61E+07 | 1.52E+07 | 1.44E+07 |
| 1.36E+07 | 1.29E+07 | 1.22E+07 | 1.16E+07 | 1.09E+07 | 1.04E+07 | 9.28E+06 | 8.31E+06 | 7.45E+06 | 6.67E+06 |
| 5.97E+06 | 5.35E+06 | 4.79E+06 | 4.30E+06 | 3.85E+06 | 3.45E+06 | 3.09E+06 | 2.77E+06 | 2.48E+06 | 2.22E+06 |
| 1.99E+06 | 1.78E+06 | 1.60E+06 | 1.43E+06 | 1.28E+06 | 1.15E+06 | 1.03E+06 | 9.20E+05 | 8.25E+05 | 7.39E+05 |
| 6.62E+05 | 5.93E+05 | 5.31E+05 | 4.76E+05 | 4.26E+05 | 3.82E+05 | 3.42E+05 | 3.06E+05 | 2.74E+05 | 2.46E+05 |
| 2.20E+05 | 1.97E+05 | 1.77E+05 | 1.58E+05 | 1.42E+05 | 1.27E+05 | 1.02E+05 | 8.18E+04 | 6.56E+04 | 5.27E+04 |
| 4.23E+04 | 3.21E+04 | 2.44E+04 | 1.85E+04 | 1.41E+04 | 1.07E+04 | 8.12E+03 | 6.16E+03 | 4.68E+03 | |
| Tl-204 | | 3.78E+00 | 7.92E+02 | 1.52E+02 | 8.77E+01 | 5.06E+01 | 2.92E+01 | 1.68E+01 | 9.71E+00 |
| 5.60E+00 | 3.23E+00 | 1.29E+00 | 5.17E-01 | 2.07E-01 | 8.26E-02 | 3.30E-02 | 1.32E-02 | 5.28E-03 | 2.11E-03 |
| 8.43E-04 | 3.37E-04 | 1.35E-04 | 5.39E-05 | 2.15E-05 | 8.61E-06 | 3.44E-06 | 1.38E-06 | 5.50E-07 | 2.20E-07 |
| 8.79E-08 | 3.51E-08 | 1.40E-08 | 5.62E-09 | 2.25E-09 | 8.98E-10 | 3.59E-10 | 1.43E-10 | 5.73E-11 | 2.29E-11 |
| 9.17E-12 | 3.66E-12 | 1.46E-12 | 5.86E-13 | 2.34E-13 | 9.36E-14 | 3.74E-14 | 1.50E-14 | 5.98E-15 | 2.39E-15 |
| 9.56E-16 | 3.82E-16 | 1.53E-16 | 6.11E-17 | 2.44E-17 | 9.76E-18 | 3.90E-18 | 1.56E-18 | 6.23E-19 | 2.49E-19 |
| 9.96E-20 | 3.98E-20 | 1.59E-20 | 6.37E-21 | 2.54E-21 | 1.02E-21 | 1.63E-22 | 2.60E-23 | 4.15E-24 | 6.64E-25 |
| 1.06E-25 | 1.70E-26 | 2.71E-27 | 4.33E-28 | 6.92E-29 | 1.11E-29 | 1.77E-30 | 2.82E-31 | 4.51E-32 | 7.21E-33 |
| 1.15E-33 | 1.84E-34 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

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0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Tm-170           3.52E-01  7.92E+02  1.59E-05  4.33E-08  1.18E-10  3.20E-13  8.70E-16  2.37E-18
6.43E-21  1.75E-23  9.26E-28  4.91E-32  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   U-232            6.89E+01  3.97E+07  3.63E+07  3.52E+07  3.41E+07  3.31E+07  3.21E+07  3.12E+07
3.03E+07  2.94E+07  2.79E+07  2.65E+07  2.52E+07  2.40E+07  2.28E+07  2.17E+07  2.06E+07  1.96E+07
1.87E+07  1.78E+07  1.69E+07  1.61E+07  1.53E+07  1.45E+07  1.38E+07  1.31E+07  1.25E+07  1.19E+07
1.13E+07  1.07E+07  1.02E+07  9.71E+06  9.23E+06  8.78E+06  8.35E+06  7.94E+06  7.55E+06  7.18E+06
6.83E+06  6.49E+06  6.17E+06  5.87E+06  5.58E+06  5.31E+06  5.05E+06  4.80E+06  4.56E+06  4.34E+06
4.13E+06  3.93E+06  3.73E+06  3.55E+06  3.38E+06  3.21E+06  3.05E+06  2.90E+06  2.76E+06  2.63E+06
2.50E+06  2.37E+06  2.26E+06  2.15E+06  2.04E+06  1.94E+06  1.76E+06  1.59E+06  1.44E+06  1.30E+06
1.17E+06  1.06E+06  9.60E+05  8.68E+05  7.85E+05  7.10E+05  6.42E+05  5.80E+05  5.25E+05  4.75E+05
4.29E+05  3.88E+05  3.51E+05  3.17E+05  2.87E+05  2.60E+05  2.35E+05  2.12E+05  1.92E+05  1.74E+05
1.57E+05  1.42E+05  1.28E+05  1.16E+05  1.05E+05  9.49E+04  8.58E+04  7.76E+04  7.02E+04  6.35E+04
5.74E+04  5.19E+04  4.69E+04  4.24E+04  3.84E+04  3.47E+04  2.84E+04  2.32E+04  1.90E+04  1.55E+04
1.27E+04  9.87E+03  7.67E+03  5.97E+03  4.64E+03  3.61E+03  2.81E+03  2.18E+03  1.70E+03
   U-233            1.59E+05  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01
1.35E-01  1.35E-01  1.35E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01
   U-234            2.46E+05  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
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1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
   U-235            7.04E+08  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
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2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02  2.79E-02
   V-50             1.40E+17  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08  9.20E-08
   Zr-93            1.53E+06  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
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4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03  4.53E+03
   Ks-20            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-21            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-22            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-23            1.00E+00  7.92E+02  1.55E+00  1.93E-01  2.42E-02  3.02E-03  3.78E-04  4.72E-05
5.90E-06  7.38E-07  2.31E-08  7.20E-10  2.25E-11  7.03E-13  2.20E-14  6.87E-16  2.15E-17  6.71E-19
2.10E-20  6.55E-22  2.05E-23  6.40E-25  2.00E-26  6.25E-28  1.95E-29  6.10E-31  1.91E-32  5.96E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-24            4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.38E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.18E-04  1.34E-04  5.61E-05  2.36E-05  9.92E-06  4.17E-06  1.75E-06  7.38E-07
3.10E-07  1.30E-07  5.48E-08  2.31E-08  9.69E-09  4.07E-09  1.71E-09  7.20E-10  3.03E-10  1.27E-10
5.35E-11  2.25E-11  9.46E-12  3.98E-12  1.67E-12  7.03E-13  2.96E-13  1.24E-13  5.23E-14  2.20E-14
9.24E-15  3.89E-15  1.63E-15  6.87E-16  2.89E-16  1.21E-16  5.11E-17  2.15E-17  9.03E-18  3.79E-18
1.60E-18  6.71E-19  2.82E-19  1.19E-19  4.99E-20  2.10E-20  3.71E-21  6.55E-22  1.16E-22  2.05E-23
3.62E-24  6.40E-25  1.13E-25  2.00E-26  3.53E-27  6.25E-28  1.10E-28  1.95E-29  3.45E-30  6.10E-31
1.08E-31  1.91E-32  3.37E-33  5.96E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-25            4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.38E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.18E-04  1.34E-04  5.61E-05  2.36E-05  9.92E-06  4.17E-06  1.75E-06  7.38E-07
3.10E-07  1.30E-07  5.48E-08  2.31E-08  9.69E-09  4.07E-09  1.71E-09  7.20E-10  3.03E-10  1.27E-10
5.35E-11  2.25E-11  9.46E-12  3.98E-12  1.67E-12  7.03E-13  2.96E-13  1.24E-13  5.23E-14  2.20E-14
9.24E-15  3.89E-15  1.63E-15  6.87E-16  2.89E-16  1.21E-16  5.11E-17  2.15E-17  9.03E-18  3.79E-18
1.60E-18  6.71E-19  2.82E-19  1.19E-19  4.99E-20  2.10E-20  3.71E-21  6.55E-22  1.16E-22  2.05E-23
3.62E-24  6.40E-25  1.13E-25  2.00E-26  3.53E-27  6.25E-28  1.10E-28  1.95E-29  3.45E-30  6.10E-31
1.08E-31  1.91E-32  3.37E-33  5.96E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-26            2.00E+00  7.92E+02  3.50E+01  1.24E+01  4.38E+00  1.55E+00  5.47E-01  1.93E-01
6.84E-02  2.42E-02  4.27E-03  7.55E-04  1.34E-04  2.36E-05  4.17E-06  7.38E-07  1.30E-07  2.31E-08
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4.07E-09  7.20E-10  1.27E-10  2.25E-11  3.98E-12  7.03E-13  1.24E-13  2.20E-14  3.89E-15  6.87E-16
1.21E-16  2.15E-17  3.79E-18  6.71E-19  1.19E-19  2.10E-20  3.71E-21  6.55E-22  1.16E-22  2.05E-23
3.62E-24  6.40E-25  1.13E-25  2.00E-26  3.53E-27  6.25E-28  1.10E-28  1.95E-29  3.45E-30  6.10E-31
1.08E-31  1.91E-32  3.37E-33  5.96E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Th-230           7.54E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04
3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04
3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04
3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.71E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
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3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.68E+04  3.68E+04  3.68E+04
3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.68E+04
   U-236            2.34E+07  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
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1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
   U-238            4.47E+09  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01
6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01
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6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01  6.05E-01
   Pu-240           6.56E+03  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02
1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02
1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02
1.68E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02  1.66E-02  1.66E-02
1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.63E-02  1.63E-02  1.62E-02  1.62E-02
   Pu-241           1.44E+01  6.30E-01  4.09E-01  3.54E-01  3.06E-01  2.65E-01  2.29E-01  1.98E-01
1.72E-01  1.49E-01  1.17E-01  9.19E-02  7.22E-02  5.68E-02  4.46E-02  3.51E-02  2.76E-02  2.17E-02
1.70E-02  1.34E-02  1.05E-02  8.28E-03  6.51E-03  5.12E-03  4.02E-03  3.16E-03  2.48E-03  1.95E-03
1.54E-03  1.21E-03  9.49E-04  7.46E-04  5.86E-04  4.61E-04  3.62E-04  2.85E-04  2.24E-04  1.76E-04
1.38E-04  1.09E-04  8.55E-05  6.72E-05  5.28E-05  4.15E-05  3.26E-05  2.57E-05  2.02E-05  1.59E-05
1.25E-05  9.80E-06  7.70E-06  6.06E-06  4.76E-06  3.74E-06  2.94E-06  2.31E-06  1.82E-06  1.43E-06
1.12E-06  8.83E-07  6.94E-07  5.46E-07  4.29E-07  3.37E-07  2.08E-07  1.29E-07  7.96E-08  4.92E-08
3.04E-08  1.88E-08  1.16E-08  7.17E-09  4.43E-09  2.74E-09  1.69E-09  1.05E-09  6.46E-10  3.99E-10
2.47E-10  1.52E-10  9.42E-11  5.82E-11  3.60E-11  2.22E-11  1.37E-11  8.49E-12  5.25E-12  3.24E-12
2.00E-12  1.24E-12  7.65E-13  4.73E-13  2.92E-13  1.80E-13  1.12E-13  6.89E-14  4.26E-14  2.63E-14
1.63E-14  1.00E-14  6.21E-15  3.84E-15  2.37E-15  1.47E-15  5.60E-16  2.14E-16  8.16E-17  3.12E-17
1.19E-17  3.57E-18  1.07E-18  3.22E-19  9.66E-20  2.90E-20  8.70E-21  2.61E-21  7.84E-22
   Ra-226           1.60E+03  1.80E-02  1.44E+02  1.92E+02  2.40E+02  2.88E+02  3.36E+02  3.84E+02
4.31E+02  4.79E+02  5.58E+02  6.37E+02  7.16E+02  7.95E+02  8.73E+02  9.52E+02  1.03E+03  1.11E+03
1.19E+03  1.26E+03  1.34E+03  1.42E+03  1.50E+03  1.57E+03  1.65E+03  1.73E+03  1.80E+03  1.88E+03
1.95E+03  2.03E+03  2.11E+03  2.18E+03  2.26E+03  2.33E+03  2.41E+03  2.48E+03  2.56E+03  2.63E+03
2.71E+03  2.78E+03  2.85E+03  2.93E+03  3.00E+03  3.08E+03  3.15E+03  3.22E+03  3.30E+03  3.37E+03
3.44E+03  3.51E+03  3.59E+03  3.66E+03  3.73E+03  3.80E+03  3.88E+03  3.95E+03  4.02E+03  4.09E+03
4.16E+03  4.23E+03  4.30E+03  4.37E+03  4.44E+03  4.52E+03  4.66E+03  4.80E+03  4.93E+03  5.07E+03
5.21E+03  5.35E+03  5.49E+03  5.62E+03  5.76E+03  5.89E+03  6.03E+03  6.16E+03  6.29E+03  6.43E+03
6.56E+03  6.69E+03  6.82E+03  6.95E+03  7.08E+03  7.21E+03  7.34E+03  7.46E+03  7.59E+03  7.72E+03
7.84E+03  7.97E+03  8.10E+03  8.22E+03  8.34E+03  8.47E+03  8.59E+03  8.71E+03  8.83E+03  8.96E+03
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9.08E+03  9.20E+03  9.32E+03  9.44E+03  9.55E+03  9.67E+03  9.91E+03  1.01E+04  1.04E+04  1.06E+04
1.08E+04  1.11E+04  1.14E+04  1.17E+04  1.19E+04  1.22E+04  1.25E+04  1.27E+04  1.30E+04
        NUCLIDE HALFLIFE AND INVENTORY (CI) REMAINING IN THE FACILITY
 (TIMES IN YEARS) HALFLIFE        6.        9.       12.       15.       18.       21.       24.
27.       30.       35.       40.       45.       50.       55.       60.       65.       70.
75.       80.       85.       90.       95.      100.      105.      110.      115.      120.
125.      130.      135.      140.      145.      150.      155.      160.      165.      170.
175.      180.      185.      190.      195.      200.      205.      210.      215.      220.
225.      230.      235.      240.      245.      250.      255.      260.      265.      270.
275.      280.      285.      290.      295.      300.      310.      320.      330.      340.
350.      360.      370.      380.      390.      400.      410.      420.      430.      440.
450.      460.      470.      480.      490.      500.      510.      520.      530.      540.
550.      560.      570.      580.      590.      600.      610.      620.      630.      640.
650.      660.      670.      680.      690.      700.      720.      740.      760.      780.
800.      825.      850.      875.      900.      925.      950.      975.     1000.
   Pu-236          2.86E+00  9.00E-04  1.02E-04  4.91E-05  2.37E-05  1.15E-05  5.53E-06  2.67E-06
1.29E-06  6.24E-07  1.86E-07  5.53E-08  1.64E-08  4.89E-09  1.46E-09  4.33E-10  1.29E-10  3.83E-11
1.14E-11  3.39E-12  1.01E-12  3.00E-13  8.94E-14  2.66E-14  7.91E-15  2.35E-15  7.00E-16  2.08E-16
6.20E-17  1.84E-17  5.49E-18  1.63E-18  4.86E-19  1.45E-19  4.30E-20  1.28E-20  3.81E-21  1.13E-21
3.37E-22  1.00E-22  2.98E-23  8.87E-24  2.64E-24  7.85E-25  2.34E-25  6.95E-26  2.07E-26  6.15E-27
1.83E-27  5.45E-28  1.62E-28  4.82E-29  1.43E-29  4.27E-30  1.27E-30  3.78E-31  1.12E-31  3.35E-32
9.95E-33  2.96E-33  8.81E-34  2.62E-34  7.80E-35  2.32E-35  2.05E-36  1.82E-37  1.61E-38  1.42E-39
1.26E-40  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Pu-238          8.77E+01  1.80E-02  1.68E-02  1.64E-02  1.60E-02  1.56E-02  1.52E-02  1.49E-02
1.45E-02  1.42E-02  1.36E-02  1.31E-02  1.26E-02  1.21E-02  1.16E-02  1.11E-02  1.07E-02  1.03E-02
9.88E-03  9.49E-03  9.12E-03  8.76E-03  8.42E-03  8.09E-03  7.77E-03  7.47E-03  7.18E-03  6.89E-03
6.62E-03  6.36E-03  6.12E-03  5.88E-03  5.65E-03  5.42E-03  5.21E-03  5.01E-03  4.81E-03  4.62E-03
4.44E-03  4.27E-03  4.10E-03  3.94E-03  3.78E-03  3.64E-03  3.49E-03  3.36E-03  3.23E-03  3.10E-03
2.98E-03  2.86E-03  2.75E-03  2.64E-03  2.54E-03  2.44E-03  2.34E-03  2.25E-03  2.16E-03  2.08E-03
2.00E-03  1.92E-03  1.84E-03  1.77E-03  1.70E-03  1.63E-03  1.51E-03  1.39E-03  1.29E-03  1.19E-03
1.10E-03  1.01E-03  9.34E-04  8.62E-04  7.96E-04  7.35E-04  6.78E-04  6.26E-04  5.78E-04  5.34E-04
4.93E-04  4.55E-04  4.20E-04  3.87E-04  3.58E-04  3.30E-04  3.05E-04  2.81E-04  2.60E-04  2.40E-04
2.21E-04  2.04E-04  1.89E-04  1.74E-04  1.61E-04  1.48E-04  1.37E-04  1.26E-04  1.17E-04  1.08E-04
9.95E-05  9.19E-05  8.48E-05  7.83E-05  7.23E-05  6.67E-05  5.69E-05  4.85E-05  4.13E-05  3.52E-05
3.00E-05  2.46E-05  2.01E-05  1.65E-05  1.35E-05  1.10E-05  9.04E-06  7.40E-06  6.06E-06
   Pu-239          2.41E+04  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02  1.75E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02
1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02
1.68E-02  1.68E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02  1.67E-02  1.67E-02  1.66E-02
1.66E-02  1.66E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.64E-02
1.63E-02  1.63E-02  1.62E-02  1.62E-02  1.61E-02  1.61E-02  1.60E-02  1.60E-02  1.59E-02
   Pu-242          3.73E+05  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02  1.80E-02
1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02
1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.77E-02  1.76E-02  1.76E-02  1.76E-02
1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.76E-02  1.75E-02
1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.75E-02  1.74E-02  1.74E-02
1.74E-02  1.74E-02  1.74E-02  1.74E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02  1.73E-02
1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.72E-02  1.71E-02  1.71E-02  1.71E-02  1.71E-02
1.71E-02  1.71E-02  1.71E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.70E-02  1.69E-02
1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.69E-02  1.68E-02  1.68E-02  1.68E-02  1.67E-02  1.67E-02
1.67E-02  1.66E-02  1.66E-02  1.66E-02  1.65E-02  1.65E-02  1.64E-02  1.64E-02  1.64E-02
   Pu-244          8.08E+07  9.00E-04  8.99E-04  8.99E-04  8.99E-04  8.98E-04  8.98E-04  8.98E-04
8.98E-04  8.97E-04  8.97E-04  8.97E-04  8.96E-04  8.96E-04  8.95E-04  8.95E-04  8.95E-04  8.94E-04
8.94E-04  8.93E-04  8.93E-04  8.92E-04  8.92E-04  8.92E-04  8.91E-04  8.91E-04  8.90E-04  8.90E-04
8.90E-04  8.89E-04  8.89E-04  8.88E-04  8.88E-04  8.88E-04  8.87E-04  8.87E-04  8.86E-04  8.86E-04
8.85E-04  8.85E-04  8.85E-04  8.84E-04  8.84E-04  8.83E-04  8.83E-04  8.83E-04  8.82E-04  8.82E-04
8.81E-04  8.81E-04  8.81E-04  8.80E-04  8.80E-04  8.79E-04  8.79E-04  8.78E-04  8.78E-04  8.78E-04
8.77E-04  8.77E-04  8.76E-04  8.76E-04  8.76E-04  8.75E-04  8.74E-04  8.74E-04  8.73E-04  8.72E-04
8.71E-04  8.70E-04  8.70E-04  8.69E-04  8.68E-04  8.67E-04  8.66E-04  8.65E-04  8.65E-04  8.64E-04
8.63E-04  8.62E-04  8.61E-04  8.61E-04  8.60E-04  8.59E-04  8.58E-04  8.57E-04  8.57E-04  8.56E-04
8.55E-04  8.54E-04  8.53E-04  8.53E-04  8.52E-04  8.51E-04  8.50E-04  8.50E-04  8.49E-04  8.48E-04
8.47E-04  8.46E-04  8.46E-04  8.45E-04  8.44E-04  8.43E-04  8.42E-04  8.40E-04  8.39E-04  8.37E-04
8.35E-04  8.33E-04  8.32E-04  8.30E-04  8.28E-04  8.26E-04  8.24E-04  8.22E-04  8.20E-04
   Ra-228          5.75E+00  4.90E+08  1.65E+08  1.15E+08  8.02E+07  5.59E+07  3.89E+07  2.71E+07
1.89E+07  1.31E+07  7.18E+06  3.93E+06  2.15E+06  1.18E+06  6.44E+05  3.52E+05  1.93E+05  1.05E+05
5.76E+04  3.15E+04  1.72E+04  9.44E+03  5.16E+03  2.82E+03  1.54E+03  8.45E+02  4.62E+02  2.53E+02
1.38E+02  7.57E+01  4.14E+01  2.27E+01  1.24E+01  6.78E+00  3.71E+00  2.03E+00  1.11E+00  6.07E-01
3.32E-01  1.82E-01  9.94E-02  5.44E-02  2.97E-02  1.63E-02  8.90E-03  4.87E-03  2.66E-03  1.46E-03
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7.97E-04   4.36E-04   2.39E-04   1.31E-04   7.14E-05   3.91E-05   2.14E-05   1.17E-05   6.40E-06   3.50E-06
1.91E-06   1.05E-06   5.73E-07   3.13E-07   1.71E-07   9.38E-08   2.81E-08   8.40E-09   2.51E-09   7.52E-10
2.25E-10   6.74E-11   2.02E-11   6.03E-12   1.81E-12   5.41E-13   1.62E-13   4.84E-14   1.45E-14   4.34E-15
1.30E-15   3.88E-16   1.16E-16   3.48E-17   1.04E-17   3.12E-18   9.32E-19   2.79E-19   8.35E-20   2.50E-20
7.48E-21   2.24E-21   6.70E-22   2.00E-22   6.00E-23   1.80E-23   5.37E-24   1.61E-24   4.81E-25   1.44E-25
4.31E-26   1.29E-26   3.86E-27   1.16E-27   3.46E-28   1.03E-28   0.00E+00   0.00E+00   0.00E+00   0.00E+00
0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00   0.00E+00
   Re-187             4.35E+10   3.44E-02   3.18E-02   3.09E-02   3.01E-02   2.93E-02   2.85E-02   2.78E-02
2.71E-02   2.64E-02   2.52E-02   2.41E-02   2.31E-02   2.21E-02   2.11E-02   2.02E-02   1.93E-02   1.85E-02
1.77E-02   1.69E-02   1.62E-02   1.55E-02   1.48E-02   1.42E-02   1.35E-02   1.30E-02   1.24E-02   1.19E-02
1.13E-02   1.08E-02   1.04E-02   9.92E-03   9.49E-03   9.08E-03   8.69E-03   8.31E-03   7.95E-03   7.60E-03
7.27E-03   6.96E-03   6.65E-03   6.37E-03   6.09E-03   5.82E-03   5.57E-03   5.33E-03   5.10E-03   4.88E-03
4.66E-03   4.46E-03   4.27E-03   4.08E-03   3.91E-03   3.74E-03   3.57E-03   3.42E-03   3.27E-03   3.13E-03
2.99E-03   2.86E-03   2.74E-03   2.62E-03   2.51E-03   2.40E-03   2.19E-03   2.01E-03   1.84E-03   1.68E-03
1.54E-03   1.41E-03   1.29E-03   1.18E-03   1.08E-03   9.86E-04   9.02E-04   8.26E-04   7.56E-04   6.91E-04
6.33E-04   5.79E-04   5.30E-04   4.85E-04   4.43E-04   4.06E-04   3.71E-04   3.40E-04   3.11E-04   2.84E-04
2.60E-04   2.38E-04   2.18E-04   1.99E-04   1.82E-04   1.67E-04   1.53E-04   1.40E-04   1.28E-04   1.17E-04
1.07E-04   9.80E-05   8.97E-05   8.21E-05   7.51E-05   6.87E-05   5.75E-05   4.82E-05   4.03E-05   3.38E-05
2.83E-05   2.26E-05   1.81E-05   1.45E-05   1.16E-05   9.32E-06   7.46E-06   5.98E-06   4.79E-06
   Se-79              6.50E+04   1.25E+05   1.24E+05   1.24E+05   1.23E+05   1.23E+05   1.23E+05   1.22E+05
1.22E+05   1.22E+05   1.21E+05   1.20E+05   1.20E+05   1.19E+05   1.19E+05   1.18E+05   1.18E+05   1.17E+05
1.17E+05   1.16E+05   1.16E+05   1.15E+05   1.15E+05   1.14E+05   1.14E+05   1.13E+05   1.12E+05   1.12E+05
1.11E+05   1.11E+05   1.10E+05   1.10E+05   1.09E+05   1.09E+05   1.08E+05   1.08E+05   1.07E+05   1.07E+05
1.06E+05   1.06E+05   1.06E+05   1.05E+05   1.05E+05   1.04E+05   1.04E+05   1.03E+05   1.03E+05   1.02E+05
1.02E+05   1.01E+05   1.01E+05   1.00E+05   9.99E+04   9.94E+04   9.89E+04   9.85E+04   9.80E+04   9.76E+04
9.71E+04   9.67E+04   9.63E+04   9.58E+04   9.54E+04   9.49E+04   9.41E+04   9.32E+04   9.24E+04   9.15E+04
9.07E+04   8.99E+04   8.90E+04   8.82E+04   8.74E+04   8.66E+04   8.58E+04   8.51E+04   8.43E+04   8.35E+04
8.27E+04   8.20E+04   8.12E+04   8.05E+04   7.98E+04   7.90E+04   7.83E+04   7.76E+04   7.69E+04   7.62E+04
7.55E+04   7.48E+04   7.41E+04   7.35E+04   7.28E+04   7.21E+04   7.15E+04   7.08E+04   7.02E+04   6.95E+04
6.89E+04   6.83E+04   6.76E+04   6.70E+04   6.64E+04   6.58E+04   6.46E+04   6.34E+04   6.23E+04   6.11E+04
6.00E+04   5.87E+04   5.73E+04   5.60E+04   5.48E+04   5.35E+04   5.23E+04   5.11E+04   5.00E+04
   Si-32              1.72E+02   1.17E+08   1.10E+08   1.08E+08   1.06E+08   1.04E+08   1.02E+08   1.00E+08
9.82E+07   9.63E+07   9.32E+07   9.02E+07   8.74E+07   8.46E+07   8.19E+07   7.93E+07   7.67E+07   7.43E+07
7.19E+07   6.96E+07   6.74E+07   6.52E+07   6.32E+07   6.11E+07   5.92E+07   5.73E+07   5.55E+07   5.37E+07
5.20E+07   5.03E+07   4.87E+07   4.72E+07   4.57E+07   4.42E+07   4.28E+07   4.14E+07   4.01E+07   3.88E+07
3.76E+07   3.64E+07   3.52E+07   3.41E+07   3.30E+07   3.20E+07   3.09E+07   2.99E+07   2.90E+07   2.81E+07
2.72E+07   2.63E+07   2.55E+07   2.46E+07   2.39E+07   2.31E+07   2.24E+07   2.16E+07   2.10E+07   2.03E+07
1.96E+07   1.90E+07   1.84E+07   1.78E+07   1.72E+07   1.67E+07   1.56E+07   1.47E+07   1.37E+07   1.29E+07
1.21E+07   1.13E+07   1.06E+07   9.93E+06   9.31E+06   8.73E+06   8.18E+06   7.66E+06   7.18E+06   6.73E+06
6.31E+06   5.91E+06   5.54E+06   5.19E+06   4.87E+06   4.56E+06   4.27E+06   4.00E+06   3.75E+06   3.52E+06
3.30E+06   3.09E+06   2.89E+06   2.71E+06   2.54E+06   2.38E+06   2.23E+06   2.09E+06   1.96E+06   1.84E+06
1.72E+06   1.61E+06   1.51E+06   1.42E+06   1.33E+06   1.25E+06   1.09E+06   9.60E+05   8.44E+05   7.41E+05
6.51E+05   5.53E+05   4.70E+05   4.00E+05   3.40E+05   2.89E+05   2.46E+05   2.09E+05   1.78E+05
   Sm-151             9.00E+01   4.74E+07   4.41E+07   4.30E+07   4.20E+07   4.10E+07   4.00E+07   3.90E+07
3.81E+07   3.72E+07   3.57E+07   3.43E+07   3.30E+07   3.17E+07   3.04E+07   2.92E+07   2.80E+07   2.69E+07
2.59E+07   2.48E+07   2.39E+07   2.29E+07   2.20E+07   2.11E+07   2.03E+07   1.95E+07   1.87E+07   1.80E+07
1.73E+07   1.66E+07   1.59E+07   1.53E+07   1.47E+07   1.41E+07   1.36E+07   1.30E+07   1.25E+07   1.20E+07
1.15E+07   1.11E+07   1.06E+07   1.02E+07   9.81E+06   9.42E+06   9.05E+06   8.69E+06   8.35E+06   8.02E+06
7.70E+06   7.39E+06   7.10E+06   6.82E+06   6.55E+06   6.29E+06   6.04E+06   5.80E+06   5.57E+06   5.35E+06
5.14E+06   4.94E+06   4.74E+06   4.55E+06   4.37E+06   4.20E+06   3.88E+06   3.57E+06   3.30E+06   3.04E+06
2.81E+06   2.59E+06   2.39E+06   2.20E+06   2.03E+06   1.87E+06   1.73E+06   1.59E+06   1.47E+06   1.36E+06
1.25E+06   1.15E+06   1.06E+06   9.82E+05   9.05E+05   8.35E+05   7.70E+05   7.11E+05   6.55E+05   6.05E+05
5.58E+05   5.14E+05   4.74E+05   4.38E+05   4.04E+05   3.72E+05   3.43E+05   3.17E+05   2.92E+05   2.70E+05
2.49E+05   2.29E+05   2.12E+05   1.95E+05   1.80E+05   1.66E+05   1.41E+05   1.20E+05   1.02E+05   8.70E+04
7.40E+04   6.05E+04   4.94E+04   4.04E+04   3.30E+04   2.70E+04   2.20E+04   1.80E+04   1.47E+04
   Sn-121m            5.50E+01   9.68E+07   8.64E+07   8.32E+07   8.01E+07   7.71E+07   7.43E+07   7.15E+07
6.88E+07   6.63E+07   6.22E+07   5.84E+07   5.49E+07   5.15E+07   4.84E+07   4.54E+07   4.26E+07   4.00E+07
3.76E+07   3.53E+07   3.31E+07   3.11E+07   2.92E+07   2.74E+07   2.57E+07   2.42E+07   2.27E+07   2.13E+07
2.00E+07   1.88E+07   1.76E+07   1.65E+07   1.55E+07   1.46E+07   1.37E+07   1.28E+07   1.21E+07   1.13E+07
1.06E+07   9.98E+06   9.37E+06   8.80E+06   8.26E+06   7.76E+06   7.28E+06   6.84E+06   6.42E+06   6.03E+06
5.66E+06   5.31E+06   4.99E+06   4.68E+06   4.39E+06   4.13E+06   3.87E+06   3.64E+06   3.41E+06   3.21E+06
3.01E+06   2.83E+06   2.65E+06   2.49E+06   2.34E+06   2.20E+06   1.93E+06   1.71E+06   1.50E+06   1.32E+06
1.17E+06   1.03E+06   9.07E+05   8.00E+05   7.05E+05   6.21E+05   5.48E+05   4.83E+05   4.25E+05   3.75E+05
3.31E+05   2.91E+05   2.57E+05   2.26E+05   2.00E+05   1.76E+05   1.55E+05   1.37E+05   1.20E+05   1.06E+05
9.36E+04   8.25E+04   7.27E+04   6.41E+04   5.65E+04   4.98E+04   4.39E+04   3.87E+04   3.41E+04   3.00E+04
2.65E+04   2.33E+04   2.06E+04   1.81E+04   1.60E+04   1.41E+04   1.09E+04   8.50E+03   6.61E+03   5.13E+03
3.99E+03   2.91E+03   2.12E+03   1.55E+03   1.13E+03   8.23E+02   6.01E+02   4.38E+02   3.20E+02
   Sn-126             1.00E+05   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04   5.11E+04
5.11E+04   5.11E+04   5.11E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04
5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.10E+04   5.09E+04   5.09E+04
5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.09E+04
5.09E+04   5.09E+04   5.09E+04   5.09E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04
5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.08E+04   5.07E+04
5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04   5.07E+04
5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.06E+04   5.05E+04   5.05E+04
5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.05E+04   5.04E+04   5.04E+04   5.04E+04   5.04E+04   5.04E+04
5.04E+04   5.04E+04   5.04E+04   5.03E+04   5.03E+04   5.03E+04   5.03E+04   5.03E+04   5.03E+04   5.03E+04
5.03E+04   5.02E+04   5.02E+04   5.02E+04   5.02E+04   5.02E+04   5.02E+04   5.01E+04   5.01E+04   5.01E+04
5.01E+04   5.00E+04   5.00E+04   5.00E+04   4.99E+04   4.99E+04   4.99E+04   4.98E+04   4.98E+04
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   Sr-90            2.88E+01  4.50E-02  3.26E-02  2.93E-02  2.63E-02  2.36E-02  2.12E-02  1.91E-02
1.71E-02  1.54E-02  1.29E-02  1.08E-02  9.00E-03  7.53E-03  6.29E-03  5.26E-03  4.40E-03  3.68E-03
3.08E-03  2.57E-03  2.15E-03  1.80E-03  1.50E-03  1.26E-03  1.05E-03  8.80E-04  7.36E-04  6.15E-04
5.15E-04  4.30E-04  3.60E-04  3.01E-04  2.52E-04  2.10E-04  1.76E-04  1.47E-04  1.23E-04  1.03E-04
8.61E-05  7.20E-05  6.02E-05  5.03E-05  4.21E-05  3.52E-05  2.94E-05  2.46E-05  2.06E-05  1.72E-05
1.44E-05  1.20E-05  1.01E-05  8.42E-06  7.04E-06  5.89E-06  4.92E-06  4.12E-06  3.44E-06  2.88E-06
2.41E-06  2.01E-06  1.68E-06  1.41E-06  1.18E-06  9.84E-07  6.88E-07  4.81E-07  3.37E-07  2.35E-07
1.65E-07  1.15E-07  8.05E-08  5.63E-08  3.94E-08  2.75E-08  1.92E-08  1.35E-08  9.41E-09  6.58E-09
4.60E-09  3.22E-09  2.25E-09  1.57E-09  1.10E-09  7.70E-10  5.38E-10  3.76E-10  2.63E-10  1.84E-10
1.29E-10  9.00E-11  6.30E-11  4.40E-11  3.08E-11  2.15E-11  1.51E-11  1.05E-11  7.36E-12  5.15E-12
3.60E-12  2.52E-12  1.76E-12  1.23E-12  8.61E-13  6.02E-13  2.94E-13  1.44E-13  7.04E-14  3.44E-14
1.68E-14  6.89E-15  2.82E-15  1.15E-15  4.71E-16  1.93E-16  7.87E-17  3.22E-17  1.32E-17
   Tb-157           7.10E+01  2.70E+07  2.47E+07  2.40E+07  2.33E+07  2.26E+07  2.19E+07  2.13E+07
2.07E+07  2.01E+07  1.91E+07  1.82E+07  1.73E+07  1.65E+07  1.57E+07  1.49E+07  1.42E+07  1.35E+07
1.28E+07  1.22E+07  1.16E+07  1.11E+07  1.05E+07  1.00E+07  9.54E+06  9.08E+06  8.64E+06  8.22E+06
7.83E+06  7.45E+06  7.09E+06  6.75E+06  6.42E+06  6.11E+06  5.82E+06  5.53E+06  5.27E+06  5.01E+06
4.77E+06  4.54E+06  4.32E+06  4.11E+06  3.91E+06  3.72E+06  3.54E+06  3.37E+06  3.21E+06  3.05E+06
2.91E+06  2.77E+06  2.63E+06  2.51E+06  2.38E+06  2.27E+06  2.16E+06  2.06E+06  1.96E+06  1.86E+06
1.77E+06  1.69E+06  1.60E+06  1.53E+06  1.45E+06  1.38E+06  1.25E+06  1.13E+06  1.03E+06  9.30E+05
8.43E+05  7.63E+05  6.91E+05  6.26E+05  5.67E+05  5.14E+05  4.65E+05  4.21E+05  3.82E+05  3.46E+05
3.13E+05  2.83E+05  2.57E+05  2.32E+05  2.11E+05  1.91E+05  1.73E+05  1.56E+05  1.42E+05  1.28E+05
1.16E+05  1.05E+05  9.53E+04  8.63E+04  7.82E+04  7.08E+04  6.41E+04  5.81E+04  5.26E+04  4.77E+04
4.32E+04  3.91E+04  3.54E+04  3.21E+04  2.90E+04  2.63E+04  2.16E+04  1.77E+04  1.45E+04  1.19E+04
9.77E+03  7.63E+03  5.95E+03  4.65E+03  3.63E+03  2.83E+03  2.21E+03  1.73E+03  1.35E+03
   Tb-158           1.80E+02  2.70E+07  2.60E+07  2.57E+07  2.54E+07  2.51E+07  2.48E+07  2.45E+07
2.42E+07  2.40E+07  2.35E+07  2.30E+07  2.26E+07  2.21E+07  2.17E+07  2.12E+07  2.08E+07  2.04E+07
2.00E+07  1.96E+07  1.92E+07  1.88E+07  1.85E+07  1.81E+07  1.78E+07  1.74E+07  1.71E+07  1.67E+07
1.64E+07  1.61E+07  1.57E+07  1.54E+07  1.51E+07  1.48E+07  1.45E+07  1.43E+07  1.40E+07  1.37E+07
1.34E+07  1.32E+07  1.29E+07  1.26E+07  1.24E+07  1.21E+07  1.19E+07  1.17E+07  1.14E+07  1.12E+07
1.10E+07  1.08E+07  1.06E+07  1.04E+07  1.01E+07  9.95E+06  9.75E+06  9.56E+06  9.37E+06  9.18E+06
9.00E+06  8.82E+06  8.65E+06  8.48E+06  8.31E+06  8.15E+06  7.83E+06  7.52E+06  7.23E+06  6.94E+06
6.67E+06  6.41E+06  6.16E+06  5.92E+06  5.69E+06  5.46E+06  5.25E+06  5.05E+06  4.85E+06  4.66E+06
4.48E+06  4.30E+06  4.13E+06  3.97E+06  3.81E+06  3.67E+06  3.52E+06  3.38E+06  3.25E+06  3.12E+06
3.00E+06  2.88E+06  2.77E+06  2.66E+06  2.56E+06  2.46E+06  2.36E+06  2.27E+06  2.18E+06  2.10E+06
2.01E+06  1.93E+06  1.86E+06  1.79E+06  1.72E+06  1.65E+06  1.52E+06  1.41E+06  1.30E+06  1.20E+06
1.11E+06  1.00E+06  9.06E+05  8.20E+05  7.42E+05  6.71E+05  6.08E+05  5.50E+05  4.98E+05
   Tc-99            2.11E+05  3.10E-03  2.92E-03  2.86E-03  2.81E-03  2.75E-03  2.70E-03  2.64E-03
2.59E-03  2.54E-03  2.46E-03  2.37E-03  2.30E-03  2.22E-03  2.15E-03  2.08E-03  2.01E-03  1.94E-03
1.88E-03  1.82E-03  1.76E-03  1.70E-03  1.65E-03  1.59E-03  1.54E-03  1.49E-03  1.44E-03  1.39E-03
1.35E-03  1.30E-03  1.26E-03  1.22E-03  1.18E-03  1.14E-03  1.10E-03  1.07E-03  1.03E-03  9.99E-04
9.66E-04  9.34E-04  9.04E-04  8.74E-04  8.45E-04  8.18E-04  7.91E-04  7.65E-04  7.40E-04  7.16E-04
6.92E-04  6.70E-04  6.48E-04  6.26E-04  6.06E-04  5.86E-04  5.67E-04  5.48E-04  5.30E-04  5.13E-04
4.96E-04  4.80E-04  4.64E-04  4.49E-04  4.34E-04  4.20E-04  3.93E-04  3.68E-04  3.44E-04  3.22E-04
3.01E-04  2.82E-04  2.63E-04  2.46E-04  2.31E-04  2.16E-04  2.02E-04  1.89E-04  1.77E-04  1.65E-04
1.55E-04  1.45E-04  1.35E-04  1.27E-04  1.18E-04  1.11E-04  1.04E-04  9.70E-05  9.07E-05  8.49E-05
7.94E-05  7.43E-05  6.95E-05  6.50E-05  6.08E-05  5.69E-05  5.32E-05  4.98E-05  4.66E-05  4.36E-05
4.08E-05  3.81E-05  3.57E-05  3.34E-05  3.12E-05  2.92E-05  2.56E-05  2.24E-05  1.96E-05  1.71E-05
1.50E-05  1.27E-05  1.08E-05  9.10E-06  7.71E-06  6.52E-06  5.52E-06  4.68E-06  3.96E-06
   Te-123           1.00E+13  5.24E-04  5.21E-04  5.19E-04  5.18E-04  5.17E-04  5.16E-04  5.15E-04
5.14E-04  5.13E-04  5.11E-04  5.09E-04  5.07E-04  5.05E-04  5.03E-04  5.02E-04  5.00E-04  4.98E-04
4.96E-04  4.94E-04  4.93E-04  4.91E-04  4.89E-04  4.87E-04  4.85E-04  4.84E-04  4.82E-04  4.80E-04
4.78E-04  4.77E-04  4.75E-04  4.73E-04  4.71E-04  4.70E-04  4.68E-04  4.66E-04  4.65E-04  4.63E-04
4.61E-04  4.60E-04  4.58E-04  4.56E-04  4.55E-04  4.53E-04  4.51E-04  4.50E-04  4.48E-04  4.46E-04
4.45E-04  4.43E-04  4.41E-04  4.40E-04  4.38E-04  4.37E-04  4.35E-04  4.34E-04  4.32E-04  4.30E-04
4.29E-04  4.27E-04  4.26E-04  4.24E-04  4.23E-04  4.21E-04  4.18E-04  4.15E-04  4.12E-04  4.09E-04
4.06E-04  4.03E-04  4.00E-04  3.97E-04  3.94E-04  3.91E-04  3.89E-04  3.86E-04  3.83E-04  3.80E-04
3.77E-04  3.75E-04  3.72E-04  3.69E-04  3.67E-04  3.64E-04  3.61E-04  3.59E-04  3.56E-04  3.53E-04
3.51E-04  3.48E-04  3.46E-04  3.43E-04  3.41E-04  3.38E-04  3.36E-04  3.33E-04  3.31E-04  3.29E-04
3.26E-04  3.24E-04  3.22E-04  3.19E-04  3.17E-04  3.15E-04  3.10E-04  3.06E-04  3.01E-04  2.97E-04
2.92E-04  2.87E-04  2.82E-04  2.77E-04  2.72E-04  2.67E-04  2.62E-04  2.57E-04  2.53E-04
   Th-229           7.88E+03  3.83E+05  3.82E+05  3.82E+05  3.82E+05  3.82E+05  3.82E+05  3.81E+05
3.81E+05  3.81E+05  3.81E+05  3.80E+05  3.80E+05  3.80E+05  3.79E+05  3.79E+05  3.79E+05  3.78E+05
3.78E+05  3.77E+05  3.77E+05  3.77E+05  3.76E+05  3.76E+05  3.76E+05  3.75E+05  3.75E+05  3.75E+05
3.74E+05  3.74E+05  3.74E+05  3.73E+05  3.73E+05  3.73E+05  3.72E+05  3.72E+05  3.72E+05  3.71E+05
3.71E+05  3.71E+05  3.70E+05  3.70E+05  3.70E+05  3.69E+05  3.69E+05  3.69E+05  3.68E+05  3.68E+05
3.68E+05  3.67E+05  3.67E+05  3.67E+05  3.66E+05  3.66E+05  3.66E+05  3.65E+05  3.65E+05  3.65E+05
3.64E+05  3.64E+05  3.64E+05  3.63E+05  3.63E+05  3.63E+05  3.62E+05  3.61E+05  3.61E+05  3.60E+05
3.59E+05  3.59E+05  3.58E+05  3.58E+05  3.57E+05  3.56E+05  3.56E+05  3.55E+05  3.54E+05  3.54E+05
3.53E+05  3.52E+05  3.52E+05  3.51E+05  3.50E+05  3.50E+05  3.49E+05  3.49E+05  3.48E+05  3.47E+05
3.47E+05  3.46E+05  3.45E+05  3.45E+05  3.44E+05  3.44E+05  3.43E+05  3.42E+05  3.42E+05  3.41E+05
3.40E+05  3.40E+05  3.39E+05  3.39E+05  3.38E+05  3.37E+05  3.36E+05  3.35E+05  3.34E+05  3.33E+05
3.31E+05  3.30E+05  3.28E+05  3.27E+05  3.25E+05  3.24E+05  3.22E+05  3.21E+05  3.20E+05
   Th-232           1.41E+10  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01  1.98E-01
1.98E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01  1.97E-01
1.97E-01  1.97E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01  1.96E-01
1.96E-01  1.96E-01  1.96E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.95E-01
1.95E-01  1.95E-01  1.95E-01  1.95E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01
1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.94E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01
1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.93E-01  1.92E-01  1.92E-01  1.92E-01  1.92E-01
1.92E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.91E-01  1.90E-01  1.90E-01  1.90E-01
```

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1.90E-01  1.90E-01  1.90E-01  1.89E-01  1.89E-01  1.89E-01  1.89E-01  1.89E-01  1.88E-01  1.88E-01
1.88E-01  1.88E-01  1.88E-01  1.88E-01  1.87E-01  1.87E-01  1.87E-01  1.87E-01  1.87E-01  1.87E-01
1.86E-01  1.86E-01  1.86E-01  1.86E-01  1.86E-01  1.86E-01  1.85E-01  1.85E-01  1.84E-01  1.84E-01
1.84E-01  1.83E-01  1.83E-01  1.83E-01  1.82E-01  1.82E-01  1.81E-01  1.81E-01  1.80E-01
   Ti-44            6.30E+01  2.81E+08  2.54E+08  2.46E+08  2.38E+08  2.30E+08  2.23E+08  2.15E+08
2.08E+08  2.01E+08  1.91E+08  1.80E+08  1.71E+08  1.61E+08  1.53E+08  1.44E+08  1.37E+08  1.29E+08
1.22E+08  1.16E+08  1.09E+08  1.04E+08  9.79E+07  9.26E+07  8.76E+07  8.29E+07  7.84E+07  7.42E+07
7.02E+07  6.64E+07  6.28E+07  5.94E+07  5.62E+07  5.32E+07  5.03E+07  4.76E+07  4.50E+07  4.26E+07
4.03E+07  3.81E+07  3.61E+07  3.41E+07  3.23E+07  3.05E+07  2.89E+07  2.73E+07  2.59E+07  2.45E+07
2.31E+07  2.19E+07  2.07E+07  1.96E+07  1.85E+07  1.75E+07  1.66E+07  1.57E+07  1.49E+07  1.40E+07
1.33E+07  1.26E+07  1.19E+07  1.13E+07  1.06E+07  1.01E+07  9.01E+06  8.07E+06  7.22E+06  6.46E+06
5.78E+06  5.18E+06  4.63E+06  4.15E+06  3.71E+06  3.32E+06  2.97E+06  2.66E+06  2.38E+06  2.13E+06
1.91E+06  1.71E+06  1.53E+06  1.37E+06  1.22E+06  1.09E+06  9.80E+05  8.77E+05  7.85E+05  7.02E+05
6.29E+05  5.63E+05  5.04E+05  4.51E+05  4.03E+05  3.61E+05  3.23E+05  2.89E+05  2.59E+05  2.32E+05
2.07E+05  1.86E+05  1.66E+05  1.49E+05  1.33E+05  1.19E+05  9.53E+04  7.64E+04  6.12E+04  4.90E+04
3.92E+04  2.97E+04  2.25E+04  1.71E+04  1.29E+04  9.80E+03  7.43E+03  5.63E+03  4.27E+03
   Tl-204           3.78E+00  7.92E+02  1.45E+02  8.24E+01  4.68E+01  2.66E+01  1.51E+01  8.58E+00
4.87E+00  2.77E+00  1.08E+00  4.20E-01  1.64E-01  6.37E-02  2.48E-02  9.67E-03  3.77E-03  1.47E-03
5.72E-04  2.23E-04  8.68E-05  3.38E-05  1.32E-05  5.13E-06  2.00E-06  7.78E-07  3.03E-07  1.18E-07
4.60E-08  1.79E-08  6.98E-09  2.72E-09  1.06E-09  4.13E-10  1.61E-10  6.26E-11  2.44E-11  9.50E-12
3.70E-12  1.44E-12  5.62E-13  2.19E-13  8.53E-14  3.32E-14  1.29E-14  5.04E-15  1.96E-15  7.65E-16
2.98E-16  1.16E-16  4.52E-17  1.76E-17  6.86E-18  2.67E-18  1.04E-18  4.06E-19  1.58E-19  6.15E-20
2.40E-20  9.34E-21  3.64E-21  1.42E-21  5.52E-22  2.15E-22  3.26E-23  4.95E-24  7.52E-25  1.14E-25
1.73E-26  2.63E-27  3.99E-28  6.05E-29  9.18E-30  1.39E-30  2.11E-31  3.21E-32  4.87E-33  7.39E-34
1.12E-34  1.70E-35  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Tm-170           3.52E-01  7.92E+02  1.59E-05  4.32E-08  1.17E-10  3.19E-13  8.67E-16  2.36E-18
6.41E-21  1.74E-23  9.22E-28  4.88E-32  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   U-232            6.89E+01  3.97E+07  3.62E+07  3.51E+07  3.41E+07  3.30E+07  3.20E+07  3.11E+07
3.01E+07  2.92E+07  2.78E+07  2.64E+07  2.51E+07  2.38E+07  2.26E+07  2.15E+07  2.04E+07  1.94E+07
1.85E+07  1.75E+07  1.67E+07  1.58E+07  1.50E+07  1.43E+07  1.36E+07  1.29E+07  1.23E+07  1.17E+07
1.11E+07  1.05E+07  1.00E+07  9.50E+06  9.03E+06  8.58E+06  8.15E+06  7.74E+06  7.36E+06  6.99E+06
6.64E+06  6.31E+06  6.00E+06  5.70E+06  5.42E+06  5.15E+06  4.89E+06  4.65E+06  4.42E+06  4.20E+06
3.99E+06  3.79E+06  3.60E+06  3.42E+06  3.25E+06  3.09E+06  2.93E+06  2.79E+06  2.65E+06  2.52E+06
2.39E+06  2.27E+06  2.16E+06  2.05E+06  1.95E+06  1.85E+06  1.67E+06  1.51E+06  1.36E+06  1.23E+06
1.11E+06  1.00E+06  9.06E+05  8.18E+05  7.39E+05  6.67E+05  6.02E+05  5.44E+05  4.91E+05  4.43E+05
4.00E+05  3.61E+05  3.26E+05  2.95E+05  2.66E+05  2.40E+05  2.17E+05  1.96E+05  1.77E+05  1.60E+05
1.44E+05  1.30E+05  1.18E+05  1.06E+05  9.58E+04  8.65E+04  7.81E+04  7.05E+04  6.37E+04  5.75E+04
5.19E+04  4.69E+04  4.23E+04  3.82E+04  3.45E+04  3.11E+04  2.54E+04  2.07E+04  1.69E+04  1.38E+04
1.12E+04  8.68E+03  6.73E+03  5.21E+03  4.04E+03  3.13E+03  2.42E+03  1.88E+03  1.45E+03
   U-233            1.59E+05  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.35E-01  1.34E-01
1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01  1.34E-01
1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.33E-01  1.32E-01
1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.32E-01  1.31E-01  1.31E-01
1.31E-01  1.31E-01  1.31E-01  1.31E-01  1.31E-01  1.31E-01  1.31E-01  1.31E-01  1.30E-01  1.30E-01
1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.30E-01  1.29E-01  1.29E-01
1.29E-01  1.29E-01  1.29E-01  1.29E-01  1.29E-01  1.29E-01  1.28E-01  1.28E-01  1.28E-01  1.28E-01
1.28E-01  1.27E-01  1.27E-01  1.27E-01  1.27E-01  1.27E-01  1.26E-01  1.26E-01  1.26E-01  1.26E-01
1.26E-01  1.25E-01  1.25E-01  1.25E-01  1.25E-01  1.25E-01  1.24E-01  1.24E-01  1.24E-01  1.24E-01
1.24E-01  1.23E-01  1.23E-01  1.23E-01  1.23E-01  1.23E-01  1.22E-01  1.22E-01  1.22E-01  1.22E-01
1.22E-01  1.22E-01  1.21E-01  1.21E-01  1.21E-01  1.21E-01  1.20E-01  1.20E-01  1.20E-01  1.19E-01
1.19E-01  1.18E-01  1.18E-01  1.17E-01  1.17E-01  1.16E-01  1.16E-01  1.16E-01  1.15E-01
   U-234            2.46E+05  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04  1.12E+04
1.12E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04  1.11E+04
1.11E+04  1.11E+04  1.11E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.10E+04
1.10E+04  1.10E+04  1.10E+04  1.10E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04
1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.09E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04
1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.08E+04  1.07E+04  1.07E+04  1.07E+04
1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.07E+04  1.06E+04  1.06E+04  1.06E+04
1.06E+04  1.06E+04  1.06E+04  1.05E+04  1.05E+04  1.05E+04  1.05E+04  1.05E+04  1.05E+04  1.04E+04
1.04E+04  1.04E+04  1.04E+04  1.04E+04  1.04E+04  1.04E+04  1.03E+04  1.03E+04  1.03E+04  1.03E+04
1.03E+04  1.03E+04  1.02E+04  1.02E+04  1.02E+04  1.02E+04  1.02E+04  1.02E+04  1.01E+04  1.01E+04
1.01E+04  1.01E+04  1.01E+04  1.01E+04  1.00E+04  1.00E+04  1.00E+04  9.97E+03  9.93E+03  9.90E+03
9.87E+03  9.83E+03  9.79E+03  9.76E+03  9.72E+03  9.68E+03  9.64E+03  9.60E+03  9.56E+03
   U-235            7.04E+08  2.79E-02  2.79E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02  2.78E-02
2.78E-02  2.78E-02  2.77E-02  2.77E-02  2.77E-02  2.77E-02  2.77E-02  2.76E-02  2.76E-02  2.76E-02
2.76E-02  2.76E-02  2.75E-02  2.75E-02  2.75E-02  2.75E-02  2.74E-02  2.74E-02  2.74E-02  2.74E-02
2.74E-02  2.73E-02  2.73E-02  2.73E-02  2.73E-02  2.73E-02  2.72E-02  2.72E-02  2.72E-02  2.72E-02
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2.72E-02  2.71E-02  2.71E-02  2.71E-02  2.71E-02  2.70E-02  2.70E-02  2.70E-02  2.70E-02  2.70E-02
2.69E-02  2.69E-02  2.69E-02  2.69E-02  2.69E-02  2.68E-02  2.68E-02  2.68E-02  2.68E-02  2.68E-02
2.67E-02  2.67E-02  2.67E-02  2.67E-02  2.67E-02  2.66E-02  2.66E-02  2.65E-02  2.65E-02  2.65E-02
2.64E-02  2.64E-02  2.63E-02  2.63E-02  2.63E-02  2.62E-02  2.62E-02  2.61E-02  2.61E-02  2.61E-02
2.60E-02  2.60E-02  2.59E-02  2.59E-02  2.59E-02  2.58E-02  2.58E-02  2.57E-02  2.57E-02  2.57E-02
2.56E-02  2.56E-02  2.55E-02  2.55E-02  2.55E-02  2.54E-02  2.54E-02  2.53E-02  2.53E-02  2.53E-02
2.52E-02  2.52E-02  2.51E-02  2.51E-02  2.51E-02  2.50E-02  2.50E-02  2.49E-02  2.48E-02  2.47E-02
2.46E-02  2.46E-02  2.45E-02  2.44E-02  2.43E-02  2.42E-02  2.41E-02  2.40E-02  2.39E-02
   V-50            1.40E+17  9.20E-08  9.19E-08  9.19E-08  9.19E-08  9.18E-08  9.18E-08  9.18E-08
9.18E-08  9.17E-08  9.17E-08  9.17E-08  9.16E-08  9.16E-08  9.15E-08  9.15E-08  9.14E-08  9.14E-08
9.14E-08  9.13E-08  9.13E-08  9.12E-08  9.12E-08  9.11E-08  9.11E-08  9.11E-08  9.10E-08  9.10E-08
9.09E-08  9.09E-08  9.09E-08  9.08E-08  9.08E-08  9.07E-08  9.07E-08  9.06E-08  9.06E-08  9.06E-08
9.05E-08  9.05E-08  9.04E-08  9.04E-08  9.03E-08  9.03E-08  9.03E-08  9.02E-08  9.02E-08  9.01E-08
9.01E-08  9.01E-08  9.00E-08  9.00E-08  8.99E-08  8.99E-08  8.98E-08  8.98E-08  8.98E-08  8.97E-08
8.97E-08  8.96E-08  8.96E-08  8.95E-08  8.95E-08  8.95E-08  8.94E-08  8.93E-08  8.92E-08  8.91E-08
8.91E-08  8.90E-08  8.89E-08  8.88E-08  8.87E-08  8.86E-08  8.86E-08  8.85E-08  8.84E-08  8.83E-08
8.82E-08  8.81E-08  8.81E-08  8.80E-08  8.79E-08  8.78E-08  8.77E-08  8.77E-08  8.76E-08  8.75E-08
8.74E-08  8.73E-08  8.72E-08  8.72E-08  8.71E-08  8.70E-08  8.69E-08  8.68E-08  8.68E-08  8.67E-08
8.66E-08  8.65E-08  8.64E-08  8.64E-08  8.63E-08  8.62E-08  8.60E-08  8.59E-08  8.57E-08  8.56E-08
8.54E-08  8.52E-08  8.50E-08  8.48E-08  8.46E-08  8.44E-08  8.42E-08  8.40E-08  8.38E-08
   Zr-93           1.53E+06  4.53E+03  4.53E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03  4.52E+03
4.52E+03  4.52E+03  4.52E+03  4.51E+03  4.51E+03  4.51E+03  4.51E+03  4.50E+03  4.50E+03  4.50E+03
4.50E+03  4.50E+03  4.49E+03  4.49E+03  4.49E+03  4.49E+03  4.49E+03  4.48E+03  4.48E+03  4.48E+03
4.48E+03  4.48E+03  4.47E+03  4.47E+03  4.47E+03  4.47E+03  4.46E+03  4.46E+03  4.46E+03  4.46E+03
4.46E+03  4.45E+03  4.45E+03  4.45E+03  4.45E+03  4.45E+03  4.44E+03  4.44E+03  4.44E+03  4.44E+03
4.44E+03  4.43E+03  4.43E+03  4.43E+03  4.43E+03  4.43E+03  4.42E+03  4.42E+03  4.42E+03  4.42E+03
4.41E+03  4.41E+03  4.41E+03  4.41E+03  4.41E+03  4.40E+03  4.40E+03  4.40E+03  4.39E+03  4.39E+03
4.38E+03  4.38E+03  4.38E+03  4.37E+03  4.37E+03  4.36E+03  4.36E+03  4.36E+03  4.35E+03  4.35E+03
4.34E+03  4.34E+03  4.34E+03  4.33E+03  4.33E+03  4.32E+03  4.32E+03  4.31E+03  4.31E+03  4.31E+03
4.30E+03  4.30E+03  4.29E+03  4.29E+03  4.29E+03  4.28E+03  4.28E+03  4.27E+03  4.27E+03  4.27E+03
4.26E+03  4.26E+03  4.25E+03  4.25E+03  4.25E+03  4.24E+03  4.23E+03  4.23E+03  4.22E+03  4.21E+03
4.20E+03  4.19E+03  4.18E+03  4.17E+03  4.16E+03  4.15E+03  4.14E+03  4.14E+03  4.13E+03
   Ks-20           1.00E+00  7.92E+02  1.18E+00  1.35E-01  1.54E-02  1.76E-03  2.01E-04  2.30E-05
2.63E-06  3.00E-07  8.07E-09  2.17E-10  5.84E-12  1.57E-13  4.22E-15  1.14E-16  3.05E-18  8.21E-20
2.21E-21  5.94E-23  1.60E-24  4.30E-26  1.16E-27  3.11E-29  8.37E-31  2.25E-32  6.05E-34  1.63E-35
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-21           1.00E+00  7.92E+02  1.25E+00  1.46E-01  1.70E-02  1.99E-03  2.32E-04  2.70E-05
3.15E-06  3.67E-07  1.02E-08  2.84E-10  7.89E-12  2.19E-13  6.10E-15  1.70E-16  4.72E-18  1.31E-19
3.65E-21  1.02E-22  2.83E-24  7.86E-26  2.19E-27  6.08E-29  1.69E-30  4.70E-32  1.31E-33  3.64E-35
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-22           1.00E+00  7.92E+02  1.45E+00  1.77E-01  2.17E-02  2.65E-03  3.25E-04  3.97E-05
4.86E-06  5.95E-07  1.79E-08  5.41E-10  1.63E-11  4.91E-13  1.48E-14  4.47E-16  1.35E-17  4.06E-19
1.22E-20  3.69E-22  1.11E-23  3.35E-25  1.01E-26  3.05E-28  9.19E-30  2.77E-31  8.35E-33  2.52E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-23           1.00E+00  7.92E+02  1.53E+00  1.91E-01  2.38E-02  2.97E-03  3.71E-04  4.62E-05
5.76E-06  7.18E-07  2.23E-08  6.95E-10  2.16E-11  6.72E-13  2.09E-14  6.51E-16  2.02E-17  6.30E-19
1.96E-20  6.09E-22  1.90E-23  5.90E-25  1.83E-26  5.71E-28  1.78E-29  5.52E-31  1.72E-32  5.34E-34
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
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   Ks-24             4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.88E+01  3.50E+01  2.08E+01  1.24E+01
7.35E+00  4.37E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.74E-02  2.41E-02  1.01E-02  4.27E-03
1.79E-03  7.54E-04  3.17E-04  1.33E-04  5.60E-05  2.36E-05  9.90E-06  4.16E-06  1.75E-06  7.36E-07
3.09E-07  1.30E-07  5.47E-08  2.30E-08  9.67E-09  4.06E-09  1.71E-09  7.18E-10  3.02E-10  1.27E-10
5.34E-11  2.24E-11  9.43E-12  3.97E-12  1.67E-12  7.01E-13  2.95E-13  1.24E-13  5.21E-14  2.19E-14
9.20E-15  3.87E-15  1.63E-15  6.84E-16  2.88E-16  1.21E-16  5.08E-17  2.14E-17  8.98E-18  3.78E-18
1.59E-18  6.67E-19  2.81E-19  1.18E-19  4.96E-20  2.08E-20  3.68E-21  6.51E-22  1.15E-22  2.03E-23
3.60E-24  6.35E-25  1.12E-25  1.99E-26  3.51E-27  6.20E-28  1.10E-28  1.94E-29  3.42E-30  6.05E-31
1.07E-31  1.89E-32  3.34E-33  5.91E-34  1.04E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-25             4.00E+00  7.92E+02  1.66E+02  9.90E+01  5.89E+01  3.50E+01  2.08E+01  1.24E+01
7.36E+00  4.37E+00  1.84E+00  7.73E-01  3.25E-01  1.37E-01  5.75E-02  2.42E-02  1.02E-02  4.27E-03
1.80E-03  7.55E-04  3.17E-04  1.33E-04  5.61E-05  2.36E-05  9.91E-06  4.17E-06  1.75E-06  7.37E-07
3.10E-07  1.30E-07  5.48E-08  2.30E-08  9.68E-09  4.07E-09  1.71E-09  7.19E-10  3.02E-10  1.27E-10
5.35E-11  2.25E-11  9.45E-12  3.97E-12  1.67E-12  7.02E-13  2.95E-13  1.24E-13  5.22E-14  2.19E-14
9.22E-15  3.88E-15  1.63E-15  6.85E-16  2.88E-16  1.21E-16  5.09E-17  2.14E-17  9.00E-18  3.79E-18
1.59E-18  6.69E-19  2.81E-19  1.18E-19  4.97E-20  2.09E-20  3.70E-21  6.53E-22  1.15E-22  2.04E-23
3.61E-24  6.38E-25  1.13E-25  1.99E-26  3.52E-27  6.22E-28  1.10E-28  1.94E-29  3.44E-30  6.08E-31
1.07E-31  1.90E-32  3.36E-33  5.93E-34  1.05E-34  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Ks-26             2.00E+00  7.92E+02  3.47E+01  1.22E+01  4.32E+00  1.52E+00  5.37E-01  1.89E-01
6.67E-02  2.35E-02  4.14E-03  7.28E-04  1.28E-04  2.26E-05  3.97E-06  6.99E-07  1.23E-07  2.16E-08
3.81E-09  6.70E-10  1.18E-10  2.07E-11  3.65E-12  6.43E-13  1.13E-13  1.99E-14  3.50E-15  6.16E-16
1.08E-16  1.91E-17  3.36E-18  5.91E-19  1.04E-19  1.83E-20  3.22E-21  5.67E-22  9.97E-23  1.76E-23
3.09E-24  5.44E-25  9.56E-26  1.68E-26  2.96E-27  5.21E-28  9.17E-29  1.61E-29  2.84E-30  5.00E-31
8.80E-32  1.55E-32  2.72E-33  4.79E-34  8.44E-35  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
   Th-230            7.54E+04  3.71E+04  3.71E+04  3.71E+04  3.70E+04  3.70E+04  3.70E+04  3.70E+04
3.70E+04  3.70E+04  3.70E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.69E+04  3.68E+04
3.68E+04  3.68E+04  3.68E+04  3.68E+04  3.67E+04  3.67E+04  3.67E+04  3.67E+04  3.67E+04  3.66E+04
3.66E+04  3.66E+04  3.66E+04  3.66E+04  3.66E+04  3.65E+04  3.65E+04  3.65E+04  3.65E+04  3.65E+04
3.64E+04  3.64E+04  3.64E+04  3.64E+04  3.64E+04  3.63E+04  3.63E+04  3.63E+04  3.63E+04  3.63E+04
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3.42E+04  3.41E+04  3.40E+04  3.39E+04  3.38E+04  3.38E+04  3.37E+04  3.36E+04  3.35E+04
   U-236             2.34E+07  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02  1.16E+02
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5.34E-01  5.32E-01  5.30E-01  5.28E-01  5.26E-01  5.24E-01  5.22E-01  5.20E-01  5.18E-01
   Pu-240            6.56E+03  1.80E-02  1.80E-02  1.80E-02  1.79E-02  1.79E-02  1.79E-02  1.79E-02
1.79E-02  1.79E-02  1.79E-02  1.79E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02  1.78E-02
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```

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   Ra-226           1.60E+03  1.80E-02  1.44E+02  1.92E+02  2.40E+02  2.88E+02  3.35E+02  3.83E+02
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1.00E+04  1.03E+04  1.05E+04  1.07E+04  1.10E+04  1.12E+04  1.14E+04  1.16E+04  1.18E+04
*********** MAXIMUM DOSES & DOMINANT NUCLIDES BY PATHWAY **********
 EnergySolns CAW, run VS168W, vert., 0.168 cm/yr
            PATHWAY       DUST         ATMOSPHERIC         GAMMA             WELL             FOOD
        ANNUAL DOSE     0.00E+00         0.00E+00         0.00E+00         0.00E+00         0.00E+00
               YEAR        0                0                0                0                0
   DOMINANT NUCLIDE
```

# ATTACHMENT 4
# CLASS A WEST (CAW) CELL INFILTRATION & TRANSPORT MODELING
# ELECTRONIC DATA FILES

Prepared for

*EnergySolutions, LLC*
*423 West 300 South, Suite 200*
*Salt Lake City, UT  84101*

Prepared by

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*104 W Ruby Avenue*
*Gunnison, Colorado  81230*
*970-641-7471*

*Document 4104K.111128*

November 28, 2011

# Attachment 4

# Drainage Ditch Calculations

ENERGYSOLUTIONS

# CLIVE FACILITY

# CLASS A WEST (CAW)
# DRAINAGE DITCH CALCULATIONS

**November 14, 2011**

**For**
**Utah Division of Radiation Control**
**195 North 1950 West**
**Salt Lake City, UT 84114-4850**

**By**
**Energy*Solutions*, LLC**
**423 West 300 South, Suite 200**
**Salt Lake City, UT 84101**

## 1.0 INTRODUCTION

Drainage calculations have been conducted for the design ditches surrounding the Class A West (CAW) embankment utilizing the methodologies described in NUREG-1623 and NUREG/CR-4620. Additional calculations have been completed for the entire site drainage system to the southwest corner of the 11e.(2) Embankment. An examination of outlet culverts from the CAW and 11e.(2) drainage systems has also been made.

This assessment was performed specifically for the introduction of the Class A West (CAW) embankment. After operations cease, Energy*Solutions* will take no credit for the remaining ditch systems.

As currently planned, drainage from completed portions of all embankments will be directed throughout the ditch systems to an outlet in the southwestern corner of the site. At this point, the water is dispersed into the desert south of the facility. A simple depiction of the site drainage plan is provided in Figure 1.

**Figure 1.** Simple schematic of the site with general drainage flows (not to scale)

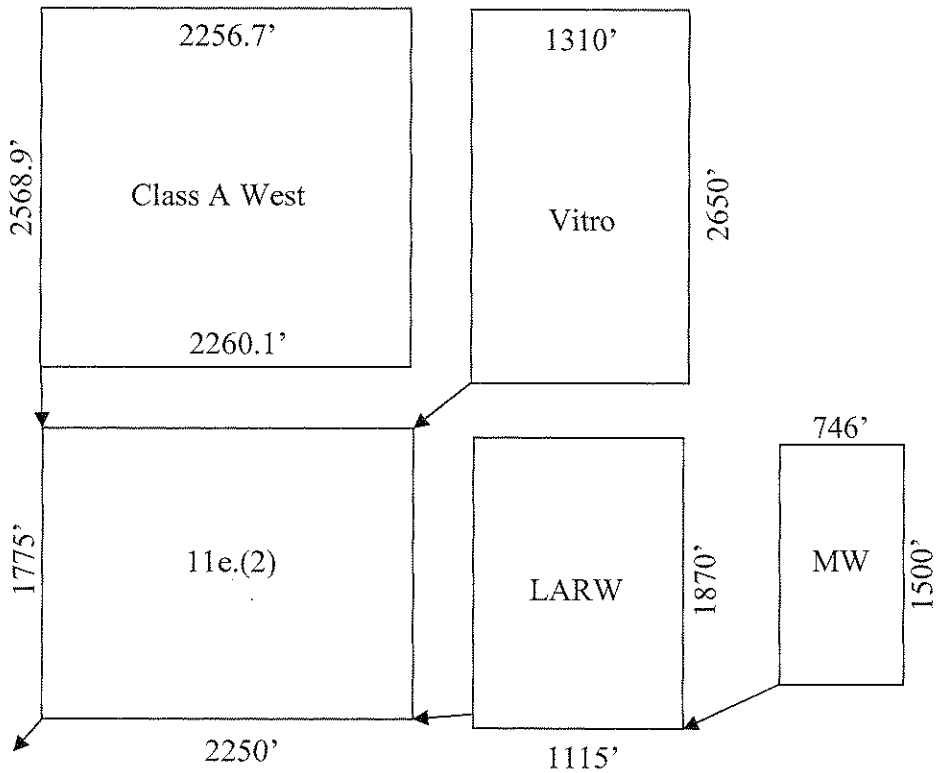

Figure 1 also provides details on the length/width geometry of each of the embankments that are part of this drainage system. With the exception of the Vitro embankment, the dimensions presented in Figure 1 are the waste limit dimensions for each embankment. The stated dimensions of the Vitro Embankment are for the entire run-off area. Dimensions for the CAW Embankment were taken from Drawing 10014 C01, Revision 1. Different dimensions are provided for the north and south sides of the CAW Embankment as depicted in the drawing.

## 2.0 FLOW VELOCITIES

To begin the performance assessment of the CAW and 11e.(2) drainage ditches, the peak flow velocities for the ditches must be calculated. These flow velocities are based upon the flow area and slope of the ditches. As depicted in Drawing 10014 C03, Revision 2, the ditches surrounding the CAW embankment are trapezoidal with a minimum base of 5.6 feet and 5:1 slopes on each of the sides. To make the calculations less cumbersome, the 2% slope in the base of the trapezoid has been ignored. The drainage ditches surrounding the 11e.(2) embankment are "V" ditches with 5:1 side slopes.

Drawing 10014 C01, Revision 1 shows design dimensions for the CAW ditches. Drawing 10014 C03, Revision 2 shows the distance between the toe of waste and the centerline of the ditch is 15.3 feet; therefore, the ditch length along each side of the CAW embankment is 30.6 feet further than that described in Figure 1 above. Table 1 uses this information, along with the specifications described in Drawing C01, Revision 1, to provide resulting slopes for each side of the CAW embankment.

**Table 1.** CAW Ditch Slope Evaluation

| Corner | Ditch Invert Elevation | Side | Length (ft) | Drop in Elevation (ft) | Slope (ft/ft) |
|---|---|---|---|---|---|
| NE | 4275.6 | North | 2,287.3 | 1.6 | 7.0E-4 |
| NW | 4274.0 | West | 2,599.5 | 2.9 | 1.1E-3 |
| SW | 4271.1 | South | 2,290.7 | 1.6 | 7.0E-4 |
| SE | 4272.7 | East | 2,599.5 | 2.9 | 1.1E-3 |

Slopes for the 11e.(2) ditch system may be discerned from the ditch centerline elevations provided in Drawing 9420-4. For the 11e.(2) ditch system, the following slopes are calculated based on ditch centerline drop in elevation across the ditch centerline length (note that the dimensions of the ditch centerline are the edge of waste dimensions provided in Figure 1 plus 42.5 feet in all directions):

North/South Lengths: 1.1 feet / 2335 feet = $4.71 \times 10^{-4}$ foot/foot
East/West Lengths: 0.9 feet / 1860 feet = $4.84 \times 10^{-4}$ foot/foot

Based on these slopes, and using Manning's Formula, the maximum flow rate for each ditch may be calculated. Manning's Formula is:

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

where,

Q = flow in cubic feet per second
n = Manning's Coefficient of Roughness (= 0.035 for ditches with earth, stone, and weeds; see Section 5.1)
A = cross-sectional area of flow ($ft^2$)
R = hydraulic radius; area of flow divided by wetted perimeter (WP) (ft)
S = slope (ft/ft)

Since the side slopes are 5:1, the water in the ditch, at the surface, will extend five times the depth (d) in each direction. For the trapezoidal ditches surrounding the CAW embankment, the cross sectional area will include a rectangular area which is the base length (at least 5.6 feet) times the depth as well as a triangular area on each side with a base of 5d and a height of d. Therefore, the total cross-sectional area of the trapezoidal ditches surrounding the CAW embankment, based on the variable depth of water in the ditch, is $5.6d + 5d^2$. For the "V" ditches of the 11e.(2) embankment, the cross-sectional area is simply equal to $5d^2$.

The wetted perimeter for the trapezoidal ditches consists of the base length and the two angled lengths of the triangle with a base of 5d and a height of d. This yields a wetted perimeter of $5.6 + 2 \times (d^2 + 25d^2)^{1/2} = 5.6 + 2(26)^{1/2}d$. For the "V" ditch, the wetted perimeter, in relation to the depth, is simply $2(26)^{1/2}d$.

### 5.1. Manning's Coefficient of Roughness, n

The literature value for the Manning's Coefficient of Roughness for ditches with earth, stone, and weeds (0.035) may be found in several references; the particular reference used for this analysis was Lindeburg, 2001. This value may alternatively be calculated based on the size of the riprap in the ditch. Several empirical equations have been derived in the literature; two of the more accepted equations are presented herein to demonstrate that the chosen coefficient is applicable and conservative.

Equation 4.41 of NUREG/CR-4620 was developed by the Army Corps of Engineers and others in 1970 and relates the roughness coefficient to the mean diameter ($d_{50}$) of the riprap. The formula is as follows:

$$n = 0.0395 * (d_{50})^{1/6}$$

where $d_{50}$ is the mean rock size in feet.

The ditch design utilizes Type A riprap with a $d_{50}$ of 4.5 inches (0.375 feet). Using this information and the NUREG/CR-4620 equation, the Manning's Coefficient of Roughness based on the riprap rock is estimated at 0.0335.

Another accepted empirical equation for determination of the roughness coefficient is the Strickler equation which is described in USACE, 1994. This equation uses the $d_{90}$ of the riprap rock. The equation is provided as equation 5-2 of USACE, 1994, and is as follows:

$$n = 0.034 * (d_{90})^{1/6}$$

The $d_{90}$ of the Type A riprap rock is 12 inches, or one foot. Therefore, using the Strickler equation, the estimated Manning's Coefficient of Roughness is 0.034.

These examples demonstrate that the literature value for the Manning's Coefficient of Roughness used in these calculations (0.035) provides a conservative estimate of the flow of water in the ditches.

Tables 1 and 2, on the next page, display the calculated flow rates of the CAW and 11e.(2) ditch systems using Manning's formula. The tables also depict the peak flows each of the ditch systems is able to manage. Flow units within these tables are provided in cubic feet per second (cfs) and cubic feet per minute (cfm).

**Table 2.** Ditch Flow Rates for the CAW Drainage Ditches

| Height of water in Ditch (ft) | Flow area in Ditch A ($ft^2$) | Wetted Perimeter WP (ft) | Hydraulic Radius R=A/WP | North (S = 0.07%) | | East (S = 0.11%) | | South (S = 0.07%) | | West (S = 0.11%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flow Rate Q (cfs) | Flow Rate Q (cfm) | Flow Rate Q (cfs) | Flow Rate Q (cfm) | Flow Rate Q (cfs) | Flow Rate Q (cfm) | Flow Rate Q (cfs) | Flow Rate Q (cfm) |
| 0.5 | 8.25 | 19.10 | 0.43 | 2.38 | 142.79 | 3.01 | 180.32 | 2.38 | 142.68 | 3.01 | 180.32 |
| 1.0 | 19.00 | 24.20 | 0.79 | 9.12 | 547.36 | 11.52 | 691.24 | 9.12 | 546.96 | 11.52 | 691.24 |
| 1.5 | 32.25 | 29.30 | 1.10 | 21.18 | 1270.71 | 26.75 | 1604.74 | 21.16 | 1269.77 | 26.75 | 1604.74 |
| 2.0 | 48.00 | 34.40 | 1.40 | 39.57 | 2374.03 | 49.97 | 2998.07 | 39.54 | 2372.27 | 49.97 | 2998.07 |
| 2.5 | 66.25 | 39.50 | 1.68 | 65.25 | 3915.05 | 82.40 | 4944.16 | 65.20 | 3912.14 | 82.40 | 4944.16 |
| 3.0 | 87.00 | 44.59 | 1.95 | 99.14 | 5948.25 | 125.20 | 7511.82 | 99.06 | 5943.83 | 125.20 | 7511.82 |
| 3.5 | 110.25 | 49.69 | 2.22 | 142.09 | 8525.41 | 179.44 | 10766.41 | 141.98 | 8519.08 | 179.44 | 10766.41 |
| 4.0 | 136.00 | 54.79 | 2.48 | 194.93 | **11696.00** | 246.17 | **14770.43** | 194.79 | **11687.32** | 246.17 | **14770.43** |

**Table 3.** Ditch Flow Rates for the 11e.(2) Drainage Ditches

| Height of water in Ditch (ft) | Flow area in Ditch A ($ft^2$) | Wetted Perimeter WP (ft) | Hydraulic Radius R=A/WP | North/South (S = 0.05%) | | East/West (S = 0.05%) | |
|---|---|---|---|---|---|---|---|
| | | | | Flow Rate Q (cfs) | Flow Rate Q (cfm) | Flow Rate Q (cfs) | Flow Rate Q (cfm) |
| 0.5 | 1.25 | 5.10 | 0.25 | 0.45 | 27.07 | 0.46 | 27.44 |
| 1.0 | 5.00 | 10.20 | 0.49 | 2.86 | 171.89 | 2.90 | 174.21 |
| 1.5 | 11.25 | 15.30 | 0.74 | 8.45 | 506.80 | 8.56 | 513.63 |
| 2.0 | 20.00 | 20.40 | 0.98 | 18.19 | 1,091.46 | 18.44 | 1,106.16 |
| 2.5 | 31.25 | 25.50 | 1.23 | 32.98 | 1,978.95 | 33.43 | 2,005.61 |
| 3.0 | 45.00 | 30.59 | 1.47 | 53.63 | 3,217.98 | 54.36 | 3,261.34 |
| 3.5 | 61.25 | 35.69 | 1.72 | 80.90 | 4,854.10 | 81.99 | 4,919.49 |
| 4.0 | 80.00 | 40.79 | 1.96 | 115.51 | **6,930.33** | 117.06 | **7,023.70** |

## 3.0 STORM EVENTS

The performance of the drainage ditches to contain runoff is only important during the active life of the facility (approximately 25 years). Upon closure, the drainage ditches will either be removed or become silted in to allow sheet flow across the site over the natural grade of the area. Therefore, a reasonable maximum normal storm event over the active life of the ditches is the 25 year, 24 hour storm event. A reasonable abnormal event during the active life of the ditches is the 100 year, 24 hour storm event.

The National Oceanic and Atmospheric Administration (NOAA) has put together precipitation and intensity maps for the western United States. The approximate location of the Clive facility was plugged into the NOAA website (NOAA, 2006) and the rainfall intensity profiles for the 25-year, 24-hour and the 100-year, 24-hour storms were downloaded. The storm intensity distributions from this website are provided in Table 4.

**Table 4.** Storm Intensity Distributions

| Time (minutes) | Normal Event (25-Year Storm) (inches/hour) | Abnormal Event (100-Year Storm) (inches/hour) |
|---|---|---|
| 5 | 3.43 | 5.22 |
| 10 | 2.61 | 3.98 |
| 15 | 2.16 | 0.28 |
| 30 | 1.45 | 2.21 |
| 60 | 0.899 | 1.37 |
| 120 | 0.491 | 0.720 |
| 180 | 0.334 | 0.484 |
| 360 | 0.184 | 0.245 |
| 720 | 0.103 | 0.130 |
| 1440 | 0.061 | 0.074 |

A copy of the NOAA information is provided as Attachment 1 of these calculations.

## 4.0 DRAINAGE AREAS

As mentioned previously, with the exception of the Vitro embankment, the dimensions presented in Figure 1 are the waste limit dimensions for each embankment. The stated dimensions for the Vitro embankment are for the entire run-off area. For the 11e.(2) embankment, the distance between the waste limits and the centerline of the ditch is 42.5 feet (8.5 feet of cover times 5 for a 5:1 side slope). For the Mixed Waste Landfill, the distance between the waste limits and the centerline of the ditch is 65 feet. For the LARW embankment, the distance between the waste limits and the centerline of the ditch varies between 15 and 35 feet, but a more conservative 35 feet is used in the area

calculation. For the Class A West embankment, the distance between the waste limits and the centerline of the ditch is at least 15.3 feet (see Drawing 10014 C03, Revision 2). Further, for all embankments except Vitro, the drainage area conservatively extends another 45.6 feet beyond the centerline of the ditch to the outer edge of the inspection road (see drawing 10014 C03, Revision 2). Using the information described above, the actual drainage dimensions and areas for each embankment are provided in Table 5.

**Table 5.** Drainage Areas

| Embankment | Length (E-W) (ft) | Width (N-S) (ft) | Drainage Area ($ft^2$) | Drainage Area (acres) |
|---|---|---|---|---|
| Class A West | 2,380.2* | 2,690.7 | 6,404,404.14 | 147.02 |
| Vitro | 1,310 | 2,650 | 3,471,500.00 | 79.69 |
| LARW | 1,276.2 | 2,031.2 | 2,592,217.44 | 59.51 |
| 11e.(2) | 2,426.2 | 1,951.2 | 4,734,001.44 | 108.68 |
| MW | 967.2 | 1,721.2 | 1,664,744.64 | 38.22 |

* For the CAW drainage area, the length dimension is an average of the northern and southern embankment dimensions as described in Drawing 10014 C01, Revision 1.

In addition to these drainage areas, the calculations within this report use partial drainage areas to estimate the run-off into individual ditches within the system. From Drawing 10014 C01, Revision 1, the CAW drainage area can be subdivided into four areas, one for each side of the embankment. The north and south side drainage areas are triangles with a base of 2,380.2 feet and a "height" of 942 + 188 + 60.9 = 1,190.9 feet. The east and west side drainage areas are parallelograms with a base of 2690.7 feet, a top length of 308.9 feet, and a depth of 1190.9 feet.

The overall site drainage area may also be subdivided as flows branch out before coming back together at the exit in the southwest corner of the 11e.(2) ditch system. Examining Figure 1, the site can be divided into two drainage areas:

(1) Western Site: CAW and the northwestern half of 11e.(2) combining into the 11e.(2) western ditch; and

(2) Eastern Site: Vitro, MW, LARW, and the southeastern half of 11e.(2) combining into the 11e.(2) southern ditch.

The calculated drainage areas associated with these additional subsections are provided in Table 6.

**Table 6.** Site Sub-Drainage Areas

| Area Description | Drainage Area ($ft^2$) | Drainage Area (acres) |
|---|---|---|
| CAW N/S | 1,417,290.09 | 32.54 |
| CAW E/W | 1,784,911.98 | 40.98 |
| Western Site | 8,771,404.86 | 201.36 |
| Eastern Site | 10,095,462.80 | 231.76 |
| Overall Site | 18,866,867.66 | 433.12 |

### 4.1 Run-Off Coefficient, C

In addition to the drainage areas, the calculations require a run-off coefficient that describes the fraction of the rainfall that will run-off the drainage area and collect within the ditches.

The literature value run-off coefficient, C, for earth with stone surface is 0.5. This run-off coefficient has been estimated based upon a worst-case review of literature values for similar surfaces (see Lindeburg, 2001). The value of 0.5 provides a conservative estimation for drainage from the embankments at the Clive facility.

The infiltration and transport modeling associated with the Class A West Embankment License Amendment Request (Whetstone, 2011), uses the HELP infiltration model to estimate, among other things, run-off coefficients for the top and side slopes. Table 11 of Whetstone, 2011 lists the results of the HELP modeling, showing an estimated top slope run-off coefficient of 0.031 and an estimated side slope run-off coefficient of 0.036. Furthermore, nine years of collected data from the Cover Test Cell (CTC) located at the Clive facility demonstrates an average annual run-off coefficient of 0.057. Based on this information, the literature value run-off coefficient of 0.5 used in these calculations provides conservative drainage results.

## 5.0 DRAINAGE CALCULATIONS

The methodology described in Section 3 of Appendix D of NUREG-1623 has been used to evaluate the depth of flow in the drainage ditches around the CAW embankment as well as the western and southern ditches of the 11e.(2) embankment. Superelevation of run-off due to bends within the ditches of the CAW embankment has also been evaluated.

### 5.1 Normal Flows

#### *5.1.1 CAW Embankment Drainage*

<u>Step 1. Determine Time of Concentration</u>

The maximum distance for water to travel within the CAW embankment ditch system is from the northern crest of the embankment, down the northeast corner slope, through the ditches, to the discharge point in the southwest corner of the embankment ditch. Ditch flow will either go across the northern ditch and then down the western ditch, or down the eastern ditch and then across the southern ditch. Since slopes and lengths are similar in the northern and southern ditches and the eastern and western ditches, both of these flow paths will result in similar calculated travel times. The distance that water must travel can be broken down into four discrete sections:

1. Northern crest to northeast corner shoulder of embankment;
2. Down northeastern shoulder to northeast corner of ditch system;
3. Down the eastern or across the northern ditch to the corner; and
4. Across the southern ditch or down the western ditch to the exit in the southwest corner.

The appropriate equation to determine the time of concentration ($T_c$) within each segment is provided in NUREG/CR-4620 (equation 4.45) and NUREG-1623 (equation D-1). This equation is:

$$T_c = \left( \frac{11.9L^3}{H} \right)^{0.385}$$

Where L is the length of travel in miles and H is the elevation difference in feet. Using the known lengths and slopes of each section (from Drawing 10014 C01, Revision 1), a complete time of concentration table can be compiled for each of the paths. Table 7 lists each of the parameters and the time of concentrations for each segment as well as the overall time of concentration for the CAW ditch system for both of the paths around the embankment. The lengths and slopes (elevation differences) for the first two segments were calculated using the northing, easting, and elevation points described in Drawing 10014 C01, Revision 1.

**Table 7.** CAW Ditch System Time of Concentration

| Segment | N/W Path | | | | | E/S Path | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | L (ft) | L (mi) | S | H (ft) | $T_c$ (hrs) | L (ft) | L (mi) | S | H (ft) | $T_c$ (hrs) |
| 1 | 1327.8 | 0.25 | 0.028 | 37.70 | 0.130 | 1327.8 | 0.25 | 0.028 | 37.70 | 0.130 |
| 2 | 265.6 | 0.05 | 0.14 | 37.60 | 0.020 | 265.6 | 0.05 | 0.14 | 37.60 | 0.020 |
| 3 (N/E) | 2378.5 | 0.45 | 7.0E-4 | 1.66 | 0.849 | 2690.7 | 0.51 | 1.1E-3 | 3.00 | 0.780 |
| 4 (W/S) | 2690.7 | 0.51 | 1.1E-3 | 3.00 | 0.780 | 2381.9 | 0.45 | 7.0E-4 | 1.66 | 0.851 |
| | | **TOTAL** | | **hrs** | **1.780** | | | | **hrs** | **1.781** |
| | | | | **min** | **106.8** | | | | **min** | **106.9** |

As expected, the travel times are almost identical through each of the paths. As a slightly conservative estimation, the E/S Path will be used in further calculations.

Step 2: Determine Rainfall Intensities of the Design Storm

The rainfall intensities associated with this time of concentration for each of the design storms are found through extrapolation from Table 4. For the E/S Path time of concentration of 106.9 minutes, the extrapolated rainfall intensities are as follows:

25-Year Event: $i = 0.580$ in/hr

100-Year Event: $i = 0.862$ in/hr

Step 3: Determine Design Flow Rate

For this small of a drainage area, the Rational Formula is acceptable for calculating the peak flow rate through the ditch system. The Rational Formula is:

$$Q = CiA$$

where, Q is the flow rate in cubic feet per second (cfs);
C is the run-off coefficient described in Section 4.1.;
i is the rainfall intensity in inches/hour; and
A is the drainage area in acres.

Using the data provided above, the peak flow rate for each of the design storm events is:

25-Year Event: $Q = 42.66$ cfs

100-Year Event: $Q = 63.39$ cfs

Step 4: Calculate the Maximum Height of Water in the Ditches

The maximum height of water in the ditches may be found by means of an iterative process using the parameters found in Table 2. The maximum height of water will be at the lowest point of the CAW ditch system, the southwest corner. The height of water in the eastern and/or southern ditches can be adjusted until the flow rate in the specific ditch is equivalent to that calculated above for each of the storm events. Table 8 provides the results of these iterative calculations.

**Table 8.** Maximum Height of Water in the CAW Ditch System

| Storm Event | Ditch | Maximum Height of Water (ft) | Freeboard in four-foot ditch |
|---|---|---|---|
| 25-Year, 24-Hour | Southern | 2.07 | 1.93 |
| | Western | 1.86 | 2.14 |
| 100-Year, 24-Hour | Southern | 2.47 | 1.53 |
| | Western | 2.23 | 1.77 |

Therefore, the four-foot deep trapezoidal ditch, with a base of at least 5.6 feet, surrounding the CAW embankment is designed adequately to contain all run-off from the system and maintain a freeboard greater than one-half foot under normal flow situations.

### *5.1.2 Overall Site Drainage*

Step 1: Determine Time of Concentration

As described in Section 4, the overall site drainage may be subdivided into western site flows and eastern site flows. The maximum distance for water to travel is different for each system. For the western site system, the maximum distance is from the northern crest of the CAW embankment and follows the same flow path as described for the CAW system and then flows down the western ditch of the 11e.(2) ditch system to the drainage outlet in the southwest corner of the facility (five discrete sections). For the eastern site system, the maximum distance is from the northern crest of the Vitro embankment, down its top and side slopes, through the northern and western Vitro ditches, down the eastern 11e.(2) ditch, and finally through the 11e.(2) southern ditch to the outlet (six discrete sections). In both instances, the transition areas between embankments has been ignored as the time through those systems will be very short in comparison to the other travel times.

Using the same equation as described above for the CAW ditch system, the time of concentration has been calculated for each of the site subdivisions. Table 9 provides the information for the western site system and Table 10 defines the eastern site system. Specific Vitro embankment information is not available; therefore, the Vitro embankment information was approximated using aerial topographic maps of the site in AutoCad, and slopes have been assumed from this data and similarities to the CAW embankment.

**Table 9.** Overall Site Western System Time of Concentration

| Segment | L (ft) | L (mi) | S | H (ft) | $T_c$ (hrs) |
|---|---|---|---|---|---|
| 1 (CAW Top) | 1329.4 | 0.25 | 0.028 | 37.70 | 0.130 |
| 2 (CAW Side) | 287.5 | 0.05 | 0.14 | 37.60 | 0.020 |
| 3 (CAW East) | 2690.7 | 0.51 | 1.1E-3 | 3.00 | 0.780 |
| 4 (CAW South) | 2381.9 | 0.45 | 7.0E-4 | 1.66 | 0.851 |
| 5 (11e.(2) West) | 1860.0 | 0.35 | 4.8E-4 | 0.90 | 0.810 |
| | | **TOTAL** | | **hrs** | **2.591** |
| | | | | **min** | **155.5** |

**Table 10.** Overall Site Eastern System Time of Concentration

| Segment | L (ft) | L (mi) | S | H (ft) | $T_c$ (hrs) |
|---|---|---|---|---|---|
| 1 (Vitro Top) | 670 | 0.13 | 0.028 | 19.02 | 0.077 |
| 2 (Vitro Side) | 281 | 0.05 | 0.14 | 39.77 | 0.021 |
| 3 (Vitro North) | 1258 | 0.24 | 2.4E-3 | 3.02 | 0.323 |
| 4 (Vitro West) | 2642 | 0.50 | 1.5E-3 | 3.96 | 0.686 |
| 5 (11e.(2) East) | 1860.0 | 0.35 | 4.8E-4 | 0.90 | 0.810 |
| 6 (113.(2) South) | 2335.0 | 0.44 | 4.7E-4 | 1.10 | 0.975 |
| | | **TOTAL** | | **hrs** | **2.892** |
| | | | | **min** | **173.5** |

Step 2: Determine Rainfall Intensities of the Design Storm

The rainfall intensities associated with this time of concentration for each of the design storms are found through extrapolation from Table 4. For the Overall Site Western System time of concentration of 155.5 minutes, the extrapolated rainfall intensities are as follows:

25-Year Event: i = 0.398 in/hr

100-Year Event: i = 0.548 in/hr

For the Overall Site Easter System time of concentration of 173.5 minutes, the extrapolated rainfall intensities are as follows:

25-Year Event: i = 0.339 in/hr

100-Year Event: i = 0.493 in/hr

Step 3: Determine Design Flow Rate

Using the Rational Formula and the data provided above, the peak flow rate for the Overall Site Western System for each of the design storm events is:

25-Year Event: Q = 40.09 cfs

100-Year Event: Q = 55.20 cfs

For the Overall Site Eastern System, the peak flow rates are calculated as:

25-Year Event: Q = 39.33 cfs

100-Year Event: Q = 57.08 cfs

Step 4: Calculate the Maximum Height of Water in the Ditches

The maximum height of water in the ditches may be found by means of an iterative process using the parameters found in Table 3. The maximum height of water will be at the lowest point of the overall site system, the southwest corner. The height of water in the eastern and/or southern 11e.(2) ditches can be adjusted until the flow rate in the specific ditch is equivalent to that calculated above for each of the storm events. Note that the western ditch calculation is associated with the data from the Overall Site Western System and the southern ditch is associated with the data from the Overall Site Eastern System. Table 11 provides the results of these iterative calculations.

**Table 11.** Maximum Height of Water in the 11e.(2) Ditch System

| Storm Event | 11e.(2) Ditch | Maximum Height of Water (ft) | Freeboard in four-foot ditch |
|---|---|---|---|
| 25-Year, 24-Hour | Southern | 2.67 | 1.33 |
| | Western | 2.68 | 1.32 |
| 100-Year, 24-Hour | Southern | 3.07 | 0.93 |
| | Western | 3.02 | 0.98 |

Therefore, the four-foot "V" ditch surrounding the 11e.(2) embankment is designed adequately to contain all run-off from the system and maintain a freeboard of at least one-half foot during the 25-Year storm event.

## 5.2 Superelevation around corners

Superelevation of the water in the ditch may occur around bends. Superelevation for channel bends is described in chapter 5 of Soil Conservation Services (SCS), 1977 and also in chapter 5 of the U.S. Department of Transportations HEC-22, 2009. In general, when fluid flows around a bend, the fluid on the inside of the bend is lowered slightly and the fluid on the outside of the bend is elevated. Superelevation is defined as the vertical distance between these two extremes. Therefore, the amount of additional height in the channel associated with superelevation will be the calculated value divided by two.

As described in SCS, 1977, the amount of superelevation for subcritical flow is:

$$s = \frac{V^2(b + 2zd)}{2(gR_c - 2zV^2)}$$

where, s = superelevation in feet
V = velocity in the ditch (ft/sec)
b = bottom width of the channel = 5.6 feet
z = cotangent of the side slope angle = 5
d = the depth of the fluid (ft)
g = gravitational acceleration = 32.2 ft/sec$^2$
$R_c$ = radius of curvature of bend, to the center of the channel = 32.2 ft

To calculate superelevation in the northwest corner, it is necessary to examine the parameters associated only with the northern CAW ditch; similarly, for the southeast corner, the parameters associated with the eastern CAW ditch will need to be examined. Superelevation in the southwest corner of the CAW ditch system will need to be examined from each side as different flows merge at this point. To obtain the velocity and depth of the water in each of the ditch sections, the four-step analysis utilized in Section 5.1 was done for each section. Results of these analyses, with all essential parameters, are shown in Table 12 on the next page. The maximum depth of flow after considering superelevation is listed in the last column (d + s/2).

The radius of curvature ($R_c$) for a 90-degree bend is the square-root of two times the length used to measure the parameter. In this case, the radius of curvature is to the centerline of the ditch. The horizontal width of the ditch is 45.6 feet (20 feet for each side slope with a 5.6 foot base); therefore, the centerline is 22.8 feet and Rc = 22.8 * $2^{1/2}$ = 32.2 feet.

The calculations show that superelevation is very small, bordering on inconsequential, for the low flows associated with the design ditch surrounding the CAW embankment. Greater than one foot of freeboard is easily maintained even after considering superelevation in this ditch system.

**Table 12.** Superelevation Results

| Storm Event | Area / Situation | $T_c$ (min) | i (in/hr) | A (acres) | Q (cfs) | d (ft) | $A_{flow}$ (sf) | V (ft/s) | Fr | s (ft) | s/2 (ft) | d + s/2 (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25-Year | NW Corner | 60.0 | 0.899 | 32.54 | 14.63 | 1.26 | 14.97 | 0.978 | 0.024 | 0.008 | 0.004 | 1.26 |
| | SE Corner | 55.8 | 0.975 | 40.98 | 19.98 | 1.31 | 15.85 | 1.261 | 0.030 | 0.015 | 0.007 | 1.31 |
| | N/W – SW Corner | 106.8 | 0.581 | 73.51 | 21.35 | 1.35 | 16.65 | 1.282 | 0.030 | 0.015 | 0.008 | 1.36 |
| | E/S – SW Corner | 106.9 | 0.580 | 73.51 | 21.33 | 1.51 | 19.76 | 1.079 | 0.022 | 0.012 | 0.006 | 1.51 |
| 100-Year | NW Corner | 60.0 | 1.371 | 32.54 | 22.30 | 1.54 | 20.41 | 1.092 | 0.022 | 0.012 | 0.006 | 1.54 |
| | SE Corner | 55.8 | 1.486 | 40.98 | 30.45 | 1.59 | 21.63 | 1.408 | 0.027 | 0.021 | 0.010 | 1.60 |
| | N/W – SW Corner | 106.8 | 0.863 | 73.51 | 31.73 | 1.62 | 22.17 | 1.423 | 0.027 | 0.022 | 0.011 | 1.64 |
| | E/S – SW Corner | 106.9 | 0.862 | 73.51 | 32.69 | 1.83 | 27.10 | 1.170 | 0.020 | 0.016 | 0.008 | 1.84 |
| 25-Year | SW Corner – Worst Case Southern Ditch | 106.9 | 0.862 | 147.02 | 42.66 | 2.07 | 33.01 | 1.29 | 0.019 | 0.021 | 0.011 | 2.08 |
| | SW Corner – Worst Case Western Ditch | | | | | 1.86 | 27.75 | 1.54 | 0.026 | 0.028 | 0.014 | 1.88 |
| 100-Year | SW Corner – Worst Case Southern Ditch | | | | 63.39 | 2.47 | 44.31 | 1.43 | 0.018 | 0.030 | 0.015 | 2.48 |
| | SW Corner – Worst Case Western Ditch | | | | | 2.23 | 37.23 | 1.70 | 0.024 | 0.040 | 0.020 | 2.25 |

## 6.0 ROCK SIZE CALCULATIONS

Rock size calculations have been completed for normal straight flow through the channels, as well as the additional strength needed for the stresses around bends in the ditches.

### 6.1 Normal Flow Rock Size Calculations

In general, the shear forces on the riprap within the ditches are the overruling parameter that defines the size of the rock necessary in the ditch. An iterative procedure for calculating the mean rock diameter is discussed in Section 3 of Appendix D of NUREG-1623. A similar iterative procedure, the Safety Factors Method, is discussed in NUREG/CR-4620. In both of these iterative procedures, the Manning's Coefficient of Roughness, n, is calculated based upon the assumed mean diameter ($d_{50}$) of the rock and then the stresses on the riprap calculated using that n-value. However, as discussed in Section 5.1, the analysis provided herein assumes a conservative literature value Coefficient of Roughness of 0.035; therefore, the iterative analysis is not necessary. A third method, discussed in Johnson and Abt, 1998, that does not use the shear forces to calculate the mean rock diameter, has also been used in this evaluation.

The equation to find the peak shear stress in normal channels is provided in NUREG-1623 and in NUREG/CR-4620 as follows:

$$\tau = \gamma d S$$

where, $\tau$ is the normal shear stress (lb/ft$^2$);
$\gamma$ is the density of water = 62.4 lb/ft$^2$;
d is the depth of flow (ft); and
S is the slope of the ditch.

Using the maximum depth of flow from Table 8, along with the corresponding ditch slope, the shear stresses associated with the designed southern and western CAW ditches can be calculated for both storm events. These calculations are tabulated in Table 13. This stress is the stress imparted on the ditch bottom. For the side slopes, the stress is increased slightly using the side slope factor, $K_1$, which is defined in USACE, 1994 (equation 3-4) as:

$$K_1 = \sqrt{1 - \frac{\sin^2\theta}{\sin^2\phi}}$$

where, $\theta$ is the angle of the side slope with the horizontal; and
$\varphi$ is the angle of repose of riprap material = 40 degrees

The angle of the side slope with the horizontal is simply the arctangent of 0.2 or 11.3 degrees. Using the equation above, these angles yield a side slope factor of 0.952. The stress on the side slopes is simply the stress on the bottom of the ditch

divided by this side slope factor. This calculated stress is also provided in Table 13 as $\tau_0$.

**Table 13.** Maximum Shear Stress During Normal Flow

| Storm Event | Ditch | d (ft) | S | $\tau$ (lb/ft$^2$) | $\tau_0$ (lb/ft$^2$) |
|---|---|---|---|---|---|
| 25-Year, 24-Hour | Southern | 2.07 | 7.0E-4 | 0.090 | 0.095 |
| | Western | 1.86 | 1.1E-3 | 0.130 | 0.136 |
| 100-Year, 24-Hour | Southern | 2.47 | 7.0E-4 | 0.108 | 0.113 |
| | Western | 2.23 | 1.1E-3 | 0.155 | 0.163 |

The mean riprap size required for this stress can be calculated using equations 4.32 and 4.33 within NUREG/CR-4620:

$$d_{50,\text{bottom}} = \frac{\tau}{0.04(\gamma_s - \gamma)} \qquad \text{and} \qquad d_{50,\text{side}} = \frac{\tau_0}{0.04(\gamma_s - \gamma)}$$

where, $\gamma_s$ and $\gamma$ are the densities of the stone and water, respectively.

The Safety Factors Method also has an expression for $d_{50}$ that is provided in equation 4.20 of NUREG/CR-4620. Assuming a stability number of one and rearranging this equation yields the following expression for $d_{50}$:

$$d_{50} = \frac{21\tau}{(S_s - 1)\gamma}$$

In this latter equation, $S_s$ is the specific gravity of the rock.

The density of the rock used at Clive has been quantified over the years. Examining results of these tests, the average specific gravity for rock used at Clive is 1.61, or a density of approximately 163 lbs/ft$^2$.

The Johnson and Abt, 1998 method does not use the shear stress to calculate the mean rock size in a trapezoidal channel. This method uses the flow rate, Q, the bottom width of the channel, b, and the slope of the channel, S, to determine the mean rock diameter. The method first calculates the design discharge as:

$$q = 1.35(Q/b).$$

The mean diameter (in inches) is then found using the following empirical equation:

$$d_{50} = 5.23S^{0.43}q^{0.56}.$$

Similar to the other methods, the Johnson and Abt, 1998 method calculates the rock size in the bottom of the channel and then uses the side slope factor to calculate the rock size necessary on the side slopes. Table 14 is an analysis of the results of all three of these rock sizing calculations.

**Table 14.** Calculated Required Mean Riprap Size ($d_{50}$)

| Storm Event | Ditch | Stress Method | | | | Safety Factors Method | | | | Johnson/Abt | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $d_{50,bottom}$ | | $d_{50,side}$ | | $d_{50,bottom}$ | | $d_{50,side}$ | | $d_{50,bottom}$ | $d_{50,side}$ |
| | | feet | inches | feet | inches | feet | inches | feet | inches | inches | inches |
| 25-Year | South | 0.022 | 0.269 | 0.024 | 0.282 | 0.019 | 0.226 | 0.020 | 0.238 | 0.344 | **0.361** |
| | West | 0.032 | 0.386 | 0.034 | 0.406 | 0.027 | 0.325 | 0.028 | 0.341 | 0.421 | **0.442** |
| 100-Year | South | 0.027 | 0.321 | 0.028 | 0.337 | 0.022 | 0.270 | 0.024 | 0.283 | 0.430 | **0.451** |
| | West | 0.039 | 0.462 | 0.040 | 0.485 | 0.032 | 0.389 | 0.034 | 0.408 | 0.526 | **0.552** |

All three of these rock calculation methods suggest that the situations present at the site require a rock much smaller then the 4.5-inch mean diameter Type A riprap. The largest calculated mean diameter rock is 0.55 inches on the side slopes using the Johnson & Abt, 1998 methodology.

## 6.2 Additional Stresses around Bends

Water flowing around bends in the ditches creates additional shear stress that the riprap rock within the ditch is required to manage. The additional shear stresses imparted on the rock is discussed in SCS, 1977 and HEC-22, 2009. A graphical factor, $K_b$, relating the radius of curvature of the bend to the bottom width of the channel has been developed and presented in these references. The relationship generally multiplies the shear stress of the straight flow by this factor to arrive at an increased shear stress on the rock at the bend.

As explained in Section 5.2, the radius of curvature for the 90-degree bends of the CAW ditch system is approximately 32.2 feet. The bottom width of the trapezoidal ditches, by design, is a minimum of 5.6 feet. The ratio of these two parameters is 32.2/5.6 = 5.75. Chart 21 in HEC-22, 2009 provides a graphical method to determine $K_b$. Using this chart and an Rc/B ratio of 5.75, $K_b$ is approximated around 1.45. Table 15 shows the riprap size required for this increased shear using this factor. The largest required riprap median size is slightly larger than 0.7 inches, which is well below the design criteria of 4.5 inches.

**Table 15.** Calculated Required Mean Riprap Size ($d_{50}$) around Bends

| Storm Event | Ditch | Stress Method | | | | Safety Factors Method | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $d_{50,bottom}$ | | $d_{50,side}$ | | $d_{50,bottom}$ | | $d_{50,side}$ | |
| | | feet | inches | feet | inches | feet | inches | feet | inches |
| 25-Year | South | 0.033 | 0.390 | 0.034 | **0.410** | 0.027 | 0.328 | 0.029 | 0.345 |
| | West | 0.047 | 0.560 | 0.049 | **0.588** | 0.039 | 0.471 | 0.041 | 0.495 |
| 100-Year | South | 0.039 | 0.465 | 0.041 | **0.489** | 0.033 | 0.391 | 0.034 | 0.411 |
| | West | 0.056 | 0.670 | 0.059 | **0.703** | 0.047 | 0.563 | 0.049 | 0.592 |

## 7.0 CULVERT CALCULATIONS

Culverts are necessary to direct the flow from the CAW ditch system into the 11e.(2) ditch system and again from the 11e.(2) ditch system out into the desert southwest of the facility.

Design of the culverts has been evaluated against both of the storm events described in Section 3.0. The culverts have been analyzed as cylinders with both a concrete design and a plastic/HDPE design. These calculations provide the minimum diameter of a cylindrical culvert necessary to accommodate the design flow.

### 7.1 Culvert Design Equations

Assuming uniform flow, the Chezy-Manning Equation is applicable for the design velocity through the culvert. This equation is:

$$\mathbf{v} = \left(\frac{\mathbf{1.49}}{\mathbf{n}}\right)\mathbf{R}^{2/3}\sqrt{\mathbf{S}}$$

where,

v = velocity (ft/sec)
n = Manning's Roughness Coefficient
R = hydraulic radius (ft)
S = slope (ft/ft)

The design flow through the culvert can be calculated as Q = vA, where A is the cross-sectional area of the culvert: $\pi D^2/4$. Further, the hydraulic radius for a circular culvert is one-fourth the diameter: R = D/4. Combining these equations yields the following equation for total flow within the culvert:

$$\mathbf{Q} = \left(\frac{\pi\mathbf{D}^2}{\mathbf{4}}\right)\left(\frac{\mathbf{1.49}}{\mathbf{n}}\right)\left(\frac{\mathbf{D}}{\mathbf{4}}\right)^{2/3}\sqrt{\mathbf{S}}$$

Rearranging this equation and solving for D, the required diameter of the cylindrical culvert, yields the following:

$$\mathbf{D} = \left[ \frac{\mathbf{nQ4^{5/3}}}{\mathbf{1.49\pi\sqrt{S}}} \right]^{3/8}$$

## 7.2 CAW – 11e.(2) Interface Culvert

The culvert directing water from the CAW ditch system into the 11e.(2) ditch system may be made of either concrete or plastic/HDPE. From Lindeburg, 2001, the value of n for concrete is 0.013 and for plastic/HDPE is 0.009.

From Drawing 10014 C03, Revision 1, the following dimensions are noted:

Length of Culvert = 110 feet

Drop in Elevation = 4271.1 – 4269.9 = 1.2 feet

Therefore, S = 1.2/110 = 0.0109 ft/ft.

Table 16 provides the calculated culvert size required for the flow parameters. The flow rate is the total CAW drainage area converging at the southwest corner. These values were previously calculated in Section 5.1.

**Table 16.** CAW – 11e.(2) Culvert Design

| Storm Event | Q (cfs) | n | S | D (ft) |
|---|---|---|---|---|
| 25-Year | 42.66 | 0.013 | 0.0109 | **2.49** |
| 100-Year | 63.39 | 0.013 | 0.0109 | **2.89** |
| 25-Year | 42.66 | 0.009 | 0.0109 | **2.17** |
| 100-Year | 63.39 | 0.009 | 0.0109 | **2.52** |

Thus a three-foot diameter culvert is adequate for this transition zone.

## 7.2 CAW Outlet Culvert

Drawing 9420-04(G) shows information about the post-closure 11e.(2)/Site drainage ditch outlet; however, a final design culvert has not been designed at this time. The calculations within this section use assumptions on a future culvert to assess the feasibility of this option and provide initial design parameters for when the final culvert is designed.

The culvert may be made of concrete or plastic/HDPE. From Lindeburg, 2001, the value of n for concrete is 0.013 and for plastic/HDPE is 0.009.

Preliminary investigations have assessed that the culvert section will have minimal slope. For this calculation, the following general dimensions are assumed:

Length of Culvert = 150 feet

Drop in Elevation = 0.06 feet

Slope, S = 4.0E-4 ft/ft.

Table 17 provides the calculated culvert size required for these parameters. The flow rate is the total sitewide drainage area converging at the southwest corner. This is calculated from the Rational Formula using the longest time of concentration rainfall intensities (as calculated in Section 5.1.2) and the overall site drainage area (433.12 acres from Table 6).

**Table 17.** CAW – 11e.(2) Culvert Design

| Storm Event | Q (cfs) | n | S | D (ft) |
|---|---|---|---|---|
| 25-Year | 73.50 | 0.013 | 0.0004 | **5.68** |
| 100-Year | 106.67 | 0.013 | 0.0004 | **6.54** |
| 25-Year | 73.50 | 0.009 | 0.0004 | **4.95** |
| 100-Year | 106.67 | 0.009 | 0.0004 | **5.69** |

Thus, a six-foot plastic/HDPE culvert is adequate for this outlet (a seven-foot concrete culvert may also be used). Multiple smaller culverts may be utilized for this outlet as long as the total area of flow is equivalent to that predicted by these diameter culverts.

## 8.0 CONCLUSIONS

These calculations demonstrate that the drainage ditches surrounding the CAW embankment are adequately designed to contain all of the flow from the worst-case storm events at Clive. Furthermore, the designed rock armor within the ditches is adequate for the site parameters.

The maximum height of water in the CAW ditch system during the normal storm event is 2.07 feet, leaving a freeboard distance of 1.93 feet. This provides a safety factor of 1.69 (3.5/2.07) from the design criterion for the normal condition of ½-foot of freeboard. The maximum height of water in the CAW ditch system during the abnormal storm event is 2.47 feet, leaving a freeboard distance of 1.53 feet. This provides a safety factor of 1.62 (4.0/2.47) from the design criterion for the abnormal condition that the ditch be able to contain all of the runoff from the embankment. For the overall site capacity, the 11e.(2) ditches reach a maximum height of 2.68 feet under the normal condition and 3.07 feet during the abnormal condition.

Rock sizing calculations show a minimum required $d_{50}$ for the riprap of 0.588 inches under the normal condition and 0.703 inches under the abnormal condition. These calculations take into account additional stresses associated with the bends in the ditch systems. The actual design rock $d_{50}$ for the Type A riprap in the ditches is 4.5 inches. Therefore, the safety factors are 7.65 (4.5/0.588) for the normal condition and 6.40 (4.5/0.703) for the abnormal condition.

Additional calculations show that a concrete culvert with a minimum diameter of 2.89 feet would adequately convey water from the CAW embankment during the abnormal condition storm. This minimum diameter is calculated at 2.52 feet if the culvert were a plastic. For the 11e.(2) outlet ditch, a culvert has not been designed yet; however, feasibility calculations confirm that a concrete culvert with minimum diameter of 6.54 feet or a plastic culvert with a minimum diameter of 5.69 feet could adequately contain the flow. These calculations will need to be redone for the actual parameters when the final culvert from the Clive system is designed. For any of these culverts, multiple smaller pipes may be utilized as long as the total area equates to the calculated area associated with these diameters.

## 9.0 REFERENCES


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## 10.0 CERTIFICATIONS

Calculations Performed by:

Timothy L. Orton, P.E. 11/16/11

Date

Calculations Checked by:

David F. Booth, P.E. 11/16/11

Date

# Attachment 1

# NOAA Precipitation Intensity Table

NOAA Atlas 14, Volume 1, Version 5
Location name: Grantsville, Utah, US*
Coordinates: 40.6912, -113.1185
Elevation: 4277ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

**PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]**

| Duration | Average recurrence interval(years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 1.13 (0.972-1.33) | 1.44 (1.25-1.69) | 2.02 (1.74-2.36) | 2.54 (2.17-2.99) | 3.43 (2.87-4.04) | 4.25 (3.44-5.04) | 5.22 (4.12-6.25) | 6.36 (4.84-7.73) | 8.18 (5.92-10.1) | 9.80 (6.82-12.3) |
| 10-min | 0.864 (0.744-1.01) | 1.10 (0.948-1.28) | 1.53 (1.32-1.80) | 1.93 (1.66-2.27) | 2.61 (2.18-3.08) | 3.23 (2.62-3.83) | 3.98 (3.13-4.75) | 4.84 (3.68-5.88) | 6.22 (4.50-7.70) | 7.45 (5.18-9.37) |
| 15-min | 0.712 (0.616-0.840) | 0.908 (0.784-1.06) | 1.26 (1.09-1.49) | 1.60 (1.37-1.88) | 2.16 (1.80-2.54) | 2.67 (2.17-3.17) | 3.28 (2.59-3.93) | 4.00 (3.04-4.86) | 5.14 (3.72-6.36) | 6.16 (4.28-7.74) |
| 30-min | 0.480 (0.414-0.566) | 0.610 (0.528-0.716) | 0.852 (0.736-1.00) | 1.08 (0.922-1.27) | 1.45 (1.21-1.71) | 1.80 (1.46-2.13) | 2.21 (1.74-2.64) | 2.69 (2.05-3.27) | 3.46 (2.51-4.29) | 4.15 (2.88-5.21) |
| 60-min | 0.297 (0.256-0.350) | 0.378 (0.327-0.443) | 0.527 (0.455-0.620) | 0.666 (0.570-0.784) | 0.899 (0.750-1.06) | 1.11 (0.903-1.32) | 1.37 (1.08-1.64) | 1.67 (1.27-2.02) | 2.14 (1.55-2.65) | 2.57 (1.79-3.23) |
| 2-hr | 0.183 (0.162-0.211) | 0.231 (0.204-0.266) | 0.306 (0.270-0.351) | 0.376 (0.328-0.432) | 0.491 (0.417-0.566) | 0.596 (0.494-0.693) | 0.720 (0.578-0.846) | 0.865 (0.670-1.04) | 1.10 (0.809-1.34) | 1.31 (0.925-1.63) |
| 3-hr | 0.137 (0.123-0.155) | 0.170 (0.152-0.193) | 0.219 (0.195-0.248) | 0.263 (0.233-0.297) | 0.334 (0.290-0.379) | 0.397 (0.338-0.466) | 0.484 (0.394-0.569) | 0.582 (0.459-0.697) | 0.739 (0.556-0.904) | 0.879 (0.638-1.10) |
| 6-hr | 0.084 (0.076-0.093) | 0.103 (0.093-0.114) | 0.128 (0.117-0.143) | 0.151 (0.136-0.167) | 0.184 (0.164-0.205) | 0.212 (0.186-0.237) | 0.245 (0.211-0.288) | 0.295 (0.240-0.353) | 0.374 (0.292-0.458) | 0.445 (0.337-0.557) |
| 12-hr | 0.049 (0.045-0.054) | 0.060 (0.055-0.066) | 0.075 (0.068-0.082) | 0.086 (0.079-0.094) | 0.103 (0.093-0.113) | 0.116 (0.103-0.128) | 0.130 (0.114-0.146) | 0.147 (0.127-0.177) | 0.188 (0.147-0.230) | 0.224 (0.169-0.280) |
| 24-hr | 0.031 (0.029-0.034) | 0.038 (0.035-0.042) | 0.046 (0.043-0.050) | 0.053 (0.049-0.057) | 0.061 (0.056-0.066) | 0.067 (0.062-0.073) | 0.074 (0.068-0.080) | 0.080 (0.073-0.090) | 0.095 (0.080-0.117) | 0.113 (0.085-0.142) |
| 2-day | 0.017 (0.015-0.018) | 0.021 (0.019-0.022) | 0.025 (0.023-0.027) | 0.028 (0.026-0.030) | 0.032 (0.029-0.034) | 0.035 (0.032-0.038) | 0.038 (0.035-0.041) | 0.041 (0.037-0.045) | 0.048 (0.041-0.059) | 0.057 (0.043-0.072) |
| 3-day | 0.012 (0.011-0.013) | 0.015 (0.014-0.016) | 0.018 (0.016-0.019) | 0.020 (0.018-0.021) | 0.023 (0.021-0.025) | 0.025 (0.023-0.027) | 0.027 (0.025-0.029) | 0.030 (0.027-0.032) | 0.034 (0.029-0.039) | 0.038 (0.031-0.048) |
| 4-day | 0.010 (0.009-0.010) | 0.012 (0.011-0.013) | 0.014 (0.013-0.015) | 0.016 (0.015-0.017) | 0.018 (0.017-0.020) | 0.020 (0.019-0.022) | 0.022 (0.020-0.024) | 0.024 (0.022-0.026) | 0.026 (0.024-0.030) | 0.029 (0.025-0.036) |
| 7-day | 0.006 (0.006-0.007) | 0.007 (0.007-0.008) | 0.009 (0.008-0.010) | 0.010 (0.009-0.011) | 0.011 (0.011-0.012) | 0.012 (0.011-0.013) | 0.013 (0.012-0.014) | 0.014 (0.013-0.015) | 0.015 (0.014-0.017) | 0.017 (0.015-0.021) |
| 10-day | 0.005 (0.004-0.005) | 0.006 (0.005-0.006) | 0.007 (0.006-0.007) | 0.007 (0.007-0.008) | 0.008 (0.008-0.009) | 0.009 (0.009-0.010) | 0.010 (0.009-0.011) | 0.010 (0.010-0.011) | 0.011 (0.010-0.012) | 0.012 (0.011-0.015) |
| 20-day | 0.003 (0.003-0.003) | 0.003 (0.003-0.004) | 0.004 (0.004-0.004) | 0.004 (0.004-0.005) | 0.005 (0.005-0.005) | 0.005 (0.005-0.006) | 0.006 (0.005-0.006) | 0.006 (0.006-0.006) | 0.006 (0.006-0.007) | 0.006 (0.006-0.007) |
| 30-day | 0.002 (0.002-0.002) | 0.003 (0.002-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.004 (0.003-0.004) | 0.004 (0.004-0.004) | 0.004 (0.004-0.004) | 0.004 (0.004-0.005) | 0.005 (0.004-0.005) | 0.005 (0.004-0.005) |
| 45-day | 0.002 (0.002-0.002) | 0.002 (0.002-0.002) | 0.002 (0.002-0.002) | 0.003 (0.002-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) |
| 60-day | 0.001 (0.001-0.002) | 0.002 (0.002-0.002) | 0.002 (0.002-0.002) | 0.002 (0.002-0.002) | 0.002 (0.002-0.003) | 0.003 (0.002-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) | 0.003 (0.003-0.003) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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## PF graphical

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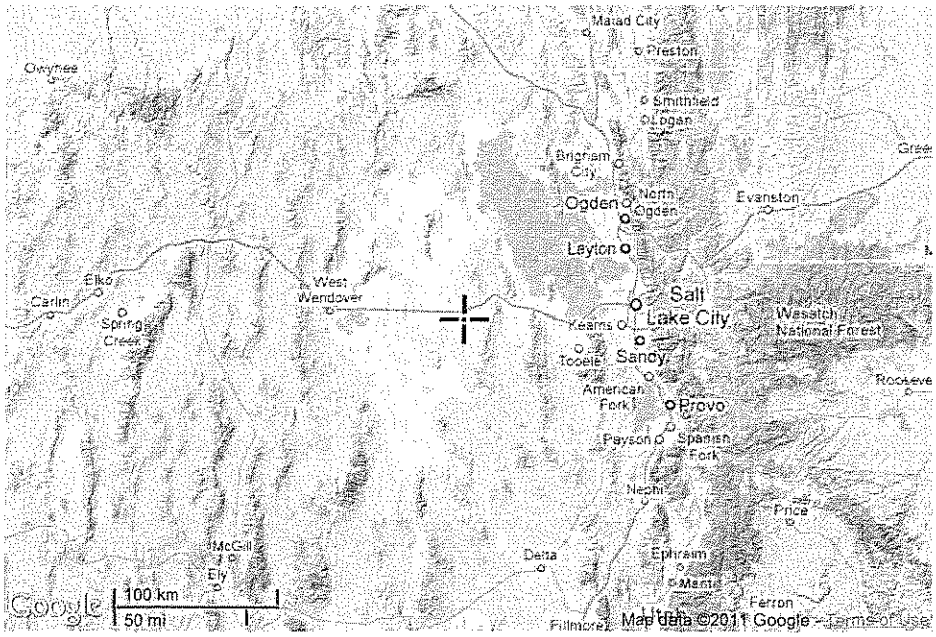
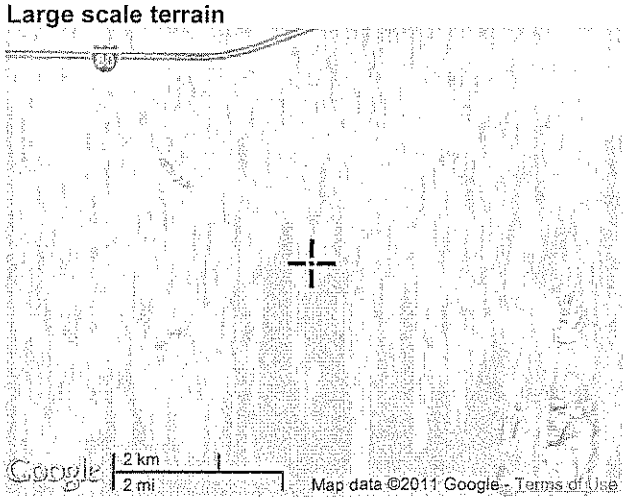
**Maps & aerials**

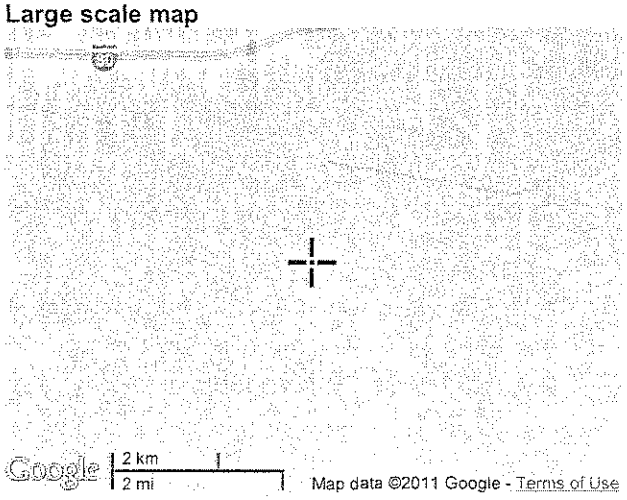
**Small scale terrain**



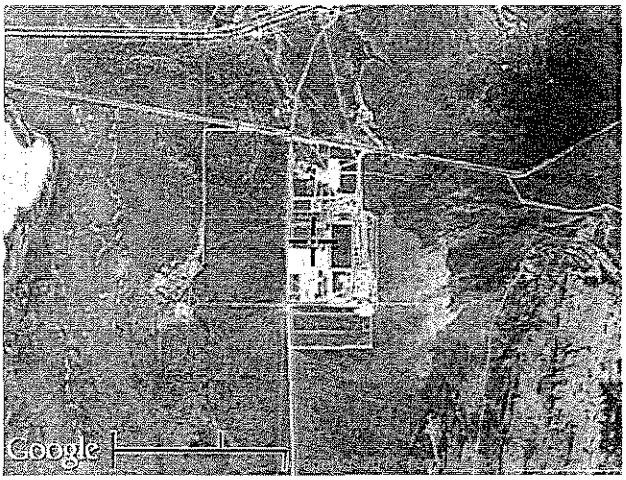

**Large scale terrain**




**Large scale map**




**Large scale aerial**

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National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

# Attachment 5

# Geotechnical Report

# GEOTECHNICAL UPDATE REPORT
# ENERGY SOLUTIONS CLIVE FACILITY
# CLASS A WEST EMBANKMENT
# CLIVE, TOOLE COUNTY, UTAH

Submitted to:
Energy*Solutions*, Inc.
423 West 300 South, Suite 200
Salt Lake City, Utah 84101

Submitted by
AMEC Earth & Environmental, Inc.
Salt Lake City, Utah

February 15, 2011
Job No. 10-817-05290

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## EXECUTIVE SUMMARY

Included herein is an update report to a study completed in 2005 by AMEC Earth & Environmental, Inc. (AMEC) that evaluated the geotechnical potential for increasing the height and expanding the footprint of the Class A low level radioactive waste embankment(s) at the Energy*Solutions* facility near Clive, Utah. The 2005 study involved reviewing previous reports to obtain basic geotechnical engineering design parameters, evaluating previous and current seismic design criteria including an updated seismic hazard analysis, completing static and seismic stability calculations, estimating deformations that may result from a design earthquake, and evaluating settlement issues that would be associated with greater embankment heights. The 2005 study concluded that stability and deformations of a combined single embankment incorporating the existing Class A and Class A North embankment footprints is feasible from a geotechnical perspective.

Since the 2005 study was completed the configuration of the enlarged waste embankment has been redesigned with a slightly larger footprint and a reduced overall slope height. This update report was prepared to recognize the current design identified as the Class A West Embankment (CAW) configuration. By observation a reduced embankment height is expected to perform better according to both stability and settlement considerations.

Several key elements presented in the 2005 study included an updated seismic hazard analysis, slope stability analysis and deformation analysis. The seismic hazard analysis indicated that the deterministic maximum considered earthquake for the site is a magnitude M 6.8 earthquake on the Skull Valley fault at less than 30 km, yielding an "average" acceleration of 0.24g for the bedrock site conditions. The probabilistic peak horizontal acceleration of 0.24g for the weighted mean hazard curve corresponds to an average recurrence interval of approximately 8,825 years. This bedrock acceleration is amplified by site conditions to a peak horizontal acceleration value of 0.28g.

The 2005 stability analyses indicated that embankment stability is primarily governed by the height of the outer 5(H):1(V) side-slopes. The 2005 calculations indicated that the Class A Combined (CAC) Embankment height of 50-feet at the 5(H):1(V) slope was geotechnically feasible. The current 38-foot height of the CAW Embankment is lower at the 5(H):1(V) slope break and slope stability calculations included with this update report continue to support our conclusions that the 5(H):1(v) slope configuration is geotechnically feasible.

The 2005 study reviewed available survey monument settlement data and found that the survey data indicated that the majority of embankment settlements will be complete within one to two years after waste placement. It is our understanding that Energy*Solutions,* Inc. is proposing to use an observational approach to monitor embankment settlement prior to final cover placement. The 2005 study concluded that scheduling the final cover placement for when monitoring data indicates the majority of the initial settlements are complete is anticipated to result in manageable settlements of the final cover. Even though the new CAW Embankment is smaller it should be anticipated that this monitoring period will require from one to two years.

# 1. INTRODUCTION

This update report summarizes our findings regarding the new proposed Class A West Embankment configuration for the combining and expanding of the existing Class A and Class A North Embankments at the Energy*Solutions* Clive Facility near Clive, Utah. AMEC completed the referenced 2005 study[1] of the feasibility to increase the height and footprint of the existing Class A Embankment (identified as the Class A Combined or CAC Embankment) and concluded that side-slope embankment heights up to 50-feet are stable under static and design seismic conditions and that deformations of the embankment associated with the design earthquake are within an acceptable range. Furthermore, the 2005 study concluded that angular distortion of the clay cap will be less than the maximum design criteria of 0.02 provided that final cover placement is delayed until majority of the initial settlements are complete. A survey monitoring program is currently planned to determine when settlements are nearly complete and the clay cap can be constructed.

The current proposed CAW Embankment configuration is depicted on the Energy*Solutions,* Inc. drawing titled Embankment Location & General Layout, dated October 4, 2010 and the drawing titled Embankment Cross Sections, dated October 27, 2010. Energy*Solutions*, Inc. is continuing to propose the combined large embankment which has been identified as the Class A West Embankment or hereinafter CAW Embankment. The footprint of the CAW Embankment is slightly larger in the north direction by 100 feet and the CAW Embankment side-slope height has been favorably reduced from 50 feet to 38 feet with the same protective cover geometries.

The general site location of the Clive Facility is shown on Figure 1, Regional Setting. Figure 2, Vicinity Map, shows the general arrangement of the various embankments at the Energy*Solutions*, Inc. Clive Facility. The locations of the AMEC field explorations completed as a part of the 2005 study and the previous 1999a[2] investigation are shown on Figure 3A, Field Exploration Location Map. An Exploration Location Map of earlier investigations is found in the 1999 investigation report. Cross sections through the proposed embankment are shown on Figure 3B, Embankment Cross-Sections.

## 1.1 OBJECTIVES

The objectives of this update report were to evaluate the new CAW Embankment configuration, which is a reduction from the 2005 CAC Embankment, considering geotechnical and seismic design considerations. This update utilizes the work of 2005 study that summarized the geotechnical design parameters and site specific data developed in our 1999a and subsequent studies, along with the supplemental subsurface investigations (site characterization) completed within the footprint of the proposed enlarged embankment. The 2005 study identified the key geotechnical design and construction parameters that are required to place the waste materials

1 AMEC (2005), Report, Combined Embankment Study, Envirocare, Tooele County, Utah, AMEC Job No. 4-817-004769, dated December 13, 2005.

2 AMEC (formerly AGRA) (1999a), Report, Geotechnical Site Characterization, Proposed New LARW Embankment, near Clive, Tooele County, Utah," AGRA Job No. 9-817-002586, dated October 26, 1999.

and meet the final cover distortion criteria previously developed. These design and construction parameters remain applicable and should be followed.

The objectives of this update study were to:

- Evaluate the static and seismic stability of the new lower height CAW Embankment.
- Evaluate the potential range in post earthquake deformations of the CAW Embankment.
- Evaluate static and post earthquake cover settlements and displacements of the smaller CAW Embankment.

## 1.2 EMBANKMENT DESIGN

The proposed EnergySolutions, Inc. embankment is located within the northwest quarter of Section 32, T1S, R11W (Salt Lake Base and Meridian). As addressed in the 2005 study the geotechnical design issues involved with the embankment are as follows:

- Stability – The embankment must meet generally accepted standards for static and seismic stability. Slope stability analyses are commonly performed using limit equilibrium techniques where a factor of safety against slope instability is calculated. The generally accepted standard for static stability is a factor of safety of at least 1.5. For seismic stability, the accepted standard is to design for factors of safety ranging from 1.0 to 1.3, depending on the sophistication of the analysis and the certainty of the geotechnical parameters used to calculate the factor of safety.

- Seismic Deformation – Although settlement is a form of deformation, the deformation of interest is deformation following closure due to an earthquake (termed post earthquake deformations). In general, deformations of the final cover tend to increase with embankment height. However, if the calculated static factor of safety of the embankment is reasonably high (above 1.5) and the materials do not loose strength during shaking, deformations under seismic conditions are anticipated to be small.

- Settlement – As embankment height increases, the total settlement of the compressible and incompressible debris within the embankment also increases. The principal item of concern is the potential for differential settlement to occur at the embankment cover due to differences in settlement of the underlying waste materials. In addition, the timing of when settlement occurs (before or after cover placement) is a design issue.

## 1.3 STEPS IN ANALYSIS

The 2005 study adhered to a sequence of analytical steps in evaluating the proposed enlarged embankment at the Clive Facility. The new CAW Embankment design is smaller than the 2005 CAC Embankment therefore for this update report we have only repeated the steps applicable

to evaluating slope stability and embankment settlement of the reduced overall embankment. The basis for our geotechnical analyses remain the same as was used for the 2005 study.

## 1.4 SETTLEMENT CONSIDERATIONS

For continuity with previous geotechnical work the following paragraphs essentially reiterate settlement considerations that were stated in the report for the 2005 study.

One of the principal items of interest for the 2005 study was differential settlement of the cover after it has been placed. AMEC's (formerly AGRA) previous work on evaluating settlements included a significant effort on evaluating the total potential magnitude of settlement from individual lifts or zones within the embankment. The difficulty in making such evaluations was that distinguishing between settlements that occur before and after cover placement was difficult since much of the settlement occurs during construction. Such predictions could therefore result in overly conservative predictions of post cover settlements.

Our previous estimates of the settlements at the cover were based on fundamental principals of soil mechanics. In those calculations, we estimated total settlement by assuming a reasonable distribution of each waste constituent, calculating the settlement potential for each lift[3] of waste, and summing these settlements on a per lift basis up to the embankment cover. Potential distortions at the cover were calculated based on the potential different magnitudes of total settlements attributed to each waste type. This methodology is conservative because it ignores the fact that waste is placed at different times and locations in the embankment. For example, waste placed at the base of the embankment may have completed settlement, while more recently placed waste continues to settle.

Subsequent settlement evaluations described in the 2005 study were based on the consideration that EnergySolutions, Inc. is following a plan to monitor the embankment settlements prior to final cover placement; and place the cover only after the rate of settlement at the cover subgrade has decreased to a manageable level. This "observational approach" to final cover settlement significantly reduces the uncertainties in estimating settlements of the waste during construction and prior to the cover being placed. It is well documented that settlements are largest immediately after fill placement and decrease either exponentially or logarithmically over time. The basis for the observational approach is to observe and measure settlement prior to final embankment cover placement. Adjustments can then be made at the top of waste prior to the cover to reduce the impact of these initial differential settlements. The goal of this approach is to permit the majority of the initial waste settlements to be complete prior to final radon barrier and rock cover placement.

The 2005 study of settlement potential, therefore, consisted of a detailed review of the available Vitro (a nearby adjacent waste embankment) and EnergySolutions, Inc. settlement data. The purpose of the review was to obtain field data that defined the length of time necessary for the majority of the initial settlements to be complete. Our review of the observed settlements was

3 A lift could consist of single lifts of compressible debris or a lift of containers / Controlled Low Strength Material (CLSM)

then used to complete predictions of the performance of the increased height embankment. The settlement evaluation also included calculations of the foundation settlements.

The conclusions and recommendations regarding embankment settlement contained in the 2005 study remain applicable and should be followed. The CAW Embankment is reduced and therefore settlements would be favorably less.

# 2. SITE CHARACTERIZATION DATA

## 2.1 SEISMIC DESIGN CRITERIA

### 2.1.1 General

An updated detailed seismic hazard analysis was completed and included in the 2005 study; a copy of the seismic hazard analysis is presented in Appendix A of this update report. The original 2005 Table A-2 of Appendix A was revised following responses to the Round 2 Interrogatories[4]. Within Appendix A of this update report the original Table A-2 has been replaced with the revised Table A-2. For continuity with the 2005 study the following paragraphs essentially reiterate the general summary that was stated in the 2005 study with revisions identified in the Round 2 Interrogatories.

The deterministic peak horizontal acceleration values for fault earthquake sources within about 70 km of the Energy*Solutions*, Inc. site are summarized in Appendix A: Table A-2. Probabilistic peak horizontal acceleration values for the background earthquake source within 100 km of the site are shown on Appendix A: Figure A-5. The largest peak acceleration in Appendix A: Table A-2 corresponds to an M 6.6 earthquake generated by the East Cedar Mountains fault. The peak acceleration corresponding to an M 6.8 earthquake generated by one of the Skull Valley faults is nearly as high. The Skull Valley faults are located no closer to the site than 30 km at the ground surface, but the faults dip toward the site, making the attenuation distance less than 30 km. The 84$^{th}$ percentile values are 0.242g and 0.238g, respectively, as calculated by the attenuation relation of Abrahamson and Silva (1997). For comparison, largest 84$^{th}$ percentile peak accelerations calculated by the Campbell and Bozorgnia (2003) and Pankow and Pechmann (2004) attenuation relations, are 0.198g and 0.181g, respectively, for the M 6.8 earthquake on one of the Skull Valley faults. The expected maximum magnitude of 6.8 comes from Wong and Others (2002), but Swan and Others (2004) report an expected maximum magnitude of 6.5 for the same fault. The lower maximum magnitude for the Skull Valley faults gives 84$^{th}$ percentile accelerations of 0.219, 0.168, and 0.154g for the three attenuation relations, as can be seen in Appendix A: Table A-2.

The second largest peak acceleration in Appendix A: Table A-2 corresponds to two different earthquakes for the three attenuation relations. A maximum magnitude of 7.0 on the Stansbury fault produces 84$^{th}$ percentile peak accelerations of 0.162 and 0.195g for the Pankow and

4 AMEC (2006), Round 2 Interrogatories and Response, Class A Embankment Height Study, Energy Solutions Facility, Near Clive, Tooele County, Utah, AMEC Job No. 4-817-004769, dated April 28, 2006.

Pechmann (2004) and Campbell and Bozorgnia (2003) relations, respectively. A maximum magnitude of 6.6 on the Cedar Mountains fault produces an 84th percentile acceleration of 0.242g for the Abrahamson and Silva (1997) relation.

Based on this review and update of earthquake ground motion at the EnergySolutions, Inc. site, a conservative, but reasonable deterministic maximum peak horizontal acceleration is 0.24g for rock site conditions. This maximum acceleration exceeds the 0.181g 84th percentile value predicted by the Pankow and Pechmann (2004) attenuation relation for any of the fault sources in the site region, and is approximately equal to the largest maximum 84th percentile value predicted by Campbell and Bozorgnia (2003) and the second largest 84th percentile value predicted by Abrahamson and Silva (1997). The probabilistic peak horizontal acceleration of 0.24g for the weighted mean hazard curve on Appendix A: Figure A-5 corresponds to an average recurrence interval of approximately 8,825 years.

The 2005 study also evaluated whether the foundation soils and embankment either amplify or attenuate this site acceleration. A one-dimensional response analysis was completed using the software program SHAKE2000. As described in the 2005 study a small amplification of the peak horizontal ground acceleration value was calculated. Based on this consideration, it was found that the free field bedrock accelerations of 0.24g may increase up to a value of 0.28g in the free field through the foundation soil. However, the presence of the embankment tends to attenuate the free field ground motions to slightly above 0.25g. The range appropriate for stability analysis was therefore from 0.25g to 0.28g.

## 2.2 SITE CONDITIONS

### 2.2.1 Background

The 2005 study completed supplemental field and laboratory evaluations of the foundation soils below the enlarged CAC Embankment footprint. The findings of the supplemental site characterization are summarized in Appendix B-1 of the 2005 report; a copy is attached in Appendix B-1 of this update report. Previously AMEC (formerly AGRA) completed a geotechnical site characterization for the existing Class A Embankment and submitted our findings in a report dated October 26, 1999. A copy of this site characterization is also included in Appendix B-2 of the report for the 2005 study. This site characterization supplemented the previous hydrogeology site characterization by Bingham Engineering, which included soil engineering property tests and shear wave velocity measurements down to 100 feet. For the purpose of the seismic wave propagation study, the depth to bedrock below the site was estimated at a depth of about 400 to 500 feet, as shown on Figure 4, Hydrogeologic Site Characterization. However, we understand that an exploratory borehole drilled to the north of the EnergySolutions, Inc. site in Section 29 did not encounter bedrock within a depth of 700 feet below the ground surface.

### 2.2.2 Subsurface Conditions

The subsurface conditions encountered in the supplemental explorations completed in 2005 were found to be consistent across the site and similar to the conditions encountered in the previously referenced investigations. The conditions observed are also in general agreement with the hydrogeologic cross sections developed by others across Section 32 and presented in Appendix D of EnergySolutions' (formerly Envirocare) Permit Application previously reviewed[5]. The general stratigraphic conditions are summarized in Table 2.1, Subsurface Characterization. The same geologic unit numbers used in the hydrogeologic characterization are used herein.

The importance of these findings is that subsurface conditions are sufficiently uniform that a single characterization is appropriate for either the individual or combined embankments. Due to the relatively minor footprint increase of the CAW Embankment, no additional subsurface exploration was deemed necessary. A stratigraphic cross section comparing the conditions below the existing embankment and the new (northern) embankment is shown on Figures 5A and 5B, Existing Class A Embankment Foundation Conditions and Class A North Foundation Conditions, respectively.

**Table 2.1 – Subsurface Characterization**

| Unit No. | Depth (ft) | Soil Type | Description |
|---|---|---|---|
| 4 | 0 to 9 +/- | Upper Clays | Silty Clays, classifying as CL in accordance with the Unified Soil Classification System. Contains some fine silt layers and is generally dry and medium stiff to stiff consistency. Considered to represent the deep Lake Bonneville clays. This material is used as both liner below the embankment and to construct the radon barrier. |
| 3 | 9 to 26 +/- | Silty Sands | Dense to medium dense silty sands and silts containing a few thin clay layers. |
| 2 | 26 to 64 +/- | Clays and Silts | Interbedded clay and silt layers with a few isolated sand layers up to two feet thick. Sand layers were discontinuous across the site. Clays are generally stiff with a few soft layers. Saturated throughout. |
| 1 | 64 to max depth | Interbedded Sand, Silt and Clay layers | A sequence of interbedded silty sand, fine sand and coarse to gravelly sand layers with interbedded clay and silt layers. Increasing sand layers beginning at depths of 50-feet and extending to maximum depth investigated, 100 feet. Dense to very dense sands and stiff clays. |

For continuity with the 2005 study the following paragraphs essentially reiterate the general summary of the subsurface conditions that was stated in the 2005 study.

5 See AGRA Letter Report, "Technical Appendix Document Review, New LARW Facility, Envirocare of Utah NW 1/4, Section 32, Near Clive, Utah, AGRA Job No. 9-817-002427, July 15, 1999.

Based on detailed geologic studies completed on other projects within the Basin and Range, we expect that the upper clays (Unit 4) represent the lake-bed clay deposited within the deep Lake Bonneville cycle(s) from about 12,000 to 30,000 years before present. The sequence of silty sands (Unit 3) below the upper clays were either alluvial, colluvial or lacustrine deposits which may have occurred during fluctuations in the Lake Bonneville level or during periods when the lake was not present (similar to current conditions). The lower (Unit 2) silts and clays most likely represent an older period of lacustrine deposition, predating 20,000 years before present and termed as the "Cutler Dam Lake cycle" in the geologic literature. The (Unit 1) sands, silts and clays most likely represent pre-Pleistocene deposits from an Interglacial period. These deposits may date as old as 100,000 to 150,000 years before present. The significance of these probable ages is that numerous earthquakes have occurred during this geologic time period surrounding the site vicinity and the probability of liquefaction with depth would be considered to be quite low based on age of the deposits alone.

Based on geologic cross sections developed for the hydrogeologic site conditions, the anticipated depth to bedrock below the site is at least 400 feet (see previous note on bedrock depth). A cross section of these generalized soil/bedrock conditions are shown on Figure 4. The geology of the surrounding area is described in the Utah Geologic Survey (UGS) Map 166 (Doelling, et al, 1994). This map and the accompanying text should be referenced for more detail than the very general description that follows herein.

In general, the bedrock exposed along the Grayback Hills to the north consists of hard, durable limestone of the Triassic Age (180 to 225 million years before present), including the Thaynes, Dinwoody Formations, and volcanoclastic rock (volcanic rock incorporating sediments, some of which contain cobbles; aged about 35 million years before present). These rocks generally form the "basin and range" blocks that have been faulted during the Quaternary (3 million years ago to present). The basin and range faulting created the typical north-south trending mountain ranges filled with thick sequences of sediment in the intervening valleys. From about 10,000 to 30,000 years before present, prehistoric Lake Bonneville covered the entire area. There were numerous lake stages and elevations during this period, along with a few intervening dry periods, similar to conditions today. In a very general manner, the collective "Bonneville" deposits consist of fine sands, silts, and clays along the valley bottoms, and granular sands and gravels deposited along lake benches and spits.

### 2.2.3 Groundwater

Groundwater was encountered during the 2005 study at a depths ranging from 37.3 feet in Boring B-2 at the time of drilling to a depth of 26 feet indicated by CPT. The depth of 26 feet generally agrees with the levels measured in nearby monitor wells. A depth of 22 feet was used in our analyses and accounts for a possible rise in groundwater.

## 2.3 EMBANKMENT DESIGN CRITERIA

### 2.3.1 Existing Embankment Geometry

In general, the Energy*Solutions*, Inc. Class A Embankment(s) has a footprint of about 1,400 by 2,260-feet and a maximum height of about 60 feet at the crest. The embankment includes a 5(H):1(V) exterior slope extending 32 feet in height, and a 4 percent top slope. The embankments are provided with a protective rock cover, filter layers, and a clay radon barrier that total 5.5-feet thick on the top and side slopes.

### 2.3.2 Proposed CAW Embankment Geometry

Energy*Solutions*, Inc. is considering constructing a combined embankment which includes the partly completed portion of the existing embankment and extending the footprint of the embankment northward and increasing the height of either combined embankment.

The new CAW Embankment is designed with a footprint of about 2,300 (east-west) by 2,600-feet (north-south). The embankment includes a 5(H):1(V) exterior slope extending 38 feet in height, and an approximate 4 to 6 percent top slope. The maximum height of the top cover extends up to about 84 feet, given this general geometry. The embankment is provided with a debris free soil layer, clay radon barrier, filter layers, and protective rock cover that total 8-feet thick on the top and side slopes.

For comparison the 2005 CAC Embankment was designed with a footprint of about 2,300 (east-west) by 2,500-feet (north-south). The embankment included a 5(H):1(V) exterior slope extending 50-feet in height, and an approximate 4 to 6 percent top slope. The maximum height of the top cover extended up to about 92-feet, given this general geometry. The CAC embankment was designed with a debris free soil layer, clay radon barrier, filter layers, and protective rock cover. The geometries of the CAW and CAC Embankments are depicted on Figures 3A and 3B

### 2.3.3 Geotechnical Design Values

A summary of the geotechnical design criteria used for the existing embankment may be found in Appendix B-1 of AMEC's (formerly AGRA) reply to Interrogatory 1 for the year 2000 amendment to the permit licensure[6], a copy of the appendix is attached in Appendix B-2 of this update report. AMEC's reply letter summarizes the existing, relevant geotechnical design criteria in a summary table format.

For continuity with the 2005 study the following paragraphs essentially reiterate the general summary of the basis for the geotechnical design values that was described in the 2005 study.

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6 AMEC (Formerly AGRA) (2000), Letter Report, Comment on Round No.1 Interrogatories, Amendment to Permit-License UT2300249," AGRA Job No. 0-817-002802, dated July 25, 2000.

A 1999a AGRA study evaluated seismic stability, deformations, development of shear strengths for compressible debris, and shear wave velocity data of the embankment materials (for seismic response). Subsequent to that study, additional embankment material types (incompressible debris, controlled low strength material [hereinafter CLSM], containerized waste, oversize debris, large components) were evaluated which generally possessed higher shear strengths. We consider the available characterization to be adequate, but conservative. By conservative, it is meant that the shear strengths used in our calculations envelop the various types of waste placed in the embankments. Less conservative design assumptions could be utilized, however using higher shear strengths may require that limitations be placed on where certain types of waste can be placed within the embankment. We therefore continued to use the lower bound shear strengths to allow flexibility in waste placement and placement methods.

AMEC completed a number of studies regarding the settlement potential of compressible debris, incompressible debris, CLSM pyramids, strong-tight containers (resin liners) placed within concrete cylinders, and large components. In general, these studies supported the placement of the various waste types within the existing embankment design. The settlement calculations were based on predicting the settlement potential from characteristics of the waste type and/or placement method. Such predictive relationships do not include a reduction in settlement over time. However, field observations indicate that a logarithmic or exponential decay in the rate of settlement over time has been observed at municipal and other waste storage sites. Our previous methodology generally calculated the total potential of a "column of waste" to settle. Since the lower portion of this "waste column" may have completed settlement when waste is placed in the upper "column," this method contains inherent conservatism. Considering that actual field performance (settlement) data regarding the rate and magnitude of settlement of materials is available for the Class A Embankment, using this data is a more realistic approach.

Material properties required for stability analysis include the in-place waste and cover density, shear strength, and dynamic properties such as damping, shear wave velocity, and the strain-dependent shear modulus and damping curves. These material properties were previously determined from field measurements (in-place density, shear strength, and shear wave velocity of the Class A Material) and the relationships between soil classification and index properties available in the published literature. The design values previously developed are summarized in Appendix B-2 of this update report. Seismic shear wave velocity data and SASW (Spectral Analysis of Surface Waves, a method used to obtain shear wave velocity data), were presented in Appendix B-4 of the 2005 study.

The stability calculations utilized an 18 degree friction angle for the LARW debris, which is representative of a very high compressible debris percentage. Field tests indicated that the internal friction angle of compressible debris increased from 24 to 34 degrees as the waste percentage increases from 10 to 40 percent, respectively. However, at higher percentages of waste (greater than 50 percent), the friction angle may approach the 18 degree friction angle value. The 18 degree friction angle value conservatively bounds the lowest available shear strength. Higher shear strength values could be justified, even with the available data; that would lead to higher calculated factors of safety for a given design consideration. However,

initial sensitivity and subsequent stability calculations revealed that less conservatism in the shear strength assumptions used in the analysis would not be necessary[7].

# 3. CALCULATIONS

## 3.1 GENERAL

Soil parameters that were summarized in Table 3.1 of the 2005 study for the foundation soil and embankment materials have continued to be used for this update report. To evaluate the CAW Embankment based on slope stability, the following sets of calculations were completed for the new reduced embankment design height:

- Static stability was calculated.
- Pseudo-static (seismic) stability was calculated.
- "Yield" accelerations (or the yield coefficient was determined) to estimate deformations.
- Deformations following a seismic event were calculated using a "Newmark Sliding Block" analysis.

The following sections discuss each of these items in further detail.

## 3.2 ENGINEERING DESIGN PARAMETERS

Soil parameters of the various embankment materials modeled in the slope stability analysis are listed in the following Table 3.1. Drained strength parameters were used in static stability calculations and both drained and undrained parameters were used in seismic stability calculations. Further details and background with regards to the soil parameters are presented in the text and appendices of the 2005 study.

The foundation layers used in the slope stability model were based on the site characterization and stratigraphy described in Section 2.3, Site Conditions; Appendix B-1 of this update; as well as presented in AMEC report dated October 26, 1999.

7 Large scale laboratory shear box testing could be completed that would reduce the shear strength conservatism in the analysis. Similarly, the strength of the radon barrier clay and clay liner was conservatively estimated from published values and laboratory testing. Supplemental testing could support higher strength values and further reduce conservatism in the values used.

**Table 3.1 – Summary of Engineering Properties in Slope Stability Analysis (ref AMEC 12/13/05)**

| Material / Soil Units | Unit Weight, (pcf) | Angle of Internal Friction, (degrees) | Cohesion Intercept, (psf) | Basis / Reference Source |
|---|---|---|---|---|
| **LARW Embankment Properties** | | | | |
| Rip Rap (Cover) | 135 | 40 | 0 | Appendix B-2, Table B |
| Clay Cover | 123 | 0 | 1000 | AMEC 1999a, Section 3.2.7 |
| Protective Soil Layer (Debris Free Soil) – silty sand | 117.5 | 38 | 250 | AMEC 1999b[8], Figure A-7 |
| Compressible Debris | 101 | 18 | 130 | AMEC 1999b, Figure 9 |
| CLSM | 120 | 0 | 15200* (equal to 100 psi) | Specification calls for minimum of 150 psi |
| Clay Liner | 123 | 0 (28) | 1000 (100) | Appendix B-2, Table B (AMEC 5/25/99, Figure A-6) |
| **Embankment Foundation Properties** | | | | |
| | | Drained / Undrained | Drained / Undrained | |
| Unit 4- Upper Clays | 118 | 29 / 0 | 0 / 2000 | CPT correlations Appendix B-1 (or AMEC 2005, App B-1) and AMEC 1999a |
| Unit 3 - Silty Sands | 120 | 34 | 0 | CPT correlations Appendix B-1 (or AMEC 2005, App B-1) and AMEC 1999a |
| Unit 2 - Clays and Silts | 121 | 29 / 0 | 1000 / 2000 | CPT correlations Appendix B-1 (or AMEC 2005, App B-1) and AMEC 1999a |
| Unit 1 - Interbedded Sand, Silt and Clay | 120 | 29 | 0 | CPT correlations Appendix B-1 (or AMEC 2005, App B-1) and AMEC 1999a |

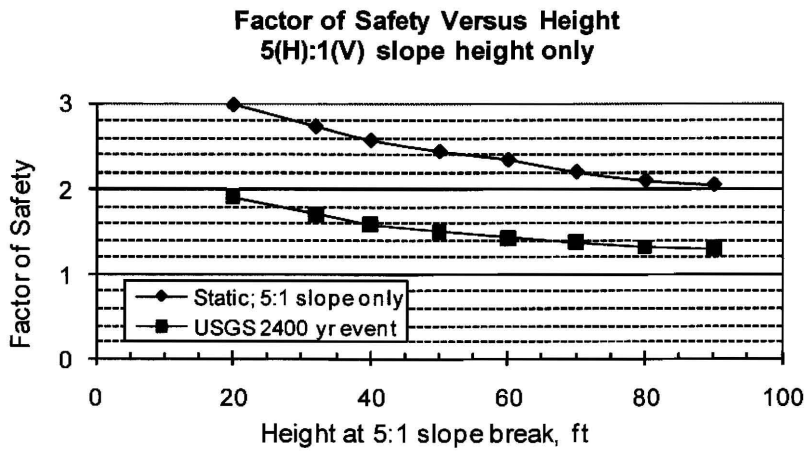
* This strength exceeds the strengths of the other materials by a large margin.

8 AMEC (formerly AGRA) (1999b), Task 2 -Summary of Field Strength Tests, Clive Disposal Facility, 75 Miles West of Salt Lake City, Clive, Utah, AGRA Job No. 8-817-002103, dated June 28, 1999.

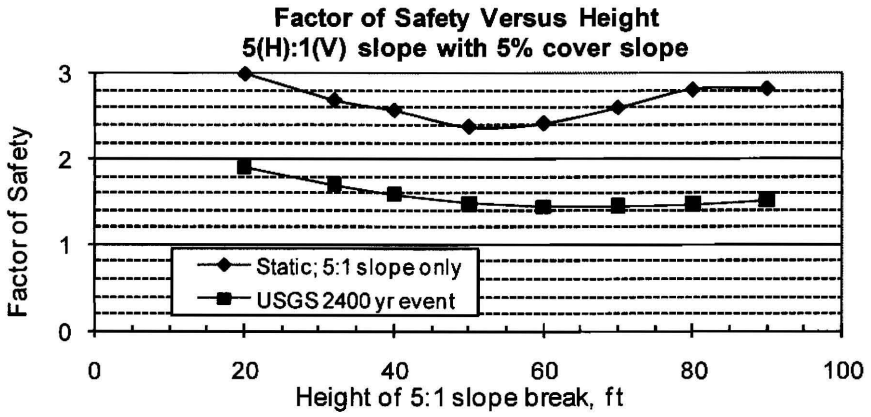
## 3.3 STABILITY CALCULATIONS

### 3.3.1 Previous Sensitivity Analysis

The 2005 study presented a slope stability sensitivity analysis to determine the sensitivity of the factor of safety to slope height and gain an understanding of the factors that lead to acceptable stability. The 2005 analysis found that in general slope stability is controlled by the height of the 5(H):1(V) side-slope. Two graphs from the 2005 study are presented below. It is observed from Graph 2 that a minimum static and pseudo static factor of safety is maintained at a height of about 60 feet at the break in slope. This analysis supports the expectation that the lower slope height of the proposed CAW Embankment will have higher factor of safety.




**Graph 1** – Factor of Safety versus Height of 5(H):1(V) Side-Slope Only




**Graph 2** – Factor of Safety Versus Height Incorporating 5% Top Slope and Top Cover Materials

### 3.3.2 CAW Embankment Static Stability

Our design slope stability analyses were performed with the microcomputer program GSTABL7[9], utilizing the Spencer's Method[10] for circular modes of movement. The geometry of the slope stability model and tabulation of the analysis is shown in Appendix C. The strength of the embankment and foundation materials was modeled using drained strength parameters.

In general, a static factor of safety greater than 1.5 is desired to meet generally accepted geotechnical design criteria (Kramer, p. 431). Stability is calculated by allowing the computer program to "search for a critical failure surface." Three scenarios or cases were studied for this Update report: Case 1 - stability within the LARW embankment; Case 2 - Stability through the lower clay unit (Unit 2), and Case 3 - stability through the upper clay unit (Unit 4). In each case, stability within the CAW embankment controlled as undrained strength within the foundation material kept the surface with the lowest factor of safety at the toe of the embankment. The minimum factor of safety was at least 2.5, which is well within the acceptable range for static stability. Details of the stability analysis, plots of the lowest 10 failure surfaces, and a tabulation of the analysis completed are found in Appendix C.

### 3.3.3 CAW Embankment Seismic Stability

Following the static stability calculations, the pseudostatic stability of the CAW Embankment was calculated for each of the cases identified in the section above. "Pseudostatic" stability is calculated by applying a horizontal coefficient equal to 50 percent of the seismic design acceleration to the embankment (Hynes-Griffin, 1984). This factor may be taken as 50 percent of the 0.28g acceleration. In general, factors of safety greater than or equal to 1.2[11] are desired when this method of seismic slope stability is utilized (Kramer, p. 436).

Again, the Spencer's Method for a circular slip surface for each of the three cases was evaluated within the GSTABL7 program. For pseudostatic stability, though, both drained and undrained foundation soil strength parameters were utilized. Stability was calculated by allowing the computer program to "search for a critical failure surface." Plots of the lowest 10 failure surfaces are also included in Appendix C.

The minimum calculated factor of safety was at least 1.2 which is an acceptable factor of safety. As with the 2005 study the critical failure surface extends through the deep clay unit of the foundation soils and remains near the "break in slope." Pseudostatic stability analysis through the CAW embankment determined the lowest factor of safety to be at least 1.7, slightly higher

9 Gregory Geotechnical Software & Harald W. Van Aller, Computer program, GTABL7 with STEDwin, Version 2.004, Copyright 2003.

10 The Spencer's Method of Calculating Slope Stability using the limiting equilibrium method (method of slices) satisfies both force and moment equilibrium. The Bishop's Method used previously satisfies only force equilibrium and is therefore less rigorous.

11 Actual values discussed by Kramer vary from 1.0 to 1.15.

than the 2005 CAC Embankment. This indicates the geotechnical benefits of reducing the embankment height.

In conclusion, the seismic factor of safety was found to be acceptable for the proposed 38-foot CAW Embankment design height using well accepted, conservative methods of slope stability analysis. As discussed in Section 2.3.3, Geotechnical Design Values, the strength parameters utilized for both the foundation and embankment materials were also conservatively selected. Higher factors of safety would be calculated under each of these conditions if less conservative strength values had been selected.

# 4. SETTLEMENTS AND DEFORMATIONS

## 4.1 GENERAL

Detailed discussion and estimates of the potential settlement amounts for both the 2005 CAC Embankment and the foundation materials were provided in Section 4, Settlements and Deformations of the 2005 study. The 2005 study addressed estimates of time rates of settlement, secondary settlements, and explained how the uncertainties and variability's of the LARW embankment materials were addressed. An important conclusion in the 2005 study is that the majority of settlement will occur during the waste placement phase of operations and prior to final cover placement. For that reason Energy*Soultions*, Inc. is proposing to monitor the completed embankment to allow the majority of settlement to occur prior to final cover placement, and thereby limiting the future differential potential.

For this update report we have only reevaluated the potential foundation settlement of the smaller CAW Embankment in order to show the embankment foundation settlements are expected to be less with the smaller embankment height.

## 4.2 FOUNDATION SETTLEMENTS

The subsurface site characterizations described early in this update report provide the information to define material boundaries and soil parameters. Compressibility parameters used in 2005 study and as described in Appendix B-2, Table F were utilized in the calculations.

Settlements of the foundation material were evaluated using the computer program FoSSA (2.0)[12]. FoSSA is an integrated stress and settlement program based on elastic solutions. The program estimates the distribution of stresses due to a variety of embankment geometry/loading conditions and the magnitude of settlement is calculated below a 2-dimensional cross-section of the embankment fills. FoSSA can calculate the magnitude of immediate/elastic settlement, consolidation settlement, and the magnitude of secondary settlement in each layer. The program, FoSSA, was used to evaluate the following settlement aspects:

12 ADAMA Engineering, Inc., Computer program, FoSSA (2.0) Foundation Stress & Settlement Analysis, Copyright 2003-2007.

- Stresses imposed on the foundation soils by the proposed combined embankments.
- The magnitude of settlement of the foundation soils for the CAW Embankment.
- The distribution of elastic/immediate and consolidation settlements by soil type (soil unit) and location.

A profile of the pattern of settlement estimated below the CAW Embankment is provided on Figure 6, CAW Embankment Foundation Settlement. As expected, the settlement profile below the CAW Embankment is slightly less than the larger CAC Embankment. However the difference is within the range of accuracy for settlement calculations and therefore the magnitude of settlement for the CAW Embankment is estimated to be 12 to 16-inches just as was estimated for the CAC Embankment. The maximum magnitude occurs below the center of the embankment. Settlement below the center of the combined embankment is essentially one-dimensional. This results in a "flat" settlement profile below the center of the embankment.

#### 4.2.1 Time Rate of Foundation Settlement

As described in the 2005 study, we anticipate that the embankment is constructed sufficiently slow that drainage (consolidation) of the foundation layers occurs during construction. If one assumes that the CAW Embankment was placed all at once our analysis estimated that 95 percent consolidation will be complete within approximately one year, which is within the time that is required for observation of settlement before the final cover is placed. Again, given the CAW Embankment will receive waste over many years before topping out, this is a worst-case scenario.

#### 4.2.2 Secondary Settlement of Foundation

FoSSA was also used to calculate the magnitude of secondary or "creep" settlements after primary foundation settlements are complete. Secondary settlements were calculated to a period of 500 years. Within this period of time, approximately an additional 8 inches of secondary settlement was calculated. These results of the secondary settlement calculations are presented on Figure 12, Secondary Settlements of the 2005 report. This magnitude of settlement should be incorporated into the final cover design. The relatively small magnitude of secondary settlement is not anticipated to adversely impact cover drainage, if properly incorporated into the final design.

#### 4.2.3 Principal Conclusions of Foundation Settlement

The as described in the 2005 report the following principal conclusions can be gained from the foundation settlement calculations:

- Settlements of the foundation soils due to the embankment loads are anticipated to be relatively small, on the order of 12 to 16 inches.

- The foundation settlements are expected to be complete within a maximum one-year period of time after waste placement. Given the period discussed in the following section to implement the "observational approach," foundation soil settlements are anticipated to be complete by the time that the final cover is placed.

- Monitoring of the embankment cover (at the debris free soil layer) is expected to be primarily a reflection of the embankment settlements and not the foundation settlements.

- The maximum settlement in the foundation soil may be up to 24 inches, or roughly 2 feet. Primary and secondary foundation settlements should be incorporated into the cover design. However, the magnitude is not expected to adversely impact drainage of the final cover.

## 4.3 EXISTING EMBANKMENT SETTLEMENTS

As described in the 2005 study we consider that the on-going Energy*Solutions*, Inc. embankment field settlement data provides one of the better measures for evaluating the future performance of the Class A cover. The settlement data obtained by Energy*Solutions*, Inc. was evaluated in the 2005 study to determine the magnitude and rate of settlement based on the survey monument data.

In summary, the conclusion of the 2005 study was that the total magnitude of settlement measured over the approximate 4-year period reviewed is less than 0.75 feet (9 inches). Given that the settlement monuments are located approximately 100 feet apart (on average), the distortion[13] measured to date is on the order of 0.0075 (versus the 0.02 criteria). The study revealed a considerable amount of scatter in the actual settlement elevations over time, but the magnitudes of settlement are overall quite low.

Our interpretation of the survey data is that a reduction in the rate of settlement with time is observed. The study revealed that settlement is reducing (slowing down) over time. It was observed that the rate of settlement decreases significantly within a 12-month, arguably 24-month period.

Another constructive interpretation of the field survey data was presented on Figure 14, Variations of Settlement with Embankment Height (elevation), of the 2005 study (see attached as Figure 7 of this update report). This plot compared the variation of observed embankment settlement versus embankment height (or elevation of survey point). It would be expected that there would be an increase in the total settlement of the cover with increased embankment height. Projecting the available settlement survey data to a 100-foot height, one may have up to

13 Distortion is defined as the vertical difference in elevation between two monuments divided by the distance between the two monuments.

0.6 feet of average settlement. This plot reveals that for about a 14-foot increase in the final cover elevation, the expected increase in total settlement is about 0.1 feet. Within a given elevation there is also a range of 0.16 to 0.23 feet of differential settlement between two potentially available settlement points. These values at a given elevation (comparing maximum to minimum settlements) result in a maximum distortion value of 0.0015 to 0.003, which is well below the distortion criteria of 0.02, by a factor of about ten. Comparing the maximum to the average settlement at a given elevation results in distortion values averaging about 0.001 (this may be more realistic since some of the data suggest very little settlement (minimum values). See additional discussion relevant to monitoring settlement of the existing embankments in the following Section 4.4, Available Monitoring Data.

### 4.3.1 Timing of Settlement

As described in the 2005 study, AMEC considers that the types and timing of the total settlements must be addressed to distinguish between settlements that occur prior to achieving the top of waste and those settlements that may occur following final cover placement. Only those settlements that occur after the cover is placed are important to the performance of the embankment cover. However, it is expected that the majority of settlement will occur during embankment construction and only a small fraction of the total settlement potential will remain after the cover is placed.

Our 2005 study concluded that the magnitude of settlement is a function of the materials (embankment and foundation), the time that the materials are placed and the time period allowed for settlements to be complete prior to final cover placement. Since it would be extremely difficult to predict or control the rates and timing of waste placement, Energy*Solutions*, Inc. is proposing to utilize a combination of quality assurance methods during construction to place waste in a controlled manner and monitor completion of the majority of settlement at the top of waste prior to final cover placement. The intent of this approach is to allow the majority of settlement to occur prior to final cover placement, thereby limiting the future differential potential.

The important understanding concluded from the 2005 study is that the majority of settlement will occur during the waste placement phase of operations. The monitoring program will only measure a fraction of the total settlement that will occur, but will allow grading to be accomplished prior to cover placement to reduce differential settlement. Completing predictions of the total settlement and ultimately the differential settlement is a function of the construction rate, when waste is placed, how long the waste materials have had to settle and a variety of other factors. It was noted in the 2005 study that the predicted measured settlement magnitudes under the current and previous waste placement techniques would be less than 1 foot of total settlement for a 100-foot high embankment. Differential settlements, which are important in meeting the distortion criteria, would be less than the total settlements. If the settlements of the compressible and incompressible waste lifts are largely complete at the time that the final cover is placed, differential settlements between the various waste types will be smaller than the total settlements.

## 4.4 AVAILABLE MONITORING DATA

To address the potential cover distortion, the 2005 study looked at the historical performance of the existing embankment(s). To gain an appreciation of the magnitude of post cover settlement versus embankment height, a number of settlement survey points were selected and a graph of settlement versus embankment height was prepared. It would be expected that settlements increase with embankment height and the data would exhibit greater scatter with height. Attached Figure 7 (or Figure 14, AMEC 2005), Variation of Settlement with Embankment Height (elevation), presented LARW settlement data in terms of embankment height. It is observed that both the range and magnitude of settlement increase with embankment height. The distortions revealed by the various ranges in the data points are also shown. Based on this data set, the current cover distortions are generally less than 0.004. Given the trend in settlement versus height, the projected settlement for the proposed 84-foot high (at the crest) CAW Embankment would be less than 0.7-feet. For a 100-foot grid spacing, the distortion would be predicted to be less than 0.007, less than half of the 0.02 normal operation target criteria.

Given the fact that Energy*Solutions*, Inc. will be modifying the waste placement methods by shredding wastes, and is now using large, landfill-type compaction equipment, it would be expected that the range in differential settlement should be equal to or less than measured under the prior waste placement techniques. With the improved waste placement methods, the waste lifts will be more uniform in terms of waste distribution, debris size and other factors. Placement of the waste using the proposed methods should result in smaller settlements of the embankment materials. The settlement below the top of the cover will be monitored prior to final cover placement. Each of these factors, along with the expected settlement behavior, will provide reasonable assurance that excessive maintenance of the final cover will not be required following closure.

### 4.4.1 Settlement Above Different Waste Types

The 2005 study also considered the potential for differential settlement that could occur in the cover due to different waste forms. The 2005 analysis considered three principal types of waste placement methodologies: 1) CLSM pyramids; 2) placement of compressible and incompressible debris in soil lifts; and 3) Containerized Waste Facility (CWF) pyramids. The details and assumptions of this analysis are given in the 2005 study. Additional clarification is described in our response to Interrogatory No. 2 (AMEC, 2006).

Summarizing the 2005 conclusions of the projected cover distortions above compressible debris, CLSM or CWF pyramids. Under the "normal" operating condition, the projected cover distortions were found to be less than 0.005 and 0.01 for the CLSM model and CWF model, respectively. These values are less than the 0.02 distortion targeted for design under normal operations. Under "accidental or abnormal settlement conditions," where settlement was studied as a random process, the distortions in such a "random" selection of settlement were found to also be less than the 0.02 criteria.

## 4.5 POST EARTHQUAKE DEFORMATIONS

### 4.5.1 General

Post earthquake deformations may be categorized into two areas: 1) settlement or strength loss of the foundation soils, and 2) deformations of the embankment. Settlement of the foundation soils as related to liquefaction and seismic sand settlement is discussed in the next section. Embankment deformations are discussed in the following section and are based on a "Newmark" type deformation analysis (after, Newmark, 1964)

### 4.5.2 Liquefaction Susceptibility

Liquefaction is defined as the condition when saturated, loose, fine sand-type soils lose their support capabilities because of excessive pore water pressure, which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event due to their cohesive nature. Problems associated with liquefaction include post earthquake settlement and strength loss. Calculations prior to the 2005 study indicated that liquefaction of the soil layers below the site is not a design issue. However, the 2005 study updated the seismic design criteria and new subsurface information become available, so AMEC confirmed the previous findings still apply.

The 2005 study determined that for the design event, the majority of the soils in the upper 30 to 60 feet of the soil profile consist of cohesive deposits, which have a low probability of liquefaction due to their high clay content. It was also found that the interbedded cohesionless silt and silty sand deposits would also be unlikely to liquefy under the design seismic event. Based on the 2005 calculations and the previous calculations, liquefaction below either the combined embankment footprint is unlikely.

### 4.5.3 Foundation Sand Settlement

The following conclusions of the 2005 study remain applicable. Although liquefaction is unlikely to occur, there may be small seismic settlements in the foundation soils associated with the design earthquake event. Post earthquake (seismic) settlements were calculated from the CPT soundings using the method of Zhang, G., Robertson, P.K., and Brachman, R.W.I., (2002). The range in settlement is a function of a number of variables, including the location of individual layers of cohesionless soils, ground shaking, and other factors and the location of the layer below the embankment. In each case for the design event, the largest sand settlement was calculated to be less than 0.5 inches. This amount of post earthquake sand settlement is considered to be negligible.

### 4.5.4 Probable Embankment Deformations

The slope stability model described previously in Section 3.3.3 CAW Embankment Seismic Stability, was also used to estimate the potential range of post earthquake deformations of the CAW Embankment. To estimate the post earthquake deformation, the seismic coefficient (acceleration) required to achieve a factor of safety of unity is calculated. This value is termed the "yield acceleration" and is utilized in conjunction with a number of published empirical relationships between yield acceleration and potential post earthquake slope deformations. The minimum yield acceleration for the CAW Embankment was found to be 0.192g.

The probable earthquake deformations were calculated for each of the three cases studied using the simplified Newmark Sliding Block Analysis subroutine in the GSTABL7 program. As was determined in the 2005 study, the probable post earthquake embankment deformations were found to be less than 1 inch. The results are presented in Appendix C. These post earthquake deformations are predicted to be quite small.

## 5. CONCLUSIONS

Based on the foregoing discussions, the following conclusions have been made for the proposed CAW Embankment:

- As with the 2005 study, the stability of the embankment is governed primarily by the height of the 5(H):1(V) slope. At a height of 38 feet, the static and pseudostatic stability of CAW embankment was found to be acceptable.

- Foundation settlements of a smaller combined embankment will be slightly less than the CAC Embankment yet still higher than the individual embankments. The majority of foundation settlements are anticipated to be complete by the time the final cover is to be placed.

- The study of settlement monitoring data presented in the 2005 report indicated that the majority of the embankment settlements are complete within a 12 to 24 month period after the cover is placed. The available survey data also indicated that the distortion of the existing cover appears to be less by a factor of 10 than the previously selected design criteria of 0.02.

- EnergySolutions, Inc. has proposed an observational approach. In this observational approach, settlements of the debris free soil layer will be monitored prior to the final cover placement. By delaying placement of the final cover, the potential for future differential settlements of the cover is significantly reduced. Based on available monitoring data, we expect that the monitoring period will extend from 1 to 2 years maximum.

- To evaluate the survey monitoring data, we recommend that the survey data be evaluated in terms of settlement rate and differential settlement, in addition to total settlement.

## 6. LIMITATIONS

This report was prepared within the scope of generally accepted geotechnical engineering practices under the direction of a licensed engineer. No warranty, express or implied is made as to the conclusions and professional advice included in this report. AMEC Earth & Environmental, Inc. disclaims responsibility and liability for problems that may occur if the recommendations contained herein are not followed.

This report was prepared for Energy*Solutions*, Inc and their design consultants solely for the design and construction of the project described herein. It may not contain sufficient information for other uses or the purposes of other parties. These recommendations should not be extrapolated to other areas or used for other facilities with consulting AMEC Earth & Environmental, Inc.

Recommendations herein are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations. The interpretations may vary horizontally and vertically across the site.

We trust that this report adequately provides the design support for the CAW Embankment height and footprint increase. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,

**AMEC Earth & Environmental, Inc.**

Reviewed by:

2/15/11

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Steve M. Newton (1)

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# FIGURES

EnergySolutions, Inc.
Geotechnical Update Report
Job No. 10-817-05290
Class A West Embankment

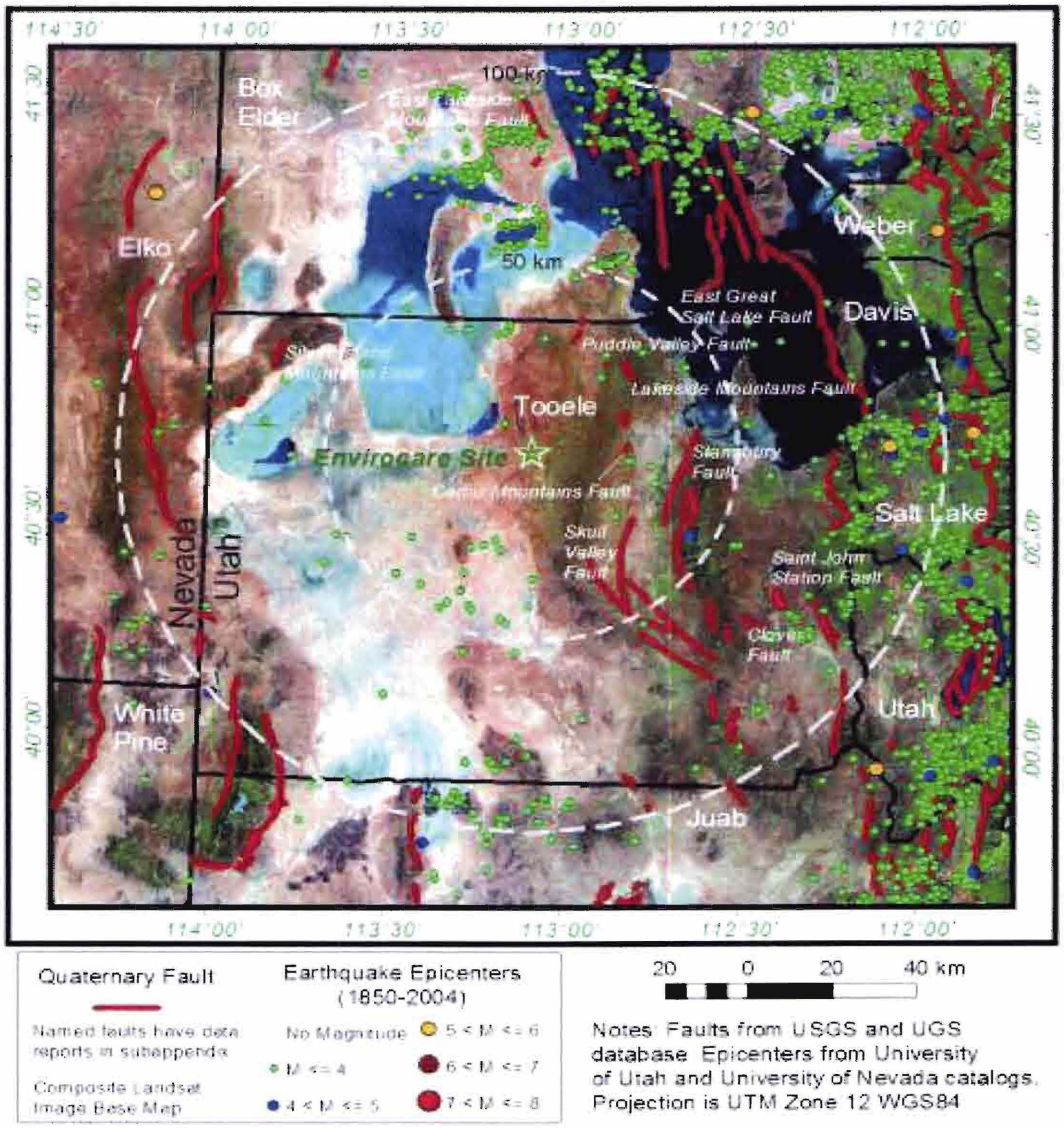
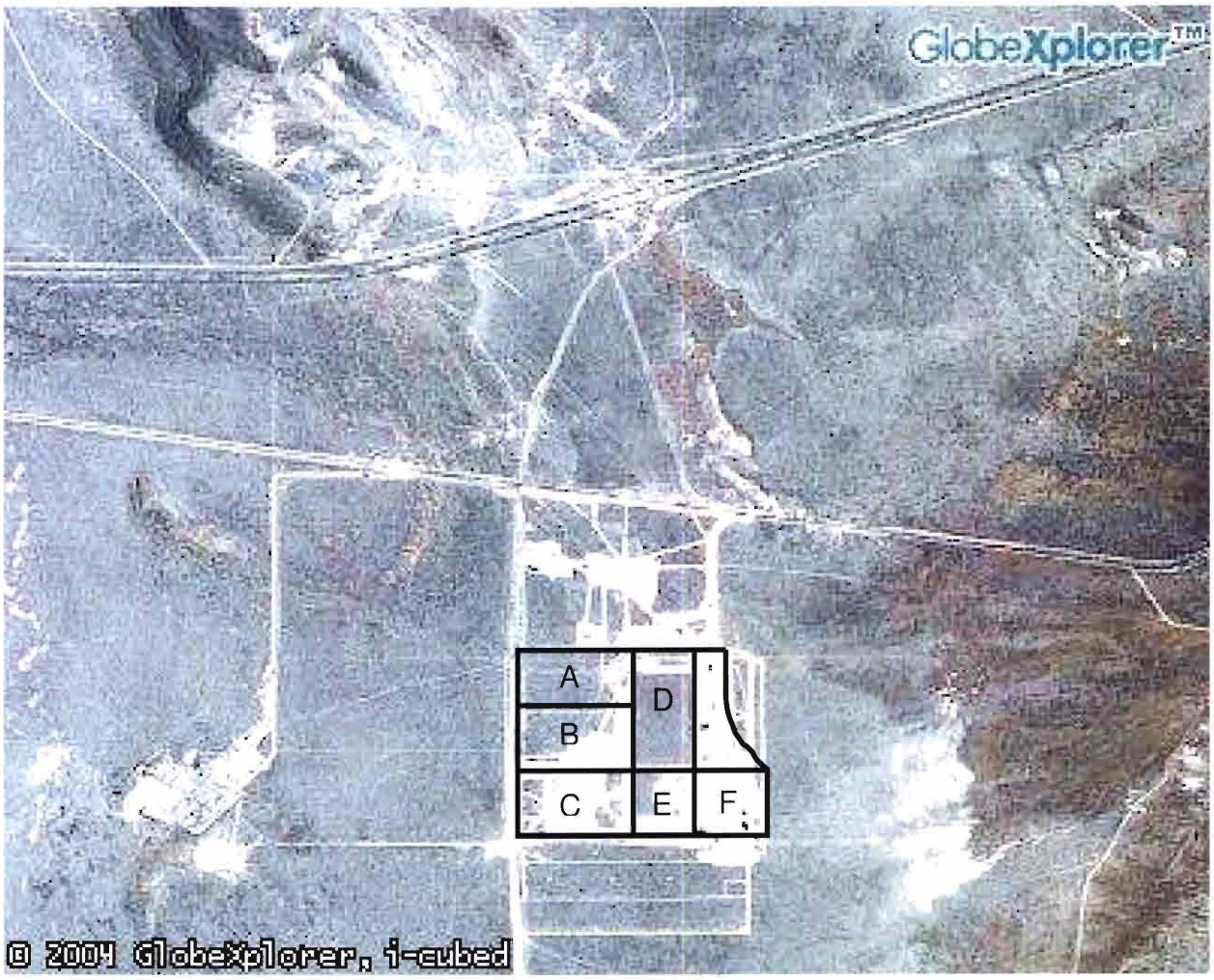



**FIGURE 1**
REGIONAL SETTING

Reference: Adapted from AMEC 2005, FIGURE 1



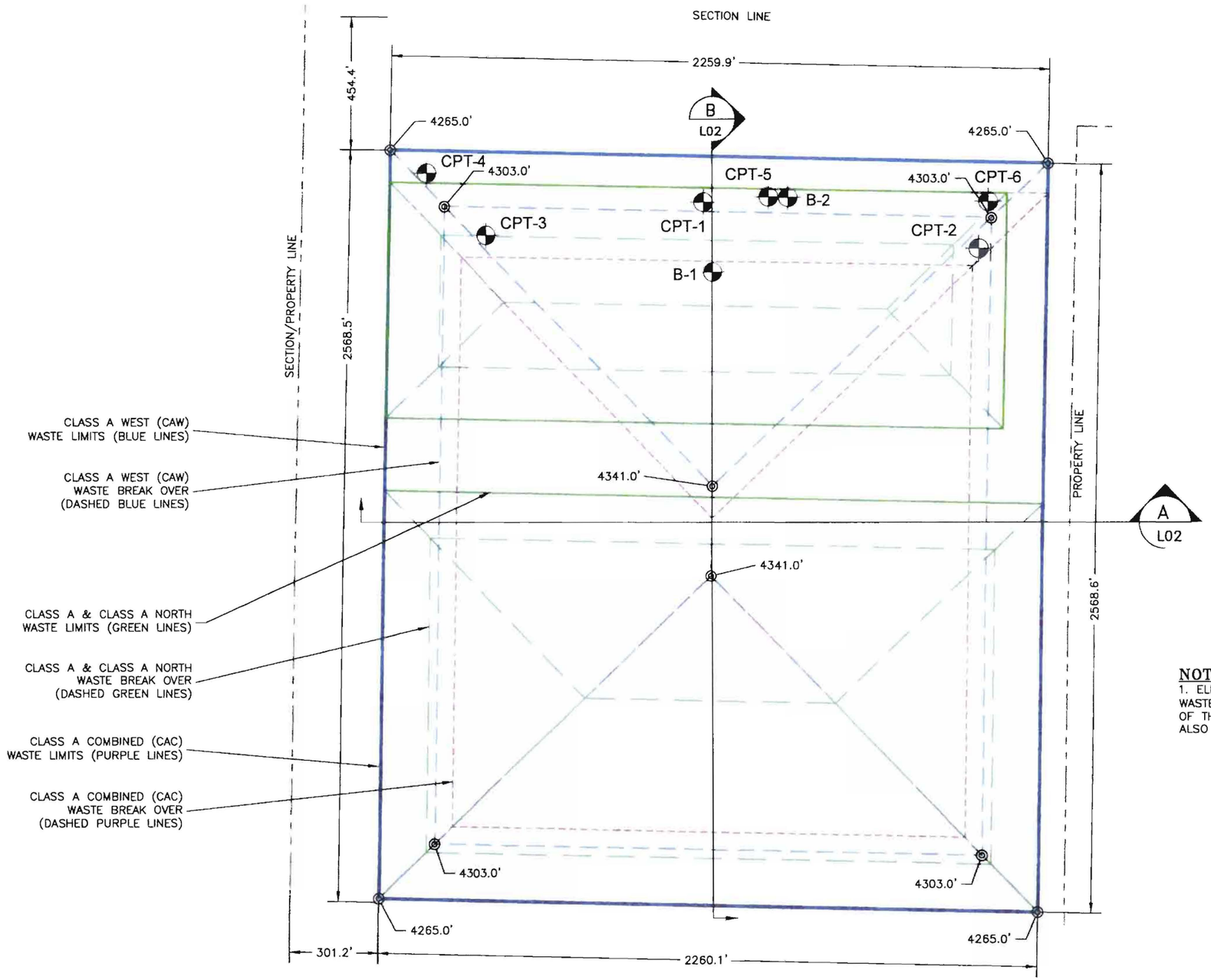

Legend:

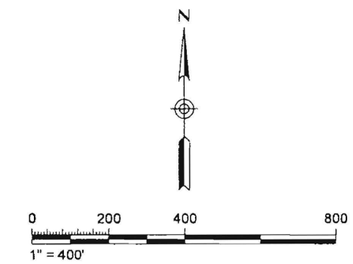
A – 2005 Study Area
B – AGRA 1999 – Existing LARW
C – 11e.(2)
D – Vitro
E – LARW / NORM
F – Mixed Waste

NOT TO SCALE

**FIGURE 2**
VICINITY MAP

Reference: Adapted from AMEC 2005, Aerial Photograph Map, GlobeXplorer 2004




Legend

B-1 Approximate Location of Exploratory Excavation

CPT-1 Approximate Location of Cone Penetration Test

**NOTES:**

1. ELEVATIONS SHOWN ARE FOR TOP OF WASTE (CAW ONLY), WITH THE EXCEPTION OF THE PERIMETER POINTS WHICH ARE ALSO TOP OF LINER.

References:

1. AMEC (formerly AGRA), Report, Geotechnical Site Characterization, Proposed New LARW Embankment, near Clive, Tooele County, Utah, AGRA Job No. 9-817-002586, dated October 26, 1999.

2. AMEC, Report, Combined Embankment Study, Envirocare, Tooele County, Utah, AMEC Job No. 4-817-004769, dated December 13, 2005.

3. EnergySolutions, Inc. Clive Facility, Class A West Embankment, Location & General Layout, Drawing 10014-L01, Scale As Noted, Dated October 4, 2010.

| | |
|---|---|
| JOB NO. | 10-817-05290 |
| DESIGN: | EAB |
| DRAWN: | GWH |
| DATE: | 1/2011 |
| SCALE: | 1" = 400' |

CLIVE FACILITY - CLASS A WEST EMBANKMENT
CLIVE, UTAH

FIELD EXPLORATION LOCATION MAP

FIGURE 3A

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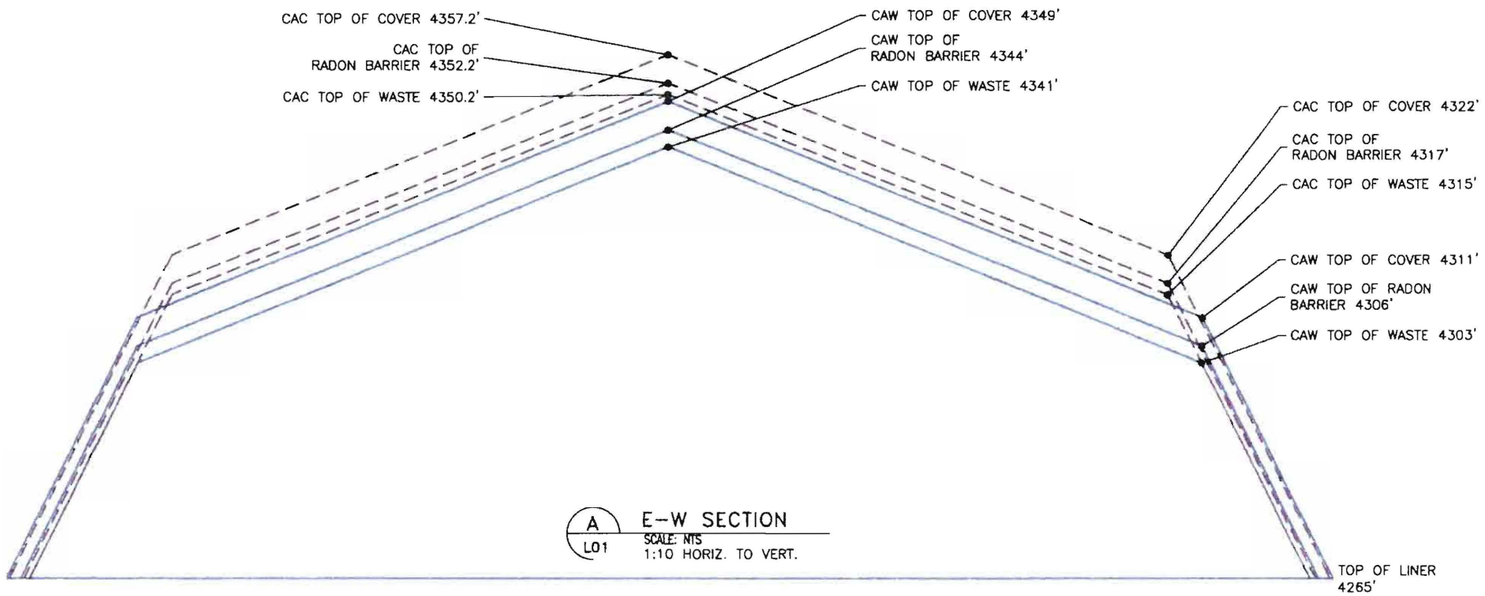
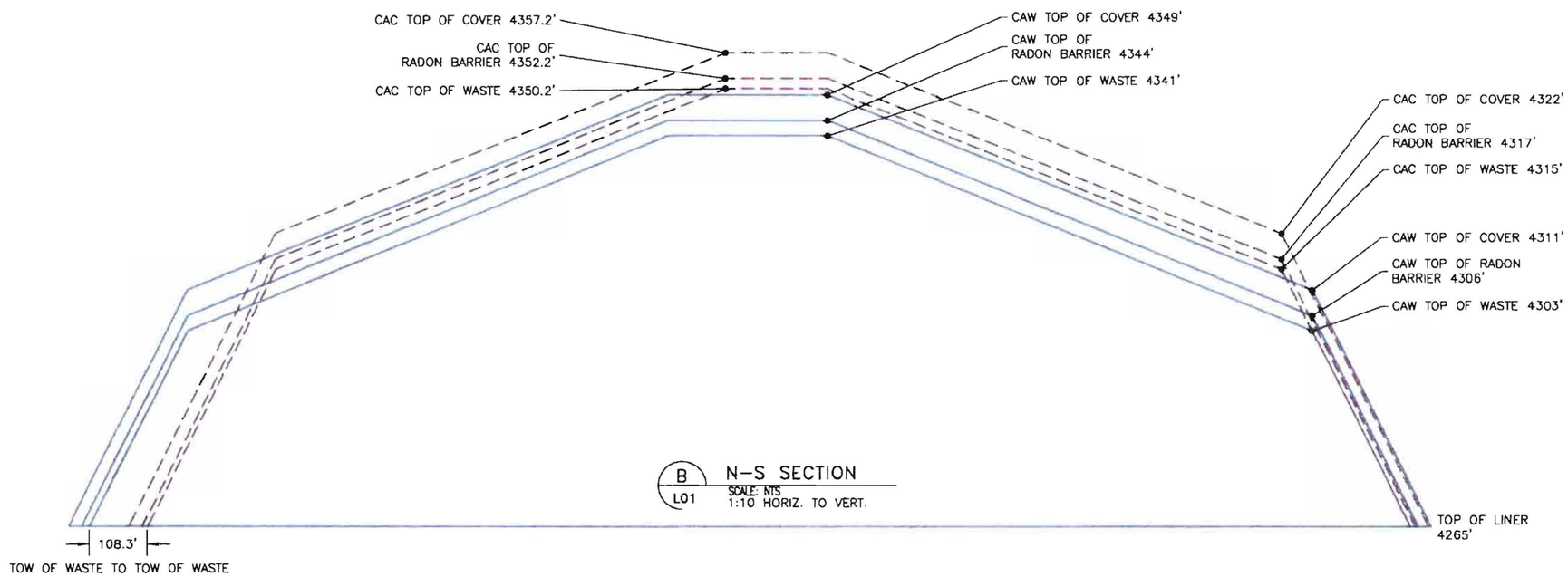
G:\Geotechnical\Salt Lake City Cad\Figure-3 Location Map.dwg




A / L01 E-W SECTION
SCALE: NTS
1:10 HORIZ. TO VERT.

**NOTE:**
1. CAC DESIGN PLACED 1 FT OF TEMPORARY COVER BELOW THE WASTE LIMITS.
2. CAW DESIGN PLACES 1 FT OF TEMPORARY COVER ON TOP OF THE WASTE LIMITS.
3. TEMPORARY COVER IS 1 FT OF NATIVE CLAY COMPACTED TO AT LEAST 90% OF A STD. PROCTOR.




B / L01 N-S SECTION
SCALE: NTS
1:10 HORIZ. TO VERT.

References: 1. EnergySolutions, Inc. Clive Facility, Class A West Embankment, Embankment Cross Sections, Drawing 10014-L02, Scale As Noted, Dated October 27, 2010.

| | |
|---|---|
| JOB NO. | 10-817-05290 |
| DESIGN: | EAB |
| DRAWN: | GWH |
| DATE: | 1/2011 |
| SCALE: | AS NOTED |

CLIVE FACILITY - CLASS A WEST EMBANKMENT
CLIVE, UTAH

EMBANKMENT CROSS-SECTIONS

FIGURE 3B

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G:\Geotechnical\Salt Lake City Cad\Figure-3 Location Map.dwg

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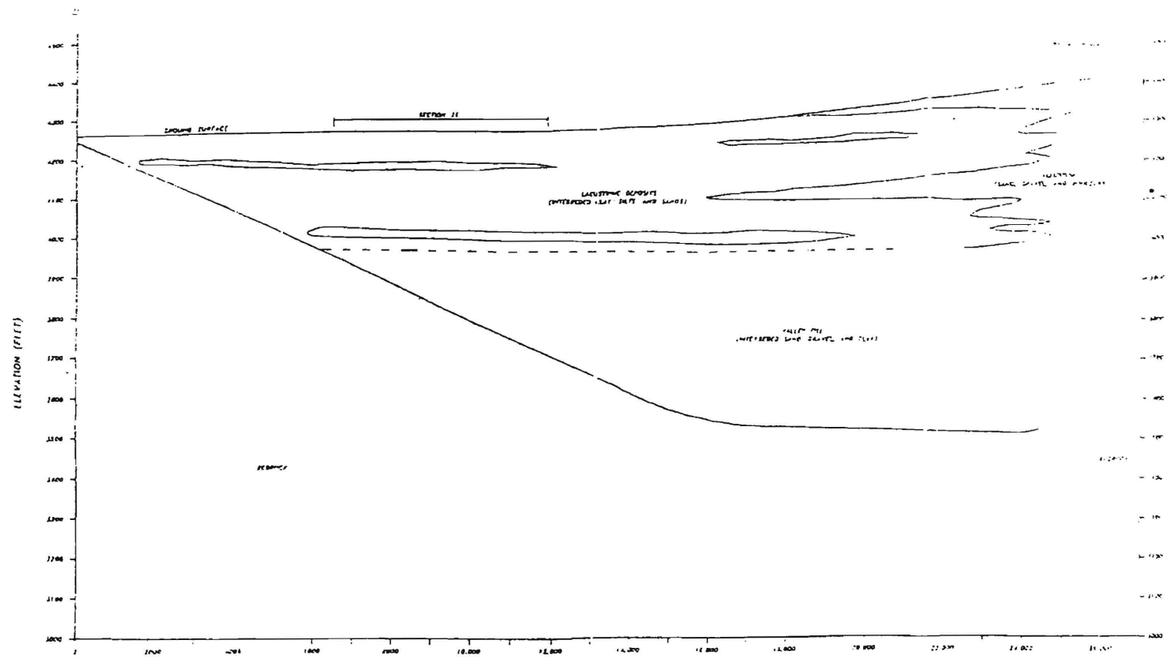
Class A West Embankment



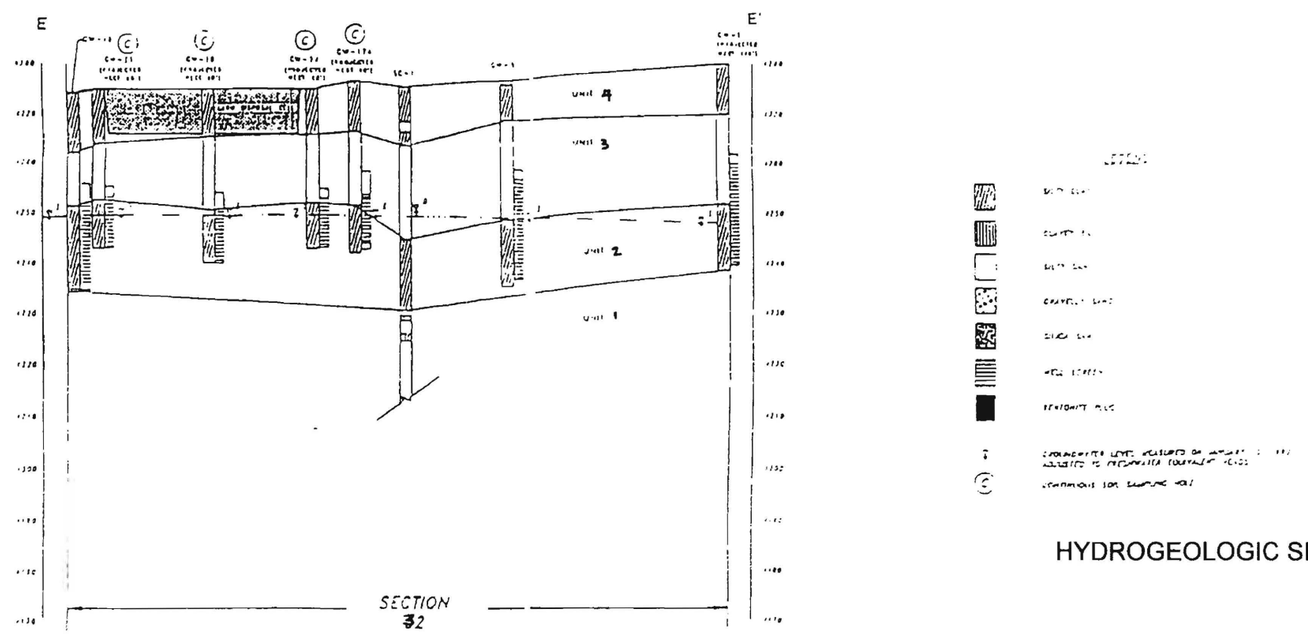




**FIGURE 4**
HYDROGEOLOGIC SITE CHARACTERIZATION

Reference: Adapted from AMEC 2005, FIGURE 5 Hydrogeologic Site Characterization. Quality of original is very poor.

# West to East Cross Section showing CPT Tip Resistence and Friction Ratio Versus Depth

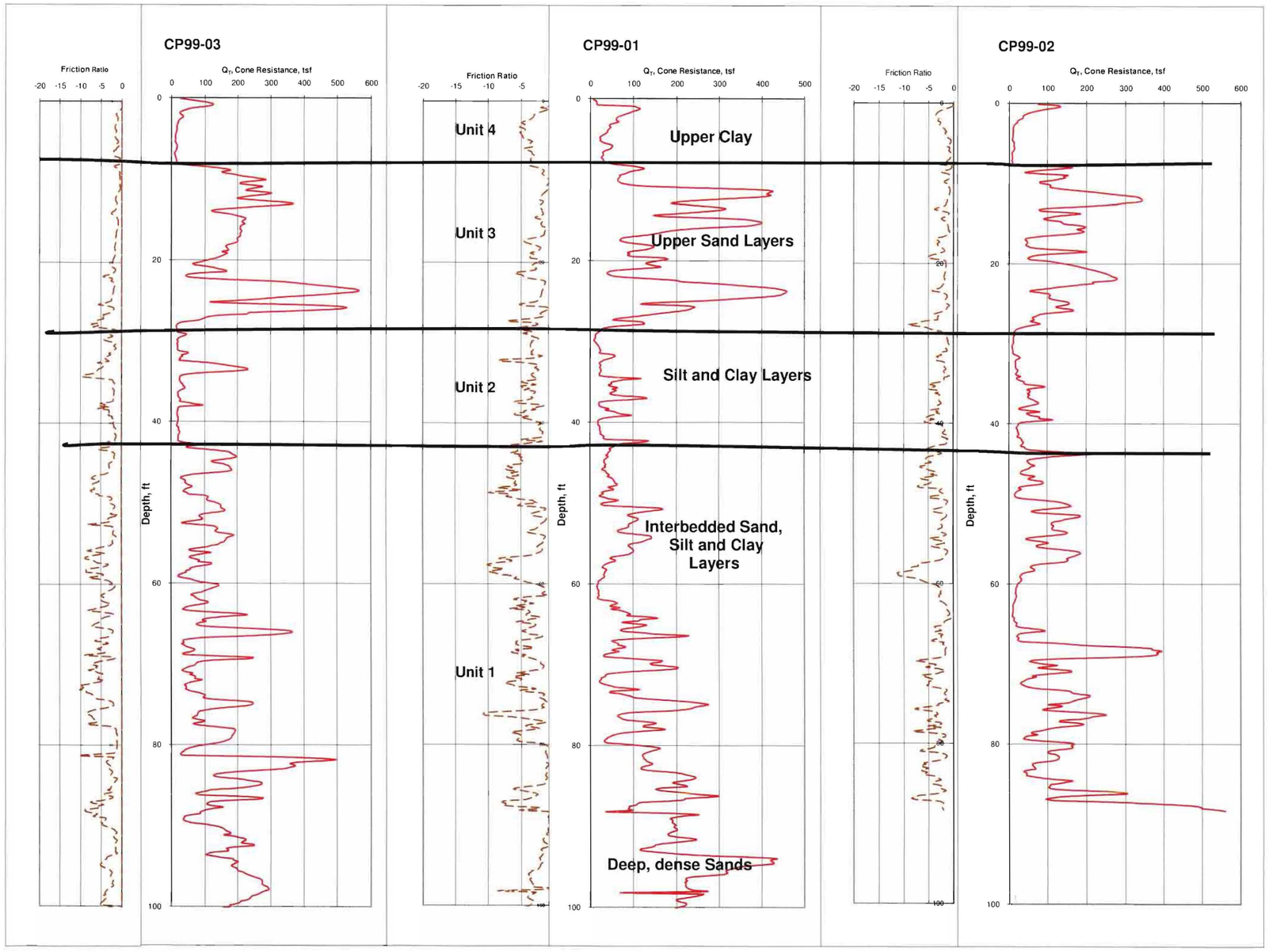



Figure 5A has been adapted from Figure 6a of AMEC 2005.

**FIGURE 5A**
**EXISTING CLASS A EMBANKMENT FOUNDATION CONDITIONS**

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Class A West Embankment
Job No. 10-817-05290

# West to East Cross Section showing CPT Tip Resistence and Friction Ratio Versus Depth

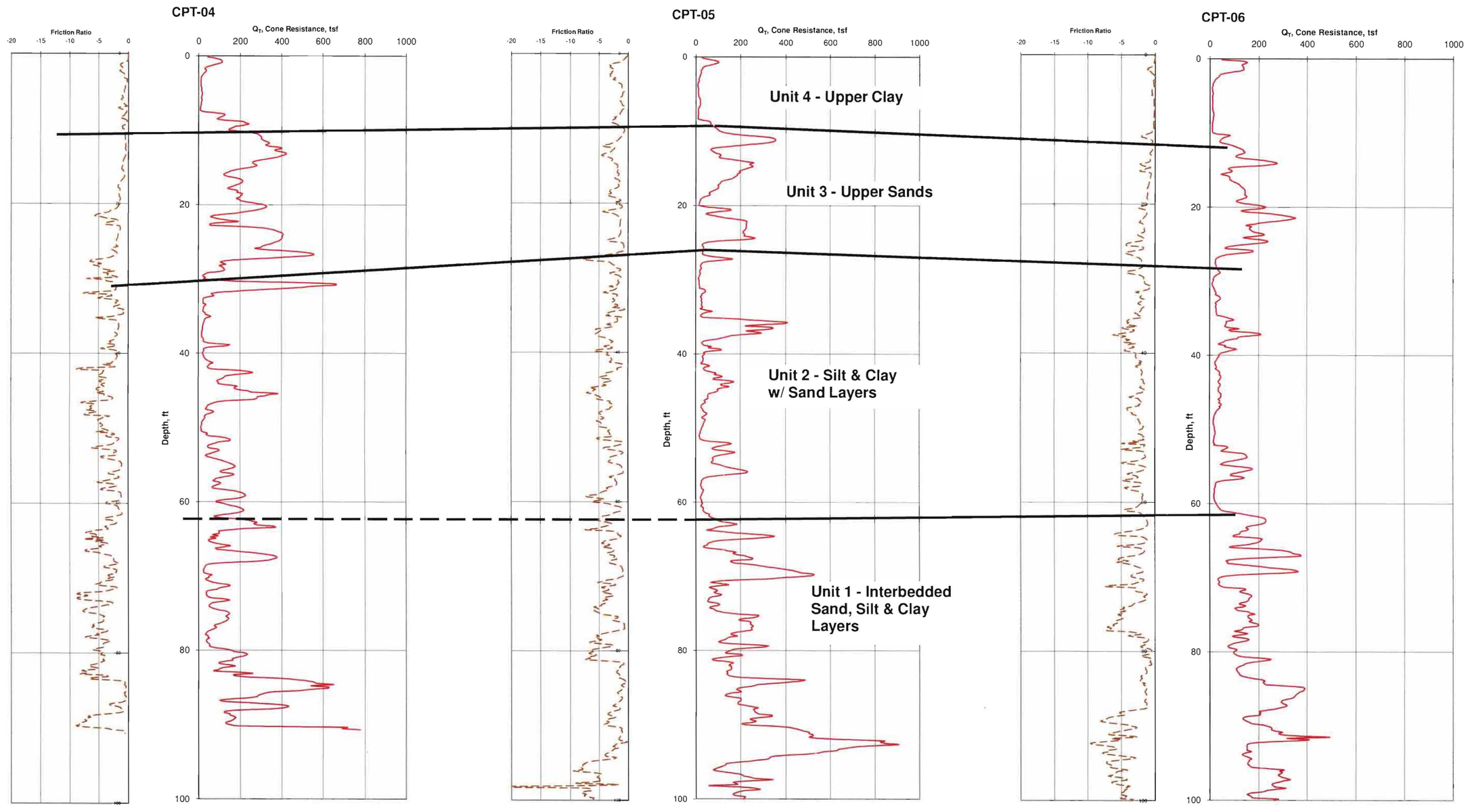
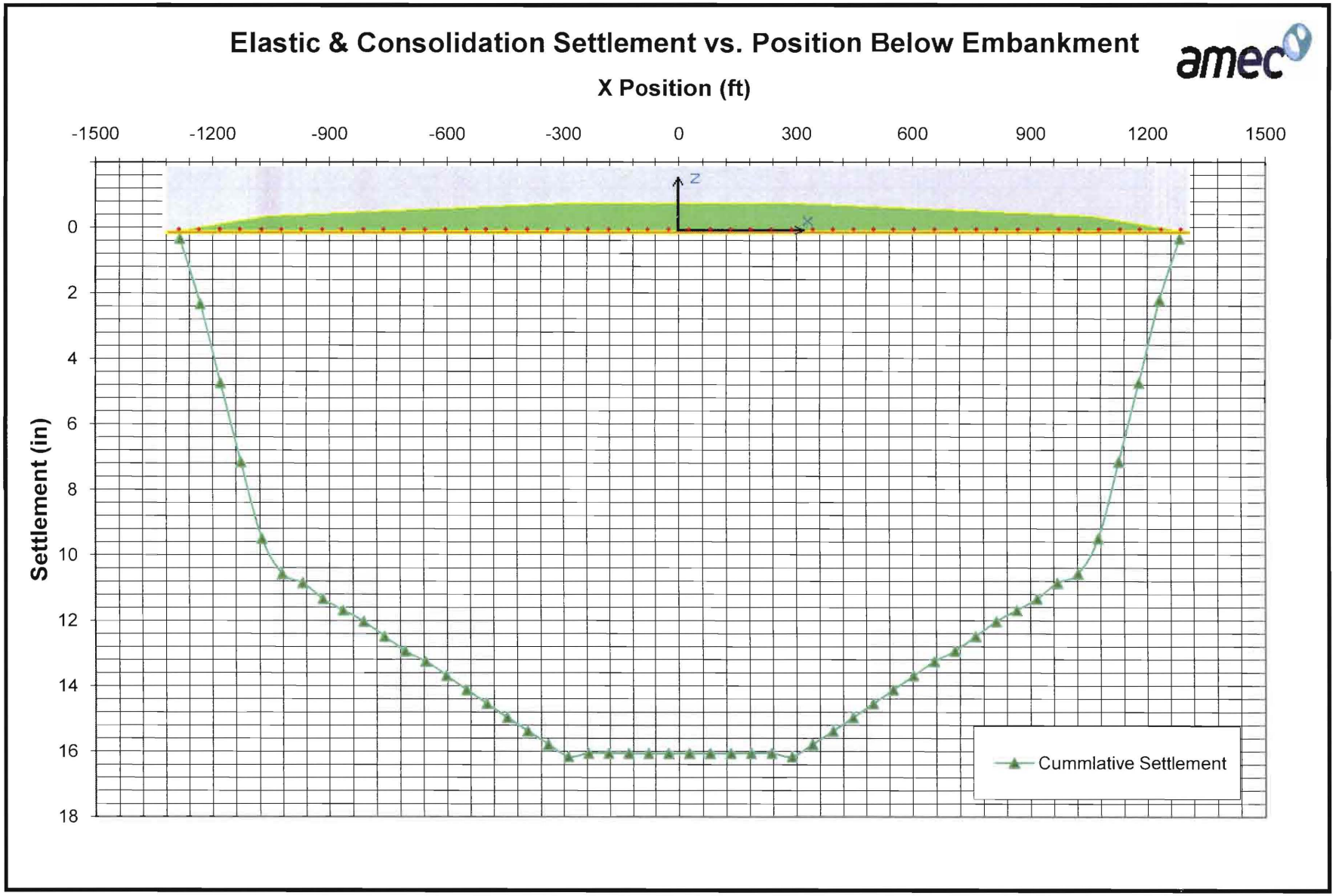



Figure 5B has been adapted from Figure 6b of AMEC 2005.

**FIGURE 5B**
**CLASS A NORTH EMBANKMENT FOUNDATION CONDITIONS**

amec




EnergySolutions, Inc.
Geotechnical Update Report
Job No. 10-817-05290
Class A West Embankment

**FIGURE 6**

CAW Embankment Foundation Settlement

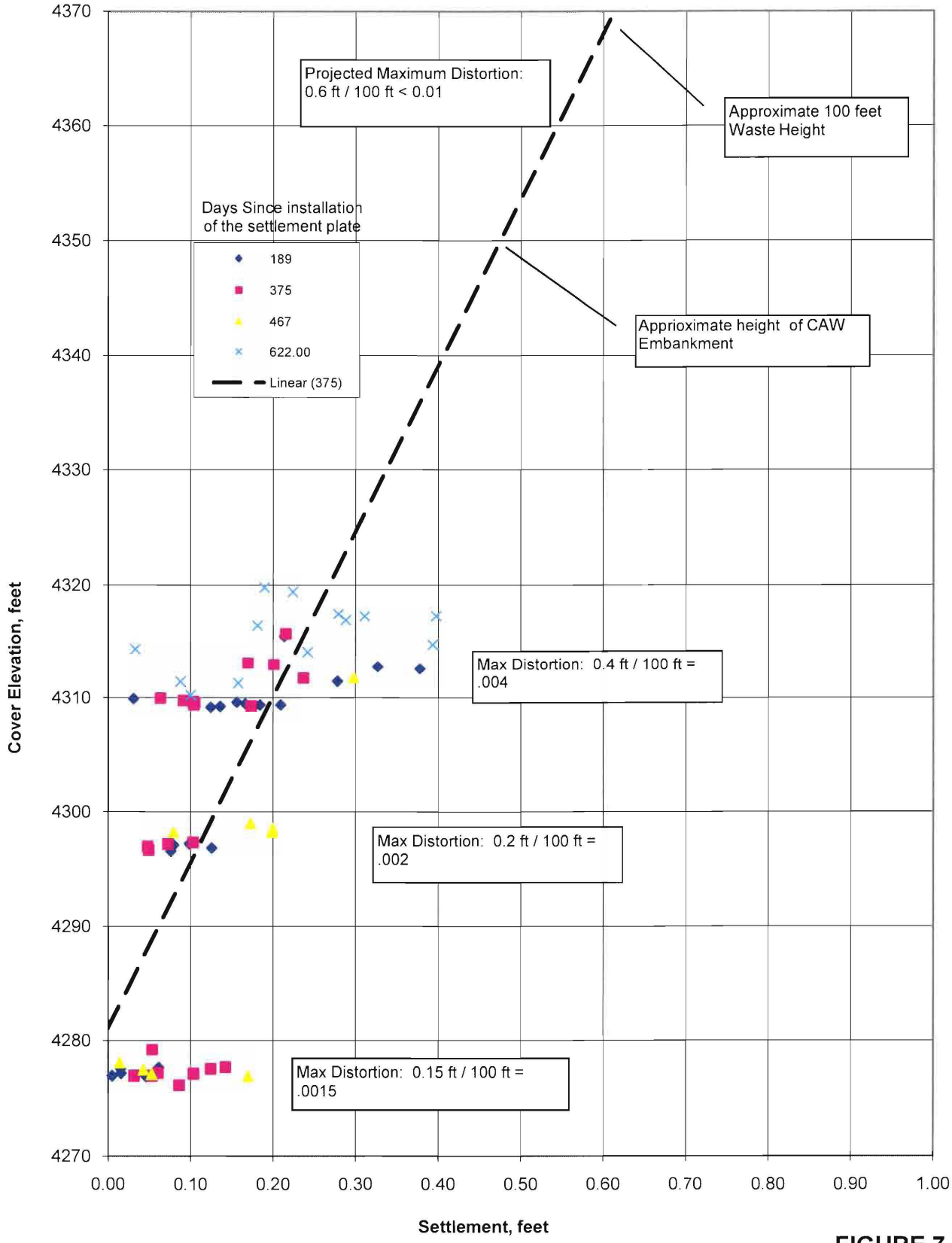



**FIGURE 7**

**Variation of Settlement with Embankment Height (elevation)**

Figure 7 has been adapted from Figure 14 of AMEC 2005. Refer to 2005 report for additional infomation on settlement data.

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# APPENDIX A

**APPENDIX A**
**Seismic Hazard (ref AMEC 12/13/2005)**
**Quaternary Fault Reports From USGS Website**

# APPENDIX A

# UPDATE OF SEISMIC DESIGN PARAMETERS FOR ENVIROCARE OF UTAH FACILITY

## INTRODUCTION

The seismic design philosophy for the Envirocare facility is based a deterministic approach, meaning that sources of ground motion in the site area are located and evaluated for the largest earthquake that could be reasonably expected. The ground motion is attenuated over the distance between the source and the site, and the largest ground motion produced by the different sources is accepted as the design value. The ground motion at sites located near major active faults is dominated by the nearby faults; however, deterministic design at sites located at moderate to large distances from active faults may be dominated by a so-called 'background' or 'random' earthquake that is not associated with a known active fault.

Probabilistic seismic hazard evaluations take into account the rate at which earthquakes of varying magnitude can be generated by area or line sources within a site region. The contributions of each source to the seismic hazard at the site are combined to produce a representation of the ground motion that corresponds to a specific exceedance probability in a fixed number of years. A fundamental assumption is made that the occurrence of each earthquake is independent of earthquakes that precede and follow it. Such an assumption is consistent with Poisson statistics.

Exceedance probabilities and exposure times are used to calculate the annual frequency of the ground motion in the following Poisson formula:

$$AF = \frac{-\ln(1-p)}{t}$$

where $AF$ is annual frequency, ln() is the natural logarithm of the argument inside the parentheses, $p$ is exceedance probability in decimal form, and $t$ is exposure time in years. Recurrence interval is the inverse or reciprocal of annual frequency. The results of probabilistic seismic hazard evaluations can be useful in developing deterministic estimates of ground motion for comparing earthquake magnitudes and distances.

Significant probabilistic seismic hazard evaluations were completed by the United States Geological Survey (USGS) in 1996 and updated in 2002 (Frankel and others, 1996, 2002) and revised twice in 2003 (http://eqhazmaps.usgs.gov/html/data2002.html). For this reason, the results of the USGS probabilistic seismic hazard mapping are indexed to 2003 in this appendix. The 1996 seismic hazard maps were developed to provide the ground motion basis for the International Building Code 2000 (IBC2000), which replaced the Uniform Building Code, the Southern Building Code, and the Standard Building Code. The fundamental difference in approach to ground motion between the older building codes and the IBC2000 is that the older codes used broad seismic zones, whereas the IBC2000 uses a grid of ground motion values spaced at 0.1 degrees of latitude and longitude, except in California, Nevada, and western Utah, where the grid spacing is 0.05 degrees.

The probabilistic seismic hazard evaluation is based on two types of earthquake sources – areas and lines. The area sources are defined by historical earthquake epicenter distributions and clusters, and an understanding of regional geology and tectonic features (seismotectonic provinces). The line sources are faults with evidence of movements during Quaternary time. Only those faults with published information on earthquake recurrence were included in the USGS probabilistic model. Some faults were included in the 2003 update of the ground motion but were not used in the 1996 evaluation. Such is the case with faults in Skull Valley, located approximately 30 km southeast of the Envirocare site. Data reports from the USGS website on fault sources within approximately 70 km of the Envirocare site are contained in the Sub-Appendix A.

The remaining sections of this appendix contain discussions of historical earthquakes, Quaternary faults, results of the USGS seismic hazard mapping project, results of a probabilistic seismic hazard assessment for the background earthquake at the Envirocare site, and recommended earthquake ground motion expressed as peak horizontal acceleration for rock site conditions.

## HISTORICAL EARTHQUAKES

Earthquake catalogs for the site region were obtained from the seismological observatories at the University of Utah and the University of Nevada, and plotted using geographic information system (GIS) tools (Figure A-1). The Utah catalog begins in 1850, whereas the Nevada catalog begins in 1852. The two catalogs combined contain 1277 epicenters within 100 km of the Envirocare site. The earliest earthquake occurred in 1915 and the latest in September 2005; the smallest was M 0.0 and the largest M 5.2; the closest was 9.9 km from the site and the farthest was 99.9 km. Selected data for 26 earthquakes are presented in Table A-1, which is sorted by increasing distance from the site. These 26 earthquakes are located within 100 km of the site, but a magnitude and distance filter was applied to the catalogs to produce the data shown in Table A-1 because most of the epicenters represent small earthquakes more than 50 km from the site. Earthquakes of $M \geq 1$ are listed in Table A-1 within 30 km of the site, $M \geq 3$ within 50 km, and $M \geq 4$ within 100 km.

The catalogs probably are reasonably complete for earthquakes of $M \geq 6$; however, completeness for $M \geq 4$ is problematic prior to the 1960s or 1970s. Table A-1 shows that the closest earthquake to the site occurred in 1998 at a distance of nearly 10 km with M 2.0. The closest earthquake of $M \geq 4$ occurred in 1915 at a distance of approximately 44 km. Only one $M \geq 5$ earthquake is reported within 100 km of the site since 1850; it occurred in 1962 at a distance of about 86 km.

## QUATERNARY FAULTS

Most of the faults in the site region that cut deposits of Quaternary age were identified a number of years ago. Most of them had not been studied in detail by the time the USGS was conducting their 1996 seismic hazard mapping project, and the USGS omitted them as line sources because key parameters (maximum magnitude and recurrence or slip rate) were not available. Subsequently, a systematic inventory of Quaternary faults was completed in the Western United States, and more complete information was available for the 2002 USGS update. In addition, faults in the Skull Valley were discovered and characterized (Swan and others, 2004).

Ten Quaternary faults are included in the USGS database within about 70 km of the Envirocare site. Quaternary faults are shown on Figure A-1; those with labels are the eleven faults closest to the site. Data reports for ten of these faults from the USGS website (http://qfaults.cr.usgs.gov/) are reproduced in Sub-Appendix A; the Springline fault is not included in the USGS database, but it was used by Wong and others (2002) as one of the earthquake sources for an assessment of ground motion in the Salt Lake City area. The closest Quaternary fault to the Envirocare site is the Cedar Mountains fault at a distance of 23 km to the east.

## USGS SEISMIC HAZARD MAPS

The results of the USGS seismic hazard mapping projects are arrays of acceleration values at regular geographic grid spacing. The USGS used a grid spacing of 0.05 degrees of latitude and longitude for the site region in both the 1996 and 2003 seismic hazard mapping projects. Figures A-2 and A-3 are the values representing 2 percent exceedance in 50 years (corresponding to an average recurrence of about 2475 years) on rock for both 1996 and 2003, respectively, displayed as grids interpolated at a spacing of 30 m superimposed on the hillshade relief image calculated from the digital elevation model of the site region. It can be seen on Figures A-2 and A-3 that 0.164g was the peak acceleration value at the site from the 1996 results, whereas 0.153g was the value from the 2003 results. The ratio of the 2003 value to the 1996 value at the site is 0.93.

The comparison of acceleration values shown on Figures A-2 and A-3 shows that the ground motion centered on the Skull Valley area is much higher in 2003 than it was in 1996 because of the addition of the Skull Valley faults and a change in the understanding of the Stansbury fault. Elsewhere in the vicinity of the Envirocare site, the 2003 ground motion is lower than it was in 1996 because of moderation of conservative assumptions used in ground motion attenuation.

## DETERMINISTIC GROUND MOTION

Ground motion in terms of peak horizontal acceleration for the Envirocare site was calculated for specific (deterministic) earthquake magnitudes and distances using relations published by Pankow and Pechmann (2004), Campbell and Bozorgnia (2003), and Abrahamson and Silva (1997) for rock site conditions. The deterministic rock motions are the index of seismic hazard at the site and are useful for comparing to the USGS seismic hazard mapping project probabilistic results. The Envirocare site has soil conditions, so the rock motions have been propagated through the soil column to give correlative motions for analysis and design at the site. The site response analysis is described in the body of the report. The deterministic ground motion estimates for the Envirocare site are presented in Table A-2 for both mean and 84$^{th}$ percentile (mean-plus-one standard deviation) levels for eleven faults. Data reports from the USGS website regarding ten of the faults are contained in Sub-Appendix A. The Skull Valley fault is listed twice because of two estimations of the maximum magnitude.

The deterministic design approach used for the Uranium Mill Tailings Reclamation Act Projects (UMTRAP) in the 1980s called for the 84$^{th}$ percentile ground motion to be applied to embankment stability evaluations because of the uncertainty in empirical attenuation relations. Although the confidence in earthquake ground motion attenuation relations has improved, the 84$^{th}$ percentile (1 sigma) ground motion estimated for specific faults remains useful to consider and is reported in Table A-2 along with the mean ground motion values.

Distances listed in Table A-2 were taken from the GIS display of Quaternary faults (Figure A-1). Fault dip is important in the formulation of some attenuation distances, and the symbols in Table A-2 (+, -, 0) denote fault dip toward, away, or neutral to the site. The maximum or characteristic magnitudes for the faults were obtained one of three ways: The magnitude values were 1) taken from published references, 2) based on surface-rupture lengths obtained from the USGS data reports included in Sub-Appendix A and empirical relations published by Wells and Coppersmith (1994), or 3) specified to be the threshold magnitude above which surface rupture would be expected. One of the faults was addressed in two published references (Wong and others, 2002, and Swan and others, 2004), and reported maximum magnitudes are shown in Table A-2.

The three ground motion attenuation relations used in this evaluation consider earthquake source-to-site distances differently. The Pankow and Pechmann (2004) relation uses the Joyner and Boore distance (rjb in Table A-2), which is the horizontal distance from the site to the vertical projection of the fault. Thus, dipping faults can have shorter attenuation distances than the distance to the surface fault trace, but attenuation distances cannot be longer than the distance to the surface fault trace.

The Campbell and Bozorgnia (2003) relation uses the seismogenic distance (rseis in Table A-2), which is the slant distance from the site to the closest point on the fault plane that is below the top of the seismogenic crust. The seismogenic crust in the site region is taken to be 3 km. Thus, dipping faults can have shorter or longer attenuation distances than the distance to the surface fault trace.

The Abrahamson and Silva (1997) relation uses the rupture distance (rrup in Table A-2), which is the slant distance from the site to the closest point on the fault plane. This distance is similar to the seismogenic distance of Campbell and Bozorgnia (2003) except that the geometry takes into account the entire fault plane, not just the part below the top of seismogenic crust.

Inspection of Table A-2 reveals that the results from Campbell and Bozorgnia (2003) and Abrahamson and Silva (1997) exceed results from Pankow and Pechmann (2004). Pankow and Pechmann (2004) is a desirable relation to use because it was developed for extensional tectonic regimes, such as those in the site area. The other two relations were developed from earthquakes and ground motions that are dominated by compressional tectonic regimes, which generate larger ground motions for the same magnitude and distance parameters than Pankow and Pechmann (2004). The Campbell and Bozorgnia (2003) and Abrahamson and Silva (1997) relations were considered in this evaluation because they are widely used in geotechnical earthquake engineering, making the results useful for comparison.

The fault with the closest surface trace to the site is the Cedar Mountains (east side) fault, at 23 km. This fault dips away from the site, in contrast to the Skull Valley faults, which dip toward the site. The closest approach of the surface traces of the Skull Valley faults is 30 km, but the attenuation distance is 19.5 km (rjb) or 24.6 km (rseis and rrup). Wong and others (2002) assigned magnitudes of 6.5, 6.8, and 7.1 in their probabilistic ground motion study of Salt Lake Valley. Swan and others (2004) assigned a maximum magnitude of 6.5 to the faults. Table A-2 has two lines for the Skull Valley faults to reflect maximum magnitudes of 7.1 (after Wong) and 6.5 (after Swan). The largest deterministic ground motions in Table A-2 are associated with the magnitude 7.1 earthquake on the Skull Valley faults for all three attenuation relations. The second largest deterministic ground motions in Table A-2 are associated with the magnitude 7.0 earthquake on the Stansbury fault for the Pankow and Pechmann (2004) and the Campbell and

Bozorgnia (2003) attenuation relations, and with the magnitude 6.6 earthquake on the Cedar Mountains fault for the Abrahamson and Silva (1997) attenuation relation.

The largest values of mean ground motion in Table A-2 are 0.126g (Pankow and Pechmann, 2004), 0.148g (Campbell and Bozorgnia, 2003), and 0.170g (Abrahamson and Silva, 1997). The second largest values of mean ground motion in Table A-2 are 0.097g (Pankow and Pechmann, 2004), 0.118g (Campbell and Bozorgnia, 2003), and 0.149g (Abrahamson and Silva, 1997). The largest values of 84$^{th}$ percentile ground motion in Table A-2 are 0.212g (Pankow and Pechmann, 2004), 0.237g (Campbell and Bozorgnia, 2003), and 0.261g (Abrahamson and Silva, 1997). The second largest values of 84th percentile ground motion in Table A-2 are 0.162g (Pankow and Pechmann, 2004), 0.195g (Campbell and Bozorgnia, 2003), and 0.242g (Abrahamson and Silva, 1997).

## PROBABILISTIC GROUND MOTION FOR THE BACKGROUND EARTHQUAKE

The historical earthquake activity within 100 km of the Envirocare site provides some context for the deterministic peak horizontal acceleration values listed in Table A-2 and a rate of seismic activity used in calculating the background earthquake. One set of data points and six curves are plotted on Figure A-4. The data points (gray circles) on Figure A-4 represent earthquakes within 100 km of the site (Figure A-1) from earthquake catalogs maintained by the University of Utah and the University of Nevada-Reno. The catalogs cover a 154-year period from 1850 to present; the most recent earthquake in the available catalog for the Wasatch Front Region was September 29, 2005.

The two lines labeled 'Activity within 100 km of Envirocare site' are truncated exponential regressions based on the actual values for M ≥ 4 and assumed maximum magnitudes of 7.5 (thin solid line) and 6.5 (thin dashed line). The larger value of maximum magnitude is comparable to the maximum magnitude assumed for the larger faults in the region, whereas the smaller value of maximum magnitude is the threshold of surface faulting earthquakes, which makes it appropriate for the background earthquake. The equations for these lines on Figure A-4 are:

$$AF_{7.5,100} = 0.11438 \times 10^{-0.99988(M-4.0)} - 0.000036$$

$$AF_{6.5,100} = 0.11438 \times 10^{-0.99988(M-4.0)} - 0.000362$$

where $AF_{7.5,100}$ and $AF_{6.5,100}$ are the annual frequencies of earthquakes within 100 km of the site truncated at maximum magnitudes of 7.5 and 6.5, and $M$ is earthquake magnitude. The earthquake activity graph (Figure A-4) indicates that one earthquake of M 6.0 corresponds to an approximate annual frequency of 0.001, and should be expected to occur on average once every 1,000 years somewhere within 100 km of the Envirocare site.

The earthquake activity function can be normalized for areas smaller than the area of a circle with a 100-km radius (31,416 km$^2$). Normalized curves are shown on Figure A-4 corresponding to the two 100-km activity curves: the thin dash-dot line is the earthquake activity normalized to an area of 1,000 km$^2$ for a maximum magnitude of 7.5, whereas the thin dash-dot-dot line is normalized to an area of 1,000 km$^2$ for a maximum magnitude of 6.5. A 1,000-km$^2$ circle has a radius of 17.84 km. The normalized earthquake activity graph (Figure A-4) indicates that one earthquake of M 4.5 corresponds to an approximate annual frequency of 0.001, and should be

expected to occur on average once every 1,000 years somewhere within 17.84 km of the Envirocare site.

The Wasatch Front Region is a rectangular, 86,800-km$^2$ area studied by Pechmann and Arabasz (1995). The earthquake activity in the Wasatch Front Region is represented by the thick, closely spaced dashed line on Figure A-4. The equation for this line on Figure A-4 is:

$$AF_{7.75,WFR} = (3.2 \pm 0.3) \times 10^{(-0.72 \pm 0.06)(M_L - 3.0)} - 1.2^{+1.4}_{-0.6} \times 10^{-3}$$

where $AF_{7.75,WFR}$ is the annual frequency of earthquakes within the Wasatch Front Region truncated at a maximum magnitude of 7.75, and $M_L$ is earthquake magnitude local scale. Other earthquake magnitudes used in this appendix are generally moment magnitude, which is comparable to local magnitude in the range of magnitudes considered in this study. The thick, widely spaced dashed line on Figure A-4 is the Wasatch Front Region earthquake activity normalized to a 1,000 km$^2$ area. The normalized activity curves for the Wasatch Front Region and the area within 100 km of the Envirocare site indicates that the site area has a lower level of earthquake activity than the Wasatch Front Region. The normalized earthquake activity graph for the Wasatch Front Region (Figure A-4) indicates that one earthquake of M 5.2 corresponds to an approximate annual frequency of 0.001, and should be expected to occur on average once every 1,000 years within an average 1,000-km$^2$ area. The normalized activity within 100 km of the site corresponds to one earthquake of M 4.5 occurring on average once every 1,000 years within an average 1,000-km$^2$ area.

The shaded box on Figure A-4 represents the average annual frequency of surface-faulting earthquakes in the Wasatch Front Region from Hecker (1993) as displayed in Pechmann and Arabasz (1995). The box covers a magnitude range of 6.5 to 7.0 and a range of recurrence intervals of 125 to 300 years. The horizontal line inside the box represents a preferred recurrence estimate of 176 years.

The ground motion at the site generated by the background earthquake was estimated with a Probabilistic Seismic Hazard Analysis (PSHA) using the computer program EZ-FRISK (Risk Engineering, 2005). The PSHA was calculated using the seismicity grids for the background source model generated by the United States Geological Survey (USGS) National Seismic Hazard Mapping Project which are included in EZ-FRISK.

EZ-FRISK uses the USGS seismicity grids to model the variable seismicity background source by placing a pseudo-fault at the latitude and longitude at each of the grid points considered at a range of depths and orientations. All grid points within 100 kilometers are included in the analysis, and processed with the same algorithm.

The peak horizontal accelerations for rock site conditions were developed using the 2002 gridded background earthquake source for the extensional part of the western United States in EZ-FRISK and attenuation relations of Abrahamson and Silva (1997), Campbell and Bozorgnia (2003), and Pankow and Pechmann (2004). Rock site conditions were assumed to have an average shear-wave velocity of 760 m/s in the upper 30 m of the profile. To account for the uncertainty in the ground motion attenuation relationships, each relationship was integrated to three standard deviations beyond the median. Weighting factors were used to develop the mean hazard curve from the EZ-FRISK output. Pankow and Pechmann's relation was developed from earthquakes generated in extensional tectonic regions representative of the Envirocare site, whereas the other two relations were developed from earthquakes generated in

tectonic regimes dominated by compressional tectonic features. Therefore, a weighting factor of 0.6 was applied to results from Pankow and Pechmann (2004). The remaining 0.4 weighting factor was divided evenly between Abrahamson and Silva (1997) and Campbell and Bozorgnia (2003).

The results of the PSHA for background earthquake sources are presented on Figure A-5. A peak horizontal acceleration of 0.146g is estimated from Figure A-5 corresponding to a 2 percent exceedance probability in 50 years, or a recurrence interval of 2,475 years. The value from the US Geological Survey PSHA for the site is 0.153 g, as shown on Figure A-3. The PSHA results on Figure A-5 are for the background source only, whereas those on Figure A-3 include fault sources, too. It can be seen on Figure A-5 that a 5,000-year peak horizontal acceleration on rock at the Envirocare site is approximately 0.2g

## RECOMMENDED GROUND MOTION

The deterministic peak horizontal acceleration values for fault earthquake sources within about 70 km of the Envirocare site are summarized in Table A-2. Probabilistic peak horizontal acceleration values for the background earthquake source within 100 km of the site are shown on Figure A-5. The largest peak acceleration in Table A-2 corresponds to an M 7.1 earthquake generated by one of the Skull Valley faults. The faults are located no closer to the site than 30 km at the ground surface, but the fault dips toward the site, making the attenuation distance less than 30 km. The 84$^{th}$ percentile value is 0.261g, as calculated by the attenuation relation of Abrahamson and Silva (1997). For comparison, 84$^{th}$ percentile peak accelerations of 0.237 and 0.212g are calculated for the same earthquake by the Campbell and Bozorgnia (2003) and Pankow and Pechmann (2004) attenuation relations, respectively. The maximum magnitude of 7.1 comes from Wong and others (2002), but Swan and others (2004) report a maximum magnitude of 6.5 for the same fault. The lower maximum magnitude for the Skull Valley faults gives 84$^{th}$ percentile accelerations of 0.219, 0.168, and 0.154g for the three attenuation relations.

The second largest peak acceleration in Table A-2 corresponds to two different earthquakes for the three attenuation relations. A maximum magnitude of 7.0 on the Stansbury fault produces 84$^{th}$ percentile peak accelerations of 0.162 and 0.195g for the Pankow and Pechmann (2004) and Campbell and Bozorgnia (2003) relations, respectively. A maximum magnitude of 6.6 on the Cedar Mountains fault produces an 84$^{th}$ percentile acceleration of 0.242g for the Abrahamson and Silva (1997) relation.

Based on the review and update of earthquake ground motion at the Envirocare site described in this Appendix, A conservative, but reasonable deterministic maximum peak horizontal acceleration is 0.24g for rock site conditions. This maximum acceleration exceeds the 0.212g 84$^{th}$ percentile value predicted by the Pankow and Pechmann (2004) attenuation relation for any of the fault sources in the site region, and is approximately equal to the largest maximum 84$^{th}$ percentile value predicted by Campbell and Bozorgnia (2003) and the second largest 84$^{th}$ percentile value predicted by Abrahamson and Silva (1997). The probabilistic peak horizontal acceleration of 0.24g for the weighted mean hazard curve on Figure A-5 corresponds to an average recurrence interval of approximately 8,825 years.

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Table A-1. Selected data from 26 earthquakes within 100 km of the Envirocare site. Data from catalogs maintained by the University of Utah and the University of Nevada-Reno.

| Year | Month | Day | North Latitude | West Longitude | Earthquake Magnitude | Site Distance (km) |
|---|---|---|---|---|---|---|
| 1998 | 04 | 03 | 40.7568 | -113.1897 | 2.00 | 9.87 |
| 1976 | 10 | 23 | 40.6723 | -112.8315 | 1.30 | 23.81 |
| 1979 | 03 | 29 | 40.4807 | -113.2092 | 2.20 | 24.69 |
| 1979 | 11 | 15 | 40.8668 | -112.9173 | 2.00 | 25.58 |
| 1975 | 06 | 10 | 40.5408 | -112.8650 | 1.20 | 26.71 |
| 1981 | 07 | 11 | 40.4573 | -113.1952 | 1.70 | 26.82 |
| 2004 | 04 | 26 | 40.4685 | -113.2412 | 1.07 | 26.95 |
| 1996 | 12 | 06 | 40.4627 | -113.2773 | 2.32 | 28.89 |
| 1975 | 01 | 04 | 40.6602 | -112.7690 | 1.20 | 29.20 |
| 1988 | 08 | 05 | 40.9568 | -113.0798 | 1.90 | 29.71 |
| 1915 | 08 | 11 | 40.5000 | -112.6500 | 4.30 | 44.46 |
| 1987 | 10 | 23 | 41.1963 | -113.1693 | 4.20 | 56.39 |
| 1987 | 09 | 25 | 41.1957 | -113.2137 | 4.30 | 56.77 |
| 1987 | 10 | 26 | 41.2008 | -113.1777 | 4.70 | 56.95 |
| 1987 | 09 | 25 | 41.2068 | -113.1357 | 4.10 | 57.38 |
| 1987 | 09 | 26 | 41.2090 | -113.1500 | 4.00 | 57.68 |
| 1987 | 09 | 25 | 41.2135 | -113.1318 | 4.80 | 58.12 |
| 1987 | 09 | 28 | 41.2267 | -113.1808 | 4.00 | 59.84 |
| 1967 | 02 | 16 | 41.2733 | -113.3338 | 4.00 | 67.37 |
| 1962 | 09 | 05 | 40.7153 | -112.0888 | 5.20 | 86.52 |
| 1943 | 02 | 22 | 40.7000 | -112.0800 | 5.00 | 87.23 |
| 1992 | 04 | 10 | 40.7000 | -112.0800 | 4.30 | 87.23 |
| 1992 | 03 | 16 | 40.4702 | -112.0448 | 4.20 | 93.60 |
| 1992 | 11 | 04 | 41.5098 | -113.3878 | 4.80 | 93.91 |
| 1983 | 10 | 08 | 40.7480 | -111.9927 | 4.30 | 94.78 |
| 1915 | 10 | 05 | 40.1000 | -114.0000 | 4.30 | 99.91 |

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**Table A-2. Deterministic ground motion estimates for rock site conditions at the Envirocare site.**

| Fault Name (USGS Number) | Horizontal Distance To Site (km) | Fault Dip (+, -, 0) | Maximum/ Characteristic Magnitude | Basis for Magnitude | Pankow & Pechmann, 2004 | | | Campbell & Bozorgnia, 2003 | | | Abrahamson & Silva, 1997 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dist (rjb) | PHA (g) Mean | PHA (g) 1 Sigma | Dist (rseis) | PHA (g) Mean | PHA (g) 1 Sigma | Dist (rrup) | PHA (g) Mean | PHA (g) 1 Sigma |
| Cedar Mountains (east side) (2385) | 23 | - | 6.6 | Wong | 23.0 | 0.083 | 0.139 | 25.3 | 0.103 | 0.173 | 23.0 | 0.149 | 0.242 |
| Puddle Valley (2383) | 30 | 0 | 6.5 | Threshold | 30.0 | 0.061 | 0.102 | 30.1 | 0.080 | 0.139 | 30.0 | 0.107 | 0.177 |
| Skull Valley (mid-valley) (2387) | 30 | + | 6.8 | Wong | 19.5 | 0.108 | 0.181 | 24.6 | 0.120 | 0.198 | 24.6 | 0.150 | 0.238 |
| Skull Valley (mid-valley) (2387) | 30 | + | 6.5 | Swan | 19.5 | 0.092 | 0.154 | 24.6 | 0.099 | 0.168 | 24.6 | 0.133 | 0.219 |
| Lakeside Mountains (west side) (2384) | 31 | + | 6.5 | Threshold | 20.5 | 0.088 | 0.147 | 25.4 | 0.096 | 0.163 | 25.4 | 0.129 | 0.212 |
| Springline (n/a) | 35 | + | 6.8 | Wong | 24.5 | 0.087 | 0.146 | 28.7 | 0.103 | 0.173 | 28.7 | 0.128 | 0.203 |
| Stansbury (2395) | 35 | + | 7.0 | Swan | 24.5 | 0.097 | 0.162 | 28.7 | 0.118 | 0.195 | 28.7 | 0.140 | 0.215 |
| East Lakeside Mountains (2368) | 57 | - | 6.9 | SRL | 57.0 | 0.039 | 0.065 | 59.2 | 0.052 | 0.092 | 57.0 | 0.066 | 0.102 |
| Silver Island Mountains (west side) (2381) | 65 | - | 6.5 | Threshold | 65.0 | 0.028 | 0.046 | 67.2 | n/a | n/a | 65.0 | 0.046 | 0.075 |
| Clover (2396) | 68 | 0 | 6.5 | Threshold | 68.0 | 0.026 | 0.044 | 68.1 | n/a | n/a | 68.0 | 0.043 | 0.071 |
| Saint John Station (2397) | 70 | + | 6.5 | Threshold | 59.5 | 0.030 | 0.051 | 61.4 | n/a | n/a | 61.4 | 0.049 | 0.080 |
| East Great Salt Lake (Fremont Island section) (2369b) | 75 | + | 7.5 | Wong | 64.5 | 0.047 | 0.079 | 66.2 | n/a | n/a | 66.2 | 0.079 | 0.121 |

Notes: USGS Number: USGS Quaternary Fault and Fold Database; data reports for each fault are included in the Sub-Appendix A
Fault Dip: + = dip toward site; - = dip away from site; 0 = fault strike toward site; dip assumed to be 55 degrees for all faults
Maximum/Characteristic Magnitude: Moment Magnitudes; mean or expected values; minimum surface rupture magnitude assumed to be 6.5
Basis for Magnitude: Wong = Wong et al., 2002; Threshold = fault rupture minimum; Swan = Swan et al., 2004; SRL = surface rupture length (Wells & Coppersmith, 1994)
Dist (rjb): Joyner-Boore distance; horizontal distance to vertical projection of fault; faults assumed to extend to 15 km depth; km
Dist (rseis): Seismogenic distance; shortest distance to fault at or below 'seismogenic' depth, which is taken to be 3 km; km
Dist (rrup): Rupture distance; shortest distance to rupturing part of fault; km

This revised Table A-2 has been obtained from AMEC, April 28, 2006, Round 2 Interrogatories and Response, Class A Embankment Height Study, Energy Solutions Facility, Near Clive, Utah. See Page 4 Section 2 of this update report (AMEC, 2/15/11) for further details regarding seismic hazard analysis.

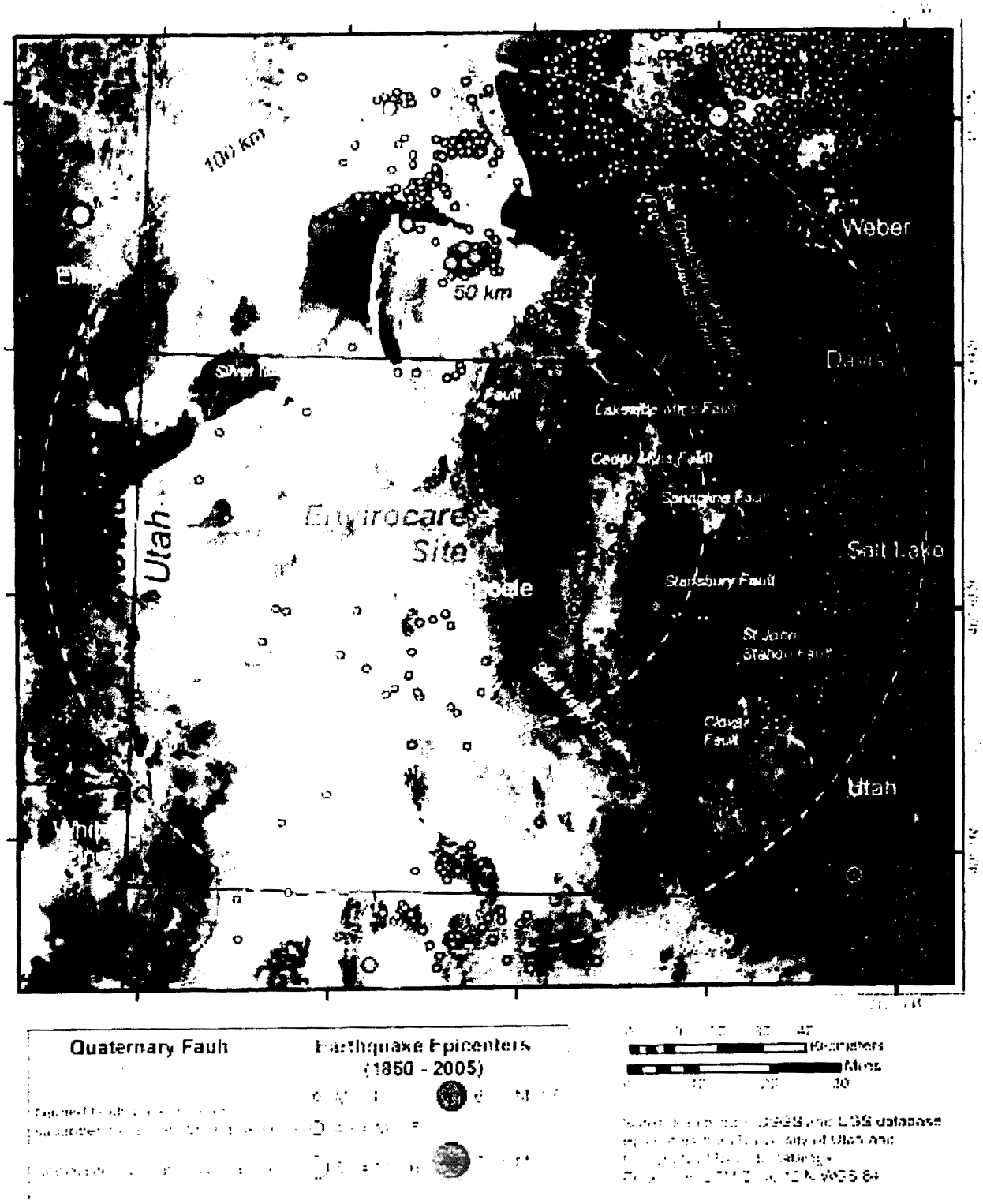


Figure A-1. Earthquake epicenters and Quaternary faults in the Envirocare site region, western Utah and eastern Nevada.

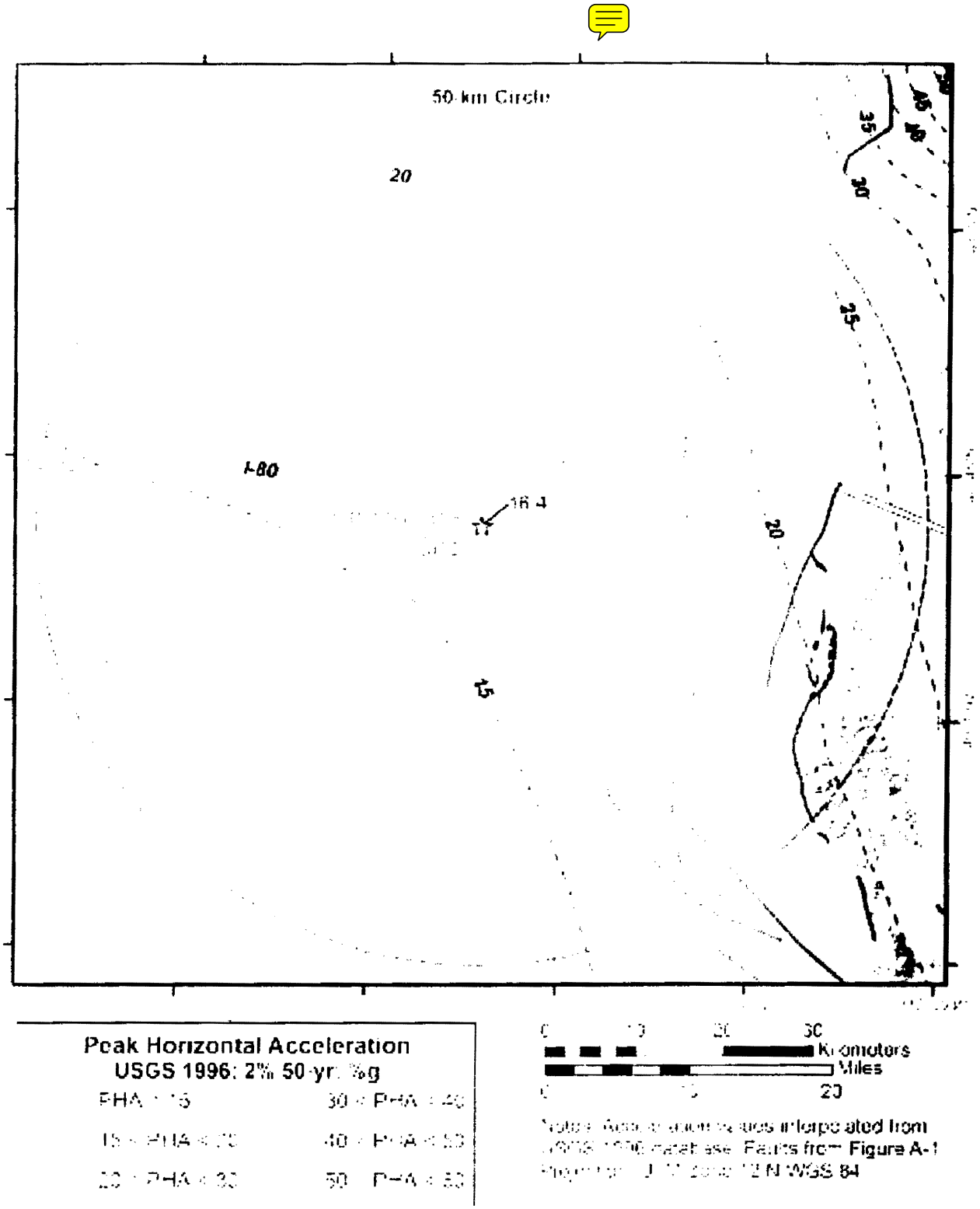


Figure A-2. Peak acceleration values for rock site conditions interpolated from the 1996 US Geological Survey seismic hazard mapping project.

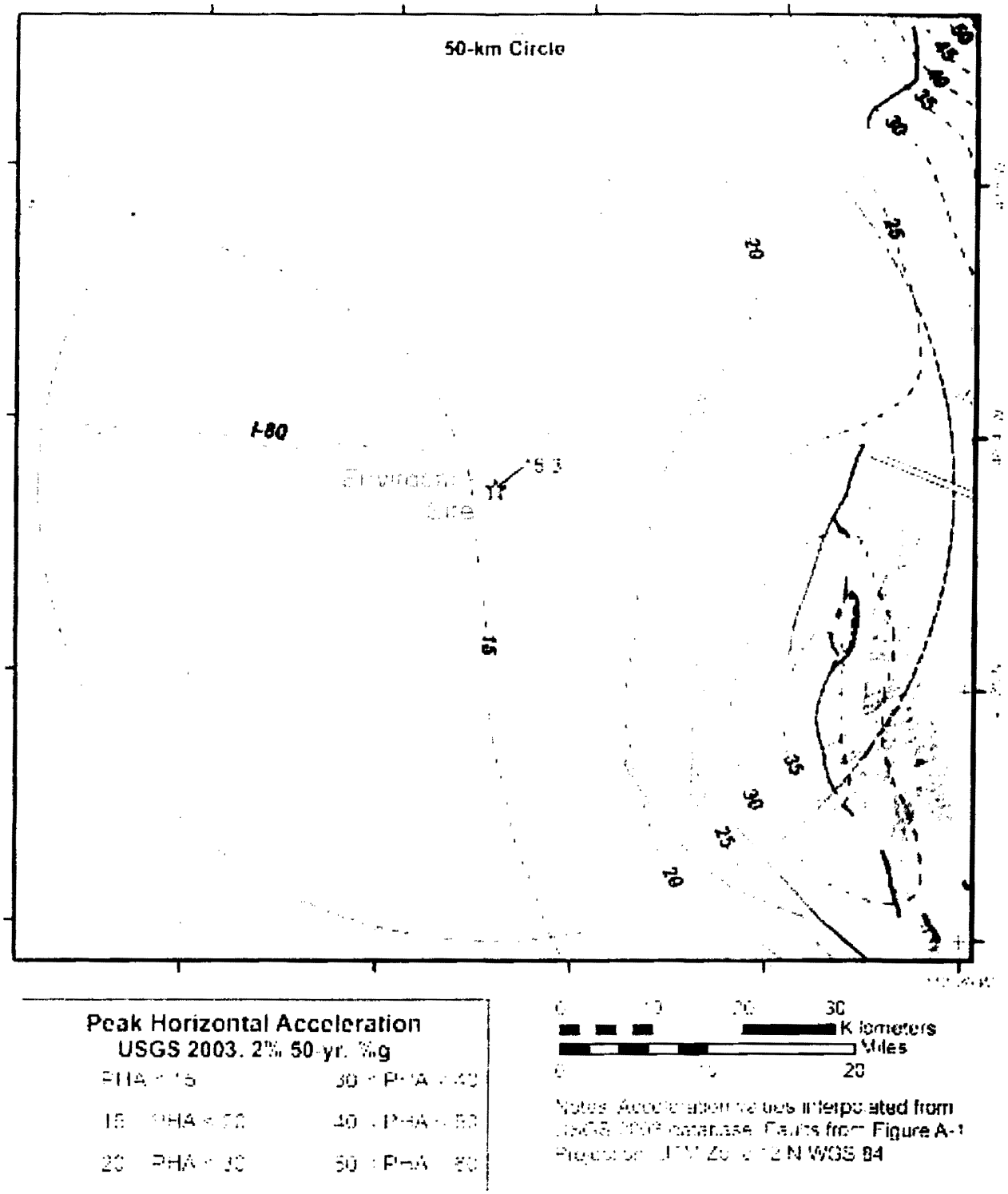


Figure A-3. Peak acceleration values for rock site conditions interpolated from the 2003 US Geological Survey seismic hazard mapping project.

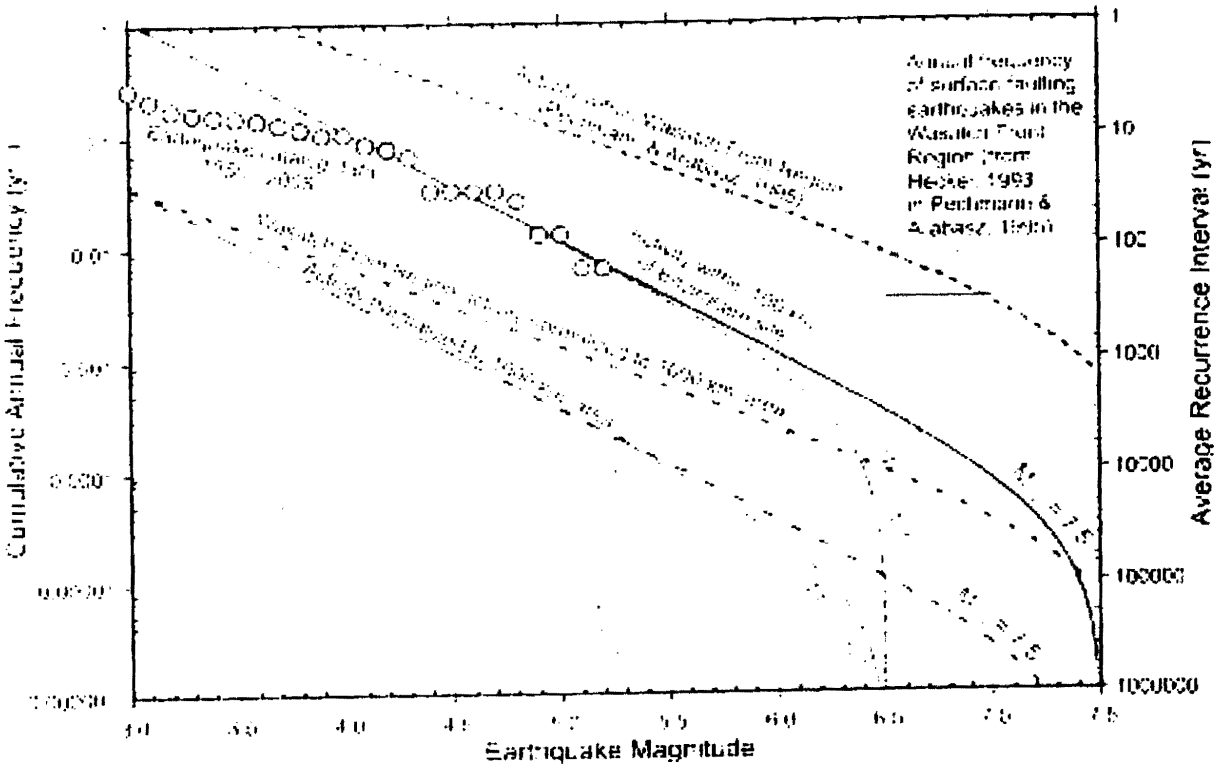


Figure A-4. Earthquake activity within 100 km of the Envirocare site.

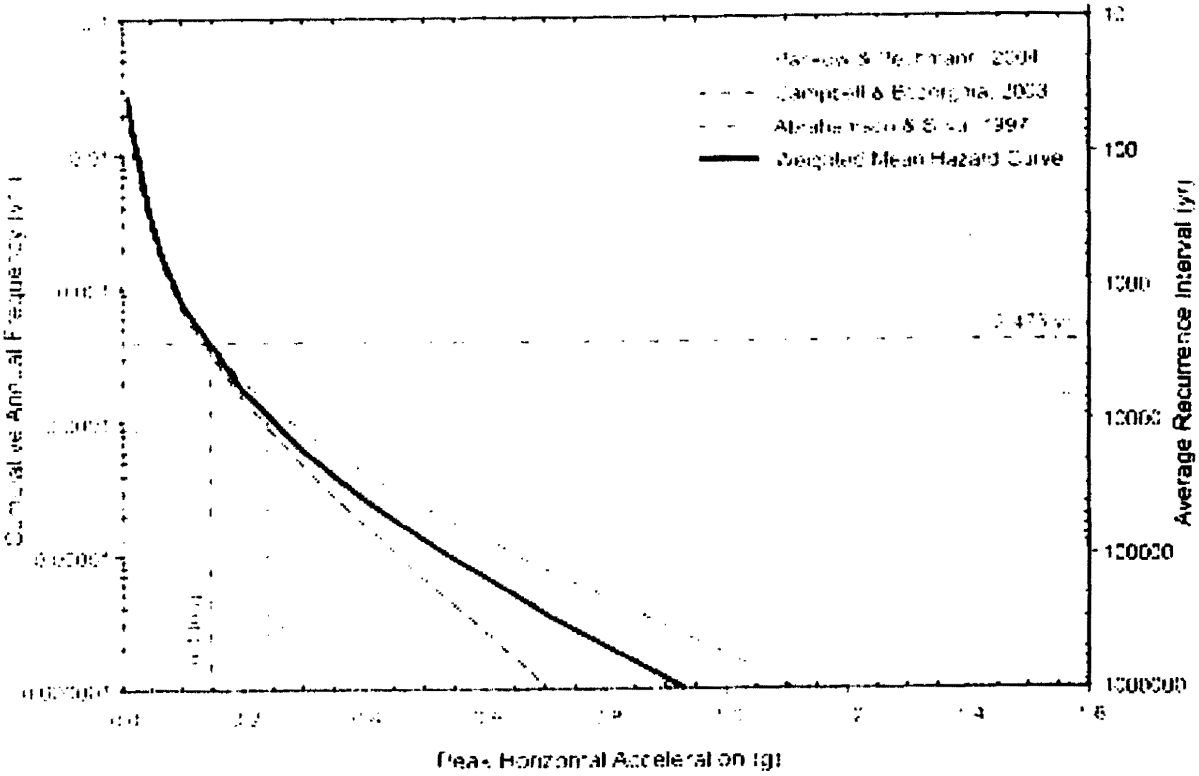


Figure A-5. Probabilistic seismic hazard curve for rock site conditions generated by the background earthquake source at the Envirocare site.

# Complete Report for Cedar Mountains (east side) faults (Class A) No. 2385

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2385, Cedar Mountains (east side) faults, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood Quaternary(?) faults on the east side of the Cedar Mountains. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 7-9 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s) | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Short north-trending normal faults along the eastern side of the Cedar Mountains. The Cedar Mountains are the westernmost and lowest of three distinctive north-south mountain ranges in the Basin and Range west of the high central part of the Wasatch Range. |
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| Reliability of location: | Poor.<br>Compiled at 1:250,000 scale.<br><br>*Comments:* Fault traces from mapping of Barnhard and Dodge (1988 #429). Faults are also included on map in Arabasz and others (1989 #4515) and Geomatrix (1999 #4513). |
| Length (km): | 9.9<br><br>*Comments:* |
| Average strike: | N6°E |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | E<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | Barnhard and Dodge (1988 #429) identified photo lineaments that possibly represent fault scarps, but the lineaments were not field checked or investigated. The lineaments were not mapped as faults by Sack (1993 #4514), who shows Lake Bonneville shorelines in the area of the northern traces. Hood and Waddell (1968 #4516) inferred a fault along the eastern margin of the Cedar Mountains, south of the faults mapped by Barnhard and Dodge (1988 #429), and Geomatrix (1999 #4513) inferred a fault along the entire eastern front of the Cedar Mountains. |
| Age of faulted surficial deposits: | Quaternary (?) |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Quaternary (<1.6 Ma)<br><br>*Comments:* Geomatrix Consultants, Inc. (1999 |

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| | #4513) found no definitive evidence of post-Bonneville (<15 ka) displacement, but could not preclude the possibility of middle or late Pleistocene displacement. |
| Recurrence interval: | *Comments:* |
| Slip-rate category: | less than 0.2 mm/yr<br><br>*Comments:* Poor geomorphic expression and lack of post-Bonneville (<15 ka) displacement indicate a low slip rate. |
| Compiled or modified by and affiliation: | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey, 1999 |
| References: | #4515 Arabasz, W.J., Pechmann, J.C., and Brown, E.D., 1989, Evaluation of seismicity relevant to the proposed siting of a Superconducting Supercollider (SSC) in Tooele County, Utah: Utah Geological and Mineral Survey Miscellaneous Publication 89-1, p. 107.<br><br>#429 Barnhard, T.P., and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1°x2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, 1 sheet, scale 1:250,000.<br><br>#4513 Geomatrix Consultants, I., 1999, Fault evaluation study and seismic hazard assessment, Private Fuel Storage Facility, Skull Valley, Utah: Technical report to Stone and Webster Engineering Corporation, San Francisco, California, under Contract 4790, 118 p., scale 1:100,000.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4516 Hood, J.W., and Waddell, K.M., 1968, Hydrologic reconnaissance of Skull Valley, Tooele County, Utah: Utah Department of Natural |

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| | Resources Technical Publication No. 18, 57 p.<br><br>#4514 Sack, D., 1993, Quaternary geologic map of Skull Valley, Tooele County, Utah: Utah Geological Survey Map 150, 16 p. pamphlet, scale 1:100,000. |

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# Complete Report for Skull Valley (mid-valley) faults (Class A) No. 2387

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Solomon, B.J., Christenson, G.E., and McDonald, G.N., compilers, 1999, Fault number 2387, Skull Valley (mid-valley) faults, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood Quaternary fault zone comprised of northwest-trending normal faults in southern Skull Valley and a northeast-trending normal fault in northern Skull Valley. A detailed geotechnical study at the Skull Valley site [2387-1] includes surface reconnaissance, aerial-photo interpretation, seismic-reflection and gravity surveys, boreholes, test pits, and shallow trenches. The latest movement on the fault zone is younger than the formation of the Provo shoreline (12 ka) of Lake Bonneville. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Not included in Hecker (1993 #642) |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic: | Basin and Range province |

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| Evidence of | |
| Geologic setting | Northwest-trending normal faults in southern Skull Valley and a northeast-trending normal fault in northern Skull Valley. Surficial geology in the valley is dominated by lake deposits and alluvium. The valley is bounded on the west by the Cedar Mountains and on the east by the Stansbury Mountains, both composed mainly of Paleozoic rocks. |
| Reliability of location: | Poor.<br>Compiled at 1:100,000 scale.<br><br>*Comments:* Fault traces from mapping by Geomatrix Consultants, Inc. (1999 #4513). |
| Length (km): | 54.8<br><br>*Comments:* |
| Average strike: | N24°W |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | SW, NW<br><br>*Comments:* |
| Paleoseismology studies: | Geomatrix Consultants, Inc. (1999 #4513) conducted a detailed geotechnical study at the Skull Valley site [2387-1] that included surface reconnaissance, aerial-photo interpretation, seismic-reflection and gravity surveys, boreholes, test pits, and shallow trenches. Offset Pleistocene geomorphic surfaces and seismic reflectors were used to estimate fault slip rates. |
| Geomorphic expression: | Geomatrix Consultants, Inc. (1999 #4513) identified two faults, the east and west faults, in southern Skull Valley from seismic shear-wave and reflection surveys. The east fault coincides, in part, with prominent linear reaches of Indian Hickman Creek and a topographic escarpment along the west flank of Castle Rock Knoll. The |

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| | west fault coincides with linear drainages and tonal lineaments identified on aerial photographs along the western boundary of Hickman Knolls. Small faults identified on seismic lines between the east and west faults, referred to by Geomatrix Consultants, Inc. (1999 #4513) as the zone of distributed faulting, are interpreted to be the result of secondary deformation in the hanging wall of the east fault. A fault in northern Skull Valley is inferred from the linearity of the locations of the warm saline springs between Iosepa and Timpie. Geomatrix Consultants, Inc. (1999 #4513) refers to this as the Springline fault, earlier mapped by Rigby (1958 #4518), Hood and Wadell (1968 #4516), and Helm (1994 #4517). |
| Age of faulted surficial deposits: | Late Pleistocene-Holocene(?). In the subsurface, the youngest faults in southern Skull Valley offset a reflector interpreted to be at the base of the Bonneville Alloformation (28 ka) (Geomatrix Consultants, 1999 #4513). At the surface, the east fault truncates an alluvial fan of Bull Lake age or older (>160 ka) and lies between the Provo shoreline (12-14.3 ka) at a higher elevation in the footwall than in the hanging wall. The projected trace of the west fault coincides with possible vertical displacements of a Stansbury-age (20-22 ka) cross-valley (Geomatrix Consultants, 1999 #4513). Quaternary activity has not been documented for the springline fault, but it may be a northward extension of the east fault. |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Latest Quaternary (<15 ka)<br><br>*Comments:* Later than the formation of the Provo shoreline (<12 ka). |
| Recurrence interval: | *Comments:* |
| Slip-rate category: | less than 0.2 mm/yr<br><br>*Comments:* Geomatrix Consultants, Inc. (1999 #4513) estimated slip rates of 0.1-0.3 mm/yr for |

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| | the east fault, and 0.05-0.07 mm/yr for the west fault. The slip rate for the west fault is based on a single event, and Geomatrix considers it to be not very reliable. |
| Compiled or modified by and affiliation: | Barry J. Solomon, Utah Geological Survey; Gary E. Christenson, Utah Geological Survey; Greg N. McDonald, Utah Geological Survey, 1999 |
| References: | #4513 Geomatrix Consultants, I., 1999, Fault evaluation study and seismic hazard assessment, Private Fuel Storage Facility, Skull Valley, Utah: Technical report to Stone and Webster Engineering Corporation, San Francisco, California, under Contract 4790, 118 p., scale 1:100,000.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4517 Helm, J.M., 1994, Structure and tectonic geomorphology of the Stansbury fault zone, Tooele County, Utah, and the effect of crustal structure on Cenozoic Faulting patterns: Salt Lake City, University of Utah, unpublished M.S. thesis, 128 p.<br><br>#4516 Hood, J.W., and Waddell, K.M., 1968, Hydrologic reconnaissance of Skull Valley, Tooele County, Utah: Utah Department of Natural Resources Technical Publication No. 18, 57 p.<br><br>#4518 Rigby, J.K., 1958, Geology of the Stansbury Mountains, eastern Tooele County, Utah, in J.K., R., ed., Geology of the Stansbury Mountains, Tooele County, Utah: Utah Geological Society Guidebook to the Geology of Utah No. 13, p. 1-134. |

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# Complete Report for Stansbury fault zone (Class A) No. 2395

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2395, Stansbury fault zone, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Moderately to poorly understood Quaternary fault zone along the western side of the Stansbury Mountains. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 7-10 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Generally north-trending normal fault zone bounding the western side of the Stansbury Mountains. The Stansbury Mountains expose mainly Paleozoic rock, and are the centermost of three prominent north-south mountain ranges |

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| | (including the Oquirrh Mountains to the east and Cedar Mountains to the west) west of the high central part of the Wasatch Range. Surficial geology in the valleys between the ranges is dominated by lake deposits and alluvium. |
| Reliability of location | Good.<br>Compiled at 1:250,000 scale.<br><br>*Comments:* Mapped or discussed by Everitt and Kaliser (1980 #4524), Barnhard and Dodge (1988 #429), Sack (1993 #4514), Helm (1994 #4517), and Geomatrix Consultants, Inc. (1999 #4513). Fault traces from Sack (1993 #4514) and 1:250,000-scale mapping of Barhard and Dodge (1988 #429) . |
| Length (km): | 49.8<br><br>*Comments:* |
| Average strike: | N17°W |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | W<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | The surface trace of the Stansbury fault is simple in the southern half of the fault (south of Pass Canyon) but complex to the north, suggesting the fault may consist of two independent sections. A down-to-the-south cross-fault at Pass Canyon forms the boundary between the sections (Helm, 1994 #4517). In the south, a single fault strand consisting of a main fault and a subsidiary antithetic fault cuts Quaternary alluvial fans and forms a narrow (about 20-m-wide) graben along most of the fault trace (Helm, 1994 #4517). North of Pass Canyon, the trace is a complex fault zone consisting of multiple synthetic and antithetic fault |

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| | traces showing evidence of Quaternary movement. Based on scarp morphology and observation of stream knickpoints a short distance from the fault trace, Everitt and Kaliser (1980 #4524) concluded that the most recent movement was during the Holocene. Helm (1994 #4517) reports maximum scarp angle vs. scarp height plots suggest the Stansbury fault is generally older than the highstand of Lake Bonneville. However, Geomatrix Consultants, Inc. (1999 #4513) states that the southern section of the fault is inferred to have moved in a single event during the early to middle Holocene. From scarp-profile data collected by Geomatrix Consultants, Inc. (1999 #4513), the Stansbury scarps of the southern section appear younger than the Sheeprock [2405], Topliff Hill [2407] and Mercur [2399] fault scarps. Measured scarp heights are from 3.9 to 49.5 m, though net tectonic displacement may be less. |
| Age of faulted surficial deposits: | Early to middle Holocene and late Pleistocene. |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Latest Quaternary (<15 ka)<br><br>*Comments:* Helm (1994 #4517) reports scarps in the north section are modified by shoreline processes, indicating a pre-Bonneville age (>16.8 ka). However, Sack (1993 #4514) indicates air-photo evidence for displaced intermediate and Bonneville shorelines, and maps faults in Lake Bonneville and younger deposits in the northern section. Helm (1994 #4517) observed no evidence to indicate an age for the southern section, which may be younger. Geomatrix Consultants, Inc. (1999 #4513) reports that the geomorphic position of a displaced stream terrace and relatively subdued character of the fault scarp suggests early to middle Holocene (6-10 ka) displacement along the southern section. |
| Recurrence interval: | *Comments:* |
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| [illegible] | less than 0.2 mm/yr<br><br>*Comments:* Helm (1994 #4517) estimated an average slip rate of 0.26 mm/yr based on diffusion modeling of the scarps, but notes this rate is tentative and possibly high. Geomatrix Consultants, Inc. (1999 #4513) estimated a slip rate of 0.39 mm/yr, summing slip rates on individual traces across the fault zone in post-35 ka alluvial-fan and post-18 ka lacustrine deposits west of Indian Hickman Canyon. Slip rates on individual traces range from 0.11-0.15 mm/yr. |
| Compiled or modified by and affiliation: | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey, 1999 |
| References: | #429 Barnhard, T.P., and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1° x 2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, 1 sheet, scale 1:250,000.<br><br>#4524 Everitt, B.L., and B.N., K., 1980, Geology for assessment of seismic risk in the Tooele and Rush Valleys, Tooele County, Utah: Utah Geological and Mineral Survey Special Studies 51, 33 p.<br><br>#4513 Geomatrix Consultants, I., 1999 (revised 2001), Fault evaluation study and seismic hazard assessment, Private Fuel Storage Facility, Skull Valley, Utah: Technical report to Stone and Webster Engineering Corporation, San Francisco, California, under Contract 4790, 118 p., scale 1:100,000.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4517 Helm, J.M., 1994, Structure and tectonic geomorphology of the Stansbury fault zone, Tooele County, Utah, and the effect of crustal structure on Cenozoic Faulting patterns: Salt Lake City, University of Utah, unpublished M.S. |

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| | thesis, 128 p.<br><br>#4514 Sack, D., 1993, Quaternary geologic map of Skull Valley, Tooele County, Utah: Utah Geological Survey Map 150, 16 p. pamphlet, scale 1:100,000. |

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# Complete Report for Silver Island Mountains (west side) fault (Class A) No. 2381

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2381, Silver Island Mountains (west side) fault, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood Quaternary(?) fault along the western side of the Silver Island Mountains, west of the Great Salt Lake Desert in northwestern Utah. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 7-4 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Short, generally northeast-trending normal fault along the western side of the Silver Island Mountains, west of the Great Salt Lake Desert in northwestern Utah. |

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| Reliability of location | Poor.<br>Compiled at 1:250,000 scale.<br><br>*Comments:* Fault traces from mapping of Moore and Sorensen (1979 #4512) |
| Length (km) | 6.4<br><br>*Comments:* |
| Average strike: | N19°E |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | NW<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | Linear range-front contact between bedrock and unconsolidated alluvium. |
| Age of faulted surficial deposits: | Quaternary (?) |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Quaternary (<1.6 Ma)<br><br>*Comments:* Based on fault control of the bedrock-alluvium contact. |
| Recurrence interval: | *Comments:* |
| Slip-rate category: | less than 0.2 mm/yr<br><br>*Comments:* Poor geomorphic expression (linear range-front only) indicates a low slip rate. |
| Compiled by: | Bill D. Black, Utah Geological Survey; Suzanne |

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| modified by date affiliation | Hecker, U.S. Geological Survey, 1999 |
| References | #642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4512 Moore, W.J., and Sorensen, M.L., 1979, Geologic map of the Tooele 1° x 2° quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1132, scale 1:250,000. |

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# Complete Report for Saint John Station fault zone (Class A) No. 2397

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2397, Saint John Station fault zone, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood zone of late Quaternary faults near Saint John Station in southern Rush Valley. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 7-13 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Several short northwest-trending normal faults in southern Rush Valley. Surficial geology of the valley is dominated by lake deposits and alluvium. |
| | Good. |

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| Reliability of location | Compiled at 1:250,000 scale.<br><br>*Comments:* Mapped or discussed by Everitt and Kaliser (1980 #4524), Barnhard and Dodge (1988 #429), and Krinitsky (1989 #4525). Fault traces from 1:250,000-scale mapping of Barnhard and Dodge (1988 #429). |
| Length (km): | 5.2<br><br>*Comments:* |
| Average strike: | N19°W |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | SW and NE<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | Wide zone of discontinuous en-echelon scarps in Quaternary alluvium and pre-Bonneville gravel-capped pediments. The scarps are topographically below the Bonneville highstand, and do not deform Lake Bonneville spit deposits crossing the fault scarps (Everitt and B.N., 1980 #4524). Unmapped, small displacement faults in alluvium are also several kilometers to the southeast, within a portion of the Tooele Army Depot, and are buried beneath an unfaulted soil estimated to be older than 125 ka (Krinitzsky, 1989 #4525). |
| Age of faulted surficial deposits: | Late Pleistocene |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Late Quaternary (<130 ka)<br><br>*Comments:* |

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| [illegible] interval | *Comments:* |
| Slip rate category | less than 0.2 mm/yr<br><br>*Comments:* Lack of post-Bonneville displacement indicates a low slip rate. |
| Compiled or modified by and affiliation. | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey, 1999 |
| References: | #429 Barnhard, T.P., and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1°x2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, 1 sheet, scale 1:250,000.<br><br>#4524 Everitt, B.L., and B.N., K., 1980, Geology for assessment of seismic risk in the Tooele and Rush Valleys, Tooele County, Utah: Utah Geological and Mineral Survey Special Studies 51, 33 p.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4525 Krinitzsky, E.L., 1989, Empirical earthquake ground motions for an engineering site with fault sources–Tooele Army Depot, Utah: Bulletin of the Association of Engineering Geologists, v. 26, no. 3, p. 283-308. |

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# Complete Report for Puddle Valley fault zone (Class A) No. 2383

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2383, Puddle Valley fault zone, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Three short faults in Quaternary basin-fill deposits east of the Grassy Mountains in northwestern Utah. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 7-16 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Characeterized by generally north-trending normal faults in Puddle Valley, between the Lakeside and Grassy Mountains in western Utah. Surficial geology of the valley is dominated by deposits of late Pleistocene Lake Bonneville. |

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| Reliability of location: | Good.<br>Compiled at 1:250,000 scale.<br><br>*Comments:* Fault traces from mapping of Barnhard and Dodge (1988 #429) |
| Length (km): | 6.5<br><br>*Comments:* |
| Average strike: | N10°E |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | E<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | The fault zone displaces Quaternary basin-fill (primarily lacustrine) deposits down to the east and is topographically below the Bonneville and Provo shorelines. Barnhard and Dodge (1988 #429) measured eight profiles across scarps in the fault zone; scarp heights range from 1.3 to 4.4 m and maximum scarp slope angles are 6.5°-13.5°; displacement per event is 0.7-2.3 m. Fault-scarp morphology suggests two spatially distinct surface-faulting events; surface faulting associated with scarps in the southern end of the fault zone appears younger than the northern end (Barnhard and Dodge, 1988 #429). Scarps in the northern end have heights greater than 2 m, whereas scarps in the southern end are less than 2 m high. |
| Age of faulted surficial deposits: | Late Pleistocene basin-fill (primarily lacustrine) deposits |
| Year of historic deformation: | |
| Most recent | Latest Quaternary (<15 ka) |

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| [illegible] | *Comments:* Scarps at the north end of the fault zone appear older than the Bonneville shoreline (14.5 ka), whereas those at the south end appear to be younger than the shoreline but older than the Drum Mountains [2432] fault scarps (dated at 9 ka). |
| Recurrence interval: | *Comments:* |
| Slip-rate category: | less than 0.2 mm/yr<br><br>*Comments:* Estimated slip rate is 0.05-0.26 mm/yr. Thus, we categorize the fault as being <0.2 mm/yr. |
| Compiled or modified by and affiliation: | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey, 1999 |
| References: | #429 Barnhard, T.P., and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1°x2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, 1 sheet, scale 1:250,000.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000. |

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# Complete Report for Lakeside Mountains (west side) fault (Class B) No. 2384

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., compiler, 1999, Fault number 2384, Lakeside Mountains (west side) fault, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood lineament along the western flank of the Lakeside Mountains west of Great Salt Lake. The feature is either a Quaternary fault or a shoreline feature of Lake Bonneville. Owing to the uncertainity of the origin of this feature, we consider it to be a Class B feature. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 7-5 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Northwest trending range-front fault(?) along the western flank of the Lakeside Mountains and |

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| | southeast side of Puddle Valley in western Utah. Surficial geology of the valley is dominated by deposits of late Pleistocene Lake Bonneville. |
| Reliability of location: | Good.<br>Compiled at 1:250,000 scale.<br><br>*Comments:* Mapped or discussed by Young (1955 #5019), Moore and Sorensen (1979 #4512), and Arabasz and others (1989 #4515). Fault trace from mapping of Moore and Sorensen (1979 #4512). |
| Length (km): | 4.7<br><br>*Comments:* |
| Average strike: | N25°W |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | SW<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | Lineament is along bedrock-alluvium contact. Arabasz and others (1989 #4515) include the feature as a fault (queried as to activity) in a seismic-source compilation for the region. They referenced T.P. Barnhard as identifying the feature as a lineament that is probably not related to faulting; the lineament parallels topography and thus may be a shoreline feature. Owing to the uncertainity of the origin of this feature, we consider it to be a Class B feature. |
| Age of faulted surficial deposits: | Deposits of late Pleistocene Lake Bonneville (undifferentiated). |
| Year of historic deformation: | |
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| Most recent prehistoric deformation: | Late Quaternary (<130 ka)<br><br>*Comments:* Timing of possible faulting controlled by age of deposits on which the lineament is mapped. These are deposits of late Pleistocene Lake Bonneville (undifferentiated, <130 ka). |
| Recurrence interval: | *Comments:* |
| Slip-rate category: | less than 0.2 mm/yr<br><br>*Comments:* |
| Compiled or modified by and affiliation: | Bill D. Black, Utah Geological Survey, 1999 |
| References: | #4515 Arabasz, W.J., Pechmann, J.C., and Brown, E.D., 1989, Evaluation of seismicity relevant to the proposed siting of a Superconducting Supercollider (SSC) in Tooele County, Utah: Utah Geological and Mineral Survey Miscellaneous Publication 89-1, p. 107.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4512 Moore, W.J., and Sorensen, M.L., 1979, Geologic map of the Tooele 1° x 2° quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1132, scale 1:250,000.<br><br>#5019 Young, J.C., 1955, Geology of the southern Lakeside Mountains, Utah: Utah Geological and Mineral Survey Bulletin 56, 116 p. |

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# Complete Report for East Lakeside Mountains fault zone (Class A) No. 2368

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2368, East Lakeside Mountains fault zone, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood zone of Quaternary(?) faults beneath Great Salt Lake. Comprised of two north-trending, east-dipping normal faults that bound the west side of the complexly faulted Great Salt Lake graben and the East Lakeside Mountains. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Refers to fault number 6-14 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Box Elder |
| AMS sheet(s): | Brigham City<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Two north-trending, east-dipping normal faults bound the west side of the complexly faulted |

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| | Great Salt Lake graben and form the East Lakeside Mountains fault zone. The Great Salt Lake graben is bounded on the east by the west-dipping East Great Salt Lake fault zone [2369]. |
| Reliability of location: | Poor.<br>Compiled at 1:700,000 scale.<br><br>*Comments:* Identified only from gravity (Mikulich and Smith, 1974 #4504) and seismic data (Cook and others, 1980 #4503). Fault traces from Mikulich and Smith (1974 #4504). |
| Length (km): | 36<br><br>*Comments:* |
| Average strike: | N8°W |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | E<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | Subaqueous. Seismic-reflection profiles indicate that faulting penetrates upward into the Quaternary section. Gravity data suggest the fault lies along the Lakeside Mountains, extending farther south than mapped. |
| Age of faulted surficial deposits: | Quaternary(?). |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Quaternary (<1.6 Ma)<br><br>*Comments:* Based on the depth to faulted sediment and geophysical fault expression. |
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| [illegible] | *Comments:* |
| Slip rate category | less than 0.2 mm/yr<br><br>*Comments:* Depth to faulted lake-bottom sediment indicates a low slip rate. |
| Compiled or modified by and affiliation | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey, 1999 |
| References | #4503 Cook, K.L., Gray, E.F., Iverson, R.M., and Strohmeier, M.T., 1980, Bottom gravity meter regional survey of the Great Salt Lake, Utah, in Gwynn, J.W., ed., Great Salt Lake - A scientific, historical and economic overview: Utah Geological Survey Bulletin, p. 125-143.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000.<br><br>#4504 Mikulich, M.J., and Smith, R.B., 1974, Seismic-reflection and aeromagnetic surveys of the Great Salt Lake, Utah: Geological Society of America Bulletin, v. 85, no. 6, p. 991-1002. |

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# Complete Report for Clover fault zone (Class A) No. 2396

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., and Hecker, S., compilers, 1999, Fault number 2396, Clover fault zone, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

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| Synopsis: | Poorly understood zone of late Quaternary(?) faults near Clover in western Rush Valley. |
| | **Name Comments:**<br><br>**Number Comments:**<br><br>Hecker's (1993 #642) fault number 7-11Refers to fault number 7-11 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Tooele |
| AMS sheet(s): | Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Four short northwest-trending faults in western Rush Valley northeast of the Onaqui Mountains. Surficial geology of the valley is dominated by lake deposits and alluvium. |
| [illegible] | Poor.<br>Compiled at 1:250,000 scale. |

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| [illegible] | *Comments:* Fault traces from 1:250,000-scale mapping of Barnhard and Dodge (1988 #429) |
| Length (km): | 4<br><br>*Comments:* |
| Average strike: | N24°W |
| Sense of movement: | Normal<br><br>*Comments:* |
| Dip: | NE<br><br>*Comments:* |
| Paleoseismology studies: | |
| Geomorphic expression: | Northwest-trending scarps in alluvium. The scarps are modified by agricultural activities and provide no information about the estimated age of faulting. |
| Age of faulted surficial deposits: | Late Pleistocene to Holocene(?). |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Late Quaternary (<130 ka)<br><br>*Comments:* Graded profiles of streams that cross the fault zone suggest that faulting occurred more than several thousand years ago. |
| Recurrence interval: | *Comments:* |
| Slip-rate category: | less than 0.2 mm/yr<br><br>*Comments:* |
| Compiled or verified by and | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey, 1999 |

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|---|---|
| [illegible] | |
| References | #429 Barnhard, T.P., and Dodge, R.L., 1988, Map of fault scarps formed on unconsolidated sediments, Tooele 1° x 2° quadrangle, northwestern Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1990, 1 sheet, scale 1:250,000.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000. |

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# Complete Report for East Great Salt Lake fault zone, Fremont Island section (Class A) No. 2369b

Brief Report || Partial Report

In cooperation with the Utah Geological Survey

*citation for this record:* Black, B.D., Hecker, S., and Christenson, G.E., compilers, 1999, Fault number 2369b, East Great Salt Lake fault zone, Fremont Island section, in Quaternary fault and fold database of the United States, ver 1.0: U.S. Geological Survey Open-File Report 03-417, http://qfaults.cr.usgs.gov.

Synopsis:

**General:**
This is a zone of Holocene faulting beneath Great Salt Lake that was identified from seismic-reflection profiling. Subsidiary faulting is common in the hanging wall west of the main fault in the southern Great Salt Lake. The faults may take a right step and connect with the Oquirrh fault zone [2398] to the south. The entire fault zone appears to have been active in the latest Pleistocene or Holocene (<15 ka).

**Sections:**
This fault has 3 sections. Dinter and Pechmann (1999 #4526; 1999 #4645; 2000 #4646) indicate the active East Great Salt Lake fault trace west of Antelope Island shows a 2-km-wide left step, suggesting the fault may form two north-northwest trending sections south of Promontory Point: a 35-km-long Antelope Island section and a 30-km-long Fremont Island section. A right step west of Promontory Point suggests that a northern Promontory section probably exists north of the Fremont Island section, although no high-resolution seismic profiles exist for the Promontory section. High-resolution seismic profiles show a sharp westward bend in the southern end of the fault indicating a step-over to the Oquirrh fault zone [2398].

**Name Comments:**

**Number Comments:**

| | |
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| | Refers to fault number 6-8 of Hecker (1993 #642). |
| State(s): | Utah |
| County(s): | Davis<br>Box Elder<br>Weber |
| AMS sheet(s): | Brigham City<br>Tooele<br><br>view map |
| Physiographic province(s): | Basin and Range province |
| Geologic setting: | Generally north-trending normal faults beneath Great Salt Lake identified from seismic reflection data. Subsidiary faulting is common in the hanging wall west of the main fault in the southern Great Salt Lake. |
| Reliability of location: | Good.<br>Compiled at 1:89,700 scale.<br><br>*Comments:* The mapped traces are from high-resolution seismic reflection lines located using GPS by Dinter and Pechmann (1999 #4526; 1999 #4645; 2000 #4646; unpublished mapping, 1:95,000 scale). |
| Length (km): | This section is 30.1 km of a total fault length of 102.9 km.<br><br>*Comments:* |
| Average strike: | N21°W (for section) versus N29°W (for whole fault) |
| Sense of movement: | Normal<br><br>*Comments:* |
| Up: | W |

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| | *Comments:* A steeply west-dipping fault is evident on seismic reflection profiles but dips are not reported. Interpretation of reflection data suggests the fault may flatten with depth (Smith and Bruhn, 1984 #4561) and merge into a horizontal detachment at a depth of about 6 km (Viveiros, 1986 #4649). However, the evidence is equivocal. |
| Paleoseismology studies: | |
| Geomorphic expression: | Subaqueous. Evidence of repeated displacements in post-Bonneville time (Dinter and Pechmann (1999 #4526; 1999 #4645; 2000 #4646). No scarps are preserved on the lakebed west of Fremont Island where the fault is buried beneath horizontal lake-bottom sediments, indicating that movement on this part of the fault may predate movement on the Antelope Island section [2369c] to the south. Diapiric domes and lake-bottom piercement structures, identified from seismic data, developed at least partly from flowage of the salt deposits during construction of the Southern Pacific Causeway in 1957-1959 (Mikulich, 1974 #4492). |
| Age of faulted surficial deposits: | Holocene. Cores collected in August 2000 by Dinter and Pechmann (2000 #4646) may yield dates and improve the geologic interpretation. |
| Year of historic deformation: | |
| Most recent prehistoric deformation: | Latest Quaternary (<15 ka)<br><br>*Comments:* High-resolution seismic data show stratigraphic and structural anomalies, including auxiliary faults and tectonically produced angular unconformities and on-lap surfaces, that indicate at least three surface-faulting earthquakes on the Fremont Island section since the disappearance of Lake Bonneville (Dinter and Pechmann, 2000 #4646). |
| Recurrence interval: | 3.8-5.6 ky (<9.2-9.3 ka)<br><br>*Comments:* Dinter and Pechmann (2000 #4646) |

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| | indicate three events have occurred since 9.2-9.3 ka. Section lengths are comparable to those of the Wasatch fault zone [2351] and suggest comparable earthquake magnitudes. This recurrence interval is preliminary pending dating of deposits obtained from cores collected in August 2000. |
| Slip-rate category: | between 0.2 and 1.0 mm/yr<br><br>*Comments:* A preliminary vertical slip rate of 0.67+0.06 mm/yr and a fault-parallel slip rate of 0.9+0.2 mm/yr are estimated by Dinter and Pechmann (2000 #4646). Slip rates are preliminary pending dating of deposits obtained from cores in August 2000. |
| Compiled or modified by and affiliation: | Bill D. Black, Utah Geological Survey; Suzanne Hecker, U.S. Geological Survey; Gary E. Christenson, Utah Geological Survey, 1999 |
| References: | #4526 Dinter, D.A., and Pechmann, J.C., 1999a, Sublacustrine paleoseismology-Evidence for recent earthquakes on the East Great Salt Lake fault, Utah: Association of Engineering Geologists, 42nd Annual Meeting Abstracts with Program, p. 62-63.<br><br>#4645 Dinter, D.A., and Pechmann, J.C., 1999b, Multiple Holocene earthquakes on the East Great Salt Lake fault, Utah - Evidence from high-resolution seismic reflection data: EOS, Transactions of the American Geophysical Union, v. 80, no. 46 (supplement), p. F734.<br><br>#4646 Dinter, D.A., and Pechmann, J.C., 2000, Late Quaternary slip rates and recurrence intervals of large earthquakes on the East Great Salt fault, Utah - Estimates from high-resolution siesmic reflection data: Geological Society of America, Abstracts with Programs, 2000 Annual Meeting, v. 32.<br><br>#642 Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p., 6 pls., scale 1:500,000. |

#4492 Mikulich, M.J., and Smith, R.B., 1974, Seismic-reflection and aeromagnetic surveys of the Great Salt Lake, Utah, in Seismic-Reflection and Aeromagnetic Surveys of the Great Salt Lake, Utah: Geological Society of America Bulletinp. 991-1002, 1 pl.

#4561 Smith, R.B., and Bruhn, R.L., 1984, Intraplate extensional tectonics of the western U.S. Cordillera-Inferences on structural style from seismic-reflection data, regional tectonics and thermal-mechanical models of brittle-ductile deformation: Journal of Geophysical Research, v. 89, no. B7, p. 5733-5762.

#4649 Viveiros, J.J., 1986, Cenozoic tectonics of Great Salt Lake from seismic-reflection data: Salt Lake City, University of Utah, unpublished M.S. thesis, 81 p.

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# APPENDIX B - 1

**APPENDIX B-1**
**Geotechnical Site Characterization**
**(ref AMEC 12/13/2005)**

# APPENDIX B
# GEOTECHNICAL SITE CHARACTERIZATION

## 1. INTRODUCTION

### 1.1 GENERAL

This appendix presents the results of our geotechnical site characterization performed for the expanded Low Activity Radioactive Waste (LARW) embankment to be constructed north of the existing LARW embankment at the Envirocare facility near Clive, Utah. AGRA (now AMEC Earth & Environmental, Inc. [AMEC]) previously completed a geotechnical site characterization for the existing embankment and submitted our findings in a report dated October 26, 1999[1]. The site described in that report is presently occupied by the existing LARW embankment with the location of this study being immediately to the north of the existing LARW embankment.

The general location of the site showing major topographic features and existing facilities, as of 1973, is presented on Figure B-1, Vicinity Map. The locations of the previous studies and subsurface investigations are presented on Figure B-2, Exploration Location Map, which was taken from the referenced 1999 AGRA study. The locations of the Cone Penetration Test (CPT) soundings and boring drilled in conjunction with this study are shown on Figure B-3, Supplemental Exploration Location Map.

During the course of this investigation, preliminary findings and recommendations were discussed with representatives of Envirocare of Utah, Inc.

### 1.2 OBJECTIVES AND SCOPE

The objectives and scope of this phase of our study were planned in discussions between Mr. David Shockey of Envirocare of Utah, Inc., and Mr. Joergen Pilz of AMEC.

In general, the objectives of this phase of our study were to complete supplemental subsurface investigations to evaluate the conditions below the expanded LARW embankment. The investigation work was combined with previous investigations to confirm that the geologic conditions below the new embankment are similar to those used for design of the existing embankments. One boring was drilled to obtain samples for laboratory testing and three CPT soundings were completed to determine stratigraphy and soil properties below the proposed expanded embankment.

---

1 "Report, Geotechnical Site Characterization, Proposed new LARW embankment, near Clive, Tooele County, Utah," AGRA Job no. 9-817-002586.

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Fax +1 (801) 266-0727 www.amec.com

In accomplishing this objective, our work scope included the following:

1. Completion of three CPT soundings arranged in an east-to-west alignment along the northern edge of the proposed new LARW embankment footprint. One CPT was a seismic cone sounding to obtain a shear wave velocity profile versus depth below the embankment and compare this result to previous tests.

2. A field program consisting of drilling, logging, and sampling one 100-foot deep boring. The boring was drilled adjacent to the seismic CPT sounding to obtain samples of the materials delineated by the CPT tests.

3. Grouting the CPT soundings and boring with a commercial bentonite grout mixture.

4. A laboratory testing program to measure classification and index properties.

5. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary appendix.

### 1.3 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based, are presented in subsequent sections of this appendix. Recommendations presented in our report are governed by the physical properties of the soils encountered in the boring and CPT soundings, projected groundwater conditions, and the design data discussed in Section 2., Proposed Construction, of the main body of the report. If subsurface conditions other than those described in this appendix are encountered and/or if design and layout changes are implemented, AMEC must be informed so that our recommendations can be reviewed and amended, as appropriate.

## 2. SITE INVESTIGATIONS

As shown on Figure B-2, extensive geotechnical and hydrogeological investigations have previously been completed for both the Vitro and existing Envirocare embankments; therefore, adequate subsurface data was available to provide a basis for design of the proposed embankment. Based on the extent of existing data and satisfactory performance of the foundation soils below existing embankments, the current field program consisted of drilling one boring near the center of the new embankment and completing three CPT soundings to observe the continuity of subsurface conditions for comparison with adjacent subsurface conditions. As discussed in subsequent sections, relatively uniform conditions were encountered.

## 3. FIELD PROGRAM

To characterize the subsurface conditions, three CPT soundings were advanced and one exploration boring was drilled and sampled. Three CPT soundings were also completed to depths ranging from 91 to 100 feet. Conetec Investigations Ltd. of Salt Lake City advanced the

CPT soundings using a 20-ton CPT rig. CPT-04 encountered refusal on a dense layer at a depth of approximately 91 feet. The remaining CPTs were advanced their full planned depth of 100 feet. The boring was advanced using a truck-mounted Marl M-10 drill rig, also operated by Conetec Investigations. The boring was advanced using a hollow-stem auger down to a depth of 100 feet.

CPT tests were completed to evaluate liquefaction susceptibility of the soils and determine the stratigraphy of the subsurface profile below the site. The CPT test is an in-situ test that measures three parameters: the tip resistance (Qc) of a 10-square-centimeter conical-shaped tip, the sleeve resistance along a cylindrical sleeve, and the pore water pressure (u) developed during pushing the instrument into the ground at a constant rate. These parameters provide an indication of the soil behavior during either undrained loading (pore water pressures develop but are not allowed to drain) or drained loading (such as penetration through sands).

Based on our experience, the interpretation of the CPT tests provides a reasonably accurate profile of expected subsurface conditions. A report summarizing the investigations completed by Conetec Investigations, Ltd. of Salt Lake City, Utah is included as an attachment at the end of this appendix, following the figures. The report contains the interpretation of the soil types encountered at the CPT locations along with the measured CPT parameters.

Figure B-4, Stratigraphic Cross-Section Based on CPT, presents the results of the CPT soundings. The shear wave velocity profile was also measured at the CPT-04 location. The previous and current shear wave velocity data are presented on Figure B-5, Shear Wave Velocity Measurements.

A single boring was subsequently drilled using a hollow-stem auger and sampled at depths determined by the CPT stratigraphy to obtain samples for laboratory testing. Sampling in the boring was completed using a two and one-half-inch inside diameter drive sampler with brass rings. Locations of the CPT soundings and boring are presented on Figure B-3.

The field portion of our investigation was under the direct control and supervision of our engineering staff. A continuous log of the subsurface conditions encountered in the boring was maintained during the course of the drilling. In addition, representative disturbed and relatively undisturbed samples of the soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent observation and testing in our laboratory. Detailed graphical representation of the soils encountered is presented on Figure B-6, Log of Boring. Soils were classified in accordance with the nomenclature described on Figure B-7, Unified Soil Classification System.

The boring and each CPT Soundings were tremie grouted their full depth using a three-quarter-inch diameter pipe and a commercially available product, Enviroplug Grout.

## 3.1 LABORATORY TESTING

### 3.1.1 General

A laboratory testing program was completed to provide data necessary for our engineering analyses. The program included engineering classification tests, moisture content, density, partial gradation, and Atterberg limits tests on representative samples. Engineering property tests, including consolidation tests, were also completed to estimate settlements below the proposed embankment and compare to previous test results.

The laboratory tests completed as part of this investigation were compared to the more extensive database of laboratory test results previously completed by others and found as summarized in attached Table 1, Summary of Envirocare Lab Data. The laboratory tests described below are plotted versus depth on Figure B-8, Summary Plot of Laboratory Test Results. Topography of the site is relatively level; therefore, depths are comparable to elevation below ground surface. This plot shows a summary of moisture content, density, over-consolidation ratio, compressibility, and plasticity tests versus depth. The data obtained by AMEC for this investigation are indicated by "X" symbols within each plot. The intent of preparing this plot is to show that soils below the proposed New LARW embankment fall within the range (and variability) of laboratory tests performed by others for the Vitro and existing LARW embankments.

The following paragraphs describe the tests and summarize the test data.

### 3.1.2 Moisture and Density Tests

Moisture and density tests were performed on selected samples to aid in classifying the soils and to develop the present in-situ moisture content and unit weight of the soils. The results of these tests are presented to the left of the boring log sheets on Figure B-5 and are tabulated in the following table:

| Boring No. | Depth (feet) | Soil Type | Dry Density (pcf) | Moisture Content (percent) |
|---|---|---|---|---|
| B-2 | 5.0 | CL | 86 | 31.5 |
| B-2 | 10.5 | SM | 112 | 3.4 |
| B-2 | 15.5 | SM | 128 | 11.5 |
| B-2 | 20.5 | SM | 101 | 19.1 |
| B-2 | 23.5 | SM | 102 | 12.6 |
| B-2 | 30.5 | CL | 65 | 60.7 |
| B-2 | 37.5 | SC | 77 | 60.7 |
| B-2 | 49.5 | CL | 94 | 28.1 |
| B-2 | 60.5 | CL | 92 | 29.5 |
| B-2 | 70.5 | SC | 111 | 16.6 |
| B-2 | 80.5 | SM | 105 | 22.6 |
| B-2 | 90.5 | SM | 103 | 22.7 |
| B-2 | 99.0 | CL | 93 | 27.8 |

### 3.1.3 Partial Gradation Tests

Partial gradation tests were performed on a series of samples to aid in classifying the soils. The results of these tests are tabulated in the following table:

| Boring No. | Depth (feet) | No. 200 | Soil Classification |
|---|---|---|---|
| B-2 | 15.5 | 35.0 | SM |
| B-2 | 23.5 | 43.7 | SM/ML |
| B-2 | 70.5 | 29.5 | SC |
| B-2 | 80.5 | 31.2 | SM |

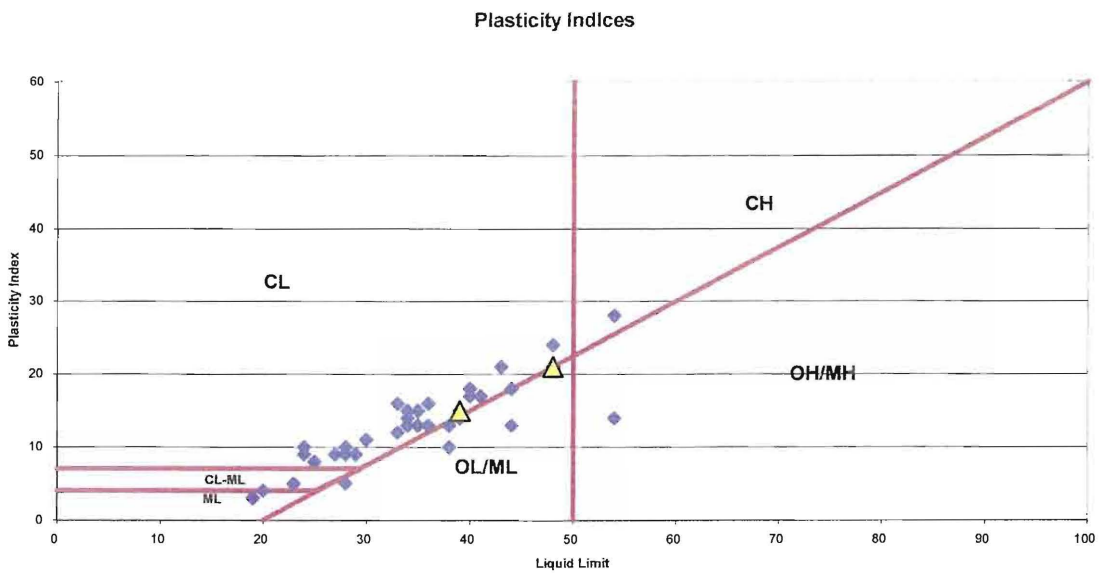
Based on these results, the majority of the sandy soils classify as silty sands with moderate to high percentages of silt and clay.

### 3.1.4 Atterberg Limits Tests

Atterberg limits tests were performed on representative samples to aid in classifying the finer-grained soils encountered at the site. The test results are tabulated below:

| Boring No. | Depth (feet) | Liquid Limit (percent) | Plasticity Index (percent) | Soil Type |
|---|---|---|---|---|
| B-2 | 5.0 | 39 | 15 | CL |
| B-2 | 30.5 | 48 | 21 | ML |
| B-2 | 70.5 | NP | NP | SM |

A summary of all the Atterberg limit tests on at the site (♦) is presented on the following plot on the next page, along with the samples tested during this study (▲).




### 3.1.5 Consolidation Tests

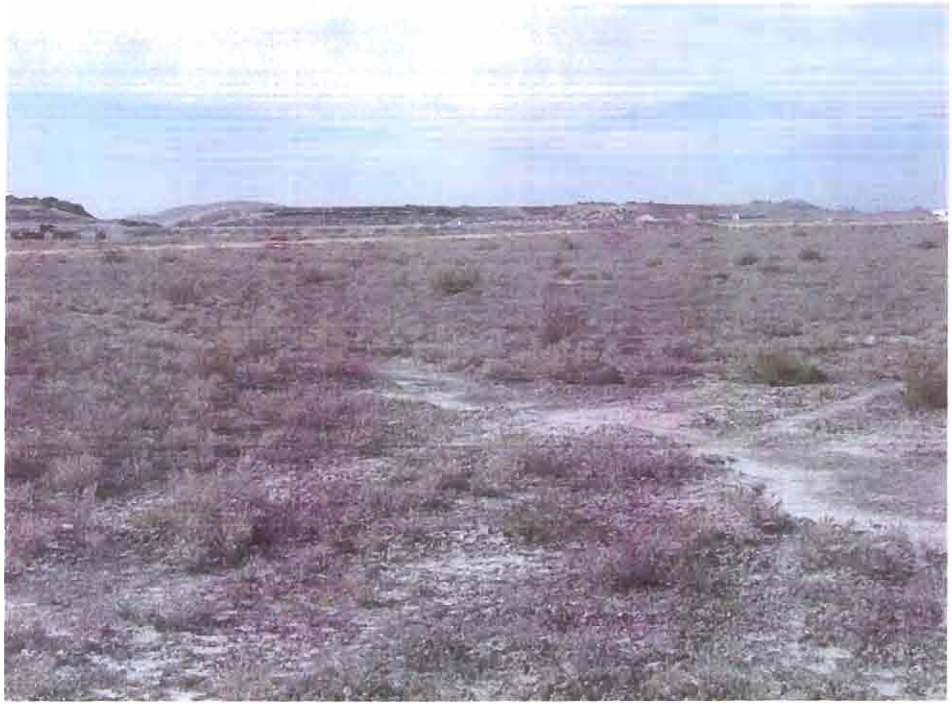
Consolidation tests were performed on representative samples of the clay and silt soils to assess their load-deformation characteristics and estimate their degree of over-consolidation. The data obtained from these tests was used to calculate foundation settlements below the proposed embankment at its ultimate height. Samples from Boring B-2 at depths of 30.5 and 49.5 feet were tested. The samples were each tested under flooded (saturated) conditions to reflect the in-situ conditions. Data obtained from the consolidation tests indicates that the clay and silty clay soils are slightly over-consolidated near the surface. In general, these soils will exhibit low compressibility characteristics under the anticipated loadings. Results of the consolidation tests are presented on Figure B-9, Consolidation Test Results.

## 4. SITE CONDITIONS

### 4.1 SURFACE

The location of the proposed new LARW embankment is an undeveloped parcel immediately to the north of the existing LARW class A embankment. The site is relatively flat. Over three-quarters of the site is covered principally by sagebrush, some grass, and poorly vegetated areas.

A photograph of the site is shown on the next page.



The site was surrounded by monitor well pads and a few roadways. Graded access roads connect the monitor well pads. The existing operating LARW embankment and containerized waste facility (CWF) is situated to the south. The area is undeveloped to the north.

## 4.2 SUBSURFACE SOIL CONDITIONS

The subsurface conditions encountered in the three CPT soundings and boring were found to be consistent across the site and similar to the conditions encountered in our previously referenced investigation. The conditions observed are also in general agreement with the hydrogeologic cross-sections developed by others across Section 32 and presented in Appendix D of the permit application previously reviewed[2]. The general stratigraphic conditions are summarized below. Unit numbers used in the referenced hydrogeologic documents are provided for reference on the next page.

[2] See AGRA Letter Report, "Technical Appendix Document Review, New LARW Facility, Envirocare of Utah NW 1/4, Section 32, Near Clive, Utah," Job No. 9-817-002427, July 15, 1999.

| Unit No. | Depth, ft | Soil Type | Description |
|---|---|---|---|
| 4 | 0 to 9+/- | Upper Clays | Silty clays, classifying as CL in accordance with the Unified Classification System. Contains some fine silt, ML, layers and is generally dry and medium to stiff in consistency. Considered to represent the deep Lake Bonneville clays. |
| 3 | 9 to 26+/- | Silty Sands | Dense to medium dense silty sands and silts containing a few thin clay layers. |
| 2 | 26 to 64+/- | Clays and Silts | Interbedded clay and silt layers with a few isolated sand layers up to two feet thick. Sand layers were discontinuous across the site. Clays are generally stiff with a few soft layers. Saturated throughout. |
| 1 | 64 to maximum depth | Interbedded Sand, Silt, and Clay Layers | A sequence of interbedded silty sand, fine sand, and coarse to gravelly sand layers with interbedded clay and silt layers. Increasing sand layers beginning at depths of 50 feet and extending to the maximum depth investigated, 100 feet. Dense to very dense sands and stiff clays. |

Based on detailed geologic studies completed on other projects within the Basin and Range, we expect that the upper clays represent the lakebed clay deposits deposited within the deep Lake Bonneville cycle(s) from about 12,000 to 20,000 years before present. The sequence of silty sands below the upper clays were either alluvial, colluvial, or lacustrine deposits, which may have occurred during fluctuations in the Lake Bonneville level. The lower (Unit 2) silts and clays most likely represent an older period of lake deposition predating 20,000 years before present and termed the "Cutler Dam Lake Cycle" in geologic literature. The Unit 1 sands, silts, and clays most likely represent pre-Pleistocene deposits from an Interglacial period. These deposits may date as old as 100,000 to 150,000 years before present. The significance of these probable ages is that numerous earthquakes have occurred during this geologic time period and the probability of liquefaction would be considered quite low based on age of the deposits alone.

## 4.3 GROUNDWATER

Groundwater was encountered at a depth of 37.3 feet in Boring B-2 at the time of drilling. The appearance of water in the boring appeared to correspond to the presence of a sand layer. The boring was subsequently grouted; therefore, a stabilized groundwater level could not be measured. A pore pressure dissipation test was completed during the CPT investigation. The pore pressure dissipation test was completed in the more permeable silty sand layer by stopping CPT penetration and recording the stabilized reading from the pore pressure sensor on the CPT unit. These readings are similar to electrical piezometer readings. The pore pressure was found to be 42 feet of head at a depth of 68 feet. This indicates a water level of 26 feet below the ground surface. This measurement generally agrees with the levels measured in nearby monitor wells.

# 5. SUMMARY OF FINDINGS

The field and laboratory portion of this study identified an overall relatively stiff to dense sequence of distinct sand, clay, and silt layers. There are principally two layers which may be

subject to consolidation settlements: the upper clays (Unit 4) and the lower silts and clays (Unit 2). The upper clays are at a percent saturation estimated to range from 50 to 90 percent and of low unit weight. Neither the upper clays nor the sands are expected to contribute significantly to long-term settlements or to seismic instability. Only the lower silts and clays are saturated and of potential concern to seismic stability. The lowermost sequence of sands, silts, and clays are not expected to impact either stability or long-term settlements.

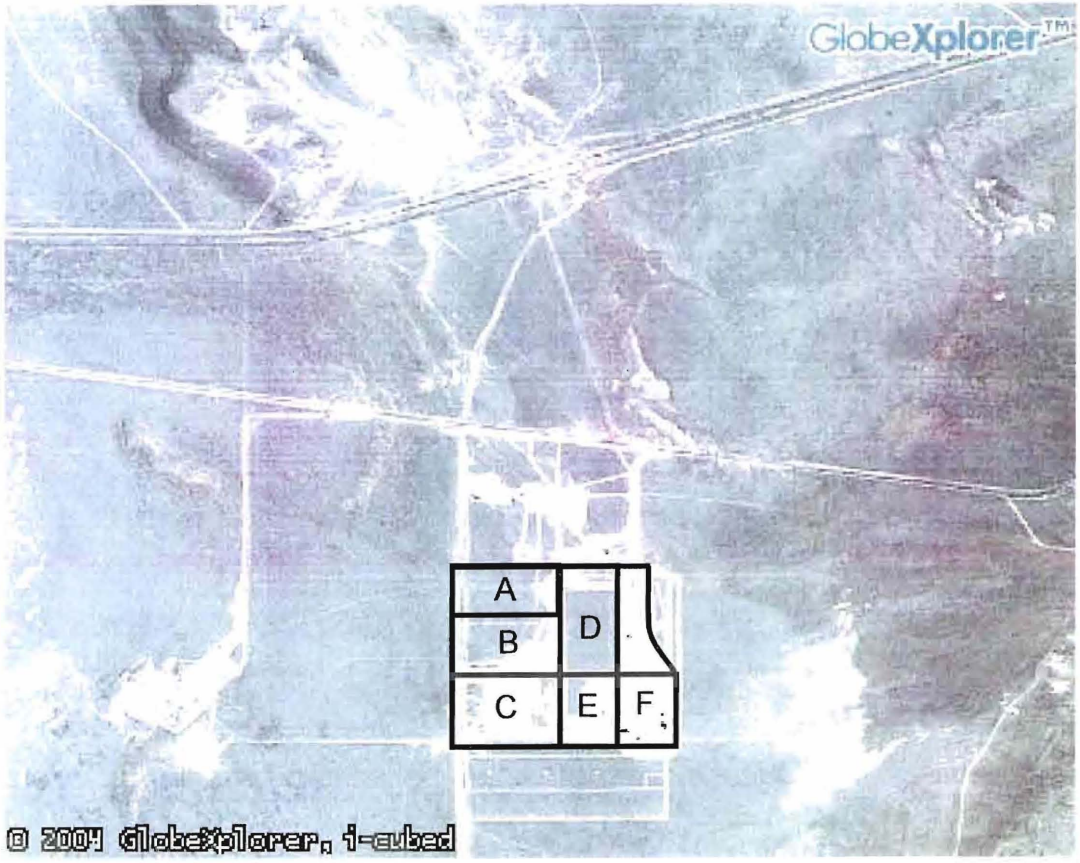
Subsurface conditions at the new LARW site are substantially the same as the adjacent areas underlying existing embankments. Therefore, the site is judged suitable from a geotechnical perspective for the proposed embankment.

Encl. Table 1, Summary of Envirocare Lab Data
Figure B-1, Vicinity Map
Figure B-2, Exploration Location Map
Figure B-3, Supplemental Exploration Location
Figure B-4, Stratigraphic Cross Section Based on CPT
Figure B-5, Shear Wave Velocity Measurements
Figure B-6, Log of Boring
Figure B-7, Unified Soil Classification System.
Figure B-8, Summary Plot of Laboratory Test Results
Figure B-9, Consolidation Test Results
ConeTec, Inc. Investigation Report

Table 1 - Summary of Envirocare Lab Data

| Boring No. | Depth ft | Soil Description | USCS | W.C. % | $\gamma_{dry}$ pcf | $\gamma_{tot}$ pcf | Gradation % Gravel | % Sand | % Silt-clay | Atterberg Limits LL | PL | PI | $Su_{(lab\ vane)}$ psf | Cc | Cr | Pc psf | OCR | Source / Date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Foundation Soils** | | | | | | | | | | | | | | | | | | |
| SC-1 | 40.0 | | | 32% | 90 | 119 | | | | 24 | 14 | 10 | | 0.180 | 0.040 | 9500 | 2.4 | D&M, 1984 |
| SC-7 | 5.0 | | | 34% | 85.4 | 114 | | | | | | | | 0.120 | 0.012 | 1400 | 2.5 | D&M, 1984 |
| SC-7 | 35.0 | | | 40% | 80.9 | 113 | | | | | | | | 0.216 | 0.030 | 6200 | 1.8 | D&M, 1984 |
| SC-8 | 29.0 | | | 67% | 60.6 | 101 | | | | 54 | 40 | 14 | | 0.228 | 0.034 | 4000 | 1.4 | D&M, 1984 |
| SC-10 | 10.0 | | | 44% | 77.9 | 112 | | | | | | | | 0.240 | 0.048 | 6000 | 5.4 | D&M, 1984 |
| SLC-84 | 4.0 | | | 21% | 98.8 | 119 | | | | 38 | 28 | 10 | | 0.075 | | 4000 | 8.4 | D&M, 1984 |
| SLC-84 | 8.5 | | | 37% | 77.6 | 106 | | | | 20 | 16 | 4 | | 0.239 | | 4000 | 4.4 | D&M, 1984 |
| SLC-84 | 6.0 | | | 42% | 65.2 | 92.3 | | | | 38 | 25 | 13 | | 0.441 | 0.009 | 4000 | 7.2 | D&M, 1984 |
| | | | | | | | | | | | | | | | | | | |
| GW-16 | 4.0 | Silty Clay | | 21% | 106 | 128 | | | | 34 | 19 | 15 | | 0.500 | 0.007 | 2000 | 3.9 | Bingham Eng |
| GW-19A | 6.0 | Silty Clay | | 45% | 73.2 | 106 | | | | 44 | 26 | 18 | | 0.160 | 0.021 | 4000 | 6.3 | Bingham Eng |
| GW-19B | 23.0 | Silty Sand | | 33% | 112 | 149 | | | | | | | | | | | | Bingham Eng |
| GW-18 | 31.0 | Silty Clay | | 46% | 79 | 115 | | | | 40 | 22 | 18 | | 0.100 | 0.020 | 6200 | 1.8 | Bingham Eng |
| GW-17A | 8.3 | Silty Clay | | 34% | 87.2 | 117 | | | | 34 | 20 | 14 | | 0.100 | 0.020 | 1600 | 1.7 | Bingham Eng |
| GW-17A | 20.0 | Silty Sand | | 16% | 104 | 121 | | | | | | | | | | | | Bingham Eng |
| GW-17A | 28.0 | Silty Sand | | 49% | 82.4 | 123 | | | | | | | | | | | | Bingham Eng |
| GW-18 | 5.8 | | | | | | | | | 34 | 21 | 13 | | | | | | Bingham Eng |
| GW-18 | 21.0 | Silty Sand | | 27% | 96.7 | 123 | | | | | | | | | | | | Bingham Eng |
| GW-16 | 35.2 | Silty Clay | | 38% | 104 | 143 | | | | 19 | 16 | 3 | | | | | | Bingham Eng |
| GW-24 | 6.5 | | | | | | | | | 33 | 21 | 12 | | | | | | Bingham Eng |
| GW-24 | 26.5 | | | | | | | | | 30 | 19 | 11 | | | | | | Bingham Eng |
| GW-24 | 31.5 | | | | | | | | | 41 | 24 | 17 | | | | | | Bingham Eng |
| GW-27 | 9.0 | | | | | | | | | 36 | 23 | 13 | | | | | | Bingham Eng |
| GW-27 | 29.0 | | | | | | | | | 36 | 20 | 16 | | | | | | Bingham Eng |
| GW-29 | 4.0 | | | | | | | | | 54 | 26 | 28 | | | | | | Bingham Eng |
| GW-29 | 9.0 | | | | | | | | | 35 | 22 | 13 | | | | | | Bingham Eng |
| GW-29 | 23.5 | | | | | | | | | 28 | 18 | 10 | | | | | | Bingham Eng |
| GW-29 | 31.5 | | | | | | | | | 40 | 23 | 17 | | | | | | Bingham Eng |
| DH-33 | 4.0 | | | | | | | | | 48 | 24 | 24 | | | | | | Bingham Eng |
| DH-33 | 9.0 | | | | | | | | | 39 | 25 | 14 | | | | | | Bingham Eng |
| DH-33 | 26.5 | | | | | | | | | 23 | 18 | 5 | | | | | | Bingham Eng |
| GW-36 | 5.0 | | | | | | | | | 33 | 21 | 12 | | | | | | Bingham Eng |
| GW-36 | 27.0 | | | | | | | | | 44 | 31 | 13 | | | | | | Bingham Eng |
| GW-41 | 25.0 | | | | | | | | | 27 | 18 | 9 | | | | | | Bingham Eng |
| GW-55 | 7.0 | | | | | | | | | 33 | 21 | 12 | | | | | | Bingham Eng |
| DH-51 | 21.0 | | | | | | | | | 24 | 15 | 9 | | | | | | Bingham Eng |
| DH-51 | 25.0 | | | | | | | | | 25 | 17 | 8 | | | | | | Bingham Eng |
| DH-48 | 26.0 | | | | | | | | | 29 | 20 | 9 | | | | | | Bingham Eng |
| | | | | | | | | | | | | | | | | | | |
| DH-1 | 5 | | CL-ML | 30.9% | 87.8 | 115 | | | | 35 | 20 | 15 | | 0.13 | 0.01 | 4600 | 8 | AGRA, 1999 |
| DH-1 | 12 | | SM | 6.1% | | | 9 | 77 | 14 | | | | | | | | | AGRA, 1999 |
| DH-1 | 22 | | SM | 16.7% | | | | 83 | 17 | | | | | | | | | AGRA, 1999 |
| DH-1 | 30.5 | | CL-ML | 64.0% | 59.9 | 98.2 | | | | 43 | 22 | 21 | 920 | 0.13 | 0.025 | 4000 | 1.4 | AGRA, 1999 |
| DH-1 | 40 | | CL-ML | 30.2% | 93.3 | 121 | | | | 33 | 17 | 16 | 2800 | 0.125 | 0.02 | 4200 | 1 | AGRA, 1999 |
| DH-1 | 45 | | CL-ML | 26.1% | 98.8 | 125 | | | | 28 | 19 | 9 | 1985 | 0.08 | 0.02 | 6000 | 1.3 | AGRA, 1999 |
| DH-1 | 60 | | CL-ML | 28.6% | 92.2 | 119 | | | | 28 | 23 | 5 | 1615 | 0.08 | 0.02 | 6000 | 1.2 | AGRA, 1999 |
| DH-1 | 69 | | CL-ML | 28.0% | | | 1 | 42 | 57 | | | | | | | | | AGRA, 1999 |
| DH-1 | 80 | | SM | 16.7% | | | 13 | 67 | 20 | | | | | | | | | AGRA, 1999 |
| DH-1 | 93 | | SM | 23.1% | | | | 57 | 43 | | | | | | | | | AGRA, 1999 |
| | | | | | | | | | | | | | | | | | | |
| B-2 | 5 | | CL | 31.5% | 85.9 | 113.0 | | | | 39 | 24 | 15 | | | | | | AMEC, 2004 |
| B-2 | 10.5 | | SM | 3.4% | 112 | 116.0 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 15.5 | | SM | 11.5% | 128 | 142.8 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 20.5 | | SM | 19.1% | 101 | 120.8 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 23.5 | | SM | 12.6% | 102 | 115.3 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 30.5 | | CL | 60.7% | 64.6 | 103.9 | | | | 48 | 28 | 21 | | 0.22 | 0.01 | 3200 | 1.1 | AMEC, 2004 |
| B-2 | 37.5 | | SC | 60.7% | 77.2 | 124.1 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 49.5 | | CL | 28.1% | 94.1 | 120.5 | | | | | | | | 0.125 | 0.004 | 6000 | 1.3 | AMEC, 2004 |
| B-2 | 60.5 | | CL | 29.5% | 91.8 | 118.8 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 70.5 | | SC | 16.6% | 111 | 129.6 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 80.5 | | SM | 22.6% | 105 | 128.5 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 90.5 | | SM | 22.7% | 103 | 125.7 | | | | | | | | | | | | AMEC, 2004 |
| B-2 | 99 | | CL | 27.8% | 93.4 | 119.3 | | | | | | | | | | | | AMEC, 2004 |

ENVIROCARE OF UTAH, INC.
JOB NO. 4-817-004769




A - This Study
B - AGRA 1999 - Existing LARW
C - 11e.(2)
D - Vitro
E - LARW/NORM
F - Mixed Watse

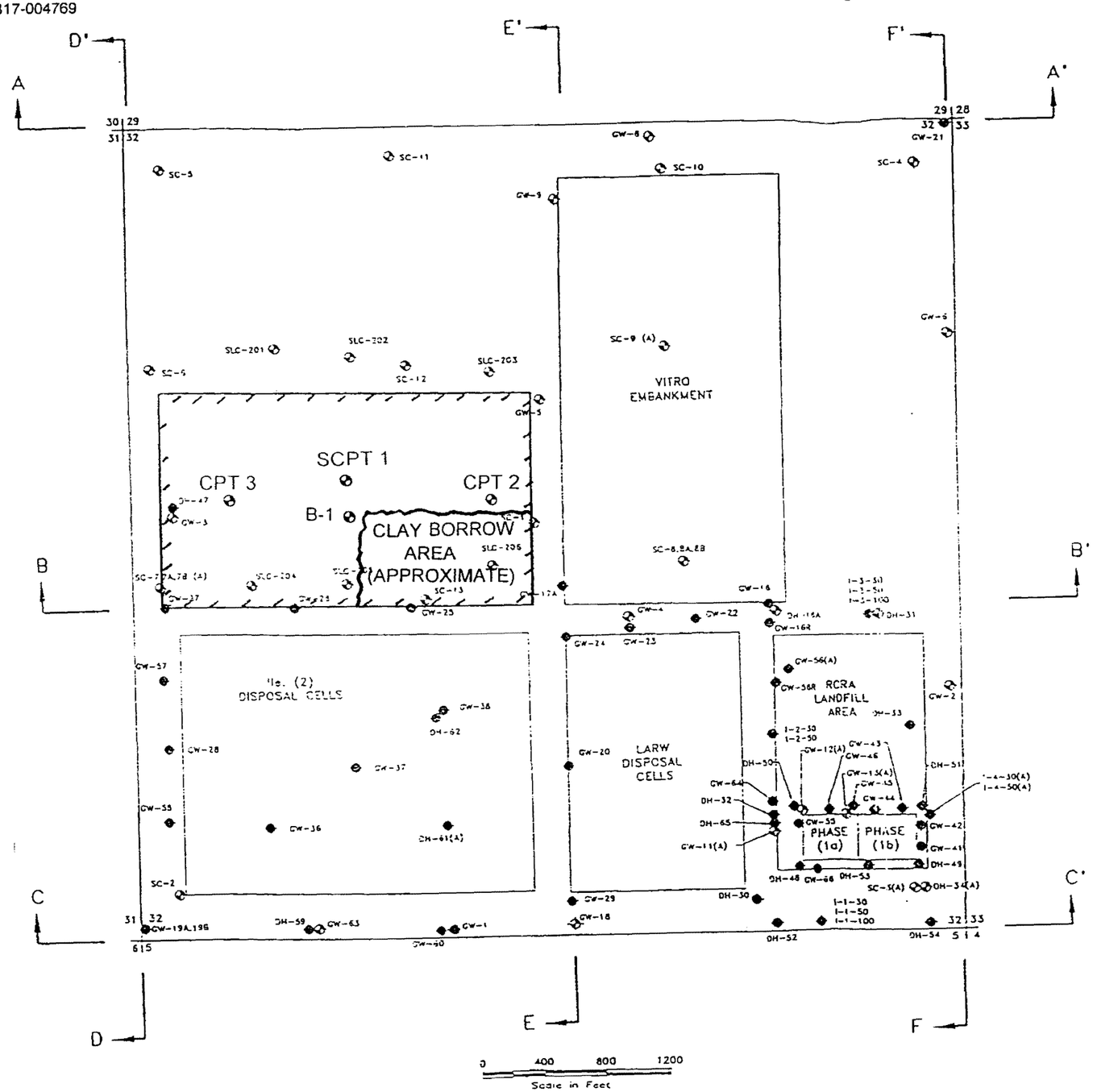
NOT TO SCALE

FIGURE B-1
VICINITY MAP

REFERENCE:
AERIAL PHOTOGRAPH MAP
GLOBECPLORER 2004

amec

JOB NO. 4-817-004769




## LEGEND

| | |
|---|---|
| GW-16 Through GW-66 | Monitor Wells-Bingham Environmental (1991-1994) |
| DH-30 Through DH-65 | Exploratory Holes / Piezometers-Bingham Environmental (1991-1993) |
| I and other GW's: | Delta Geotechnical Consultants (1988,1990) |
| SLC- | Jacobs Engineering Group, Inc. (1984) |
| SC- | Dames & Moore (1981-1982) |

## SOIL SAMPLING CODE

- Continuous Soil Sampling Hole
- Discontinuous Soil Sampling Hole

## NOTES

1. DH- DESIGNATES EXPLORATORY DRILL HOLES WHICH WERE NOT COMPLETED AS MONITOR WELLS. DH-31,DH-32,DH-33,DH-34,DH-59,DH-61 AND DH-62 WERE COMPLETED AS PIEZOMETERS.
2. GW-11,GW-12,GW-13,DH-34,DH-61,GW-56,I-4-30,I-4-50 AND SC-3 WERE ABANDONED IN 1994.
3. (A) INDICATES WELL HAS BEEN ABANDONED

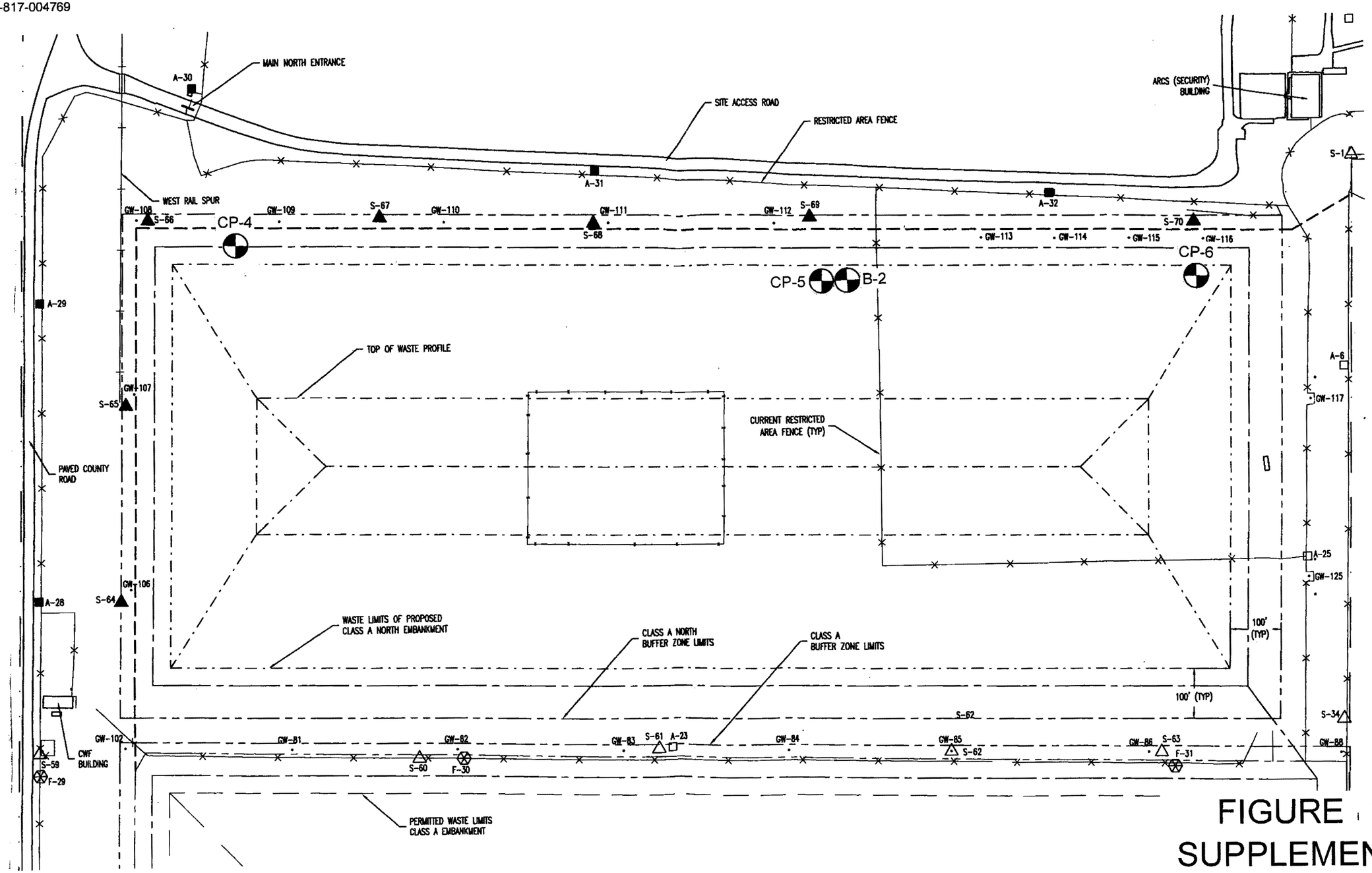
# FIGURE B-2
# EXPLORATION LOCATION MAP

amec

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"SITE PLAN, EXPLORATION LOCATION MAP"
BY BINGHAM ENVIRONMENTAL
DATED FEBRUARY 1996

N117726

ENVIROCARE OF UTAH, INC.
JOB NO. 4-817-004769




# FIGURE 3
# SUPPLEMENTAL EXPLORATION LOCATION MAP

REFERENCE:
ADAPTED FROM DRAWING PROVIDED BY
ENVIROCARE OF UTAH
DATED OCTOBER 19, 2004

amec

DATE ____ CHECKED BY ____ DATE ____ BY ____ FILE NO. ____

N117726

ENVIROCARE OF UTAH, INC.
JOB NO. 4-817-004769

## West to East Cross Section Showing CPT Tip Resistence and Friction Ratio Versus Depth

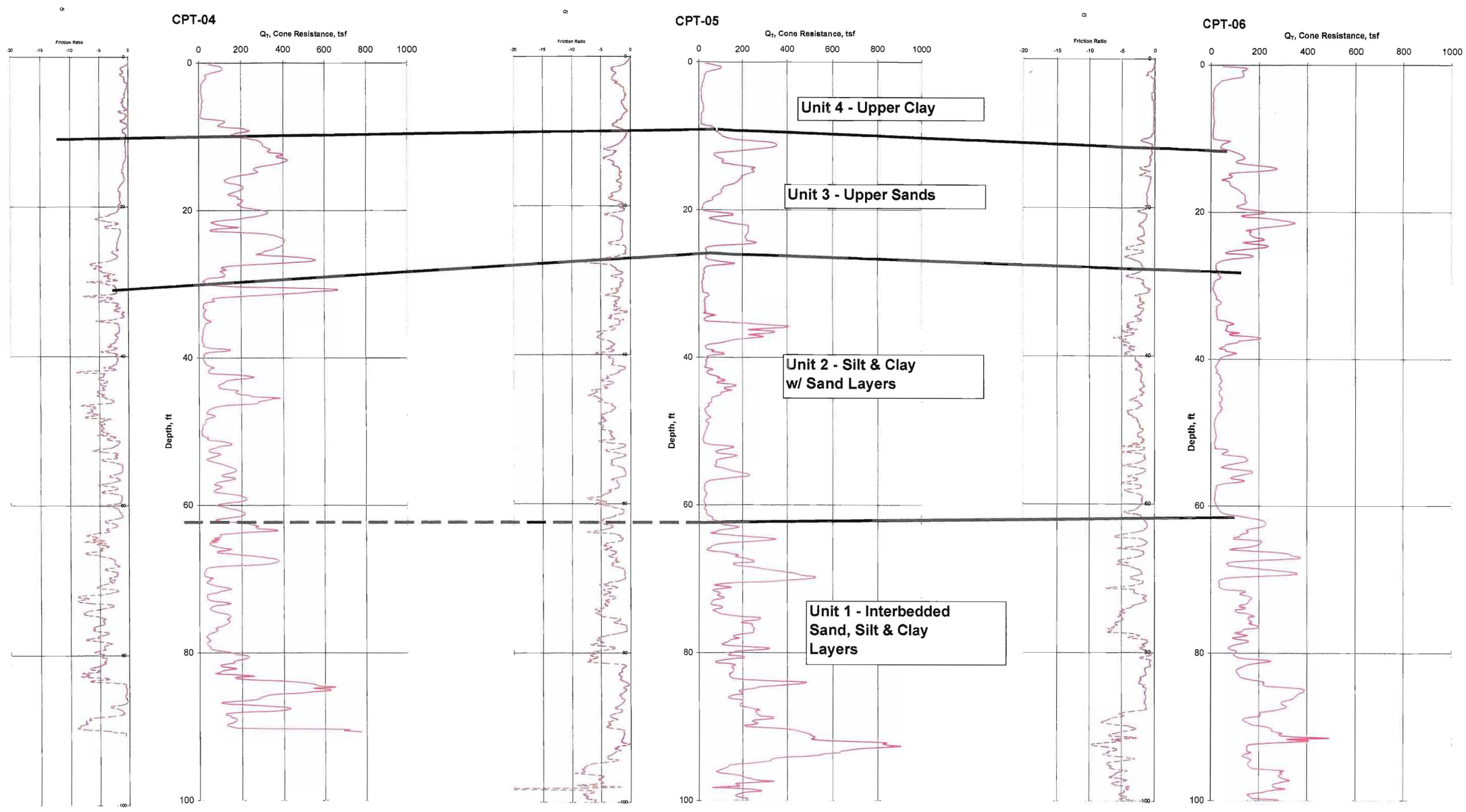
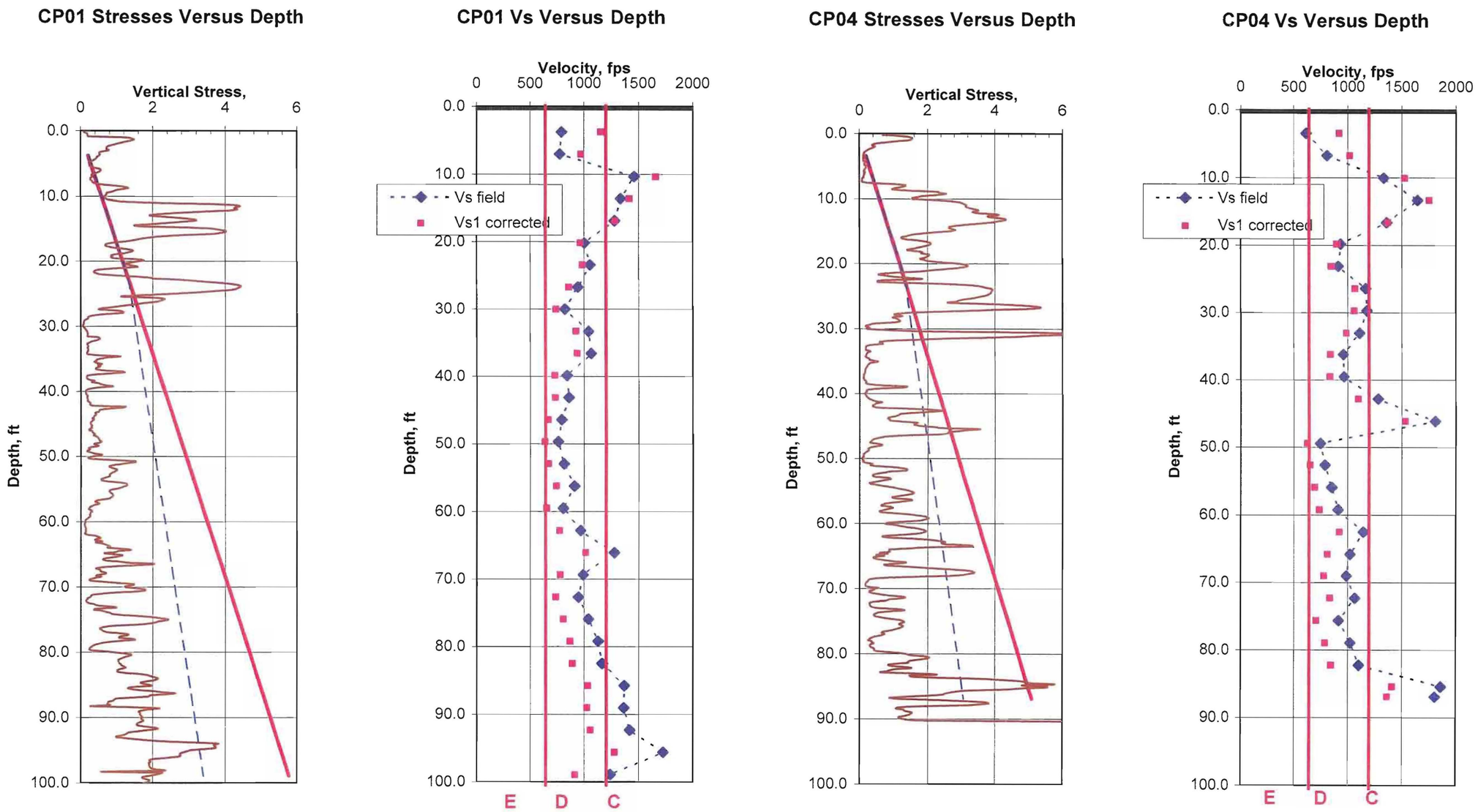



Figure B-4 - Stratigraphic Cross Section Based on CPT

Envirocare of Utah, Inc.
Job No. 4-817-004769

# Shear Wave Data Reduction Versus Depth

amec




Seismic Site Class
In accordance with IBC 2003
E- Soft Soil, Vs < 600 fps
D- Stiff Soil, 600 < Vs < 1200 fps
C- Very Dense Soil, 1200 < Vs < 2500 fps

**Figure B-5 - Shear Wave Velocity Measurements**

Envirocare of Utah, Inc.
Job No. 4-817-004769

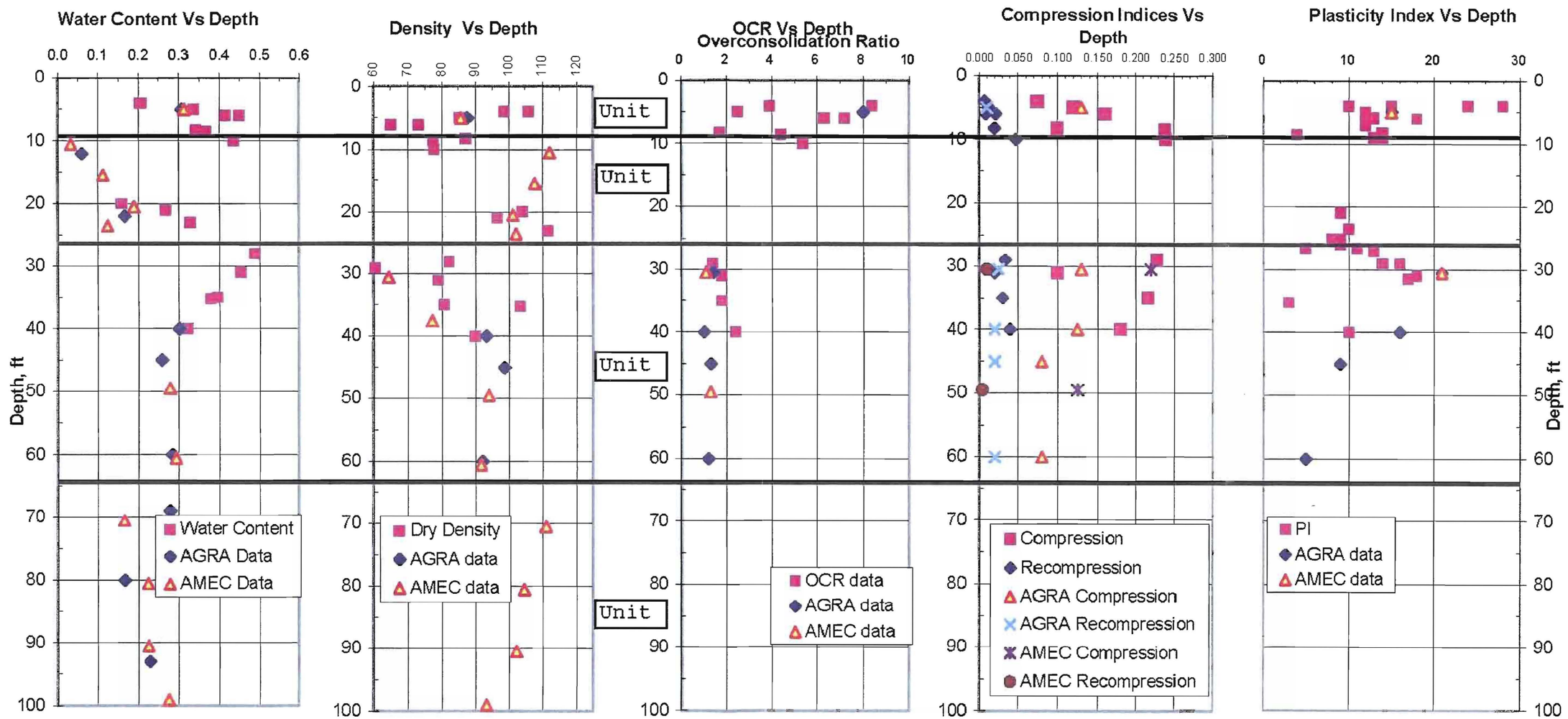



**Figure B-8 - Summary Plot of Laboratory Test Results**

PROJECT Envirocare Facility
Near Clive, Utah

# LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004769 DATE 10-07-04

RIG TYPE Marl M-10
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows/foot 140 lb. 30" free-fall drop hammer | Dry Density lbs. per cubic foot | Moisture Content Percent of Dry Weight | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | CL | dry | **SILTY CLAY** with some fine sand; light gravel; no topsoil; roots present; open structure; loose to 6"; desiccated |
| 5 | | | | D | 7 | 86 | 31.5 | CL | moist medium stiff | gray with oxidation stains |
| | | | | | | | | SM | slightly moist medium dense | **SILTY SAND** with trace fine gravel; fine to medium sand; light brown |
| 10 | | | | D | 67 | 112 | 3.4 | | | |
| 15 | | | | D | 54 | 128 | 11.5 | | moist | grades silty fine sand; light brown |
| 20 | | | | D | 32 | 101 | 19.1 | | slightly moist | occasional silty clay and silt layers |
| | | | | D | 54 | 102 | 12.6 | | moist | |
| 25 | | | | | | | | | | |

GROUNDWATER

| DEPTH | HOUR | DATE |
|---|---|---|
| 37.3 | 11:00 | 10-07-04 |
| | | |

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE B-6A

amec

PROJECT Envirocare Facility
Near Clive, Utah

# LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004769 DATE 10-07-04

RIG TYPE Marl M-10
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows/foot 140 lb. 30" free-fall drop hammer | Dry Density lbs. per cubic foot | Moisture Content Percent of Dry Weight | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 25 | | | | | | | | | | |
| | | | | | | | | CL | very moist to wet medium stiff | **SILTY CLAY**; gray |
| | | | | | | | | | | a few sand layers and stringers throughout |
| 30 | | | | D | 8 | 65 | 60.7 | | | |
| 35 | | | | | | | | | | grades slightly cemented with fine sand; greenish-gray |
| | | | | D | 37 | 77 | 60.7 | SC | saturated very stiff | **CLAYEY SAND** with some silt; fine sand; slightly cement; greenish-gray |
| 40 | | | | | | | | | | |
| | | | | | | | | CL | saturated stiff | **SILTY CLAY** with some fine sand layers; light brown |
| 45 | | | | | | | | | | |
| | | | | D | 17 | 94 | 28.1 | | | |
| 50 | | | | | | | | | | |

GROUNDWATER

| DEPTH | HOUR | DATE |
|---|---|---|
| 37.3 | 11:00 | 10-07-04 |
| | | |

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE B-6A
(con't)

amec

PROJECT Envirocare Facility
Near Clive, Utah

# LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004769 DATE 10-07-04

RIG TYPE Marl M-10
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows/foot 140 lb. 30" free-fall drop hammer | Dry Density lbs. per cubic foot | Moisture Content Percent of Dry Weight | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | | | | | | | | | | |
| 55 | | | | | | | | | | |
| 60 | | | | D | 23 | 92 | 29.5 | | very stiff | grades fine sandy silty clay; brown |
| | | | | | | | | SC | saturated dense | **CLAYEY SAND**; some cemented layers; brown |
| 65 | | | | | | | | | | |
| 70 | | | | D | 80 | 111 | 16.6 | | | |
| 75 | | | | | | | | | | |

GROUNDWATER

| DEPTH | HOUR | DATE |
|---|---|---|
| 37.3 | 11:00 | 10-07-04 |
| | | |

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE B-6A
(con't)

amec

PROJECT Envirocare Facility
Near Clive, Utah

# LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004769 DATE 10-07-04

RIG TYPE Marl M-10
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows/foot 140 lb. 30" free-fall drop hammer | Dry Density lbs. per cubic foot | Moisture Content Percent of Dry Weight | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 75 | | | | | | | | | | |
| | | | | | | | | SM | saturated dense | **SILTY SAND**; brown |
| 80 | | | | D | 93 | 105 | 22.6 | | | |
| 85 | | | | | | | | | | |
| | | | | | | 93 | 27.8 | | | |
| 90 | | | | D | 29 | 103 | 22.7 | | medium dense | grades with occasional fine gravel |
| 95 | | | | | | | | CL | saturated hard | **SILTY CLAY** with occasional fine gravel and sand; brown |
| | | | | D | 68 | | | | | |
| 100 | | | | | | | | | | |

GROUNDWATER

| DEPTH | HOUR | DATE |
|---|---|---|
| 37.3 | 11:00 | 10-07-04 |
| | | |

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE B-6A
(con't)

amec

PROJECT Envirocare Facility
Near Clive, Utah

# LOG OF TEST BORING NO. B-2

JOB NO. 4-817-004769 DATE 10-07-04

RIG TYPE Marl M-10
BORING TYPE 4.25" Hollow-Stem Auger
SURFACE ELEV.
DATUM

| Depth in Feet | Continuous Penetration Resistance | Graphical Log | Sample | Sample Type | Blows/foot 140 lb. 30" free-fall drop hammer | Dry Density lbs. per cubic foot | Moisture Content Percent of Dry Weight | Unified Soil Classification | REMARKS | VISUAL CLASSIFICATION |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | | | | | | | | | | Stopped drilling at 98.5'. |
| | | | | | | | | | | Stopped sampling at 100.0'. |
| 105 | | | | | | | | | | |
| 110 | | | | | | | | | | |
| 115 | | | | | | | | | | |
| 120 | | | | | | | | | | The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials. |
| 125 | | | | | | | | | | |

GROUNDWATER

| DEPTH | HOUR | DATE |
|---|---|---|
| 37.3 | 11:00 | 10-07-04 |
| | | |

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE B-6A
(con't)

amec

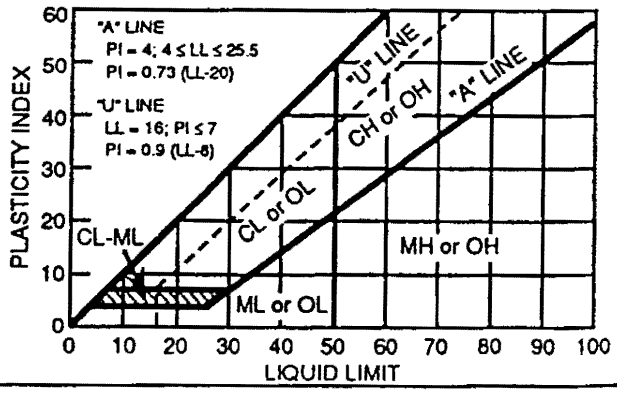
# UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

| MAJOR DIVISIONS | | | | GRAPHIC SYMBOL | GROUP SYMBOL | TYPICAL NAMES |
|---|---|---|---|---|---|---|
| COARSE-GRAINED SOILS Less than 50% passes No. 200 sieve) | GRAVELS (50% or less of coarse fraction passes No. 4 sieve) | CLEAN GRAVELS (Less than 5% passes No. 200 sieve) | | | GW | Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures |
| | | | | | GP | Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures |
| | | GRAVELS WITH FINES (More than 12% passes No. 200 sieve) | Limits plot below "A" line & hatched zone on plasticity chart | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | | Limits plot above "A" line & hatched zone on plasticity chart | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | SANDS (50% or more of coarse fraction passes No. 4 sieve) | CLEAN SANDS (Less than 5% passes No. 200 sieve) | | | SW | Well graded sands, gravelly sands |
| | | | | | SP | Poorly graded sands, gravelly sands |
| | | SANDS WITH FINES (More than 12% passes No. 200 sieve) | Limits plot below "A" line & hatched zone on plasticity chart | | SM | Silty sands, sand-silt mixtures |
| | | | Limits plot above "A" line & hatched zone on plasticity chart | | SC | Clayey sands, sand-clay mixtures |
| FINE-GRAINED SOILS (50% or more passes No. 200 sieve) | SILTS (Limits plot below "A" line & hatched zone on plasticity chart) | SILTS OF LOW PLASTICITY (Liquid Limit less than 50) | | | ML | Inorganic silts, clayey silts of low to medium plasticity |
| | | SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more) | | | MH | Inorganic silts, micaceous or diatomaceous silty soils, elastic silts |
| | CLAYS (Limits plot above "A" line & hatched zone on plasticity chart) | CLAYS OF LOW PLASTICITY (Liquid Limit less than 50) | | | CL | Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays |
| | | CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more) | | | CH | Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity |
| | ORGANIC SILTS AND CLAYS | ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50) | | | OL | Organic silts and clays of low to medium plasticity, sandy organic silts and clays |
| | | ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more) | | | OH | Organic silts and clays of high plasticity, sandy organic silts and clays |
| ORGANIC SOILS | | PRIMARILY ORGANIC MATTER (dark in color and organic odor) | | | PT | Peat |

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART



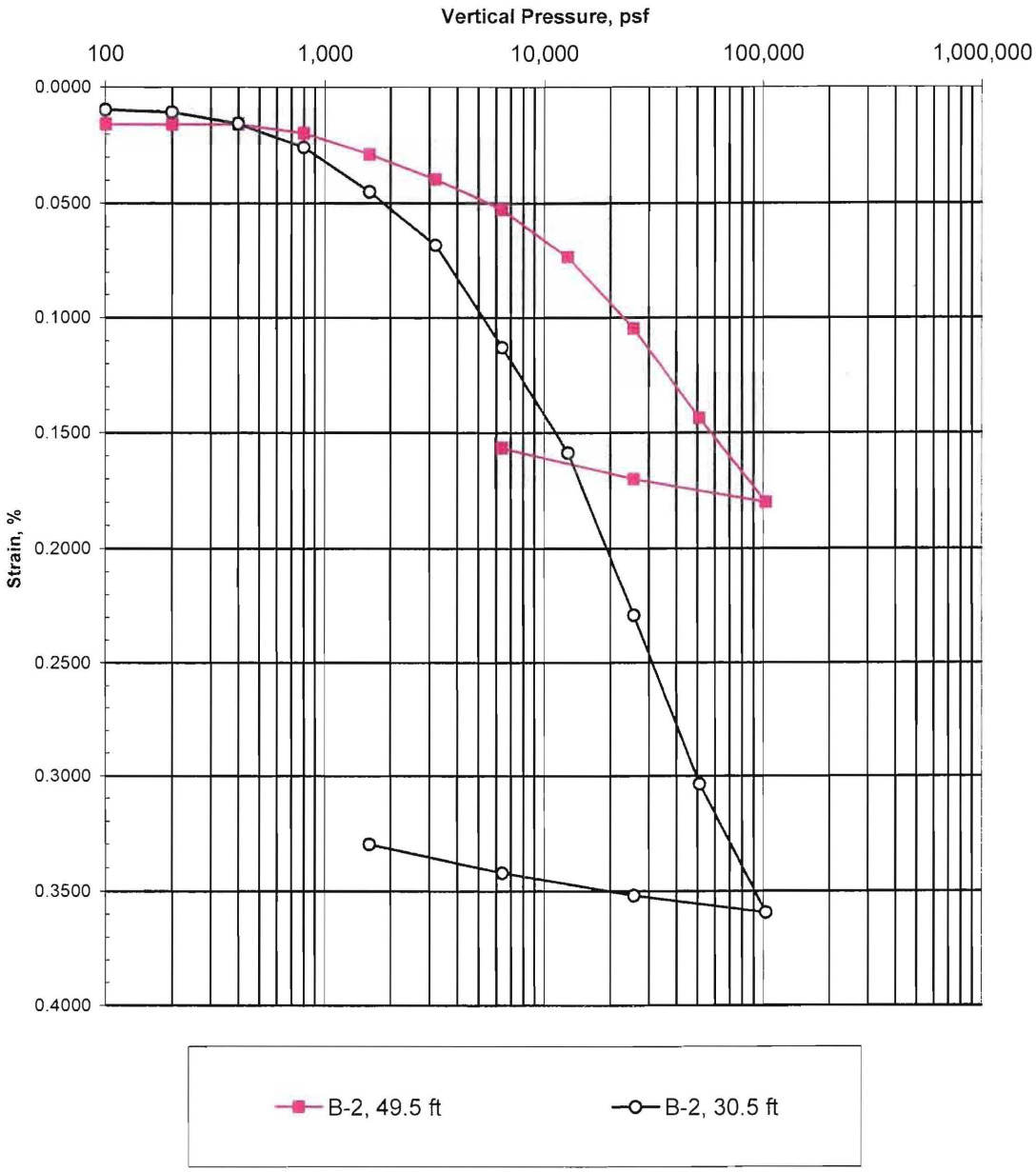

DEFINITION OF SOIL FRACTIONS

| SOIL COMPONENT | PARTICLE SIZE RANGE |
|---|---|
| Boulders | Above 12 in. |
| Cobbles | 12 in. to 3 in. |
| Gravel | 3 in. to No. 4 sieve |
| Coarse gravel | 3 in. to 3/4 in. |
| Fine gravel | 3/4 in. to No. 4 sieve |
| Sand | No. 4 to No. 200 sieve |
| Coarse sand | No. 4 to No. 10 sieve |
| Medium sand | No. 10 to No. 40 sieve |
| Fine sand | No. 40 to No. 200 sieve |
| Fines (silt and clay) | Less than No. 200 sieve |

FIGURE B-7

amec

Job No. 4-817-004769
Envirocare of Utah, Inc.




| | B-2, 30.5 ft | | B-2, 49.5 ft | |
|---|---|---|---|---|
| USCS Class | CL | | CL | |
| | Initial | Final | Initial | Final |
| Dry Density, pcf | 64.4 | 96.1 | 93.1 | 108.3 |
| Water Content, % | 62.5% | 33.8% | 29.9% | 23.8% |
| Total Density, pcf | 104.7 | 128.6 | 120.9 | 134.1 |

Figure B-9
Consolidation Test Results

consols.xls

CONETEC

**ConeTec, Inc.**

***Geotechnical and Environmental Site Investigation Contractors***

3589 West 500 South, Suite 3, Salt Lake City, UT 84104 • PO Box 22082, Salt Lake City, UT 84122
Tel: (801) 973-3801 • Fax: (801) 973-3802 • Web: www.conetec.com • Email: saltlakecity@conetec.com

October 19, 2004 Job No.: 04-406

Mr. Joergen Pilz
**AMEC Earth & Environmental, Inc.**
4137 South 500 West
Salt Lake City, UT 84123

Tel: (801) 266-0720
Fax: (801) 266-0727

Re: CPT Results
Envirocare Site
Tooele, Utah

Dear Joergen,

Per your request, we have completed the CPT investigation for the above referenced project. Enclosed is one set of standard CPT plots, seismic CPT plots, pore pressure dissipation plots and a data diskette. The diskette contains the CPT data files (*.cor files), and the pore pressure dissipation data files (*.ppd files). The "cor" and "ppd" files are text files that can be viewed with any text editor or imported into various programs, such as a spreadsheet. In addition to the data files, we have included digital copies of the CPT plots in PDF format. The following table summarizes the work performed at the site.

| CPT Location | CPT Filename | Maximum Depth (ft) | PPD Depth (ft) | PPD Time (sec) | Ueq (ft) | Comments |
|---|---|---|---|---|---|---|
| CPT-04 | 406CP04 | 90.71 | | No PPD | | Refusal & Seismic |
| CPT-05 | 406CP05 | 100.06 | 67.91 | 600 | 42.0 | |
| CPT-06 | 406CP06 | 100.06 | | | | |

Many correlations have been developed for design parameters based on CPT data. The interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design.

Assumptions have been made regarding soil unit weights, groundwater level and interpretational methods, which may or may not apply to this site. Additionally, the following table summarizes the values assigned to the specific soil behavior type zones.

Job No.: 04-406

| Zone | SPT Qt/N | Unit Wt. ($kN/m^3$) | Unit Wt. (pcf) | K (cm/s) | Description |
|---|---|---|---|---|---|
| 0 | 1.0 | 19.5 | 124.1 | $1x10^{-15}$ | Undefined |
| 1 | 2.0 | 12.5 | 79.6 | $1x10^{-7}$ | Sensitive Fines |
| 2 | 1.0 | 17.5 | 111.4 | $1x10^{-15}$ | Organic Soil |
| 3 | 1.0 | 17.5 | 111.4 | $5x10^{-8}$ | Clay |
| 4 | 1.5 | 18.0 | 114.6 | $5x10^{-7}$ | Silty Clay |
| 5 | 2.0 | 18.0 | 114.6 | $5x10^{-6}$ | Clayey Silt |
| 6 | 2.5 | 18.0 | 114.6 | $5x10^{-5}$ | Silt |
| 7 | 3.0 | 18.5 | 117.8 | $5x10^{-4}$ | Sandy Silt |
| 8 | 4.0 | 19.0 | 120.9 | $5x10^{-3}$ | Silty Sand/Sand |
| 9 | 5.0 | 19.5 | 124.1 | $5x10^{-2}$ | Sand |
| 10 | 6.0 | 20.0 | 127.3 | 5 | Gravelly Sand |
| 11 | 1.0 | 20.5 | 130.5 | $1x10^{-15}$ | Stiff Fine Grained |
| 12 | 2.0 | 19.0 | 120.9 | $1x10^{-5}$ | Cemented Sand |

We appreciate the opportunity of providing these services to you. If you have any questions regarding the enclosed material or if, we can be of additional assistance, please contact us.

Sincerely,

ConeTec, Inc.

Shawn D. Steiner, P.E.
Manager

Enclosures

CONETEC

# Shear Wave Velocity Calculations

Job No.: 04-406
Client: AMEC Earth & Environmental
CPT No.: CPT-04
Location Envirocare
Date: 10/7/04

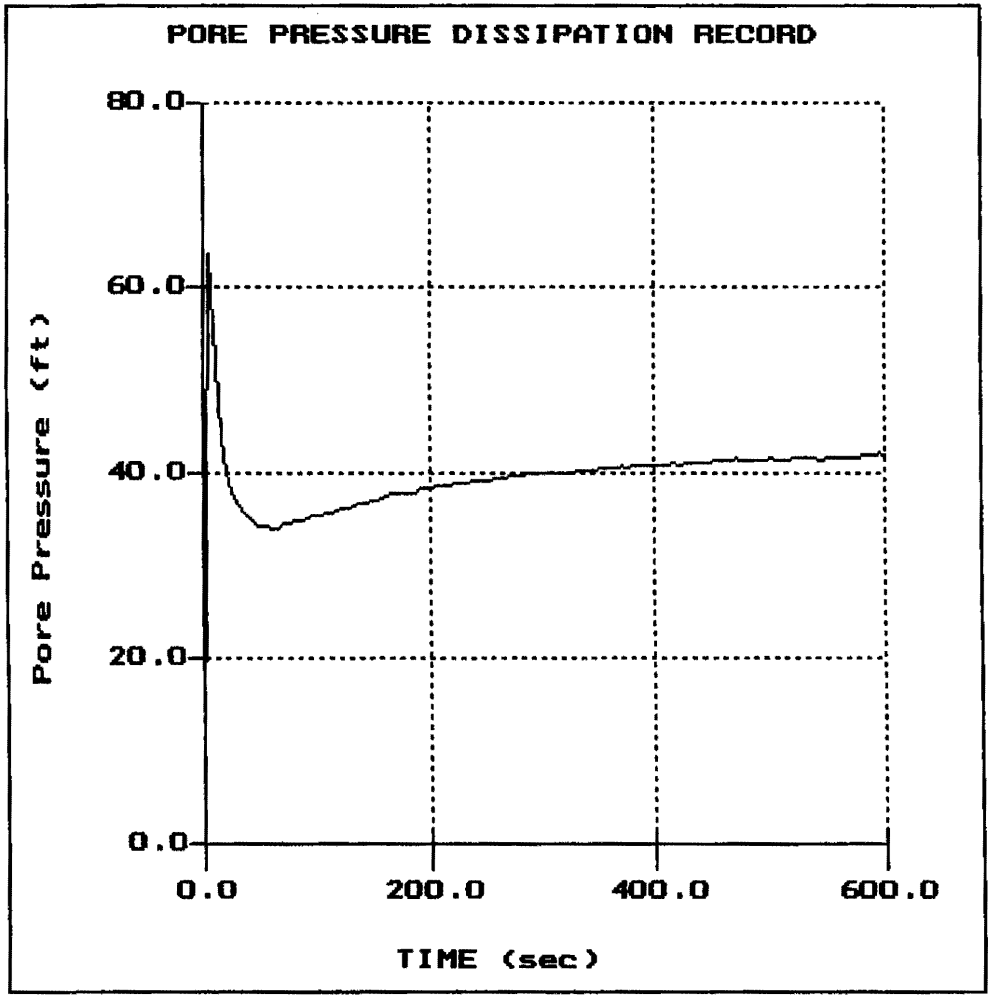
Geophone Offset (m): 0.20
Source Offset (8") (m): 0.20

| Test Depth (m) | Geophone Depth (m) | Ray Path (m) | Incremental Distance (m) | Time Interval (ms) | Interval Velocity (m/s) | Interval Depth (m) | Interval Velocity (ft/s) | Interval Depth (ft) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 0.75 | 0.55 | 0.59 | | | | | | |
| 1.75 | 1.55 | 1.56 | 0.98 | 5.23 | 187 | 1.05 | 613 | 3.4 |
| 2.75 | 2.55 | 2.56 | 0.99 | 4.04 | 246 | 2.05 | 807 | 6.7 |
| 3.75 | 3.55 | 3.56 | 1.00 | 2.45 | 407 | 3.05 | 1334 | 10.0 |
| 4.75 | 4.55 | 4.55 | 1.00 | 1.99 | 502 | 4.05 | 1646 | 13.3 |
| 5.75 | 5.55 | 5.55 | 1.00 | 2.41 | 415 | 5.05 | 1361 | 16.6 |
| 6.75 | 6.55 | 6.55 | 1.00 | 3.52 | 284 | 6.05 | 931 | 19.8 |
| 7.75 | 7.55 | 7.55 | 1.00 | 3.61 | 277 | 7.05 | 908 | 23.1 |
| 8.75 | 8.55 | 8.55 | 1.00 | 2.81 | 356 | 8.05 | 1167 | 26.4 |
| 9.75 | 9.55 | 9.55 | 1.00 | 2.78 | 359 | 9.05 | 1178 | 29.7 |
| 10.75 | 10.55 | 10.55 | 1.00 | 2.95 | 339 | 10.05 | 1111 | 33.0 |
| 11.75 | 11.55 | 11.55 | 1.00 | 3.43 | 292 | 11.05 | 956 | 36.2 |
| 12.75 | 12.55 | 12.55 | 1.00 | 3.41 | 294 | 12.05 | 963 | 39.5 |
| 13.75 | 13.55 | 13.55 | 1.00 | 2.55 | 391 | 13.05 | 1284 | 42.8 |
| 14.75 | 14.55 | 14.55 | 1.00 | 1.81 | 552 | 14.05 | 1812 | 46.1 |
| 15.75 | 15.55 | 15.55 | 1.00 | 4.40 | 227 | 15.05 | 745 | 49.4 |
| 16.75 | 16.55 | 16.55 | 1.00 | 4.16 | 240 | 16.05 | 788 | 52.6 |
| 17.75 | 17.55 | 17.55 | 1.00 | 3.86 | 259 | 17.05 | 850 | 55.9 |
| 18.75 | 18.55 | 18.55 | 1.00 | 3.61 | 277 | 18.05 | 909 | 59.2 |
| 19.75 | 19.55 | 19.55 | 1.00 | 2.86 | 350 | 19.05 | 1147 | 62.5 |
| 20.75 | 20.55 | 20.55 | 1.00 | 3.21 | 311 | 20.05 | 1021 | 65.8 |
| 21.75 | 21.55 | 21.55 | 1.00 | 3.32 | 301 | 21.05 | 987 | 69.0 |
| 22.75 | 22.55 | 22.55 | 1.00 | 3.08 | 325 | 22.05 | 1066 | 72.3 |
| 23.75 | 23.55 | 23.55 | 1.00 | 3.59 | 278 | 23.05 | 912 | 75.6 |
| 24.75 | 24.55 | 24.55 | 1.00 | 3.21 | 312 | 24.05 | 1022 | 78.9 |
| 25.75 | 25.55 | 25.55 | 1.00 | 2.97 | 337 | 25.05 | 1104 | 82.2 |
| 26.75 | 26.55 | 26.55 | 1.00 | 1.76 | 567 | 26.05 | 1861 | 85.4 |
| 27.65 | 27.45 | 27.45 | 1.90 | 3.45 | 551 | 26.50 | 1806 | 86.9 |
| | | | | | | | | |

AMEC

Hole:CPT-05
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 09:17



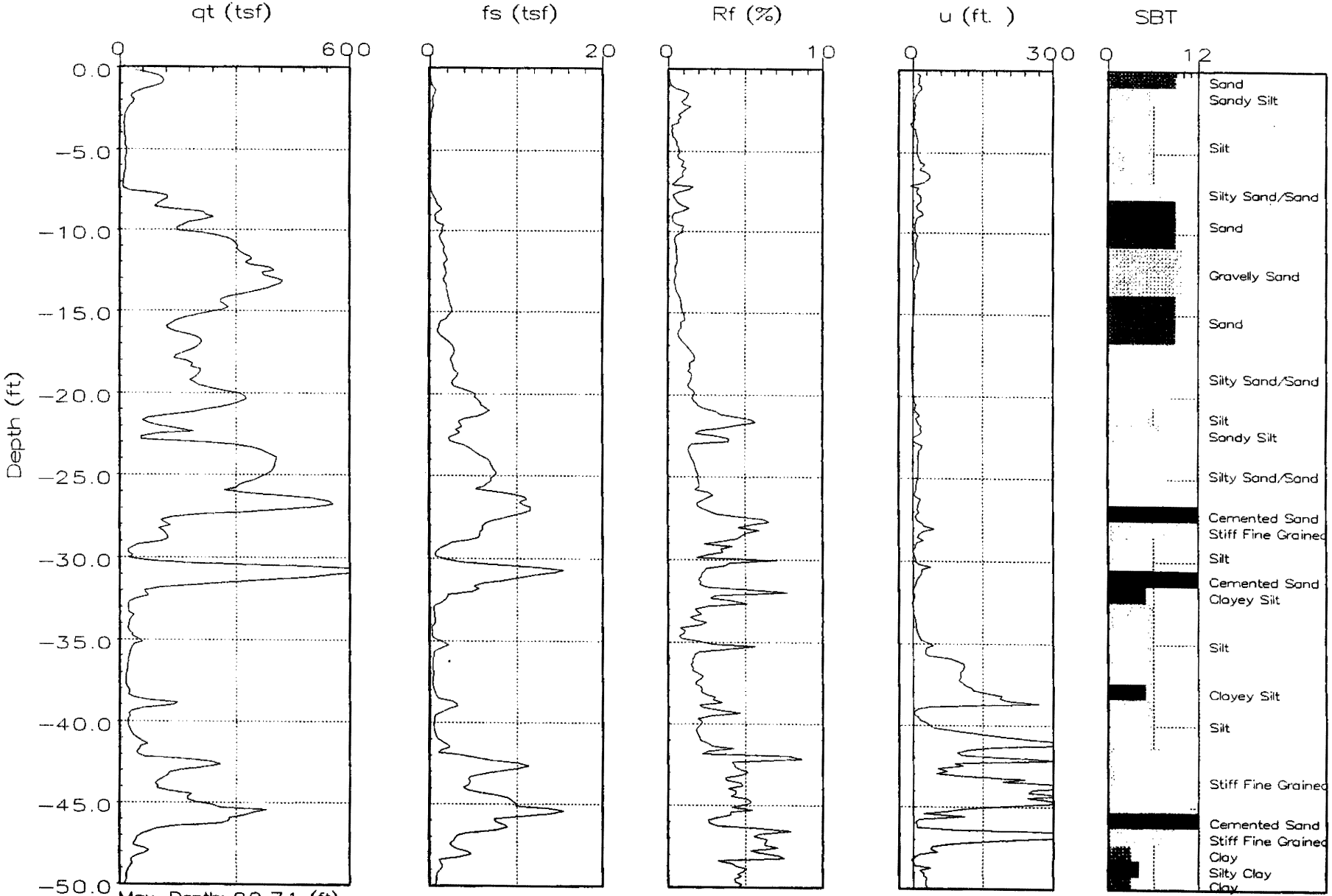

File: 406CP05.PPD
Depth (m): 20.70
(ft): 67.91
Duration : 600.0s
U-min: 5.02 0.0s
U-max: 63.64 5.0s

CONETEC

AMEC

Hole No.:CPT-04
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 10:40




Max. Depth: 90.71 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

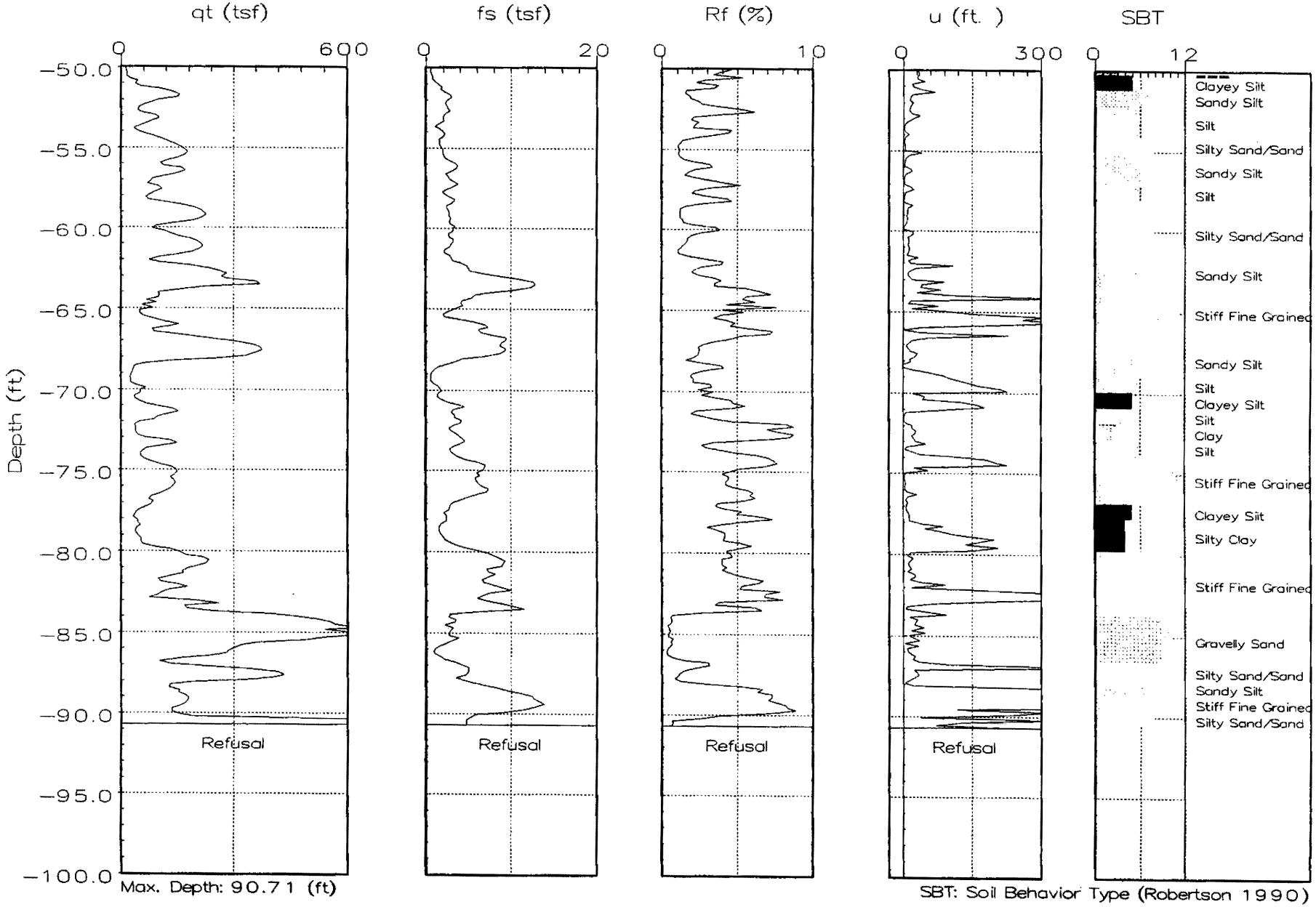
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-04
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 10:40




Max. Depth: 90.71 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

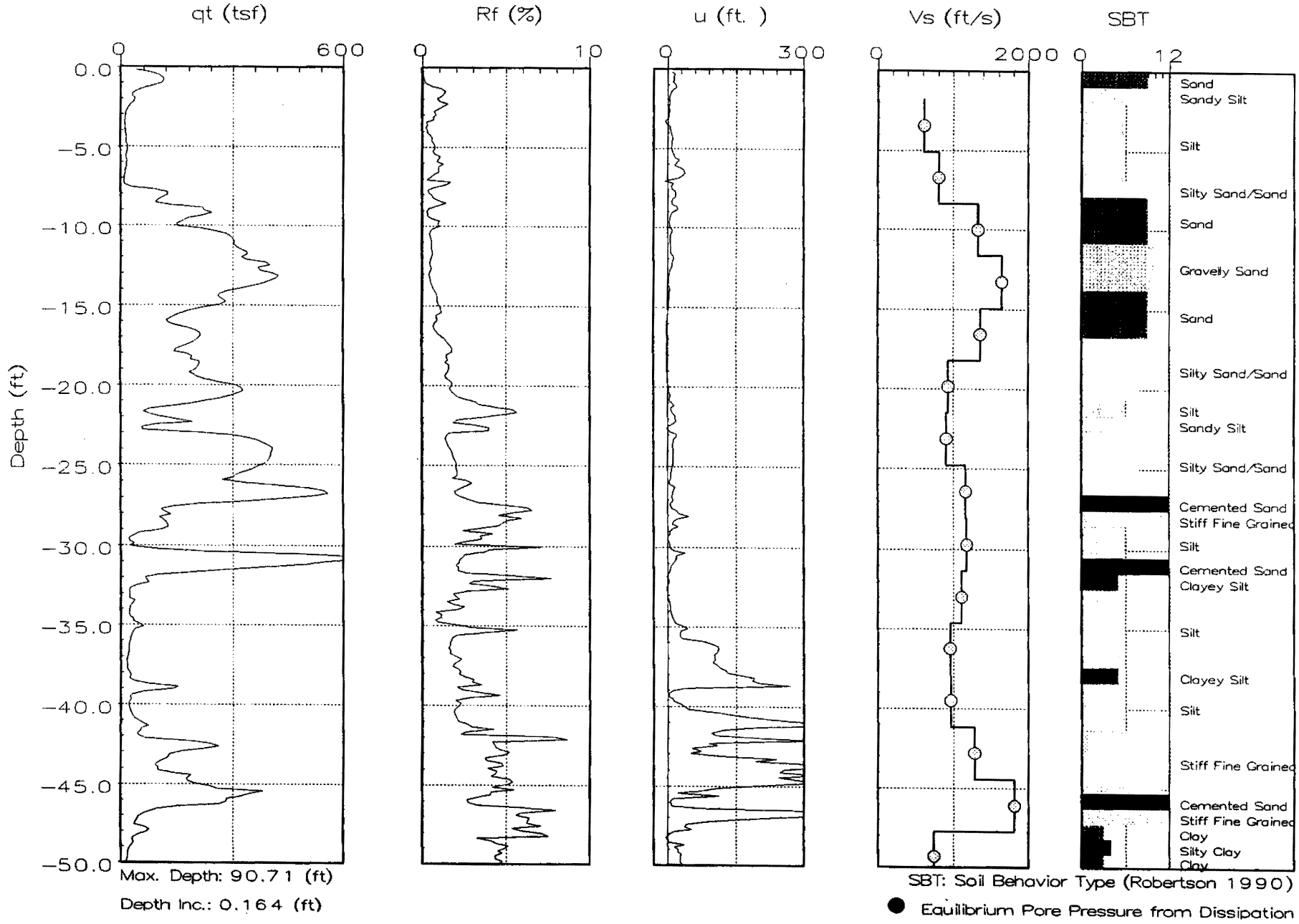
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-04
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 10:40




Max. Depth: 90.71 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

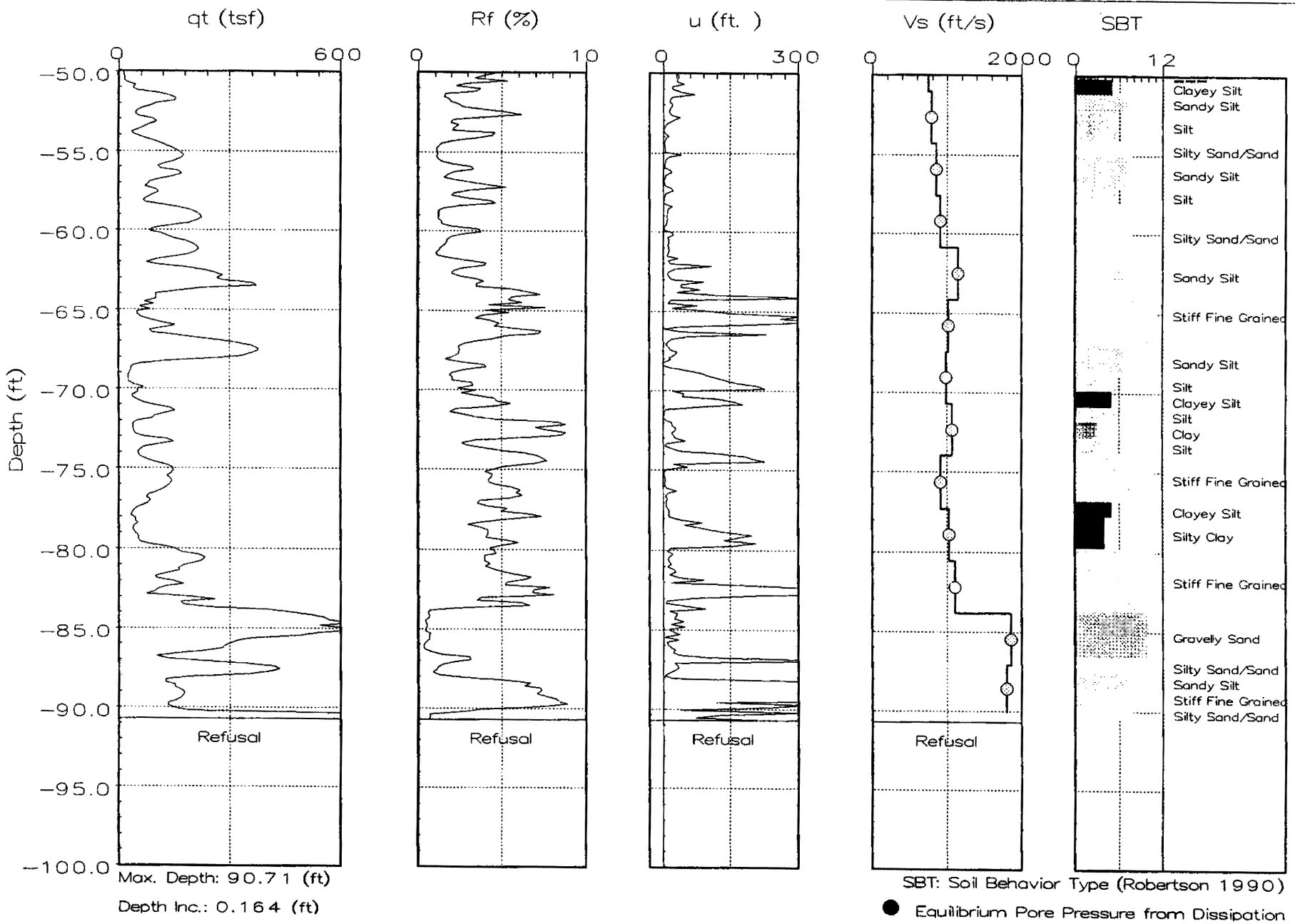
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-04
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 10:40




Max. Depth: 90.71 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

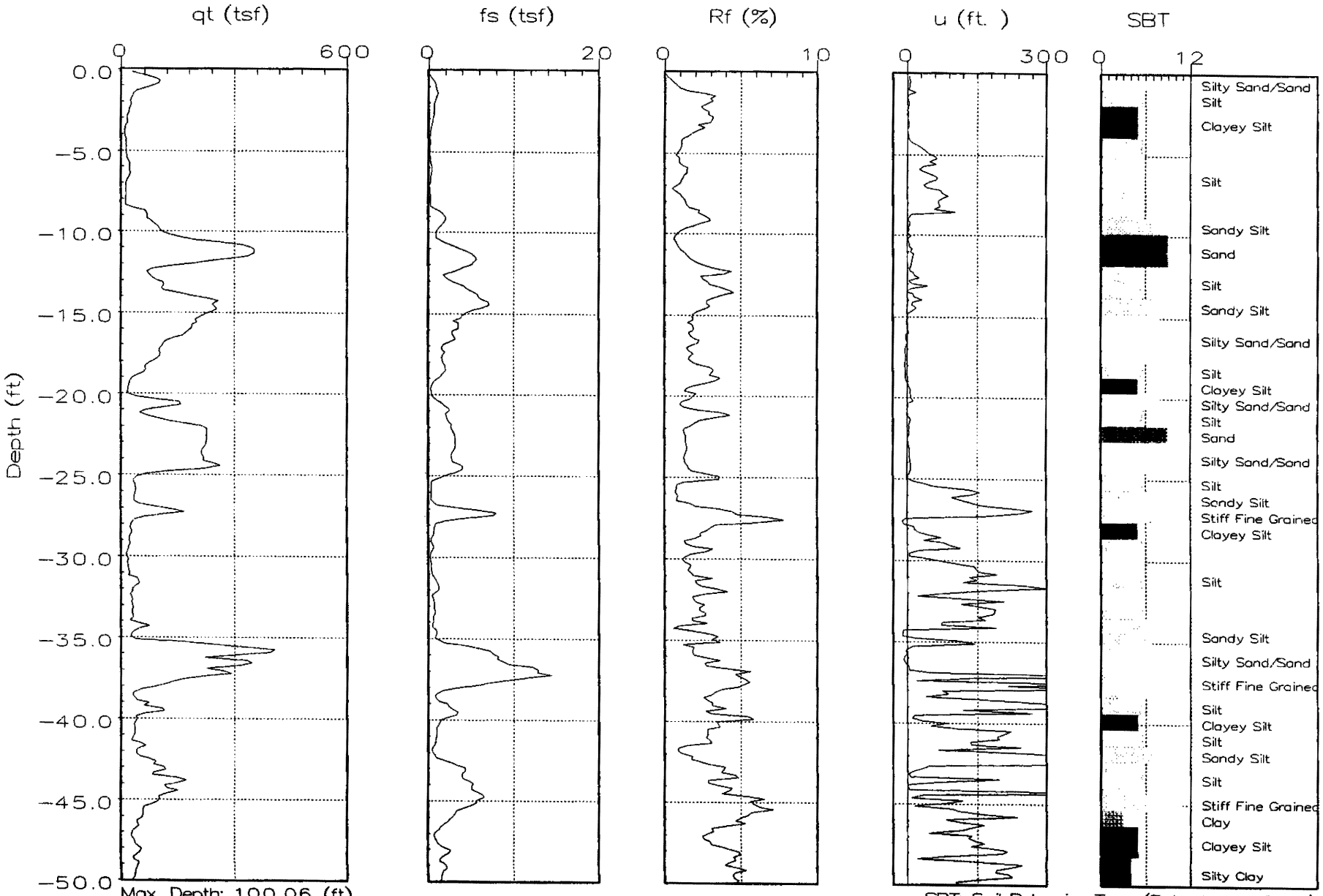
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-05
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 09:17




Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

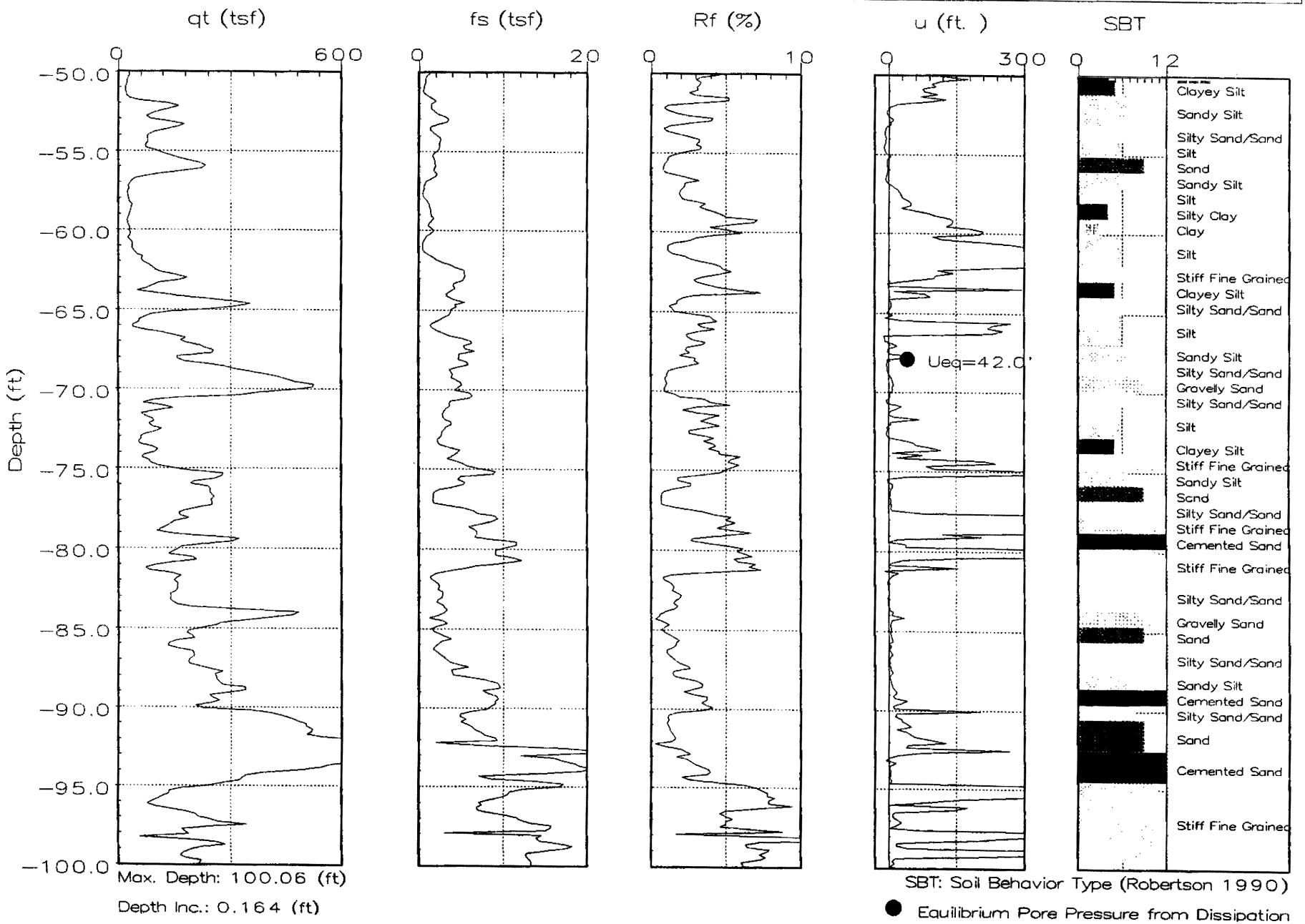
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-05
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 09:17




Max. Depth: 100.06 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

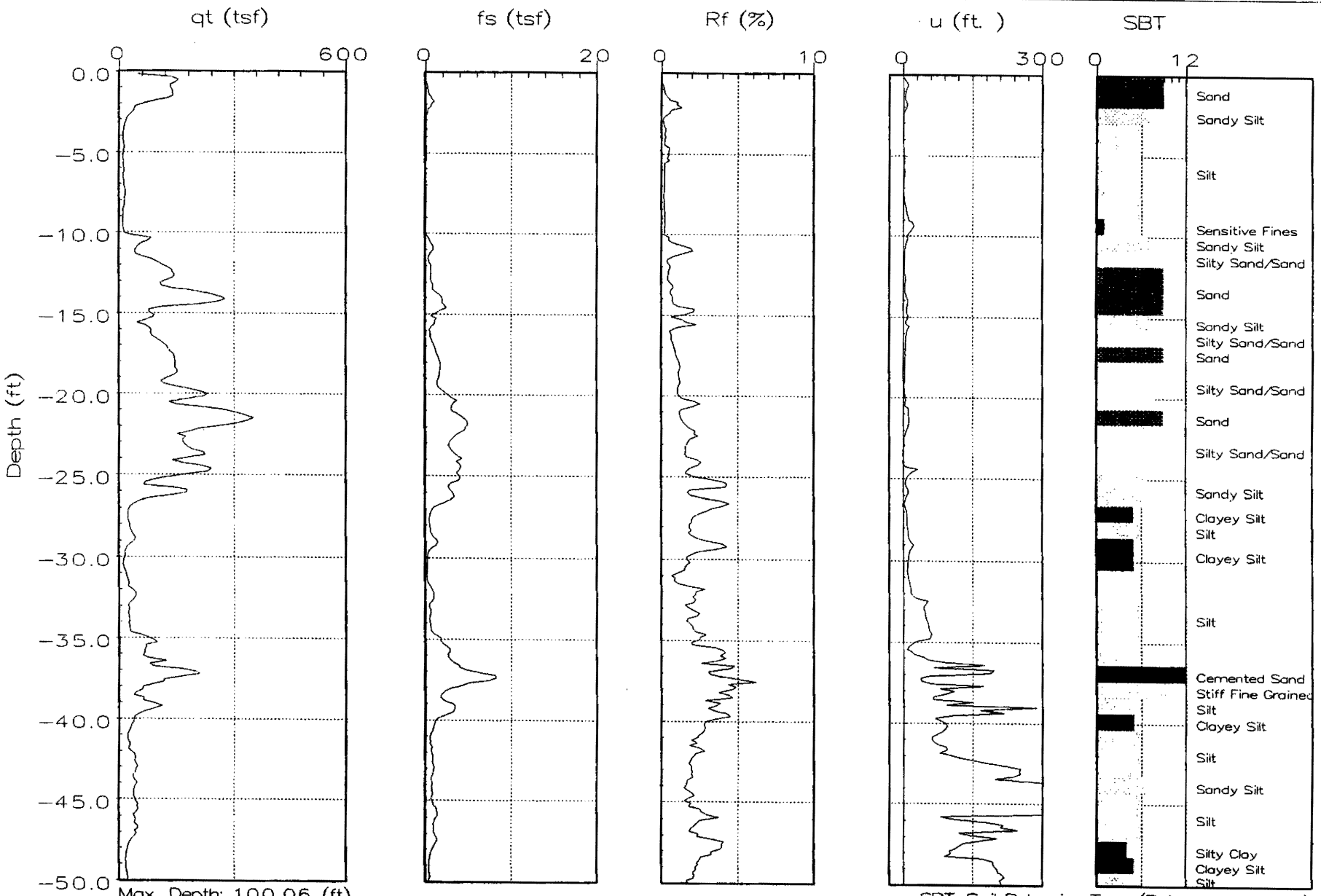
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-06
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 12:39




Max. Depth: 100.06 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

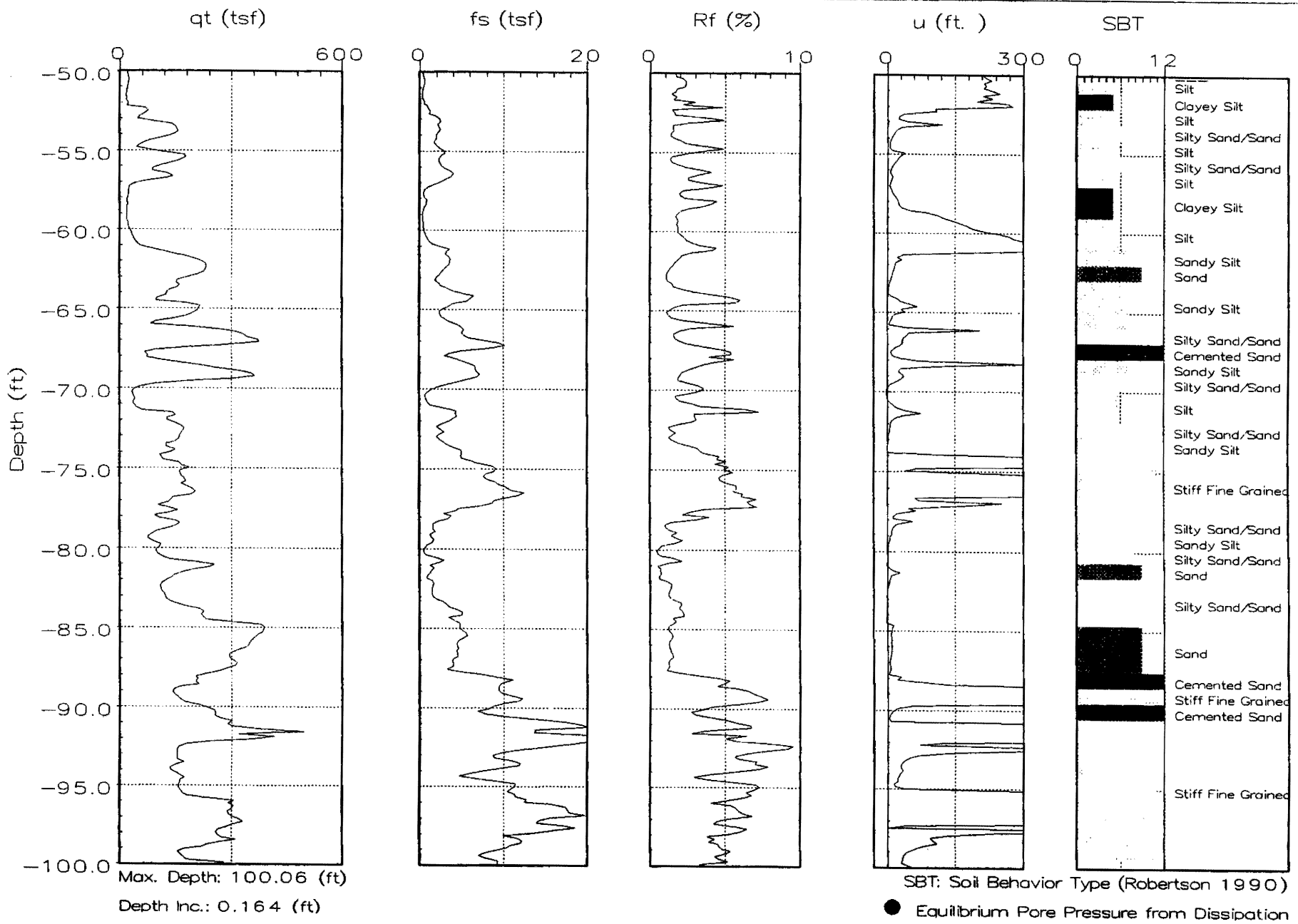
● Equilibrium Pore Pressure from Dissipation

CONETEC

AMEC

Hole No.:CPT-06
Location:ENVIROCARE

Cone: 20 Ton St 146
Date:10:07:04 12:39




Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

● Equilibrium Pore Pressure from Dissipation

# APPENDIX B - 2

**APPENDIX B-2**
**Response to Interrogatory 1, Existing CLASS A EMBANKMENT (ref AMEC 7/25/2000)**

Table A - Envirocare of Utah Geotechnical Design Criteria Summary Table

| Design Item | Property | Values | Reference, Methodology used for Analysis or Comment |
|---|---|---|---|
| Static Stability | Unit Weight, Friction Angle, Cohesion | See Table 1 below: | Must be based on site specific data |
| | Factor of Safety | See Table 3 below<br>FS > 1.5<br>(10% to 25% waste) | Embankment and Embankment dam design normally requires FS > 1.5 for satisfactory bahavior |
| Seismic Stability | Peak Horizontal Ground Accelerations | M = 6.5[1]<br>Dist = 15 Km<br>PHGA = 0.31 g +/- 0.06g<br>(Mean +/- std deviation) | - Seismic Design Criteria completed for Vitro Embankment, see Appendix J, (same as for existing LARW)<br>- See also 9-817-002103, 7/15/99 (Tab 5, Book 1) for comment on the conservatism of analysis. |
| | Seismic Coefficient | Seismic Coefficient should be 50% of PHGA | Griffeth and Hynes and Corp of Engineer Procedures |
| | Factor of Safety, pseudo static | FS > 1.2<br>(10% to 25% waste) | Factors of Safety near 1.0 are problematic for post earthquake deformations. Post earthquake deformations can be maintained adequately by designing to Factors of Safety greater than 1.2 |

[1] The seismic hazard attachment H does not stipulate an earthquake magnitude attenuation relationship used to develop the peak acceleration at the site. It is our opinion (based on checking a number of earthquake magnitude recurrence relationships) that the 0.37 g peak acceleration is overly conservative, since only the Campbell 1997 relationship will yield a mean plus one standard deviation peak acceleration of 0.37 g based on a Magnitude 6.5 earthquake at a focal distance of 15 kilometers.



AGRA

| Design Item | Property | Values | Reference, Methodology used for Analysis or Comment |
|---|---|---|---|
| Seismic Design | Post Earthquake Cover Deformations | 150 to 300 mm | Seed and Bonaparte, 1992.<br>Deformations less than 150 mm desirable |

Table B - Material Parameters for Stability Analysis

| TABLE 1 (Ref 8-817-002103, 9/1/99)<br>SUMMARY OF MATERIAL PROPERTIES | | | | |
|---|---|---|---|---|
| Material Description | Depth (feet) | In-place Density (pcf) | Friction Angle (degree) | Cohesion (psf) |
| Rip-Rap Rock | 0 – 2 | 135 | 40 | 0 |
| Clay Cover | 2 – 9 | 123 | 0 | 1,000 |
| Protective Layer | 9 – 11 | 117.5 | 38 | 250 |
| LARW Debris | 11 – 51 | 101 – 25% Waste | 18 | 130 |
| | | 113 – 10% Waste | 18 | 130 |
| Sand | 51 – 53 | 117.5 | 38 | 250 |
| Clay Liner | 53 – 55 | 123 | 0 | 1,000 |

Basis:
1) Unit weights based on statistical analysis of Field Density and Moisture Content data (no change from 1996)
2) Select Proctor Compaction tests (Supplemental data since 1996 analysis)
3) Laboratory and Field Strength tests (Supplemental data since 1996)

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Table C - Summary of Strength Parameters Recommended for Stability Analysis (Ref 8-817-002103, 9/1/99)

| Description | [illegible] | [illegible] |
|---|---|---|
| Lower bound shear strength, waste on waste material | 18° | 130 |
| Soil shear strength -representative of ratios ranging from 10% to 40% waste to soil | 29° | 200 |

Basis:

1) The 1996 stability analysis used published values for frictional values between LDPE (low density polyethylene) on LDPE. These values were used as a conservative assumption since site specific values for the compressible debris were not available. It was recommended in 1996 that supplemental testing be completed to confirm or modify these values.
2) The 1999 stability analysis used results of site specific large scale direct shear testing for the lower bound shear strength. The shear strength was based on placing as close to 100% waste materials along the base of the shear box and using the resulting values as being representative of 10% to 25% waste to soil (loose lift thickness). Actual test results on 10% to 25% waste indicated that the waste materials tended to "reinforce the embankment" and lead to higher shear strength with waste than without the waste.

Table D - Stability Analysis Summary

| TABLE 2 (Ref 8-817-002103, 9/1/99)<br>SUMMARY OF STABILITY ANALYSES | | | |
|---|---|---|---|
| Analysis Scenario | Failure Mode | Minimum Factors of Safety | |
| | | 10 % Waste | 25 % Waste |
| Static | Circular | 2.4 | 2.3 |
| Pseudo-static | Circular | 1.4 | 1.3 |

Based on:

1) Limit Equilibrium Slope stability analysis using modified Bishop's method and SLOPE/W computer software.

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Table E - Deformation Analysis Summary

| TABLE 3 (Ref 8-817-002103, 9/1/99)<br>SUMMARY OF CALCULATED YIELD ACCELERATIONS | | |
|---|---|---|
| Approximate Block Size (feet) | Approximate Block Height (feet) | Yield Acceleration |
| 50 | 10<br>25<br>45 | 0.45<br>0.32<br>0.30 |
| 200 | 10<br>25<br>45 | 0.40<br>0.35<br>0.30 |
| 350 | 10<br>25<br>45 | 0.38<br>0.34<br>0.30 |

| TABLE 4 (Ref 8-817-002103, 9/1/99)<br>PERMANENT EMBANKMENT DEFORMATIONS (EMPIRICAL METHODS) | | |
|---|---|---|
| Direction of Motion | Mammoth Lakes Records | El Centro Records |
| Horizontal (Makdisi and Seed)<br>Plum et al<br>Bray et al<br>Vertical (all methods) | <1 mm<br><1 mm<br><1 mm<br><1 mm | 1 to 80 mm<br>5 to 40 mm<br>20 to 60 mm<br><1 mm |

| PERMANENT EMBANKMENT DEFORMATIONS (NEWMARK ANALYSIS) | | |
|---|---|---|
| Direction of Motion | Mammoth Lakes Records | El Centro Records |
| Horizontal<br>Vertical | < 2 mm<br><1 mm | 8 to 47 mm<br><1 mm |

Basis:

1) Yield Accelerations based on sliding block analysis (limit equilibrium) and SLOPE/W

2) Deformations based on Makdisi Seed analysis and other referenced analysis.



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Table F - Summary of Engineering Properties used for Settlement Analysis (Ref 6/1/2000, 9-817-002642)

| Parameter | 1996 Study | Selected for this study | | Reference / Basis |
|---|---|---|---|---|
| | Value | Value | Range | |
| Classification | CL | CL | CL to SM | Based on clay cover soils (sand soils are considerably less compressible and not subject to creep) |
| Atterberg Limits | LL = 36<br>PI = 16 | LL = 26<br>PI = 14 | plastic to non-plastic | Laboratory Testing / Field QC tests |
| Dry Density, pcf | Debris = 40<br>Soil = 120<br>10 percent<br>Tot = 112<br>25 percent<br>Tot = 100 | Debris = 40<br>Soil = 128 | Debris = 30 to 40<br>Soil = 120 to 130 | Based on ratio of unit weights of soil to debris |
| Optimum Water Content, percent | 20 percent | 20 percent | 10 to 25 percent | Field and Laboratory tests |
| Placement Compaction, percent | 90 % D-698 | 90 % D-698 | 90 to 95 % D-698 | QA program / Project Specifications |
| Recompression Ratio, RR | 0.00312 | 0.017 | .001 to .002 | Laboratory Tests |
| Compression Ratio, CR | 0.0854 | .097 | .07 to 0.10 | Laboratory Tests |



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| Parameter | 1996 Study | Selected for this study | | Reference / Basis |
|---|---|---|---|---|
| | Value | Value | Range | |
| Preconsolidation Stress due to Compaction | 3685 (10 percent)<br>4324 (25 percent) | 3500 | 3000 to 10,000 | Laboratory Tests (settlement of compacted soil samples) |
| Coefficient of Consolidation, Cv | n.a. | .008 to .0012 $inch^2/min$ | not available | Laboratory Tests on Compacted Soil Samples |
| Coefficient of Secondary Consolidation, Cα | .005 | .004 | .003 to 0.006 | Laboratory Tests on Compacted Soil Samples |
| Power Curve Parameter, m (Edil) | 3 X 10-5 kPa | $9X\ 10^{-6}$ | $5\ to\ 9\ X\ 10^{-6}$ | Laboratory Tests on Compacted composite soil/waste samples |
| Power Curve Parameter, n (Edil) | 0.3 | 0.35 | 0.3 to 0.35 | Laboratory Tests on Compacted composite soil/waste samples |
| Cover Load, psf | 10.2 ft X 120 pcf = 1224 psf | 1224 | 1100 to 1300 psf | Calculated based on Unit Weights |

Based on:

1) Input required for "Terzaghi type" settlement computations
2) Power fit "curves" by Edil, et al.

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# APPENDIX C

## APPENDIX C

### Slope Stability Analysis

The following table summarizes results of the slope stability calculations. Calculations for each case are attached following this table. Refer to Section 3.3 Stability Calculations, of the report for further details.

**Table C.1 -- Summary of Slope Stability Analyses**

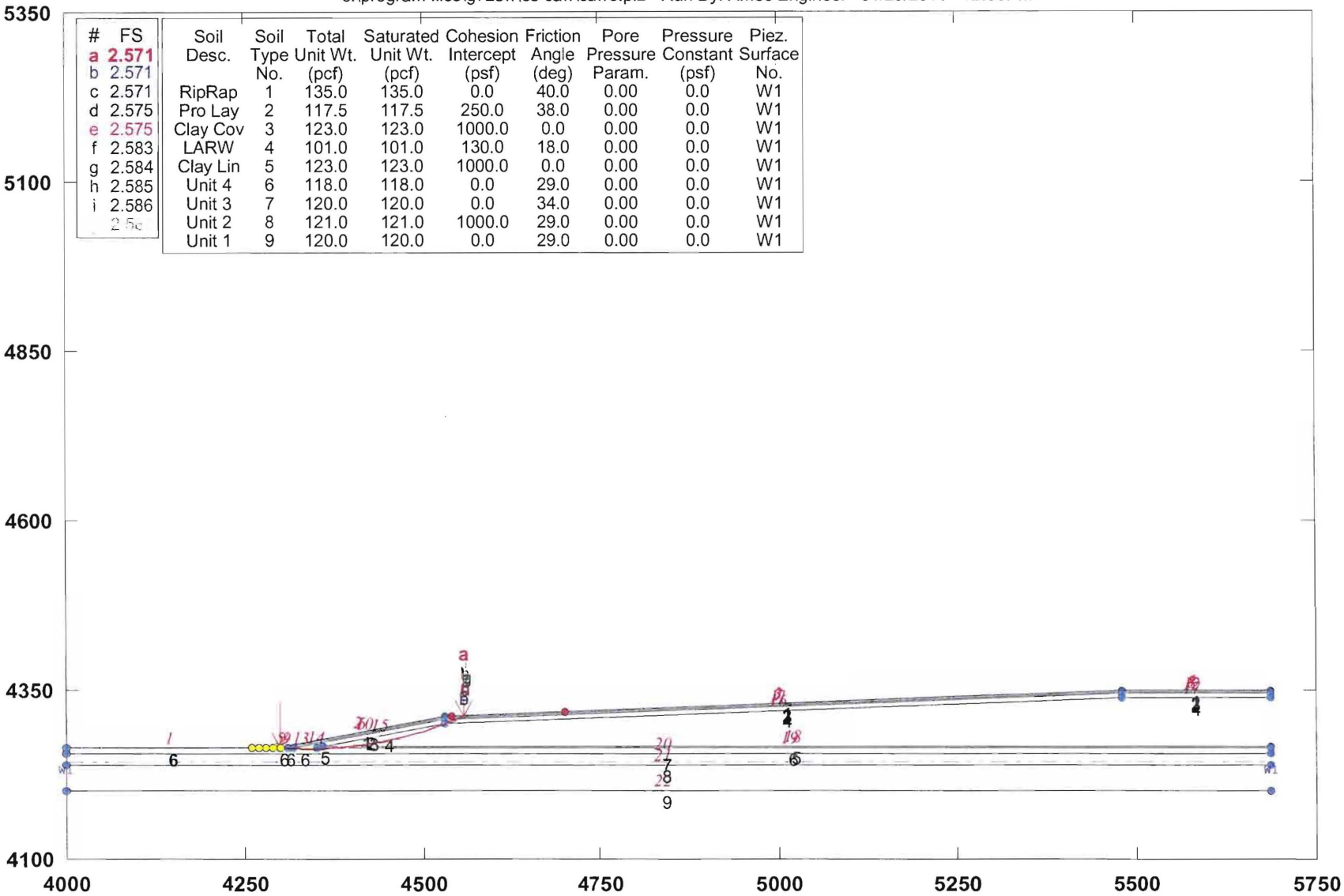
| Case | Description of Analysis | Analysis Condition | Factor of Safety | Yield Acceleration / Displacement (in) | Filename |
|---|---|---|---|---|---|
| 1 | Potential failure paths were studied within CAW Embankment above elevation 4260 | Static | 2.6 | | CAWE |
| | | Pseudostatic | 1.7 | | CAWES |
| | | Yield Analysis | 1.0 | 0.33g / 0.3 | CAWEY |
| | | | | | |
| 2 | Potential failure paths through the lower clay unit (Unit 2) were studied | Static | | | CAWF |
| | | Pseudostatic | 1.2 | | CAWFS |
| | | Yield Analysis | 1.0 | 0.19g / 0.7 | CAWFY |
| | | | | | |
| 3 | Potential failure paths through the upper clay unit (Unit 4) were studied | Static | 2.6 | | CAWP |
| | | Pseudostatic | 2.0 | | CAWPS |
| | | Yield Analysis | 1.0 | 0.36g / 0.2 | CAWPY |

# CAW Emb 38' 5(H):1(V) side-slopes, Static, Embankment 121810 CAWE

c:\program files\g72sw\es caw\cawe.pl2 Run By: Amec Engineer 01/29/2011 12:03PM

| # | FS |
|---|---|
| a | 2.571 |
| b | 2.571 |
| c | 2.571 |
| d | 2.575 |
| e | 2.575 |
| f | 2.583 |
| g | 2.584 |
| h | 2.585 |
| i | 2.586 |
| | 2.5c |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 1000.0 | 29.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |



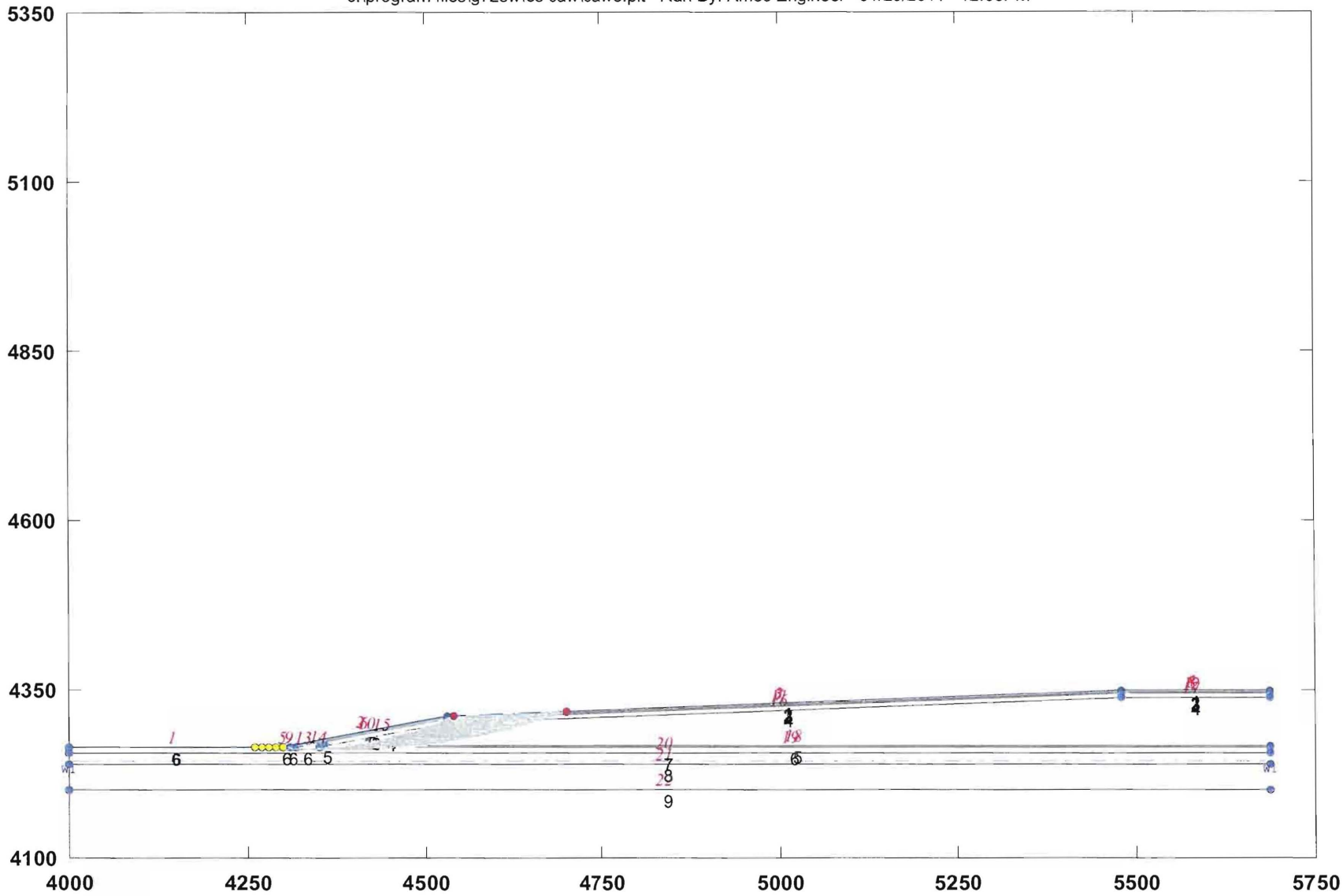

**GSTABL7 v.2 FSmin=2.571**

**Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, Static, Embankment 121810 CAWE

c:\program files\g72sw\es caw\cawe.plt Run By: Amec Engineer 01/29/2011 12:03PM




GSTABL7

```
                    ***  GSTABL7  ***

              ** GSTABL7 by Garry H. Gregory, P.E. **

   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)

*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************


Analysis Run Date:        01/29/2011
Time of Run:              12:03PM
Run By:                   Amec Engineer
Input Data Filename:      C:\Program Files\G72SW\ES CAW\cawe.
Output Filename:          C:\Program Files\G72SW\ES CAW\cawe.OUT
Unit System:              English

Plotted Output Filename:  C:\Program Files\G72SW\ES CAW\cawe.PLT



PROBLEM DESCRIPTION:  CAW Emb 38' 5(H):1(V) side-slopes,
                      Static, Embankment 121810  CAWE



BOUNDARY COORDINATES

    4 Top   Boundaries
   22 Total Boundaries

Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
   No.        (ft)       (ft)       (ft)       (ft)     Below Bnd

    1       4000.00    4265.00    4300.00    4265.00        6
    2       4300.00    4265.00    4530.00    4311.00        1
    3       4530.00    4311.00    5480.00    4349.00        1
    4       5480.00    4349.00    5689.00    4349.00        1
    5       4300.00    4265.00    4310.00    4265.00        6
    6       4310.00    4265.00    4530.00    4309.00        2
    7       4530.00    4309.00    5480.00    4347.00        2
    8       5480.00    4347.00    5689.00    4347.00        2
    9       4310.00    4265.00    4318.00    4265.00        6
   10       4318.00    4265.00    4530.00    4307.50        3
   11       4530.00    4307.50    5480.00    4345.50        3
   12       5480.00    4345.50    5689.00    4345.50        3
   13       4318.00    4265.00    4353.00    4265.00        6
   14       4353.00    4265.00    4361.00    4267.00        5
   15       4361.00    4267.00    4530.00    4300.50        4
   16       4530.00    4300.50    5480.00    4338.50        4
   17       5480.00    4338.50    5689.00    4338.50        4
   18       4361.00    4267.00    5689.00    4267.00        5
   19       4353.00    4265.00    5689.00    4265.00        6
   20       4000.00    4256.00    5689.00    4256.00        7
   21       4000.00    4239.00    5689.00    4239.00        8
   22       4000.00    4201.00    5689.00    4201.00        9

User Specified Y-Origin =      4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)
1


ISOTROPIC SOIL PARAMETERS


 9 Type(s) of Soil


Soil  Total  Saturated  Cohesion  Friction   Pore    Pressure   Piez.
Type Unit Wt. Unit Wt.  Intercept  Angle  Pressure Constant Surface
 No.  (pcf)    (pcf)      (psf)    (deg)   Param.   (psf)     No.

  1   135.0    135.0       0.0     40.0    0.00       0.0      1
  2   117.5    117.5     250.0     38.0    0.00       0.0      1
  3   123.0    123.0    1000.0      0.0    0.00       0.0      1
  4   101.0    101.0     130.0     18.0    0.00       0.0      1
  5   123.0    123.0    1000.0      0.0    0.00       0.0      1
  6   118.0    118.0       0.0     29.0    0.00       0.0      1
```

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 1000.0 | 29.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

5000 Trial Surfaces Have Been Generated.

1000 Surface(s) Initiate(s) From Each Of 5 Points Equally Spaced
Along The Ground Surface Between X =4260.00(ft)
and X =4300.00(ft)

Each Surface Terminates Between X =4540.00(ft)
and X =4700.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 4260.00(ft)

8.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 5000

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS = 37

Number of Trial Surfaces With Valid FS = 4963

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted = 0.7 %

Statistical Data On All Valid FS Values:
FS Max = 6.315 FS Min = 2.571 FS Ave = 2.894
Standard Deviation = 0.374 Coefficient of Variation = 12.91 %

((Modified Bishop FS for Critical Surface = 2.566))

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.979 | 4264.419 |
| 3 | 4315.966 | 4263.965 |
| 4 | 4323.959 | 4263.638 |
| 5 | 4331.957 | 4263.437 |
| 6 | 4339.957 | 4263.362 |
| 7 | 4347.957 | 4263.414 |
| 8 | 4355.955 | 4263.593 |
| 9 | 4363.949 | 4263.898 |
| 10 | 4371.937 | 4264.330 |
| 11 | 4379.917 | 4264.888 |
| 12 | 4387.888 | 4265.572 |
| 13 | 4395.847 | 4266.383 |
| 14 | 4403.792 | 4267.319 |
| 15 | 4411.721 | 4268.381 |
| 16 | 4419.632 | 4269.569 |
| 17 | 4427.524 | 4270.881 |
| 18 | 4435.394 | 4272.319 |
| 19 | 4443.240 | 4273.881 |
| 20 | 4451.060 | 4275.567 |
| 21 | 4458.853 | 4277.376 |
| 22 | 4466.616 | 4279.309 |
| 23 | 4474.347 | 4281.364 |
| 24 | 4482.045 | 4283.542 |
| 25 | 4489.708 | 4285.840 |
| 26 | 4497.333 | 4288.260 |
| 27 | 4504.919 | 4290.801 |
| 28 | 4512.464 | 4293.461 |
| 29 | 4519.966 | 4296.240 |
| 30 | 4527.422 | 4299.138 |
| 31 | 4534.833 | 4302.153 |
| 32 | 4542.194 | 4305.285 |
| 33 | 4549.505 | 4308.534 |
| 34 | 4556.763 | 4311.897 |
| 35 | 4557.154 | 4312.086 |

Circle Center At X = 4340.668 ; Y = 4768.680 ; and Radius = 505.319

*** FOS = 2.571 Theta (ki=1.0) = 9.12 ***
Lambda = 0.161

Individual data on the 44 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.0 | 1132.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 2 | 2.0 | 642.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 3 | 6.0 | 2638.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 4 | 2.0 | 1141.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 5 | 6.0 | 4038.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 6 | 8.0 | 7002.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 7 | 8.0 | 8709.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 8 | 8.0 | 10295.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 9 | 5.0 | 7250.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 10 | 3.0 | 4507.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 11 | 5.0 | 8115.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 12 | 2.9 | 4961.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 13 | 8.0 | 14067.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 14 | 8.0 | 14877.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 15 | 1.3 | 2508.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 16 | 6.7 | 13043.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 17 | 8.0 | 16081.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 18 | 5.2 | 10818.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 19 | 2.7 | 5668.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 20 | 7.9 | 16892.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 21 | 7.9 | 17223.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 22 | 7.9 | 17447.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 23 | 7.9 | 17561.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 24 | 7.8 | 17568.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 25 | 7.8 | 17467.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 26 | 7.8 | 17261.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 27 | 7.8 | 16951.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 28 | 7.7 | 16537.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 29 | 7.7 | 16022.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 30 | 7.7 | 15408.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 31 | 7.6 | 14695.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 32 | 7.6 | 13887.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 33 | 7.5 | 12986.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 34 | 7.5 | 11994.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 35 | 7.5 | 10912.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 36 | 2.6 | 3520.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 37 | 0.9 | 1130.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 38 | 4.0 | 4843.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 39 | 7.4 | 7016.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 40 | 6.7 | 4093.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 41 | 0.6 | 270.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 42 | 2.9 | 1010.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 43 | 4.3 | 632.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 44 | 0.4 | 4.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.979 | 4264.419 |
| 3 | 4315.966 | 4263.965 |
| 4 | 4323.959 | 4263.638 |
| 5 | 4331.957 | 4263.437 |
| 6 | 4339.957 | 4263.362 |
| 7 | 4347.957 | 4263.414 |
| 8 | 4355.955 | 4263.593 |
| 9 | 4363.949 | 4263.898 |
| 10 | 4371.937 | 4264.330 |
| 11 | 4379.917 | 4264.888 |
| 12 | 4387.888 | 4265.572 |
| 13 | 4395.847 | 4266.383 |
| 14 | 4403.792 | 4267.319 |
| 15 | 4411.721 | 4268.381 |
| 16 | 4419.632 | 4269.569 |
| 17 | 4427.524 | 4270.881 |
| 18 | 4435.394 | 4272.319 |
| 19 | 4443.240 | 4273.881 |
| 20 | 4451.060 | 4275.567 |
| 21 | 4458.853 | 4277.376 |
| 22 | 4466.616 | 4279.309 |
| 23 | 4474.347 | 4281.364 |
| 24 | 4482.045 | 4283.542 |
| 25 | 4489.708 | 4285.840 |
| 26 | 4497.333 | 4288.260 |
| 27 | 4504.919 | 4290.801 |
| 28 | 4512.464 | 4293.461 |
| 29 | 4519.966 | 4296.240 |
| 30 | 4527.422 | 4299.138 |
| 31 | 4534.833 | 4302.153 |
| 32 | 4542.194 | 4305.285 |
| 33 | 4549.505 | 4308.534 |
| 34 | 4556.763 | 4311.897 |
| 35 | 4557.154 | 4312.086 |

Circle Center At X = 4340.668 ; Y = 4768.680 ; and Radius = 505.319

*** FOS = 2.571 Theta (ki=1.0) = 9.12 ***
Lambda = 0.161

1

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.979 | 4264.419 |
| 3 | 4315.966 | 4263.964 |
| 4 | 4323.959 | 4263.636 |
| 5 | 4331.957 | 4263.435 |
| 6 | 4339.957 | 4263.360 |
| 7 | 4347.957 | 4263.412 |
| 8 | 4355.955 | 4263.590 |
| 9 | 4363.949 | 4263.896 |
| 10 | 4371.937 | 4264.327 |
| 11 | 4379.917 | 4264.885 |
| 12 | 4387.888 | 4265.570 |
| 13 | 4395.847 | 4266.380 |
| 14 | 4403.792 | 4267.317 |
| 15 | 4411.721 | 4268.379 |
| 16 | 4419.632 | 4269.566 |
| 17 | 4427.524 | 4270.879 |
| 18 | 4435.394 | 4272.316 |
| 19 | 4443.240 | 4273.878 |
| 20 | 4451.060 | 4275.564 |
| 21 | 4458.853 | 4277.374 |
| 22 | 4466.616 | 4279.307 |
| 23 | 4474.347 | 4281.362 |
| 24 | 4482.045 | 4283.539 |
| 25 | 4489.708 | 4285.838 |
| 26 | 4497.333 | 4288.258 |

| | | |
|---|---|---|
| 27 | 4504.918 | 4290.798 |
| 28 | 4512.463 | 4293.458 |
| 29 | 4519.965 | 4296.238 |
| 30 | 4527.421 | 4299.136 |
| 31 | 4534.831 | 4302.151 |
| 32 | 4542.192 | 4305.284 |
| 33 | 4549.503 | 4308.532 |
| 34 | 4556.761 | 4311.896 |
| 35 | 4557.155 | 4312.086 |

Circle Center At X = 4340.681 ; Y = 4768.616 ; and Radius = 505.257

*** FOS = 2.571 Theta (ki=1.0) = 9.12 ***
Lambda = 0.161

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.984 | 4264.492 |
| 3 | 4315.975 | 4264.104 |
| 4 | 4323.970 | 4263.836 |
| 5 | 4331.969 | 4263.688 |
| 6 | 4339.969 | 4263.660 |
| 7 | 4347.968 | 4263.752 |
| 8 | 4355.965 | 4263.965 |
| 9 | 4363.958 | 4264.298 |
| 10 | 4371.946 | 4264.750 |
| 11 | 4379.925 | 4265.323 |
| 12 | 4387.896 | 4266.016 |
| 13 | 4395.854 | 4266.828 |
| 14 | 4403.800 | 4267.759 |
| 15 | 4411.730 | 4268.810 |
| 16 | 4419.645 | 4269.980 |
| 17 | 4427.540 | 4271.269 |
| 18 | 4435.416 | 4272.676 |
| 19 | 4443.269 | 4274.201 |
| 20 | 4451.098 | 4275.844 |
| 21 | 4458.902 | 4277.604 |
| 22 | 4466.678 | 4279.482 |
| 23 | 4474.426 | 4281.476 |
| 24 | 4482.143 | 4283.586 |
| 25 | 4489.827 | 4285.812 |
| 26 | 4497.477 | 4288.153 |
| 27 | 4505.090 | 4290.609 |
| 28 | 4512.667 | 4293.179 |
| 29 | 4520.203 | 4295.862 |
| 30 | 4527.699 | 4298.658 |
| 31 | 4535.151 | 4301.567 |
| 32 | 4542.560 | 4304.587 |
| 33 | 4549.921 | 4307.718 |
| 34 | 4557.235 | 4310.959 |
| 35 | 4559.919 | 4312.197 |

Circle Center At X = 4337.815 ; Y = 4796.207 ; and Radius = 532.551

*** FOS = 2.575 Theta (ki=1.0) = 8.98 ***
Lambda = 0.158

1

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.984 | 4264.492 |
| 3 | 4315.975 | 4264.104 |
| 4 | 4323.970 | 4263.835 |
| 5 | 4331.969 | 4263.688 |
| 6 | 4339.969 | 4263.660 |
| 7 | 4347.968 | 4263.752 |
| 8 | 4355.965 | 4263.964 |
| 9 | 4363.958 | 4264.297 |
| 10 | 4371.946 | 4264.750 |
| 11 | 4379.925 | 4265.322 |
| 12 | 4387.896 | 4266.015 |
| 13 | 4395.854 | 4266.827 |
| 14 | 4403.800 | 4267.758 |
| 15 | 4411.730 | 4268.809 |
| 16 | 4419.645 | 4269.979 |
| 17 | 4427.540 | 4271.268 |

| | | |
|---|---|---|
| 18 | 4435.416 | 4272.675 |
| 19 | 4443.269 | 4274.200 |
| 20 | 4451.098 | 4275.843 |
| 21 | 4458.902 | 4277.604 |
| 22 | 4466.678 | 4279.481 |
| 23 | 4474.426 | 4281.475 |
| 24 | 4482.143 | 4283.585 |
| 25 | 4489.827 | 4285.812 |
| 26 | 4497.477 | 4288.153 |
| 27 | 4505.090 | 4290.608 |
| 28 | 4512.667 | 4293.178 |
| 29 | 4520.203 | 4295.861 |
| 30 | 4527.699 | 4298.658 |
| 31 | 4535.151 | 4301.566 |
| 32 | 4542.560 | 4304.586 |
| 33 | 4549.921 | 4307.717 |
| 34 | 4557.235 | 4310.958 |
| 35 | 4559.920 | 4312.197 |

Circle Center At X = 4337.820 ; Y = 4796.183 ; and Radius = 532.527

*** FOS = 2.575 Theta (ki=1.0) = 8.99 ***
Lambda = 0.158

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.976 | 4264.382 |
| 3 | 4315.961 | 4263.889 |
| 4 | 4323.953 | 4263.520 |
| 5 | 4331.949 | 4263.276 |
| 6 | 4339.948 | 4263.158 |
| 7 | 4347.948 | 4263.164 |
| 8 | 4355.947 | 4263.295 |
| 9 | 4363.943 | 4263.552 |
| 10 | 4371.934 | 4263.933 |
| 11 | 4379.917 | 4264.439 |
| 12 | 4387.893 | 4265.070 |
| 13 | 4395.857 | 4265.825 |
| 14 | 4403.809 | 4266.705 |
| 15 | 4411.746 | 4267.709 |
| 16 | 4419.666 | 4268.837 |
| 17 | 4427.567 | 4270.088 |
| 18 | 4435.448 | 4271.463 |
| 19 | 4443.306 | 4272.960 |
| 20 | 4451.140 | 4274.581 |
| 21 | 4458.948 | 4276.323 |
| 22 | 4466.728 | 4278.188 |
| 23 | 4474.478 | 4280.173 |
| 24 | 4482.195 | 4282.280 |
| 25 | 4489.879 | 4284.507 |
| 26 | 4497.527 | 4286.854 |
| 27 | 4505.137 | 4289.319 |
| 28 | 4512.708 | 4291.904 |
| 29 | 4520.238 | 4294.606 |
| 30 | 4527.725 | 4297.426 |
| 31 | 4535.166 | 4300.363 |
| 32 | 4542.561 | 4303.415 |
| 33 | 4549.907 | 4306.583 |
| 34 | 4557.203 | 4309.864 |
| 35 | 4562.390 | 4312.295 |

Circle Center At X = 4343.539 ; Y = 4775.091 ; and Radius = 511.946

*** FOS = 2.583 Theta (ki=1.0) = 8.81 ***
Lambda = 0.155

1

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.976 | 4264.382 |
| 3 | 4315.961 | 4263.889 |
| 4 | 4323.953 | 4263.520 |
| 5 | 4331.949 | 4263.276 |
| 6 | 4339.948 | 4263.158 |
| 7 | 4347.948 | 4263.164 |
| 8 | 4355.947 | 4263.295 |

| | | |
|---|---|---|
| 9 | 4363.943 | 4263.552 |
| 10 | 4371.934 | 4263.933 |
| 11 | 4379.917 | 4264.439 |
| 12 | 4387.893 | 4265.070 |
| 13 | 4395.857 | 4265.825 |
| 14 | 4403.809 | 4266.705 |
| 15 | 4411.746 | 4267.709 |
| 16 | 4419.666 | 4268.837 |
| 17 | 4427.567 | 4270.088 |
| 18 | 4435.448 | 4271.463 |
| 19 | 4443.306 | 4272.960 |
| 20 | 4451.140 | 4274.581 |
| 21 | 4458.948 | 4276.323 |
| 22 | 4466.728 | 4278.188 |
| 23 | 4474.478 | 4280.173 |
| 24 | 4482.195 | 4282.280 |
| 25 | 4489.879 | 4284.507 |
| 26 | 4497.527 | 4286.854 |
| 27 | 4505.137 | 4289.319 |
| 28 | 4512.708 | 4291.904 |
| 29 | 4520.238 | 4294.606 |
| 30 | 4527.725 | 4297.426 |
| 31 | 4535.166 | 4300.363 |
| 32 | 4542.561 | 4303.415 |
| 33 | 4549.907 | 4306.583 |
| 34 | 4557.203 | 4309.864 |
| 35 | 4562.390 | 4312.295 |

Circle Center At X = 4343.539 ; Y = 4775.091 ; and Radius = 511.946

*** FOS = 2.584 Theta (ki=1.0) = 9.03 ***
Lambda = 0.159

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.989 | 4264.578 |
| 3 | 4315.983 | 4264.270 |
| 4 | 4323.980 | 4264.077 |
| 5 | 4331.980 | 4263.999 |
| 6 | 4339.980 | 4264.035 |
| 7 | 4347.979 | 4264.186 |
| 8 | 4355.974 | 4264.451 |
| 9 | 4363.965 | 4264.831 |
| 10 | 4371.950 | 4265.326 |
| 11 | 4379.926 | 4265.935 |
| 12 | 4387.894 | 4266.658 |
| 13 | 4395.850 | 4267.495 |
| 14 | 4403.793 | 4268.446 |
| 15 | 4411.722 | 4269.511 |
| 16 | 4419.634 | 4270.690 |
| 17 | 4427.529 | 4271.982 |
| 18 | 4435.405 | 4273.387 |
| 19 | 4443.259 | 4274.904 |
| 20 | 4451.091 | 4276.534 |
| 21 | 4458.899 | 4278.276 |
| 22 | 4466.682 | 4280.130 |
| 23 | 4474.437 | 4282.096 |
| 24 | 4482.163 | 4284.172 |
| 25 | 4489.858 | 4286.358 |
| 26 | 4497.521 | 4288.655 |
| 27 | 4505.150 | 4291.062 |
| 28 | 4512.745 | 4293.577 |
| 29 | 4520.302 | 4296.201 |
| 30 | 4527.821 | 4298.933 |
| 31 | 4535.300 | 4301.773 |
| 32 | 4542.738 | 4304.720 |
| 33 | 4550.132 | 4307.772 |
| 34 | 4557.482 | 4310.931 |
| 35 | 4560.354 | 4312.214 |

Circle Center At X = 4333.454 ; Y = 4822.129 ; and Radius = 558.132

*** FOS = 2.585 Theta (ki=1.0) = 8.92 ***
Lambda = 0.157

1

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|

| | | |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.970 | 4264.310 |
| 3 | 4315.951 | 4263.751 |
| 4 | 4323.939 | 4263.324 |
| 5 | 4331.934 | 4263.027 |
| 6 | 4339.933 | 4262.862 |
| 7 | 4347.933 | 4262.829 |
| 8 | 4355.932 | 4262.926 |
| 9 | 4363.929 | 4263.156 |
| 10 | 4371.920 | 4263.517 |
| 11 | 4379.905 | 4264.008 |
| 12 | 4387.881 | 4264.631 |
| 13 | 4395.845 | 4265.385 |
| 14 | 4403.796 | 4266.270 |
| 15 | 4411.732 | 4267.285 |
| 16 | 4419.649 | 4268.431 |
| 17 | 4427.547 | 4269.706 |
| 18 | 4435.422 | 4271.111 |
| 19 | 4443.274 | 4272.645 |
| 20 | 4451.099 | 4274.308 |
| 21 | 4458.896 | 4276.099 |
| 22 | 4466.663 | 4278.018 |
| 23 | 4474.396 | 4280.064 |
| 24 | 4482.096 | 4282.238 |
| 25 | 4489.758 | 4284.537 |
| 26 | 4497.382 | 4286.962 |
| 27 | 4504.965 | 4289.512 |
| 28 | 4512.505 | 4292.186 |
| 29 | 4520.000 | 4294.983 |
| 30 | 4527.448 | 4297.903 |
| 31 | 4534.847 | 4300.946 |
| 32 | 4542.195 | 4304.109 |
| 33 | 4549.490 | 4307.393 |
| 34 | 4556.730 | 4310.796 |
| 35 | 4559.557 | 4312.182 |

Circle Center At X = 4345.974 ; Y = 4749.775 ; and Radius = 486.950

*** FOS = 2.586 Theta (ki=1.0) = 9.14 ***
Lambda = 0.161

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4307.970 | 4264.310 |
| 3 | 4315.951 | 4263.751 |
| 4 | 4323.939 | 4263.323 |
| 5 | 4331.934 | 4263.027 |
| 6 | 4339.933 | 4262.862 |
| 7 | 4347.933 | 4262.828 |
| 8 | 4355.932 | 4262.926 |
| 9 | 4363.929 | 4263.155 |
| 10 | 4371.920 | 4263.516 |
| 11 | 4379.905 | 4264.008 |
| 12 | 4387.881 | 4264.631 |
| 13 | 4395.845 | 4265.385 |
| 14 | 4403.796 | 4266.270 |
| 15 | 4411.732 | 4267.285 |
| 16 | 4419.649 | 4268.430 |
| 17 | 4427.547 | 4269.706 |
| 18 | 4435.422 | 4271.110 |
| 19 | 4443.274 | 4272.645 |
| 20 | 4451.099 | 4274.308 |
| 21 | 4458.896 | 4276.099 |
| 22 | 4466.663 | 4278.018 |
| 23 | 4474.396 | 4280.064 |
| 24 | 4482.096 | 4282.237 |
| 25 | 4489.758 | 4284.537 |
| 26 | 4497.382 | 4286.961 |
| 27 | 4504.965 | 4289.511 |
| 28 | 4512.505 | 4292.185 |
| 29 | 4520.000 | 4294.982 |
| 30 | 4527.448 | 4297.903 |
| 31 | 4534.847 | 4300.945 |
| 32 | 4542.195 | 4304.109 |
| 33 | 4549.490 | 4307.393 |
| 34 | 4556.730 | 4310.796 |
| 35 | 4559.558 | 4312.182 |

Circle Center At X = 4345.976 ; Y = 4749.769 ; and Radius = 486.944

*** FOS = 2.586 Theta (ki=1.0) = 9.15 ***
Lambda = 0.161

```
**** END OF GSTABL7 OUTPUT ****
```

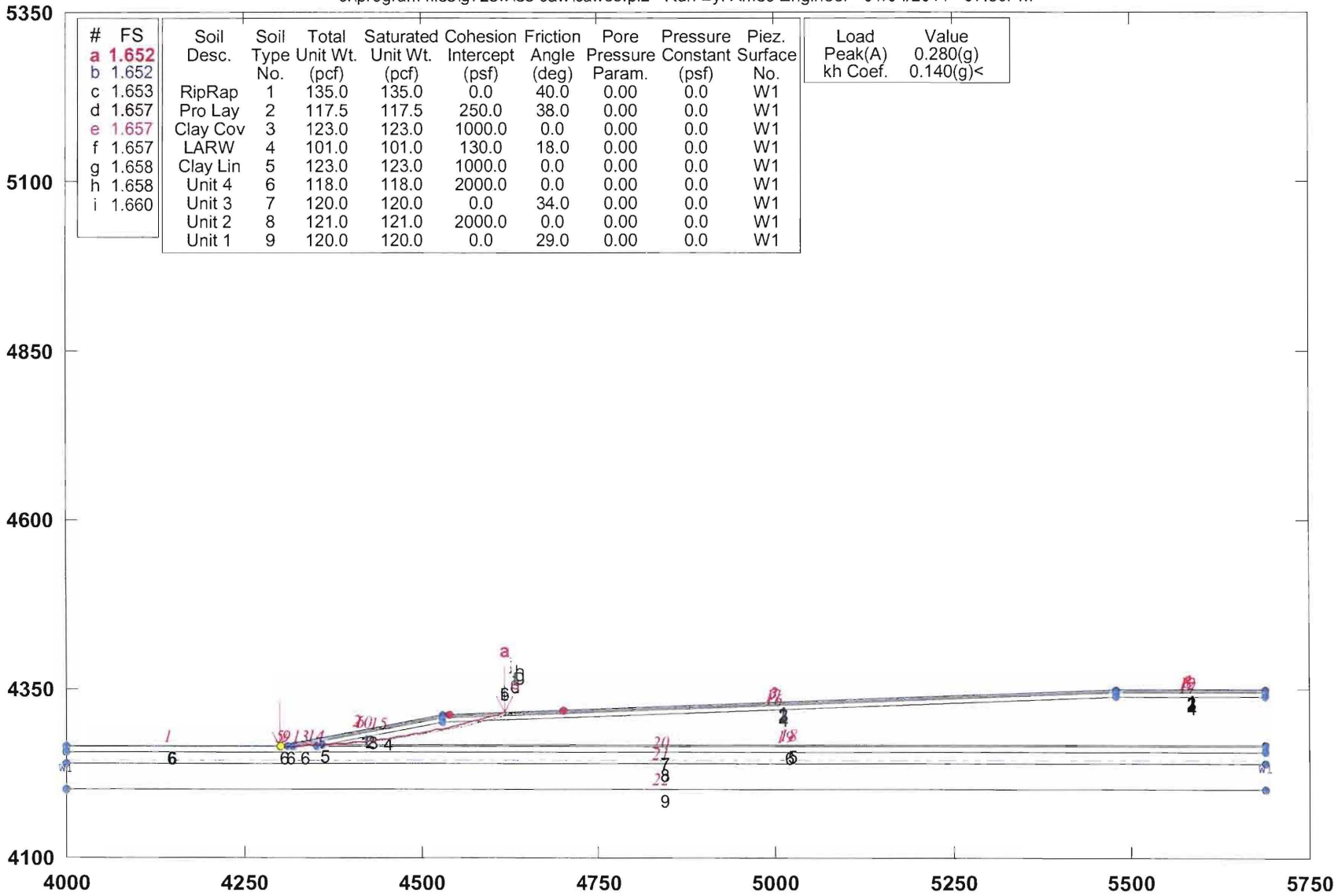
# CAW Emb 38' 5(H):1(V) side-slopes, Pseudostatic, Embankmt 121810 CAWES

c:\program files\g72sw\es caw\cawes.pl2 Run By: Amec Engineer 01/04/2011 07:36PM

| # | FS |
|---|---|
| a | 1.652 |
| b | 1.652 |
| c | 1.653 |
| d | 1.657 |
| e | 1.657 |
| f | 1.657 |
| g | 1.658 |
| h | 1.658 |
| i | 1.660 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |

| Load | Value |
|---|---|
| Peak(A) | 0.280(g) |
| kh Coef. | 0.140(g)< |



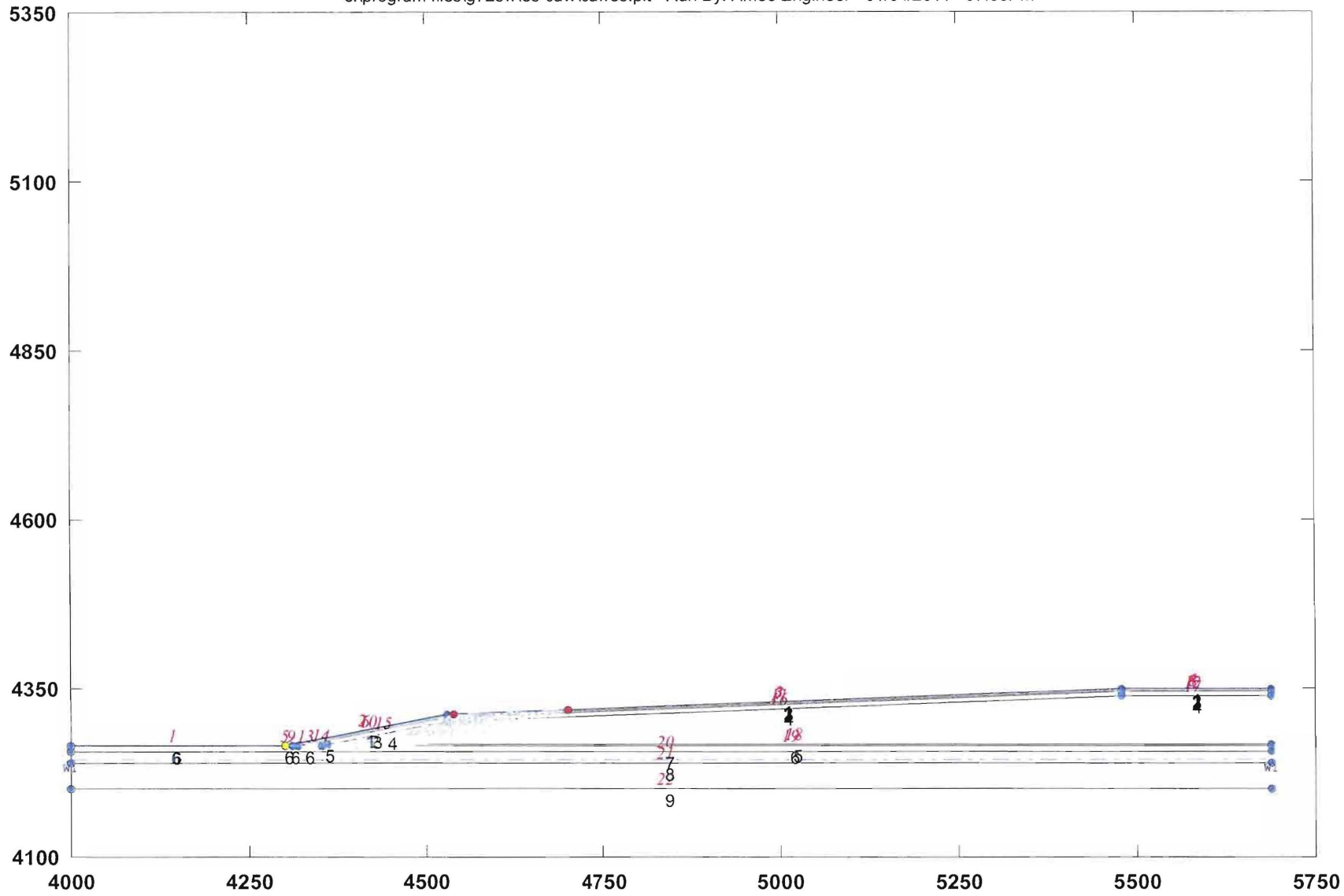

**GSTABL7 v.2 FSmin=1.652**

**Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, Pseudostatic, Embankmt 121810 CAWES

c:\program files\g72sw\es caw\cawes.plt Run By: Amec Engineer 01/04/2011 07:36PM




GSTABL7

```
                    *** GSTABL7 ***

              ** GSTABL7 by Garry H. Gregory, P.E. **

   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)

*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************


Analysis Run Date:        01/04/2011
Time of Run:              07:36PM
Run By:                   Amec Engineer
Input Data Filename:      C:\Program Files\G72SW\ES CAW\cawes.
Output Filename:          C:\Program Files\G72SW\ES CAW\cawes.OUT
Unit System:              English

Plotted Output Filename:  C:\Program Files\G72SW\ES CAW\cawes.PLT


PROBLEM DESCRIPTION:  CAW Emb 38' 5(H):1(V) side-slopes,
                      Pseudostatic, Embankmt 121810  CAWES


BOUNDARY COORDINATES

    4 Top   Boundaries
   22 Total Boundaries
```

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

```
User Specified Y-Origin =       4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)
```

1

```
ISOTROPIC SOIL PARAMETERS

 9 Type(s) of Soil
```

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

Specified Peak Ground Acceleration Coefficient (A) = 0.280(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.140(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

1000 Trial Surfaces Have Been Generated.

1000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X =4300.00(ft)
and X =4300.00(ft)

Each Surface Terminates Between X =4540.00(ft)
and X =4700.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 4260.00(ft)

8.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 1000

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS = 41

Number of Trial Surfaces with Misleading FS = 2

Number of Trial Surfaces With Valid FS = 957

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted = 4.3 %

Statistical Data On All Valid FS Values:
FS Max = 4.108 FS Min = 1.652 FS Ave = 2.135
Standard Deviation = 0.327 Coefficient of Variation = 15.29 %

((Modified Bishop FS for Critical Surface = 1.663))

Failure Surface Specified By 42 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.048 |
| 3 | 4315.999 | 4265.156 |
| 4 | 4323.997 | 4265.325 |
| 5 | 4331.994 | 4265.555 |
| 6 | 4339.988 | 4265.844 |
| 7 | 4347.980 | 4266.194 |
| 8 | 4355.970 | 4266.605 |
| 9 | 4363.956 | 4267.076 |
| 10 | 4371.938 | 4267.607 |
| 11 | 4379.917 | 4268.198 |
| 12 | 4387.890 | 4268.850 |
| 13 | 4395.858 | 4269.562 |
| 14 | 4403.821 | 4270.334 |
| 15 | 4411.778 | 4271.166 |
| 16 | 4419.728 | 4272.058 |
| 17 | 4427.671 | 4273.010 |
| 18 | 4435.607 | 4274.022 |
| 19 | 4443.535 | 4275.095 |
| 20 | 4451.454 | 4276.227 |
| 21 | 4459.365 | 4277.418 |
| 22 | 4467.266 | 4278.670 |
| 23 | 4475.158 | 4279.981 |
| 24 | 4483.040 | 4281.352 |
| 25 | 4490.911 | 4282.782 |
| 26 | 4498.771 | 4284.271 |
| 27 | 4506.619 | 4285.820 |
| 28 | 4514.456 | 4287.429 |
| 29 | 4522.280 | 4289.096 |
| 30 | 4530.091 | 4290.823 |
| 31 | 4537.890 | 4292.608 |
| 32 | 4545.674 | 4294.453 |
| 33 | 4553.445 | 4296.356 |
| 34 | 4561.201 | 4298.318 |
| 35 | 4568.941 | 4300.338 |
| 36 | 4576.667 | 4302.417 |
| 37 | 4584.376 | 4304.554 |
| 38 | 4592.069 | 4306.750 |
| 39 | 4599.745 | 4309.003 |
| 40 | 4607.404 | 4311.314 |
| 41 | 4615.045 | 4313.683 |
| 42 | 4617.627 | 4314.505 |

Circle Center At X = 4297.671 ; Y = 5323.657 ; and Radius = 1058.659

*** FOS = 1.652 Theta (ki=1.0) = 7.63 ***
Lambda = 0.134

Individual data on the 50 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.0 | 837.9 | 0.0 | 0.0 | 0. | 0. | 117.3 | 0.0 | 0.0 |
| 2 | 2.4 | 576.0 | 0.0 | 0.0 | 0. | 0. | 80.6 | 0.0 | 0.0 |
| 3 | 5.6 | 1854.5 | 0.0 | 0.0 | 0. | 0. | 259.6 | 0.0 | 0.0 |
| 4 | 3.1 | 1321.8 | 0.0 | 0.0 | 0. | 0. | 185.1 | 0.0 | 0.0 |
| 5 | 4.9 | 2502.6 | 0.0 | 0.0 | 0. | 0. | 350.4 | 0.0 | 0.0 |
| 6 | 8.0 | 5196.2 | 0.0 | 0.0 | 0. | 0. | 727.5 | 0.0 | 0.0 |
| 7 | 8.0 | 6512.2 | 0.0 | 0.0 | 0. | 0. | 911.7 | 0.0 | 0.0 |
| 8 | 8.0 | 7767.4 | 0.0 | 0.0 | 0. | 0. | 1087.4 | 0.0 | 0.0 |
| 9 | 8.0 | 8961.9 | 0.0 | 0.0 | 0. | 0. | 1254.7 | 0.0 | 0.0 |
| 10 | 4.5 | 5570.9 | 0.0 | 0.0 | 0. | 0. | 779.9 | 0.0 | 0.0 |
| 11 | 0.5 | 658.7 | 0.0 | 0.0 | 0. | 0. | 92.2 | 0.0 | 0.0 |
| 12 | 1.7 | 2161.6 | 0.0 | 0.0 | 0. | 0. | 302.6 | 0.0 | 0.0 |
| 13 | 1.3 | 1686.0 | 0.0 | 0.0 | 0. | 0. | 236.0 | 0.0 | 0.0 |
| 14 | 8.0 | 10984.3 | 0.0 | 0.0 | 0. | 0. | 1537.8 | 0.0 | 0.0 |
| 15 | 8.0 | 11814.6 | 0.0 | 0.0 | 0. | 0. | 1654.0 | 0.0 | 0.0 |
| 16 | 8.0 | 12594.8 | 0.0 | 0.0 | 0. | 0. | 1763.3 | 0.0 | 0.0 |
| 17 | 8.0 | 13323.4 | 0.0 | 0.0 | 0. | 0. | 1865.3 | 0.0 | 0.0 |
| 18 | 8.0 | 14001.1 | 0.0 | 0.0 | 0. | 0. | 1960.2 | 0.0 | 0.0 |
| 19 | 8.0 | 14627.9 | 0.0 | 0.0 | 0. | 0. | 2047.9 | 0.0 | 0.0 |
| 20 | 8.0 | 15203.4 | 0.0 | 0.0 | 0. | 0. | 2128.5 | 0.0 | 0.0 |
| 21 | 7.9 | 15728.5 | 0.0 | 0.0 | 0. | 0. | 2202.0 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 22 | 7.9 | 16200.9 | 0.0 | 0.0 | 0. | 0. | 2268.1 | 0.0 | 0.0 |
| 23 | 7.9 | 16623.5 | 0.0 | 0.0 | 0. | 0. | 2327.3 | 0.0 | 0.0 |
| 24 | 7.9 | 16995.0 | 0.0 | 0.0 | 0. | 0. | 2379.3 | 0.0 | 0.0 |
| 25 | 7.9 | 17315.5 | 0.0 | 0.0 | 0. | 0. | 2424.2 | 0.0 | 0.0 |
| 26 | 7.9 | 17584.6 | 0.0 | 0.0 | 0. | 0. | 2461.8 | 0.0 | 0.0 |
| 27 | 7.9 | 17802.8 | 0.0 | 0.0 | 0. | 0. | 2492.4 | 0.0 | 0.0 |
| 28 | 7.9 | 17971.9 | 0.0 | 0.0 | 0. | 0. | 2516.1 | 0.0 | 0.0 |
| 29 | 7.9 | 18089.0 | 0.0 | 0.0 | 0. | 0. | 2532.5 | 0.0 | 0.0 |
| 30 | 7.9 | 18155.2 | 0.0 | 0.0 | 0. | 0. | 2541.7 | 0.0 | 0.0 |
| 31 | 7.8 | 18172.9 | 0.0 | 0.0 | 0. | 0. | 2544.2 | 0.0 | 0.0 |
| 32 | 7.8 | 18139.1 | 0.0 | 0.0 | 0. | 0. | 2539.5 | 0.0 | 0.0 |
| 33 | 7.8 | 18056.2 | 0.0 | 0.0 | 0. | 0. | 2527.9 | 0.0 | 0.0 |
| 34 | 7.7 | 17716.0 | 0.0 | 0.0 | 0. | 0. | 2480.2 | 0.0 | 0.0 |
| 35 | 0.1 | 208.7 | 0.0 | 0.0 | 0. | 0. | 29.2 | 0.0 | 0.0 |
| 36 | 7.8 | 17239.2 | 0.0 | 0.0 | 0. | 0. | 2413.5 | 0.0 | 0.0 |
| 37 | 7.8 | 16026.6 | 0.0 | 0.0 | 0. | 0. | 2243.7 | 0.0 | 0.0 |
| 38 | 7.8 | 14771.1 | 0.0 | 0.0 | 0. | 0. | 2068.0 | 0.0 | 0.0 |
| 39 | 7.8 | 13472.6 | 0.0 | 0.0 | 0. | 0. | 1886.2 | 0.0 | 0.0 |
| 40 | 7.7 | 12132.0 | 0.0 | 0.0 | 0. | 0. | 1698.5 | 0.0 | 0.0 |
| 41 | 7.5 | 10463.2 | 0.0 | 0.0 | 0. | 0. | 1464.8 | 0.0 | 0.0 |
| 42 | 0.2 | 286.6 | 0.0 | 0.0 | 0. | 0. | 40.1 | 0.0 | 0.0 |
| 43 | 7.7 | 9163.3 | 0.0 | 0.0 | 0. | 0. | 1282.9 | 0.0 | 0.0 |
| 44 | 7.7 | 7385.6 | 0.0 | 0.0 | 0. | 0. | 1034.0 | 0.0 | 0.0 |
| 45 | 7.7 | 5559.2 | 0.0 | 0.0 | 0. | 0. | 778.3 | 0.0 | 0.0 |
| 46 | 4.9 | 2583.2 | 0.0 | 0.0 | 0. | 0. | 361.6 | 0.0 | 0.0 |
| 47 | 2.7 | 1108.1 | 0.0 | 0.0 | 0. | 0. | 155.1 | 0.0 | 0.0 |
| 48 | 2.9 | 915.2 | 0.0 | 0.0 | 0. | 0. | 128.1 | 0.0 | 0.0 |
| 49 | 4.7 | 870.7 | 0.0 | 0.0 | 0. | 0. | 121.9 | 0.0 | 0.0 |
| 50 | 2.6 | 125.4 | 0.0 | 0.0 | 0. | 0. | 17.6 | 0.0 | 0.0 |

Failure Surface Specified By 42 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.048 |
| 3 | 4315.999 | 4265.156 |
| 4 | 4323.997 | 4265.325 |
| 5 | 4331.994 | 4265.554 |
| 6 | 4339.988 | 4265.844 |
| 7 | 4347.980 | 4266.194 |
| 8 | 4355.970 | 4266.604 |
| 9 | 4363.956 | 4267.075 |
| 10 | 4371.938 | 4267.606 |
| 11 | 4379.917 | 4268.198 |
| 12 | 4387.890 | 4268.850 |
| 13 | 4395.858 | 4269.562 |
| 14 | 4403.821 | 4270.333 |
| 15 | 4411.778 | 4271.166 |
| 16 | 4419.728 | 4272.058 |
| 17 | 4427.671 | 4273.010 |
| 18 | 4435.607 | 4274.022 |
| 19 | 4443.535 | 4275.094 |
| 20 | 4451.454 | 4276.226 |
| 21 | 4459.365 | 4277.418 |
| 22 | 4467.266 | 4278.669 |
| 23 | 4475.158 | 4279.980 |
| 24 | 4483.040 | 4281.351 |
| 25 | 4490.911 | 4282.781 |
| 26 | 4498.771 | 4284.271 |
| 27 | 4506.619 | 4285.820 |
| 28 | 4514.456 | 4287.428 |
| 29 | 4522.280 | 4289.096 |
| 30 | 4530.091 | 4290.822 |
| 31 | 4537.890 | 4292.608 |
| 32 | 4545.674 | 4294.452 |
| 33 | 4553.445 | 4296.355 |
| 34 | 4561.201 | 4298.317 |
| 35 | 4568.941 | 4300.338 |
| 36 | 4576.667 | 4302.417 |
| 37 | 4584.376 | 4304.554 |
| 38 | 4592.069 | 4306.749 |
| 39 | 4599.745 | 4309.002 |
| 40 | 4607.404 | 4311.313 |
| 41 | 4615.045 | 4313.683 |
| 42 | 4617.629 | 4314.505 |

Circle Center At X = 4297.677 ; Y = 5323.622 ; and Radius = 1058.624

*** FOS = 1.652 Theta (ki=1.0) = 6.63 ***
Lambda = 0.116

1

Failure Surface Specified By 42 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|

| | | |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.048 |
| 3 | 4315.999 | 4265.156 |
| 4 | 4323.997 | 4265.325 |
| 5 | 4331.994 | 4265.555 |
| 6 | 4339.988 | 4265.844 |
| 7 | 4347.980 | 4266.194 |
| 8 | 4355.970 | 4266.605 |
| 9 | 4363.956 | 4267.076 |
| 10 | 4371.938 | 4267.607 |
| 11 | 4379.917 | 4268.198 |
| 12 | 4387.890 | 4268.850 |
| 13 | 4395.858 | 4269.562 |
| 14 | 4403.821 | 4270.334 |
| 15 | 4411.778 | 4271.166 |
| 16 | 4419.728 | 4272.058 |
| 17 | 4427.671 | 4273.010 |
| 18 | 4435.607 | 4274.022 |
| 19 | 4443.535 | 4275.095 |
| 20 | 4451.454 | 4276.227 |
| 21 | 4459.365 | 4277.418 |
| 22 | 4467.266 | 4278.670 |
| 23 | 4475.158 | 4279.981 |
| 24 | 4483.040 | 4281.352 |
| 25 | 4490.911 | 4282.782 |
| 26 | 4498.771 | 4284.271 |
| 27 | 4506.619 | 4285.820 |
| 28 | 4514.456 | 4287.429 |
| 29 | 4522.280 | 4289.096 |
| 30 | 4530.091 | 4290.823 |
| 31 | 4537.890 | 4292.608 |
| 32 | 4545.674 | 4294.453 |
| 33 | 4553.445 | 4296.356 |
| 34 | 4561.201 | 4298.318 |
| 35 | 4568.941 | 4300.338 |
| 36 | 4576.667 | 4302.417 |
| 37 | 4584.376 | 4304.554 |
| 38 | 4592.069 | 4306.750 |
| 39 | 4599.745 | 4309.003 |
| 40 | 4607.404 | 4311.314 |
| 41 | 4615.045 | 4313.683 |
| 42 | 4617.627 | 4314.505 |

Circle Center At X = 4297.671 ; Y = 5323.657 ; and Radius = 1058.659

*** FOS = 1.653 Theta (ki=1.0) = 5.68 ***
Lambda = 0.099

Failure Surface Specified By 44 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.045 |
| 3 | 4316.000 | 4265.146 |
| 4 | 4323.998 | 4265.303 |
| 5 | 4331.995 | 4265.515 |
| 6 | 4339.991 | 4265.784 |
| 7 | 4347.984 | 4266.108 |
| 8 | 4355.976 | 4266.488 |
| 9 | 4363.964 | 4266.923 |
| 10 | 4371.949 | 4267.415 |
| 11 | 4379.930 | 4267.962 |
| 12 | 4387.907 | 4268.565 |
| 13 | 4395.880 | 4269.224 |
| 14 | 4403.848 | 4269.938 |
| 15 | 4411.811 | 4270.708 |
| 16 | 4419.769 | 4271.534 |
| 17 | 4427.720 | 4272.415 |
| 18 | 4435.665 | 4273.351 |
| 19 | 4443.603 | 4274.343 |
| 20 | 4451.534 | 4275.390 |
| 21 | 4459.458 | 4276.493 |
| 22 | 4467.374 | 4277.650 |
| 23 | 4475.282 | 4278.863 |
| 24 | 4483.181 | 4280.131 |
| 25 | 4491.070 | 4281.455 |
| 26 | 4498.951 | 4282.833 |
| 27 | 4506.821 | 4284.266 |
| 28 | 4514.682 | 4285.754 |
| 29 | 4522.531 | 4287.297 |
| 30 | 4530.370 | 4288.895 |
| 31 | 4538.198 | 4290.547 |
| 32 | 4546.014 | 4292.254 |
| 33 | 4553.817 | 4294.016 |
| 34 | 4561.608 | 4295.832 |
| 35 | 4569.387 | 4297.702 |
| 36 | 4577.152 | 4299.626 |
| 37 | 4584.903 | 4301.605 |

| | | |
|---|---|---|
| 38 | 4592.641 | 4303.638 |
| 39 | 4600.364 | 4305.724 |
| 40 | 4608.072 | 4307.865 |
| 41 | 4615.766 | 4310.059 |
| 42 | 4623.443 | 4312.307 |
| 43 | 4631.105 | 4314.608 |
| 44 | 4632.731 | 4315.109 |

Circle Center At X = 4297.546 ; Y = 5411.033 ; and Radius = 1146.035

*** FOS = 1.657 Theta (ki=1.0) = 5.48 ***
Lambda = 0.096

1

Failure Surface Specified By 44 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.045 |
| 3 | 4316.000 | 4265.146 |
| 4 | 4323.998 | 4265.303 |
| 5 | 4331.995 | 4265.515 |
| 6 | 4339.991 | 4265.784 |
| 7 | 4347.984 | 4266.108 |
| 8 | 4355.976 | 4266.488 |
| 9 | 4363.964 | 4266.923 |
| 10 | 4371.949 | 4267.415 |
| 11 | 4379.930 | 4267.962 |
| 12 | 4387.907 | 4268.565 |
| 13 | 4395.880 | 4269.224 |
| 14 | 4403.848 | 4269.938 |
| 15 | 4411.811 | 4270.708 |
| 16 | 4419.769 | 4271.534 |
| 17 | 4427.720 | 4272.415 |
| 18 | 4435.665 | 4273.351 |
| 19 | 4443.603 | 4274.343 |
| 20 | 4451.534 | 4275.390 |
| 21 | 4459.458 | 4276.493 |
| 22 | 4467.374 | 4277.650 |
| 23 | 4475.282 | 4278.863 |
| 24 | 4483.181 | 4280.131 |
| 25 | 4491.070 | 4281.455 |
| 26 | 4498.951 | 4282.833 |
| 27 | 4506.821 | 4284.266 |
| 28 | 4514.682 | 4285.754 |
| 29 | 4522.531 | 4287.297 |
| 30 | 4530.370 | 4288.895 |
| 31 | 4538.198 | 4290.547 |
| 32 | 4546.014 | 4292.254 |
| 33 | 4553.817 | 4294.016 |
| 34 | 4561.608 | 4295.832 |
| 35 | 4569.387 | 4297.702 |
| 36 | 4577.152 | 4299.626 |
| 37 | 4584.903 | 4301.605 |
| 38 | 4592.641 | 4303.638 |
| 39 | 4600.364 | 4305.724 |
| 40 | 4608.072 | 4307.865 |
| 41 | 4615.766 | 4310.059 |
| 42 | 4623.443 | 4312.307 |
| 43 | 4631.105 | 4314.608 |
| 44 | 4632.731 | 4315.109 |

Circle Center At X = 4297.546 ; Y = 5411.033 ; and Radius = 1146.035

*** FOS = 1.657 Theta (ki=1.0) = 5.48 ***
Lambda = 0.096

Failure Surface Specified By 44 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.045 |
| 3 | 4316.000 | 4265.146 |
| 4 | 4323.998 | 4265.303 |
| 5 | 4331.995 | 4265.515 |
| 6 | 4339.991 | 4265.784 |
| 7 | 4347.984 | 4266.108 |
| 8 | 4355.976 | 4266.488 |
| 9 | 4363.964 | 4266.923 |
| 10 | 4371.949 | 4267.415 |
| 11 | 4379.930 | 4267.962 |
| 12 | 4387.907 | 4268.565 |

| | | |
|---|---|---|
| 13 | 4395.880 | 4269.224 |
| 14 | 4403.848 | 4269.938 |
| 15 | 4411.811 | 4270.708 |
| 16 | 4419.769 | 4271.534 |
| 17 | 4427.720 | 4272.415 |
| 18 | 4435.665 | 4273.351 |
| 19 | 4443.603 | 4274.343 |
| 20 | 4451.534 | 4275.390 |
| 21 | 4459.458 | 4276.493 |
| 22 | 4467.374 | 4277.650 |
| 23 | 4475.282 | 4278.863 |
| 24 | 4483.181 | 4280.131 |
| 25 | 4491.070 | 4281.455 |
| 26 | 4498.951 | 4282.833 |
| 27 | 4506.821 | 4284.266 |
| 28 | 4514.682 | 4285.754 |
| 29 | 4522.531 | 4287.297 |
| 30 | 4530.370 | 4288.895 |
| 31 | 4538.198 | 4290.547 |
| 32 | 4546.014 | 4292.254 |
| 33 | 4553.817 | 4294.016 |
| 34 | 4561.608 | 4295.832 |
| 35 | 4569.387 | 4297.702 |
| 36 | 4577.152 | 4299.626 |
| 37 | 4584.903 | 4301.605 |
| 38 | 4592.641 | 4303.638 |
| 39 | 4600.364 | 4305.724 |
| 40 | 4608.072 | 4307.865 |
| 41 | 4615.766 | 4310.059 |
| 42 | 4623.443 | 4312.307 |
| 43 | 4631.105 | 4314.608 |
| 44 | 4632.731 | 4315.109 |

Circle Center At X = 4297.546 ; Y = 5411.033 ; and Radius = 1146.035

*** FOS = 1.657 Theta (ki=1.0) = 5.28 ***
Lambda = 0.092

1

Failure Surface Specified By 44 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.005 |
| 3 | 4316.000 | 4265.066 |
| 4 | 4323.999 | 4265.184 |
| 5 | 4331.997 | 4265.357 |
| 6 | 4339.994 | 4265.586 |
| 7 | 4347.989 | 4265.871 |
| 8 | 4355.981 | 4266.212 |
| 9 | 4363.972 | 4266.609 |
| 10 | 4371.959 | 4267.062 |
| 11 | 4379.943 | 4267.571 |
| 12 | 4387.923 | 4268.136 |
| 13 | 4395.899 | 4268.756 |
| 14 | 4403.870 | 4269.433 |
| 15 | 4411.836 | 4270.165 |
| 16 | 4419.797 | 4270.952 |
| 17 | 4427.753 | 4271.796 |
| 18 | 4435.702 | 4272.695 |
| 19 | 4443.645 | 4273.650 |
| 20 | 4451.581 | 4274.660 |
| 21 | 4459.510 | 4275.726 |
| 22 | 4467.431 | 4276.848 |
| 23 | 4475.344 | 4278.024 |
| 24 | 4483.249 | 4279.256 |
| 25 | 4491.144 | 4280.544 |
| 26 | 4499.031 | 4281.887 |
| 27 | 4506.908 | 4283.285 |
| 28 | 4514.775 | 4284.738 |
| 29 | 4522.631 | 4286.246 |
| 30 | 4530.477 | 4287.809 |
| 31 | 4538.312 | 4289.426 |
| 32 | 4546.135 | 4291.099 |
| 33 | 4553.947 | 4292.826 |
| 34 | 4561.746 | 4294.607 |
| 35 | 4569.532 | 4296.444 |
| 36 | 4577.305 | 4298.335 |
| 37 | 4585.065 | 4300.280 |
| 38 | 4592.811 | 4302.280 |
| 39 | 4600.543 | 4304.333 |
| 40 | 4608.260 | 4306.441 |
| 41 | 4615.963 | 4308.603 |
| 42 | 4623.650 | 4310.819 |
| 43 | 4631.321 | 4313.088 |
| 44 | 4638.779 | 4315.351 |

Circle Center At X = 4303.255 ; Y = 5407.979 ; and Radius = 1142.984

*** FOS = 1.658 Theta (ki=1.0) = 5.54 ***
Lambda = 0.097

Failure Surface Specified By 44 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.005 |
| 3 | 4316.000 | 4265.066 |
| 4 | 4323.999 | 4265.184 |
| 5 | 4331.997 | 4265.357 |
| 6 | 4339.994 | 4265.586 |
| 7 | 4347.989 | 4265.871 |
| 8 | 4355.981 | 4266.212 |
| 9 | 4363.972 | 4266.609 |
| 10 | 4371.959 | 4267.062 |
| 11 | 4379.943 | 4267.571 |
| 12 | 4387.923 | 4268.135 |
| 13 | 4395.899 | 4268.756 |
| 14 | 4403.870 | 4269.432 |
| 15 | 4411.836 | 4270.164 |
| 16 | 4419.797 | 4270.952 |
| 17 | 4427.753 | 4271.795 |
| 18 | 4435.702 | 4272.695 |
| 19 | 4443.645 | 4273.649 |
| 20 | 4451.581 | 4274.660 |
| 21 | 4459.510 | 4275.726 |
| 22 | 4467.431 | 4276.847 |
| 23 | 4475.344 | 4278.024 |
| 24 | 4483.249 | 4279.256 |
| 25 | 4491.144 | 4280.543 |
| 26 | 4499.031 | 4281.886 |
| 27 | 4506.908 | 4283.284 |
| 28 | 4514.775 | 4284.737 |
| 29 | 4522.631 | 4286.245 |
| 30 | 4530.477 | 4287.808 |
| 31 | 4538.312 | 4289.426 |
| 32 | 4546.135 | 4291.098 |
| 33 | 4553.946 | 4292.825 |
| 34 | 4561.745 | 4294.607 |
| 35 | 4569.531 | 4296.443 |
| 36 | 4577.305 | 4298.334 |
| 37 | 4585.064 | 4300.280 |
| 38 | 4592.811 | 4302.279 |
| 39 | 4600.542 | 4304.333 |
| 40 | 4608.260 | 4306.441 |
| 41 | 4615.962 | 4308.603 |
| 42 | 4623.649 | 4310.818 |
| 43 | 4631.321 | 4313.088 |
| 44 | 4638.780 | 4315.351 |

Circle Center At X = 4303.261 ; Y = 5407.955 ; and Radius = 1142.960

*** FOS = 1.658 Theta (ki=1.0) = 5.31 ***
Lambda = 0.093

1

Failure Surface Specified By 43 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.085 |
| 3 | 4315.998 | 4265.226 |
| 4 | 4323.996 | 4265.423 |
| 5 | 4331.992 | 4265.675 |
| 6 | 4339.986 | 4265.983 |
| 7 | 4347.978 | 4266.347 |
| 8 | 4355.966 | 4266.767 |
| 9 | 4363.952 | 4267.241 |
| 10 | 4371.935 | 4267.771 |
| 11 | 4379.913 | 4268.357 |
| 12 | 4387.887 | 4268.999 |
| 13 | 4395.857 | 4269.696 |
| 14 | 4403.821 | 4270.449 |
| 15 | 4411.780 | 4271.257 |
| 16 | 4419.733 | 4272.120 |
| 17 | 4427.681 | 4273.039 |
| 18 | 4435.621 | 4274.013 |
| 19 | 4443.555 | 4275.042 |
| 20 | 4451.481 | 4276.127 |
| 21 | 4459.399 | 4277.267 |

| | | |
|---|---|---|
| 22 | 4467.310 | 4278.461 |
| 23 | 4475.211 | 4279.711 |
| 24 | 4483.104 | 4281.016 |
| 25 | 4490.988 | 4282.376 |
| 26 | 4498.862 | 4283.791 |
| 27 | 4506.726 | 4285.260 |
| 28 | 4514.580 | 4286.784 |
| 29 | 4522.422 | 4288.363 |
| 30 | 4530.254 | 4289.996 |
| 31 | 4538.074 | 4291.684 |
| 32 | 4545.882 | 4293.426 |
| 33 | 4553.677 | 4295.223 |
| 34 | 4561.460 | 4297.074 |
| 35 | 4569.230 | 4298.979 |
| 36 | 4576.986 | 4300.938 |
| 37 | 4584.729 | 4302.951 |
| 38 | 4592.458 | 4305.018 |
| 39 | 4600.171 | 4307.138 |
| 40 | 4607.870 | 4309.312 |
| 41 | 4615.554 | 4311.541 |
| 42 | 4623.222 | 4313.822 |
| 43 | 4626.644 | 4314.866 |

Circle Center At X = 4291.756 ; Y = 5413.925 ; and Radius = 1148.954

*** FOS = 1.660 Theta (ki=1.0) = 5.53 ***
Lambda = 0.097

Failure Surface Specified By 43 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.085 |
| 3 | 4315.998 | 4265.226 |
| 4 | 4323.996 | 4265.423 |
| 5 | 4331.992 | 4265.675 |
| 6 | 4339.986 | 4265.983 |
| 7 | 4347.978 | 4266.347 |
| 8 | 4355.966 | 4266.767 |
| 9 | 4363.952 | 4267.241 |
| 10 | 4371.935 | 4267.771 |
| 11 | 4379.913 | 4268.357 |
| 12 | 4387.887 | 4268.999 |
| 13 | 4395.857 | 4269.696 |
| 14 | 4403.821 | 4270.449 |
| 15 | 4411.780 | 4271.257 |
| 16 | 4419.733 | 4272.120 |
| 17 | 4427.681 | 4273.039 |
| 18 | 4435.621 | 4274.013 |
| 19 | 4443.555 | 4275.042 |
| 20 | 4451.481 | 4276.127 |
| 21 | 4459.399 | 4277.267 |
| 22 | 4467.310 | 4278.461 |
| 23 | 4475.211 | 4279.711 |
| 24 | 4483.104 | 4281.016 |
| 25 | 4490.988 | 4282.376 |
| 26 | 4498.862 | 4283.791 |
| 27 | 4506.726 | 4285.260 |
| 28 | 4514.580 | 4286.784 |
| 29 | 4522.422 | 4288.363 |
| 30 | 4530.254 | 4289.996 |
| 31 | 4538.074 | 4291.684 |
| 32 | 4545.882 | 4293.426 |
| 33 | 4553.677 | 4295.223 |
| 34 | 4561.460 | 4297.074 |
| 35 | 4569.230 | 4298.979 |
| 36 | 4576.986 | 4300.938 |
| 37 | 4584.729 | 4302.951 |
| 38 | 4592.458 | 4305.018 |
| 39 | 4600.171 | 4307.139 |
| 40 | 4607.870 | 4309.313 |
| 41 | 4615.554 | 4311.541 |
| 42 | 4623.222 | 4313.822 |
| 43 | 4626.642 | 4314.866 |

Circle Center At X = 4291.757 ; Y = 5413.904 ; and Radius = 1148.933

*** FOS = 1.660 Theta (ki=1.0) = 5.44 ***
Lambda = 0.095

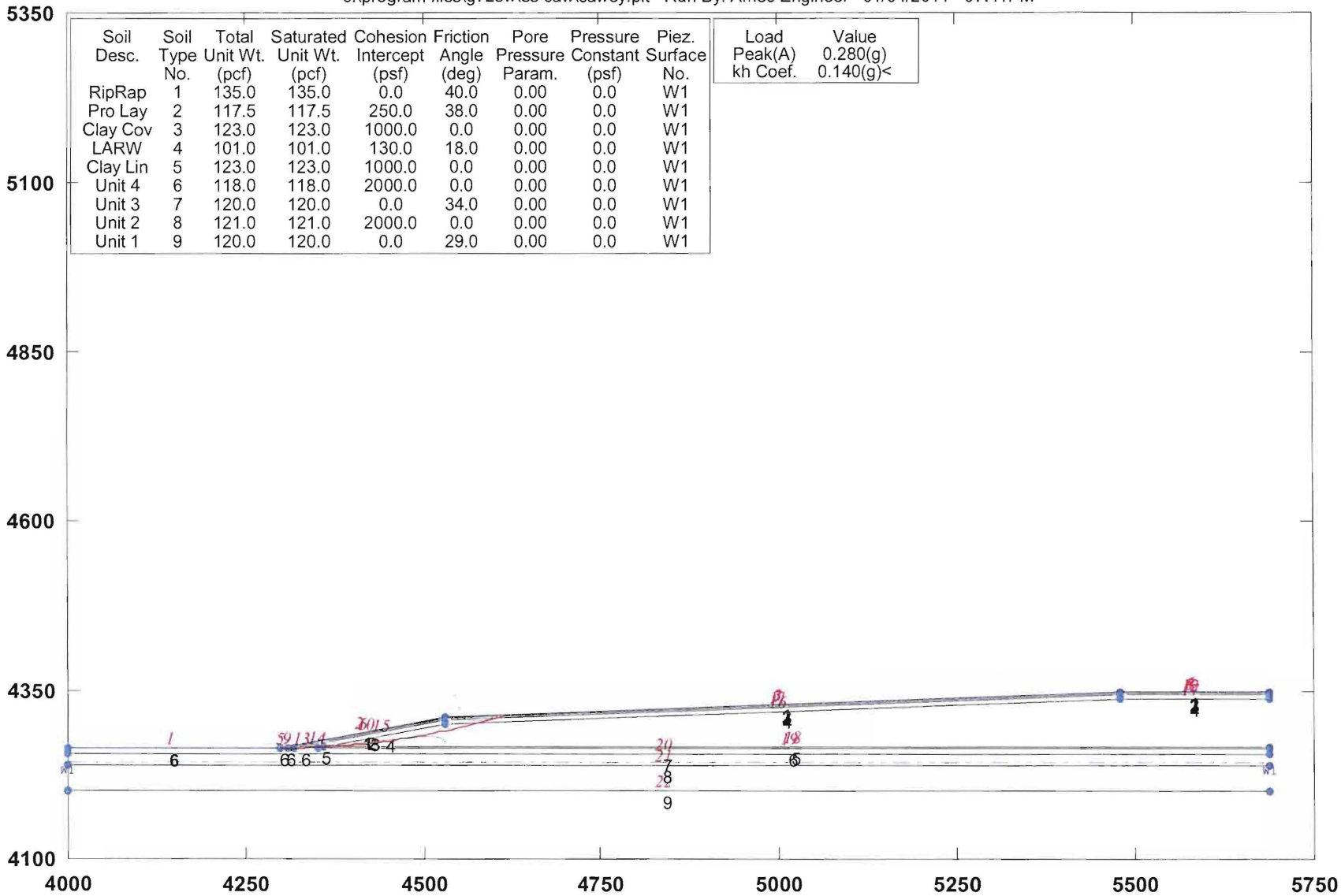
**** END OF GSTABL7 OUTPUT ****

# CAW Emb 38' 5(H):1(V) side-slopes, Yield/Deform, Embankmt 121810 CAWEY

c:\program files\g72sw\es caw\cawey.plt Run By: Amec Engineer 01/04/2011 07:41PM

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |

| Load | Value |
|---|---|
| Peak(A) | 0.280(g) |
| kh Coef. | 0.140(g)< |




**GSTABL7 v.2 FSmin=1.653**

**Factor Of Safety Is Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
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**********
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
**********

Analysis Run Date: 01/04/2011
Time of Run: 07:41PM
Run By: Amec Engineer
Input Data Filename: C:\Program Files\G72SW\ES CAW\cawey.
Output Filename: C:\Program Files\G72SW\ES CAW\cawey.OUT
Unit System: English

Plotted Output Filename: C:\Program Files\G72SW\ES CAW\cawey.PLT

PROBLEM DESCRIPTION: CAW Emb 38' 5(H):1(V) side-slopes,
Yield/Deform, Embankmt 121810 CAWEY

BOUNDARY COORDINATES

4 Top Boundaries
22 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

User Specified Y-Origin = 4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

9 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

Specified Peak Ground Acceleration Coefficient (A) = 0.280(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.140(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

Trial Failure Surface Specified By 42 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.000 | 4265.000 |
| 2 | 4308.000 | 4265.048 |
| 3 | 4315.999 | 4265.156 |
| 4 | 4323.997 | 4265.325 |
| 5 | 4331.994 | 4265.555 |
| 6 | 4339.988 | 4265.844 |
| 7 | 4347.980 | 4266.194 |
| 8 | 4355.970 | 4266.605 |
| 9 | 4363.956 | 4267.076 |
| 10 | 4371.938 | 4267.607 |
| 11 | 4379.917 | 4268.198 |
| 12 | 4387.890 | 4268.850 |
| 13 | 4395.857 | 4269.562 |
| 14 | 4403.821 | 4270.333 |
| 15 | 4411.778 | 4271.166 |
| 16 | 4419.728 | 4272.058 |
| 17 | 4427.671 | 4273.010 |
| 18 | 4435.607 | 4274.022 |
| 19 | 4443.535 | 4275.095 |
| 20 | 4451.454 | 4276.227 |
| 21 | 4459.365 | 4277.417 |
| 22 | 4467.266 | 4278.670 |
| 23 | 4475.158 | 4279.981 |
| 24 | 4483.040 | 4281.352 |
| 25 | 4490.911 | 4282.782 |
| 26 | 4498.771 | 4284.271 |
| 27 | 4506.619 | 4285.820 |
| 28 | 4514.456 | 4287.429 |
| 29 | 4522.280 | 4289.096 |
| 30 | 4530.091 | 4290.823 |
| 31 | 4537.890 | 4292.608 |
| 32 | 4545.674 | 4294.453 |
| 33 | 4553.445 | 4296.355 |
| 34 | 4561.201 | 4298.317 |
| 35 | 4568.941 | 4300.337 |
| 36 | 4576.667 | 4302.417 |
| 37 | 4584.375 | 4304.554 |
| 38 | 4592.069 | 4306.750 |
| 39 | 4599.745 | 4309.003 |
| 40 | 4607.404 | 4311.313 |
| 41 | 4615.045 | 4313.683 |
| 42 | 4617.627 | 4314.505 |

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

| Angle/Segment No. | Deflection(Deg) | Segment Length(ft) |
|---|---|---|
| 1 | 0.43 | 8.00 |
| 2 | 0.44 | 8.00 |
| 3 | 0.44 | 8.00 |

| | | |
|---|---|---|
| 4 | 0.42 | 8.00 |
| 5 | 0.44 | 8.00 |
| 6 | 0.44 | 8.00 |
| 7 | 0.43 | 8.00 |
| 8 | 0.43 | 8.00 |
| 9 | 0.43 | 8.00 |
| 10 | 0.44 | 8.00 |
| 11 | 0.44 | 8.00 |
| 12 | 0.42 | 8.00 |
| 13 | 0.44 | 8.00 |
| 14 | 0.43 | 8.00 |
| 15 | 0.44 | 8.00 |
| 16 | 0.43 | 8.00 |
| 17 | 0.44 | 8.00 |
| 18 | 0.43 | 8.00 |
| 19 | 0.42 | 8.00 |
| 20 | 0.45 | 8.00 |
| 21 | 0.43 | 8.00 |
| 22 | 0.43 | 8.00 |
| 23 | 0.44 | 8.00 |
| 24 | 0.42 | 8.00 |
| 25 | 0.44 | 8.00 |
| 26 | 0.44 | 8.00 |
| 27 | 0.43 | 8.00 |
| 28 | 0.44 | 8.00 |
| 29 | 0.42 | 8.00 |
| 30 | 0.44 | 8.00 |
| 31 | 0.43 | 8.00 |
| 32 | 0.44 | 8.00 |
| 33 | 0.43 | 8.00 |
| 34 | 0.43 | 8.00 |
| 35 | 0.43 | 8.00 |
| 36 | 0.44 | 8.00 |
| 37 | 0.42 | 8.00 |
| 38 | 0.43 | 8.00 |
| 39 | 0.44 | 8.00 |

Circle Center At X = 4297.684(ft) ; Y = 5323.575(ft); and Radius = 1058.577(ft)

| Theta (deg) (ki=1.0) | FOS (Moment) (Equil.) | FOS (Force) (Equil.) | Lambda |
|---|---|---|---|
| 5.68 | 1.656 | 1.652 | 0.099 |
| 8.51 | 1.475 | 1.652 | 0.150 |
| 5.76 | 1.653 | 1.652 | 0.101 |

((Modified Bishop FS for Specified Surface = 1.663))

Factor Of Safety For The Preceding Specified Surface = 1.653
Theta (ki = 1.0) = 5.76 Deg Lambda = 0.101

Factor Of Safety Is Calculated By GLE (Spencer`s) Method (0-1)

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Center of Last Slice = 0.000(ft)

*** Line of Thrust and Slice Force Data ***

| Slice No. | X Coord. | Y Coord. | L/H | Side Force (lbs) | ki | Force Angle (Deg) | Vert. Shear Force(lbs) |
|---|---|---|---|---|---|---|---|
| 1 | 4308.00 | 4265.43 | 0.245 | 320. | 1.000 | 5.76 | 32.2 |
| 2 | 4310.40 | 4265.48 | 0.198 | 533. | 1.000 | 5.76 | 53.8 |
| 3 | 4316.00 | 4265.57 | 0.135 | 2038. | 1.000 | 5.76 | 205.6 |
| 4 | 4319.10 | 4265.71 | 0.137 | 2955. | 1.000 | 5.76 | 298.1 |
| 5 | 4324.00 | 4265.89 | 0.126 | 5520. | 1.000 | 5.76 | 557.0 |
| 6 | 4331.99 | 4266.34 | 0.134 | 9495. | 1.000 | 5.76 | 958.0 |
| 7 | 4339.99 | 4266.85 | 0.141 | 13196. | 1.000 | 5.76 | 1331.5 |
| 8 | 4347.98 | 4267.40 | 0.144 | 16616. | 1.000 | 5.76 | 1676.5 |
| 9 | 4355.97 | 4267.99 | 0.144 | 19747. | 1.000 | 5.76 | 1992.5 |
| 10 | 4360.48 | 4268.33 | 0.143 | 21378. | 1.000 | 5.76 | 2157.1 |
| 11 | 4361.00 | 4268.37 | 0.143 | 21560. | 1.000 | 5.76 | 2175.4 |
| 12 | 4362.67 | 4268.50 | 0.142 | 22144. | 1.000 | 5.76 | 2234.4 |
| 13 | 4363.96 | 4268.62 | 0.144 | 22240. | 1.000 | 5.76 | 2244.0 |
| 14 | 4371.94 | 4269.39 | 0.151 | 22744. | 1.000 | 5.76 | 2294.9 |
| 15 | 4379.92 | 4270.16 | 0.154 | 23145. | 1.000 | 5.76 | 2335.4 |
| 16 | 4387.89 | 4270.94 | 0.152 | 23432. | 1.000 | 5.76 | 2364.3 |
| 17 | 4395.86 | 4271.73 | 0.148 | 23593. | 1.000 | 5.76 | 2380.6 |
| 18 | 4403.82 | 4272.53 | 0.142 | 23624. | 1.000 | 5.76 | 2383.7 |
| 19 | 4411.78 | 4273.35 | 0.135 | 23513. | 1.000 | 5.76 | 2372.5 |
| 20 | 4419.73 | 4274.17 | 0.125 | 23257. | 1.000 | 5.76 | 2346.7 |
| 21 | 4427.67 | 4275.01 | 0.114 | 22848. | 1.000 | 5.76 | 2305.4 |
| 22 | 4435.61 | 4275.86 | 0.101 | 22283. | 1.000 | 5.76 | 2248.4 |
| 23 | 4443.53 | 4276.71 | 0.087 | 21559. | 1.000 | 5.76 | 2175.3 |
| 24 | 4451.45 | 4277.58 | 0.071 | 20675. | 1.000 | 5.76 | 2086.2 |
| 25 | 4459.36 | 4278.44 | 0.052 | 19635. | 1.000 | 5.76 | 1981.2 |
| 26 | 4467.27 | 4279.28 | 0.031 | 18430. | 1.000 | 5.76 | 1859.6 |
| 27 | 4475.16 | 4280.11 | 0.006 | 17070. | 1.000 | 5.76 | 1722.3 |
| 28 | 4483.04 | 4280.89 | -0.023 | 15555. | 1.000 | 5.76 | 1569.5 |
| 29 | 4490.91 | 4281.59 | -0.058 | 13888. | 1.000 | 5.76 | 1401.3 |
| 30 | 4498.77 | 4282.15 | -0.103 | 12079. | 1.000 | 5.76 | 1218.8 |
| 31 | 4506.62 | 4282.46 | -0.164 | 10130. | 1.000 | 5.76 | 1022.1 |
| 32 | 4514.46 | 4282.28 | -0.252 | 8047. | 1.000 | 5.76 | 812.0 |
| 33 | 4522.28 | 4280.96 | -0.400 | 5844. | 1.000 | 5.76 | 589.7 |
| 34 | 4530.00 | 4276.19 | -0.723 | 3552. | 1.000 | 5.76 | 358.4 |
| 35 | 4530.09 | 4276.09 | -0.730 | 3525. | 1.000 | 5.76 | 355.7 |
| 36 | 4537.89 | 4247.05 | -2.435 | 1192. | 1.000 | 5.76 | 120.2 |
| 37 | 4545.67 | 4345.98 | 3.000 | -1055. | 1.000 | 5.76 | -106.5 |
| 38 | 4553.45 | 4312.67 | 1.047 | -3186. | 1.000 | 5.76 | -321.5 |
| 39 | 4561.20 | 4307.41 | 0.653 | -5177. | 1.000 | 5.76 | -522.3 |
| 40 | 4568.94 | 4305.99 | 0.462 | -6997. | 1.000 | 5.76 | -706.0 |
| 41 | 4576.45 | 4305.82 | 0.330 | -8579. | 1.000 | 5.76 | -865.7 |
| 42 | 4576.67 | 4305.85 | 0.329 | -8555. | 1.000 | 5.76 | -863.2 |
| 43 | 4584.38 | 4307.06 | 0.291 | -7382. | 1.000 | 5.76 | -744.8 |
| 44 | 4592.07 | 4308.44 | 0.251 | -5534. | 1.000 | 5.76 | -558.3 |
| 45 | 4599.75 | 4310.05 | 0.218 | -2961. | 1.000 | 5.76 | -298.8 |
| 46 | 4604.66 | 4311.78 | 0.371 | -908. | 1.000 | 5.76 | -91.6 |
| 47 | 4607.40 | 4312.92 | 0.578 | -493. | 1.000 | 5.76 | -49.8 |
| 48 | 4610.30 | 4321.94 | 4.862 | -64. | 1.000 | 5.76 | -6.5 |
| 49 | 4615.04 | 4329.28 | 21.684 | -37. | 1.000 | 5.76 | -3.7 |
| 50 | 4617.63 | 4330.88 | 0.000 | -34. | 1.000 | 5.76 | -3.4 |

***Table 1 - Individual data on the 50 slices***

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.0 | 837.9 | 0.0 | 0.0 | 0.0 | 0.0 | 117.3 | 0.0 | 0.0 |
| 2 | 2.4 | 575.9 | 0.0 | 0.0 | 0.0 | 0.0 | 80.6 | 0.0 | 0.0 |
| 3 | 5.6 | 1854.5 | 0.0 | 0.0 | 0.0 | 0.0 | 259.6 | 0.0 | 0.0 |
| 4 | 3.1 | 1320.8 | 0.0 | 0.0 | 0.0 | 0.0 | 184.9 | 0.0 | 0.0 |
| 5 | 4.9 | 2503.9 | 0.0 | 0.0 | 0.0 | 0.0 | 350.5 | 0.0 | 0.0 |
| 6 | 8.0 | 5197.0 | 0.0 | 0.0 | 0.0 | 0.0 | 727.6 | 0.0 | 0.0 |
| 7 | 8.0 | 6512.2 | 0.0 | 0.0 | 0.0 | 0.0 | 911.7 | 0.0 | 0.0 |
| 8 | 8.0 | 7768.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1087.6 | 0.0 | 0.0 |
| 9 | 8.0 | 8962.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1254.7 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 4.5 | 5570.9 | 0.0 | 0.0 | 0.0 | 0.0 | 779.9 | 0.0 | 0.0 |
| 11 | 0.5 | 658.7 | 0.0 | 0.0 | 0.0 | 0.0 | 92.2 | 0.0 | 0.0 |
| 12 | 1.7 | 2160.9 | 0.0 | 0.0 | 0.0 | 0.0 | 302.5 | 0.0 | 0.0 |
| 13 | 1.3 | 1686.0 | 0.0 | 0.0 | 0.0 | 0.0 | 236.0 | 0.0 | 0.0 |
| 14 | 8.0 | 10983.6 | 0.0 | 0.0 | 0.0 | 0.0 | 1537.7 | 0.0 | 0.0 |
| 15 | 8.0 | 11816.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1654.3 | 0.0 | 0.0 |
| 16 | 8.0 | 12594.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1763.2 | 0.0 | 0.0 |
| 17 | 8.0 | 13322.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1865.1 | 0.0 | 0.0 |
| 18 | 8.0 | 14002.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1960.3 | 0.0 | 0.0 |
| 19 | 8.0 | 14628.8 | 0.0 | 0.0 | 0.0 | 0.0 | 2048.0 | 0.0 | 0.0 |
| 20 | 8.0 | 15203.8 | 0.0 | 0.0 | 0.0 | 0.0 | 2128.5 | 0.0 | 0.0 |
| 21 | 7.9 | 15727.9 | 0.0 | 0.0 | 0.0 | 0.0 | 2201.9 | 0.0 | 0.0 |
| 22 | 7.9 | 16202.7 | 0.0 | 0.0 | 0.0 | 0.0 | 2268.4 | 0.0 | 0.0 |
| 23 | 7.9 | 16623.5 | 0.0 | 0.0 | 0.0 | 0.0 | 2327.3 | 0.0 | 0.0 |
| 24 | 7.9 | 16993.6 | 0.0 | 0.0 | 0.0 | 0.0 | 2379.1 | 0.0 | 0.0 |
| 25 | 7.9 | 17316.5 | 0.0 | 0.0 | 0.0 | 0.0 | 2424.3 | 0.0 | 0.0 |
| 26 | 7.9 | 17584.6 | 0.0 | 0.0 | 0.0 | 0.0 | 2461.8 | 0.0 | 0.0 |
| 27 | 7.9 | 17802.8 | 0.0 | 0.0 | 0.0 | 0.0 | 2492.4 | 0.0 | 0.0 |
| 28 | 7.9 | 17973.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2516.2 | 0.0 | 0.0 |
| 29 | 7.9 | 18087.4 | 0.0 | 0.0 | 0.0 | 0.0 | 2532.2 | 0.0 | 0.0 |
| 30 | 7.9 | 18156.7 | 0.0 | 0.0 | 0.0 | 0.0 | 2541.9 | 0.0 | 0.0 |
| 31 | 7.8 | 18171.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2543.9 | 0.0 | 0.0 |
| 32 | 7.8 | 18140.6 | 0.0 | 0.0 | 0.0 | 0.0 | 2539.7 | 0.0 | 0.0 |
| 33 | 7.8 | 18058.2 | 0.0 | 0.0 | 0.0 | 0.0 | 2528.1 | 0.0 | 0.0 |
| 34 | 7.7 | 17714.8 | 0.0 | 0.0 | 0.0 | 0.0 | 2480.1 | 0.0 | 0.0 |
| 35 | 0.1 | 207.6 | 0.0 | 0.0 | 0.0 | 0.0 | 29.1 | 0.0 | 0.0 |
| 36 | 7.8 | 17240.3 | 0.0 | 0.0 | 0.0 | 0.0 | 2413.6 | 0.0 | 0.0 |
| 37 | 7.8 | 16025.9 | 0.0 | 0.0 | 0.0 | 0.0 | 2243.6 | 0.0 | 0.0 |
| 38 | 7.8 | 14772.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2068.1 | 0.0 | 0.0 |
| 39 | 7.8 | 13473.9 | 0.0 | 0.0 | 0.0 | 0.0 | 1886.3 | 0.0 | 0.0 |
| 40 | 7.7 | 12130.9 | 0.0 | 0.0 | 0.0 | 0.0 | 1698.3 | 0.0 | 0.0 |
| 41 | 7.5 | 10468.3 | 0.0 | 0.0 | 0.0 | 0.0 | 1465.6 | 0.0 | 0.0 |
| 42 | 0.2 | 283.4 | 0.0 | 0.0 | 0.0 | 0.0 | 39.7 | 0.0 | 0.0 |
| 43 | 7.7 | 9162.6 | 0.0 | 0.0 | 0.0 | 0.0 | 1282.8 | 0.0 | 0.0 |
| 44 | 7.7 | 7386.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1034.0 | 0.0 | 0.0 |
| 45 | 7.7 | 5559.2 | 0.0 | 0.0 | 0.0 | 0.0 | 778.3 | 0.0 | 0.0 |
| 46 | 4.9 | 2583.7 | 0.0 | 0.0 | 0.0 | 0.0 | 361.7 | 0.0 | 0.0 |
| 47 | 2.7 | 1107.8 | 0.0 | 0.0 | 0.0 | 0.0 | 155.1 | 0.0 | 0.0 |
| 48 | 2.9 | 915.6 | 0.0 | 0.0 | 0.0 | 0.0 | 128.2 | 0.0 | 0.0 |
| 49 | 4.7 | 870.8 | 0.0 | 0.0 | 0.0 | 0.0 | 121.9 | 0.0 | 0.0 |
| 50 | 2.6 | 125.4 | 0.0 | 0.0 | 0.0 | 0.0 | 17.6 | 0.0 | 0.0 |

- TABLE 2 - Base Stress Data on the 50 Slices -

| Slice No. * | Alpha (deg) | X-Coord. Slice Cntr (ft) | Base Leng. (ft) | Total Normal Stress (psf) | Total Vert. Stress (psf) | Mobilized Shear Stress (psf) |
|---|---|---|---|---|---|---|
| 1 | 0.34 | 4304.00 | 8.00 | 108.42 | 104.74 | 55.05 |
| 2 | 0.77 | 4309.20 | 2.40 | 247.05 | 239.79 | 125.43 |
| 3 | 0.77 | 4313.20 | 5.60 | 354.02 | 331.30 | 318.63 |
| 4 | 1.21 | 4317.55 | 3.11 | 447.28 | 425.21 | 362.72 |
| 5 | 1.21 | 4321.55 | 4.89 | 551.64 | 511.66 | 605.07 |
| 6 | 1.65 | 4328.00 | 8.00 | 682.36 | 649.60 | 605.07 |
| 7 | 2.07 | 4335.99 | 8.00 | 839.23 | 814.09 | 605.07 |
| 8 | 2.51 | 4343.98 | 8.00 | 988.45 | 971.07 | 605.07 |
| 9 | 2.95 | 4351.97 | 8.00 | 1129.95 | 1120.27 | 605.07 |
| 10 | 3.37 | 4358.23 | 4.52 | 1234.57 | 1231.82 | 605.07 |
| 11 | 3.37 | 4360.74 | 0.52 | 1277.31 | 1275.35 | 605.07 |
| 12 | 3.37 | 4361.84 | 1.67 | 1292.34 | 1290.66 | 605.07 |
| 13 | 3.37 | 4363.31 | 1.29 | 1300.68 | 1310.66 | 334.37 |
| 14 | 3.81 | 4367.95 | 8.00 | 1359.37 | 1373.02 | 345.91 |
| 15 | 4.23 | 4375.93 | 8.00 | 1458.93 | 1476.89 | 365.49 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16 | 4.67 | 4383.90 | 8.00 | 1551.84 | 1574.35 | 383.75 |
| 17 | 5.11 | 4391.87 | 8.00 | 1638.21 | 1665.36 | 400.73 |
| 18 | 5.53 | 4399.84 | 8.00 | 1718.39 | 1750.16 | 416.50 |
| 19 | 5.97 | 4407.80 | 8.00 | 1791.99 | 1828.50 | 430.96 |
| 20 | 6.40 | 4415.75 | 8.00 | 1859.33 | 1900.47 | 444.21 |
| 21 | 6.84 | 4423.70 | 8.00 | 1920.28 | 1966.05 | 456.19 |
| 22 | 7.27 | 4431.64 | 8.00 | 1974.96 | 2025.26 | 466.94 |
| 23 | 7.71 | 4439.57 | 8.00 | 2023.24 | 2077.95 | 476.43 |
| 24 | 8.14 | 4447.49 | 8.00 | 2065.42 | 2124.33 | 484.72 |
| 25 | 8.56 | 4455.41 | 8.00 | 2101.67 | 2164.51 | 491.85 |
| 26 | 9.01 | 4463.32 | 8.00 | 2131.32 | 2198.07 | 497.68 |
| 27 | 9.43 | 4471.21 | 8.00 | 2155.15 | 2225.42 | 502.36 |
| 28 | 9.86 | 4479.10 | 8.00 | 2172.91 | 2246.46 | 505.86 |
| 29 | 10.30 | 4486.98 | 8.00 | 2184.47 | 2261.04 | 508.13 |
| 30 | 10.72 | 4494.84 | 8.00 | 2190.35 | 2269.57 | 509.28 |
| 31 | 11.16 | 4502.69 | 8.00 | 2190.03 | 2271.65 | 509.22 |
| 32 | 11.60 | 4510.54 | 8.00 | 2183.79 | 2267.47 | 507.99 |
| 33 | 12.03 | 4518.37 | 8.00 | 2171.85 | 2257.19 | 505.65 |
| 34 | 12.47 | 4526.14 | 7.91 | 2153.91 | 2240.63 | 502.12 |
| 35 | 12.47 | 4530.05 | 0.09 | 2145.56 | 2231.97 | 500.48 |
| 36 | 12.89 | 4533.99 | 8.00 | 2069.46 | 2154.90 | 485.52 |
| 37 | 13.33 | 4541.78 | 8.00 | 1921.63 | 2003.30 | 456.45 |
| 38 | 13.76 | 4549.56 | 8.00 | 1768.97 | 1846.37 | 426.44 |
| 39 | 14.19 | 4557.32 | 8.00 | 1611.35 | 1684.10 | 395.45 |
| 40 | 14.63 | 4565.07 | 8.00 | 1448.85 | 1516.54 | 363.51 |
| 41 | 15.06 | 4572.70 | 7.78 | 1283.90 | 1346.25 | 331.08 |
| 42 | 15.06 | 4576.56 | 0.23 | 1152.69 | 1259.38 | 605.07 |
| 43 | 15.50 | 4580.52 | 8.00 | 1036.15 | 1145.43 | 605.07 |
| 44 | 15.93 | 4588.22 | 8.00 | 811.43 | 923.17 | 605.07 |
| 45 | 16.36 | 4595.91 | 8.00 | 580.26 | 694.89 | 605.07 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 46 | 16.79 | 4602.20 | 5.14 | 384.78 | 503.01 | 605.07 |
| 47 | 16.79 | 4606.03 | 2.86 | 327.06 | 386.91 | 305.88 |
| 48 | 17.23 | 4608.85 | 3.03 | 247.66 | 301.83 | 268.35 |
| 49 | 17.23 | 4612.67 | 4.97 | 159.11 | 175.34 | 80.78 |
| 50 | 17.65 | 4616.34 | 2.71 | 41.92 | 46.29 | 21.28 |

```
        *** SEISMIC SLOPE DISPLACEMENT DATA ***
(Note: kv is set = zero for displacement calculations)
Seismic Yield Coefficient (ky) =  0.3296(g)
Calculated Newmark Seismic Displacement =   0.020(ft)

Non-Symmetrical Sliding Resistance Has Been Specified
for Downhill Sliding.

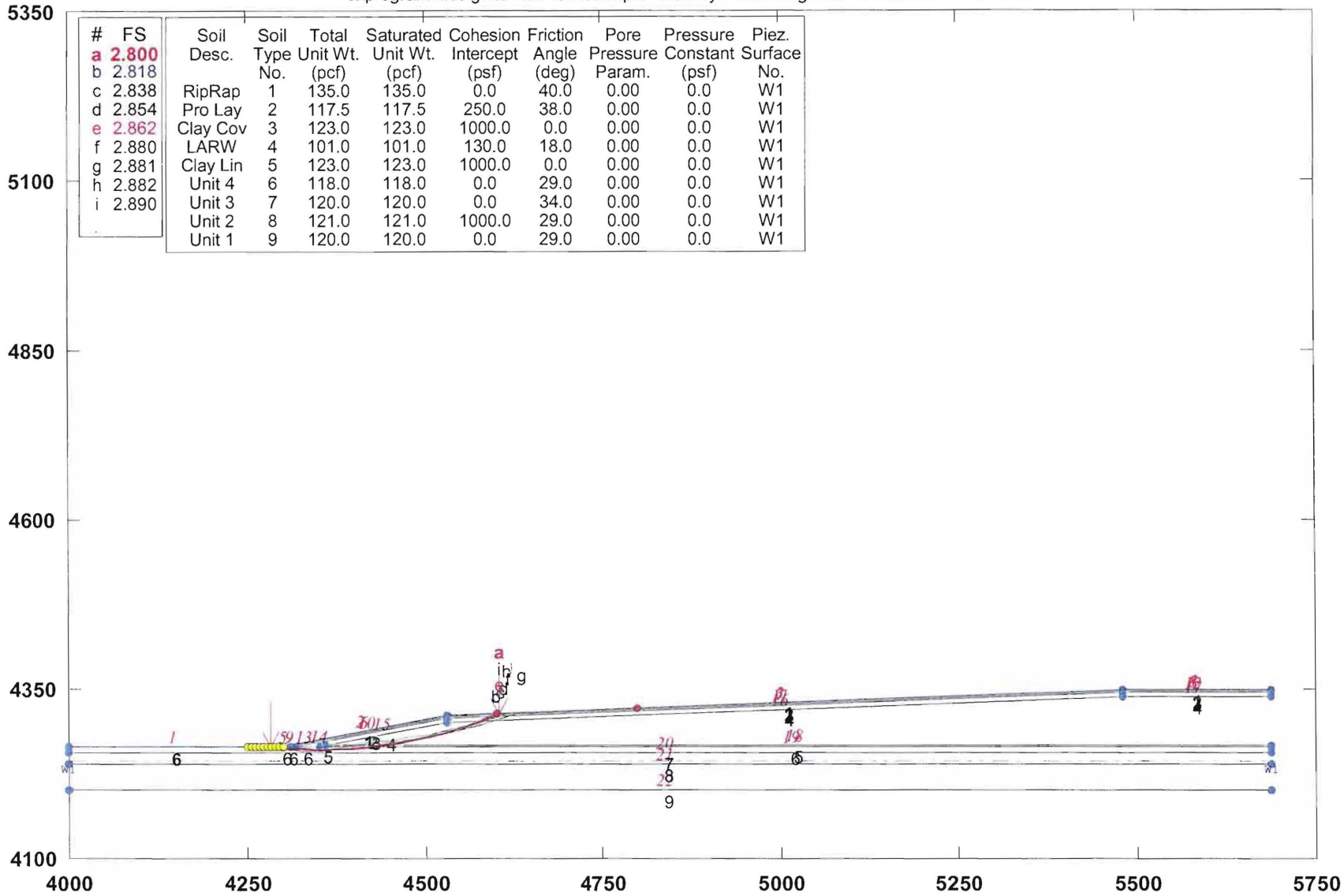
                **** END OF GSTABL7 OUTPUT ****
```

# CAW Emb 38' 5(H):1(V) side-slopes, Static, Deep Surf 121810 CAWF.DTA

c:\program files\g72sw\es caw\cawf.pl2 Run By: Amec Engineer 01/29/2011 12:47PM

| # | FS |
|---|---|
| a | 2.800 |
| b | 2.818 |
| c | 2.838 |
| d | 2.854 |
| e | 2.862 |
| f | 2.880 |
| g | 2.881 |
| h | 2.882 |
| i | 2.890 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 1000.0 | 29.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |



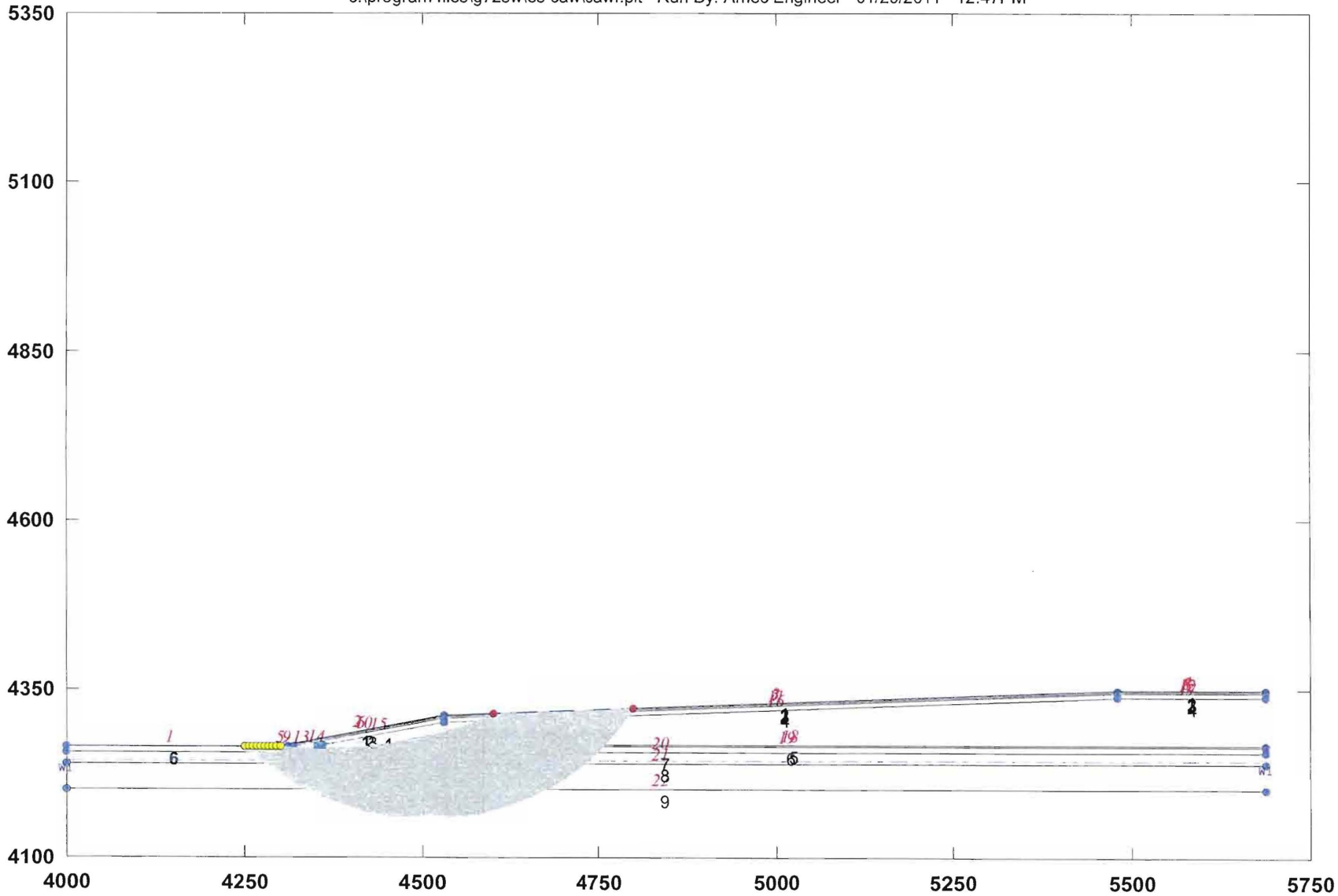

GSTABL7 v.2 FSmin=2.800

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2)

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, Static, Deep Surf 121810 CAWF.DTA

c:\program files\g72sw\es caw\cawf.plt Run By: Amec Engineer 01/29/2011 12:47PM




GSTABL7

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
(All Rights Reserved-Unauthorized Use Prohibited)

**********
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
**********

Analysis Run Date: 01/29/2011
Time of Run: 12:47PM
Run By: Amec Engineer
Input Data Filename: C:\Program Files\G72SW\ES CAW\cawf.
Output Filename: C:\Program Files\G72SW\ES CAW\cawf.OUT
Unit System: English

Plotted Output Filename: C:\Program Files\G72SW\ES CAW\cawf.PLT

PROBLEM DESCRIPTION: CAW Emb 38' 5(H):1(V) side-slopes,
Static, Deep Surf 121810 CAWF.DTA

BOUNDARY COORDINATES

4 Top Boundaries
22 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

User Specified Y-Origin = 4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

9 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 1000.0 | 29.0 | 0.00 | 0.0 | 1 |

```
  9   120.0    120.0       0.0     29.0    0.00       0.0      1
1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water =  62.40 (pcf)

Piezometric Surface No.  1 Specified by  2 Coordinate Points
Pore Pressure Inclination Factor =  0.50

  Point       X-Water      Y-Water
   No.          (ft)         (ft)

    1        4000.00      4243.00
    2        5689.00      4243.00
1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

4000 Trial Surfaces Have Been Generated.

 400 Surface(s) Initiate(s) From Each Of    10 Points Equally Spaced
Along The Ground Surface Between  X =4250.00(ft)
                              and  X =4300.00(ft)

Each Surface Terminates Between   X =4600.00(ft)
                              and   X =4800.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is  Y =       0.00(ft)

20.00(ft) Line Segments Define Each Trial Failure Surface.



Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-2) * *


Selected ki function = Bi-linear

Selected Lambda Coefficient =  1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.


Specified Tension Crack Water Force Factor =   0.000

Total Number of Trial Surfaces Attempted =  4000

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS =   12

Number of Trial Surfaces With Valid FS = 3988

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted =   0.3 %

Statistical Data On All Valid FS Values:
   FS Max =   6.700   FS Min =   2.800   FS Ave =   5.375
   Standard Deviation =    0.708   Coefficient of Variation =   13.18 %


          ((Modified Bishop FS for Critical Surface =  2.789))

Failure Surface Specified By 18 Coordinate Points
```

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4283.334 | 4265.000 |
| 2 | 4303.247 | 4263.140 |
| 3 | 4323.209 | 4261.914 |
| 4 | 4343.201 | 4261.323 |
| 5 | 4363.201 | 4261.368 |
| 6 | 4383.189 | 4262.049 |
| 7 | 4403.146 | 4263.365 |
| 8 | 4423.050 | 4265.314 |
| 9 | 4442.883 | 4267.896 |
| 10 | 4462.624 | 4271.106 |
| 11 | 4482.252 | 4274.943 |
| 12 | 4501.749 | 4279.401 |
| 13 | 4521.094 | 4284.478 |
| 14 | 4540.268 | 4290.166 |
| 15 | 4559.251 | 4296.461 |
| 16 | 4578.025 | 4303.356 |
| 17 | 4596.570 | 4310.845 |
| 18 | 4603.591 | 4313.944 |

Circle Center At X = 4351.804 ; Y = 4889.227 ; and Radius = 627.971

*** FOS = 2.800 Theta (ki=1.0) = 8.29 ***
Lambda = 0.146

Individual data on the 28 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 16.7 | 1530.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 2 | 3.2 | 796.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 3 | 6.8 | 2855.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 4 | 8.0 | 5291.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 5 | 5.2 | 4518.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 6 | 20.0 | 24611.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 7 | 9.8 | 15983.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 8 | 8.0 | 14781.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 9 | 2.2 | 4328.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 10 | 20.0 | 42998.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 11 | 20.0 | 48646.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 12 | 16.7 | 43980.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 13 | 3.2 | 8732.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 14 | 12.9 | 35747.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 15 | 6.9 | 19358.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 16 | 19.7 | 56746.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 17 | 19.6 | 57258.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 18 | 19.5 | 56427.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 19 | 19.3 | 54278.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 20 | 8.9 | 24064.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 21 | 10.3 | 25931.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 22 | 19.0 | 40110.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 23 | 15.9 | 24993.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 24 | 2.9 | 3571.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 25 | 16.7 | 13655.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 26 | 1.9 | 761.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 27 | 2.0 | 647.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 28 | 5.0 | 672.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

Failure Surface Specified By 19 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4261.111 | 4265.000 |
| 2 | 4281.007 | 4262.958 |
| 3 | 4300.955 | 4261.514 |
| 4 | 4320.937 | 4260.670 |
| 5 | 4340.935 | 4260.426 |
| 6 | 4360.932 | 4260.782 |
| 7 | 4380.909 | 4261.739 |
| 8 | 4400.849 | 4263.294 |
| 9 | 4420.732 | 4265.448 |
| 10 | 4440.542 | 4268.197 |
| 11 | 4460.261 | 4271.540 |
| 12 | 4479.871 | 4275.473 |
| 13 | 4499.353 | 4279.993 |
| 14 | 4518.691 | 4285.095 |
| 15 | 4537.867 | 4290.776 |
| 16 | 4556.864 | 4297.030 |
| 17 | 4575.665 | 4303.851 |
| 18 | 4594.252 | 4311.233 |
| 19 | 4600.208 | 4313.808 |

Circle Center At X = 4339.066 ; Y = 4926.646 ; and Radius = 666.223

*** FOS = 2.818 Theta (ki=1.0) = 8.24 ***
Lambda = 0.145

1

Failure Surface Specified By 17 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.001 | 4265.000 |
| 2 | 4319.905 | 4263.044 |
| 3 | 4339.866 | 4261.788 |
| 4 | 4359.858 | 4261.231 |
| 5 | 4379.857 | 4261.376 |
| 6 | 4399.839 | 4262.222 |
| 7 | 4419.779 | 4263.768 |
| 8 | 4439.653 | 4266.012 |
| 9 | 4459.436 | 4268.951 |
| 10 | 4479.103 | 4272.581 |
| 11 | 4498.631 | 4276.899 |
| 12 | 4517.997 | 4281.898 |
| 13 | 4537.174 | 4287.574 |
| 14 | 4556.142 | 4293.918 |
| 15 | 4574.875 | 4300.923 |
| 16 | 4593.351 | 4308.581 |
| 17 | 4605.252 | 4314.010 |

Circle Center At X = 4365.726 ; Y = 4831.679 ; and Radius = 570.477

*** FOS = 2.838 Theta (ki=1.0) = 8.32 ***
Lambda = 0.146

Failure Surface Specified By 18 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4288.890 | 4265.000 |
| 2 | 4308.794 | 4263.045 |
| 3 | 4328.751 | 4261.736 |
| 4 | 4348.740 | 4261.074 |
| 5 | 4368.740 | 4261.059 |
| 6 | 4388.730 | 4261.691 |
| 7 | 4408.689 | 4262.970 |
| 8 | 4428.597 | 4264.894 |
| 9 | 4448.431 | 4267.462 |
| 10 | 4468.172 | 4270.670 |
| 11 | 4487.799 | 4274.516 |
| 12 | 4507.292 | 4278.995 |
| 13 | 4526.628 | 4284.103 |
| 14 | 4545.790 | 4289.833 |
| 15 | 4564.755 | 4296.182 |
| 16 | 4583.506 | 4303.140 |
| 17 | 4602.021 | 4310.702 |
| 18 | 4609.836 | 4314.193 |

Circle Center At X = 4359.225 ; Y = 4877.673 ; and Radius = 616.697

*** FOS = 2.854 Theta (ki=1.0) = 8.24 ***
Lambda = 0.145

1

Failure Surface Specified By 18 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4277.778 | 4265.000 |
| 2 | 4297.644 | 4262.685 |
| 3 | 4317.577 | 4261.043 |
| 4 | 4337.553 | 4260.077 |
| 5 | 4357.551 | 4259.787 |
| 6 | 4377.547 | 4260.174 |
| 7 | 4397.519 | 4261.237 |
| 8 | 4417.443 | 4262.976 |
| 9 | 4437.297 | 4265.388 |
| 10 | 4457.059 | 4268.471 |
| 11 | 4476.704 | 4272.220 |
| 12 | 4496.211 | 4276.631 |
| 13 | 4515.558 | 4281.701 |

| | | |
|---|---|---|
| 14 | 4534.722 | 4287.422 |
| 15 | 4553.682 | 4293.788 |
| 16 | 4572.415 | 4300.792 |
| 17 | 4590.901 | 4308.427 |
| 18 | 4603.025 | 4313.921 |

Circle Center At X = 4356.115 ; Y = 4849.832 ; and Radius = 590.055

*** FOS = 2.862 Theta (ki=1.0) = 8.47 ***
Lambda = 0.149

Failure Surface Specified By 18 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.001 | 4265.000 |
| 2 | 4320.000 | 4264.754 |
| 3 | 4339.999 | 4264.952 |
| 4 | 4359.988 | 4265.593 |
| 5 | 4379.959 | 4266.677 |
| 6 | 4399.901 | 4268.204 |
| 7 | 4419.804 | 4270.172 |
| 8 | 4439.658 | 4272.581 |
| 9 | 4459.454 | 4275.429 |
| 10 | 4479.182 | 4278.716 |
| 11 | 4498.833 | 4282.439 |
| 12 | 4518.396 | 4286.597 |
| 13 | 4537.861 | 4291.187 |
| 14 | 4557.221 | 4296.208 |
| 15 | 4576.464 | 4301.657 |
| 16 | 4595.582 | 4307.531 |
| 17 | 4614.565 | 4313.827 |
| 18 | 4616.320 | 4314.453 |

Circle Center At X = 4321.118 ; Y = 5166.305 ; and Radius = 901.553

*** FOS = 2.880 Theta (ki=1.0) = 7.40 ***
Lambda = 0.130

1

Failure Surface Specified By 19 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.001 | 4265.000 |
| 2 | 4319.992 | 4264.415 |
| 3 | 4339.992 | 4264.272 |
| 4 | 4359.989 | 4264.571 |
| 5 | 4379.976 | 4265.312 |
| 6 | 4399.940 | 4266.495 |
| 7 | 4419.875 | 4268.119 |
| 8 | 4439.768 | 4270.183 |
| 9 | 4459.610 | 4272.687 |
| 10 | 4479.393 | 4275.628 |
| 11 | 4499.106 | 4279.006 |
| 12 | 4518.739 | 4282.819 |
| 13 | 4538.283 | 4287.065 |
| 14 | 4557.729 | 4291.742 |
| 15 | 4577.066 | 4296.848 |
| 16 | 4596.286 | 4302.380 |
| 17 | 4615.378 | 4308.336 |
| 18 | 4634.335 | 4314.712 |
| 19 | 4635.771 | 4315.231 |

Circle Center At X = 4336.459 ; Y = 5168.918 ; and Radius = 904.653

*** FOS = 2.881 Theta (ki=1.0) = 7.19 ***
Lambda = 0.126

Failure Surface Specified By 18 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4300.001 | 4265.000 |
| 2 | 4319.915 | 4263.144 |
| 3 | 4339.878 | 4261.942 |
| 4 | 4359.871 | 4261.396 |
| 5 | 4379.871 | 4261.507 |
| 6 | 4399.856 | 4262.275 |

| | | |
|---|---|---|
| 7 | 4419.805 | 4263.698 |
| 8 | 4439.697 | 4265.775 |
| 9 | 4459.510 | 4268.504 |
| 10 | 4479.223 | 4271.882 |
| 11 | 4498.814 | 4275.905 |
| 12 | 4518.263 | 4280.569 |
| 13 | 4537.548 | 4285.870 |
| 14 | 4556.648 | 4291.800 |
| 15 | 4575.544 | 4298.354 |
| 16 | 4594.214 | 4305.525 |
| 17 | 4612.639 | 4313.305 |
| 18 | 4615.014 | 4314.400 |

Circle Center At X = 4366.504 ; Y = 4870.004 ; and Radius = 608.648

*** FOS = 2.882 Theta (ki=1.0) = 8.08 ***
Lambda = 0.142

1

Failure Surface Specified By 20 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4250.000 | 4265.000 |
| 2 | 4269.866 | 4262.685 |
| 3 | 4289.792 | 4260.961 |
| 4 | 4309.760 | 4259.832 |
| 5 | 4329.752 | 4259.296 |
| 6 | 4349.752 | 4259.355 |
| 7 | 4369.742 | 4260.010 |
| 8 | 4389.703 | 4261.258 |
| 9 | 4409.618 | 4263.100 |
| 10 | 4429.469 | 4265.533 |
| 11 | 4449.240 | 4268.556 |
| 12 | 4468.912 | 4272.165 |
| 13 | 4488.467 | 4276.358 |
| 14 | 4507.890 | 4281.130 |
| 15 | 4527.161 | 4286.479 |
| 16 | 4546.265 | 4292.397 |
| 17 | 4565.185 | 4298.882 |
| 18 | 4583.903 | 4305.926 |
| 19 | 4602.403 | 4313.524 |
| 20 | 4603.319 | 4313.933 |

Circle Center At X = 4337.755 ; Y = 4931.399 ; and Radius = 672.152

*** FOS = 2.890 Theta (ki=1.0) = 8.17 ***
Lambda = 0.143

Failure Surface Specified By 20 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4255.556 | 4265.000 |
| 2 | 4275.468 | 4263.133 |
| 3 | 4295.423 | 4261.784 |
| 4 | 4315.406 | 4260.952 |
| 5 | 4335.403 | 4260.638 |
| 6 | 4355.402 | 4260.843 |
| 7 | 4375.389 | 4261.567 |
| 8 | 4395.351 | 4262.809 |
| 9 | 4415.273 | 4264.567 |
| 10 | 4435.143 | 4266.842 |
| 11 | 4454.948 | 4269.631 |
| 12 | 4474.673 | 4272.933 |
| 13 | 4494.307 | 4276.745 |
| 14 | 4513.834 | 4281.065 |
| 15 | 4533.244 | 4285.890 |
| 16 | 4552.521 | 4291.216 |
| 17 | 4571.654 | 4297.041 |
| 18 | 4590.630 | 4303.360 |
| 19 | 4609.435 | 4310.168 |
| 20 | 4620.834 | 4314.633 |

Circle Center At X = 4337.502 ; Y = 5030.872 ; and Radius = 770.244

*** FOS = 2.910 Theta (ki=1.0) = 7.78 ***
Lambda = 0.137

**** END OF GSTABL7 OUTPUT ****

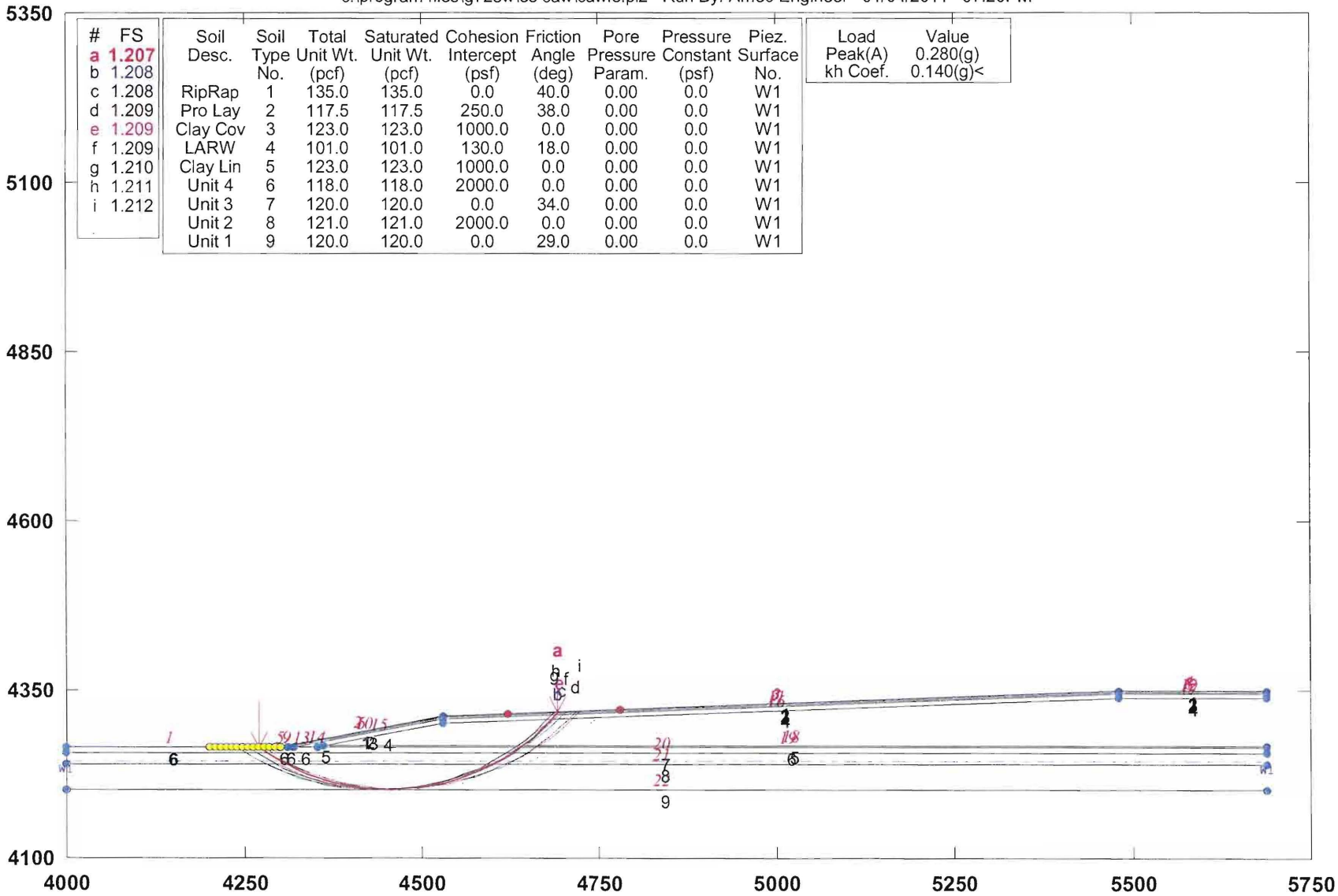
# CAW Emb 38' 5(H):1(V) side-slopes, Pseudostatic, Deep Surf 121810 CAWFS.DTA

c:\program files\g72sw\es caw\cawfs.pl2 Run By: Amec Engineer 01/04/2011 07:20PM

| # | FS |
|---|---|
| a | 1.207 |
| b | 1.208 |
| c | 1.208 |
| d | 1.209 |
| e | 1.209 |
| f | 1.209 |
| g | 1.210 |
| h | 1.211 |
| i | 1.212 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |

| Load | Value |
|---|---|
| Peak(A) | 0.280(g) |
| kh Coef. | 0.140(g)< |



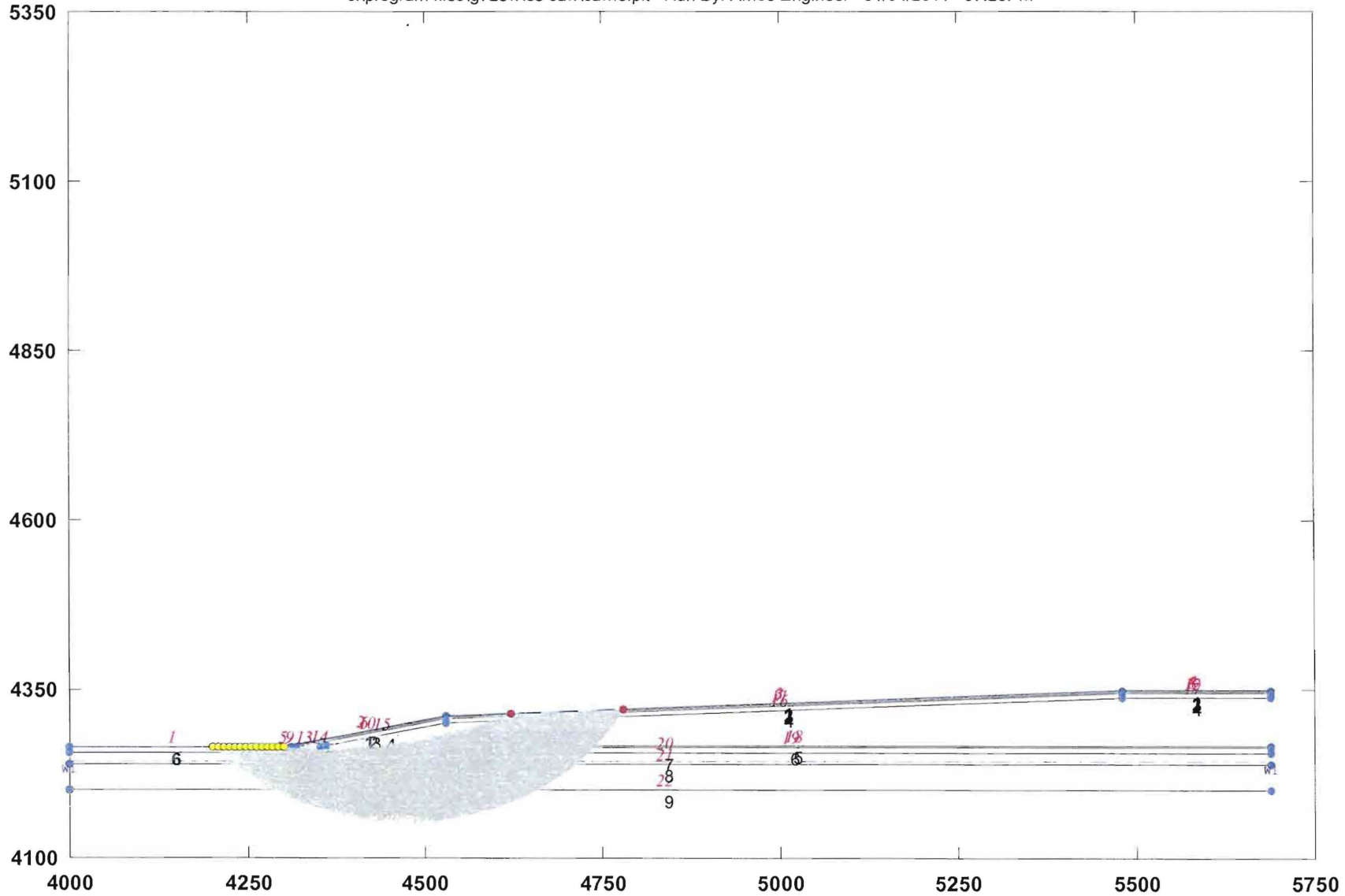

GSTABL7 v.2 FSmin=1.207

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, Pseudostatic, Deep Surf 121810 CAWFS.DTA

c:\program files\g72sw\es caw\cawfs.plt Run By: Amec Engineer 01/04/2011 07:20PM




GSTABL7

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
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**********
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
**********

Analysis Run Date: 01/04/2011
Time of Run: 07:20PM
Run By: Amec Engineer
Input Data Filename: C:\Program Files\G72SW\ES CAW\cawfs.
Output Filename: C:\Program Files\G72SW\ES CAW\cawfs.OUT
Unit System: English

Plotted Output Filename: C:\Program Files\G72SW\ES CAW\cawfs.PLT

PROBLEM DESCRIPTION: CAW Emb 38' 5(H):1(V) side-slopes,
Pseudostatic, Deep Surf 121810 CAWFS.DTA

BOUNDARY COORDINATES

4 Top Boundaries
22 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

User Specified Y-Origin = 4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

9 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

Specified Peak Ground Acceleration Coefficient (A) = 0.280(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.140(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

4200 Trial Surfaces Have Been Generated.

300 Surface(s) Initiate(s) From Each Of 14 Points Equally Spaced
Along The Ground Surface Between X =4200.00(ft)
and X =4300.00(ft)

Each Surface Terminates Between X =4620.00(ft)
and X =4780.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

20.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 4200

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS = 90

Number of Trial Surfaces With Valid FS = 4110

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted = 2.1 %

Statistical Data On All Valid FS Values:
FS Max = 2.972 FS Min = 1.207 FS Ave = 1.765
Standard Deviation = 0.308 Coefficient of Variation = 17.45 %

((Modified Bishop FS for Critical Surface = 1.262))

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4269.231 | 4265.000 |
| 2 | 4285.429 | 4253.268 |
| 3 | 4302.371 | 4242.639 |
| 4 | 4319.982 | 4233.160 |
| 5 | 4338.185 | 4224.874 |
| 6 | 4356.898 | 4217.817 |
| 7 | 4376.040 | 4212.021 |
| 8 | 4395.525 | 4207.511 |
| 9 | 4415.267 | 4204.307 |
| 10 | 4435.178 | 4202.423 |
| 11 | 4455.170 | 4201.868 |
| 12 | 4475.155 | 4202.645 |
| 13 | 4495.044 | 4204.749 |
| 14 | 4514.749 | 4208.171 |
| 15 | 4534.183 | 4212.896 |
| 16 | 4553.259 | 4218.904 |
| 17 | 4571.893 | 4226.168 |
| 18 | 4590.003 | 4234.655 |
| 19 | 4607.508 | 4244.328 |
| 20 | 4624.332 | 4255.144 |
| 21 | 4640.398 | 4267.055 |
| 22 | 4655.636 | 4280.008 |
| 23 | 4669.979 | 4293.947 |
| 24 | 4683.363 | 4308.809 |
| 25 | 4690.125 | 4317.405 |

Circle Center At X = 4453.506 ; Y = 4502.351 ; and Radius = 300.487

*** FOS = 1.207 Theta (ki=1.0) = 1.78 ***
Lambda = 0.031

Individual data on the 41 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.4 | 6597.6 | 0.0 | 0.0 | 0. | 0. | 923.7 | 0.0 | 0.0 |
| 2 | 3.8 | 4624.8 | 0.0 | 0.0 | 0. | 0. | 647.5 | 0.0 | 0.0 |
| 3 | 14.6 | 28244.8 | 0.0 | 0.0 | 0. | 0. | 3954.3 | 0.0 | 0.0 |
| 4 | 1.8 | 4627.3 | 0.0 | 0.0 | 0. | 0. | 647.8 | 0.0 | 0.0 |
| 5 | 0.6 | 1555.6 | 0.0 | 7.7 | 0. | 0. | 217.8 | 0.0 | 0.0 |
| 6 | 6.8 | 20545.8 | 0.0 | 1044.7 | 0. | 0. | 2876.4 | 0.0 | 0.0 |
| 7 | 0.9 | 2943.4 | 0.0 | 260.6 | 0. | 0. | 412.1 | 0.0 | 0.0 |
| 8 | 8.0 | 30264.1 | 0.0 | 3753.0 | 0. | 0. | 4237.0 | 0.0 | 0.0 |
| 9 | 2.0 | 8376.6 | 0.0 | 1307.1 | 0. | 0. | 1172.7 | 0.0 | 0.0 |
| 10 | 18.2 | 91751.8 | 0.0 | 17450.6 | 0. | 0. | 12845.3 | 0.0 | 0.0 |
| 11 | 14.8 | 93131.5 | 0.0 | 20668.9 | 0. | 0. | 13038.4 | 0.0 | 0.0 |
| 12 | 3.9 | 27067.7 | 0.0 | 6356.0 | 0. | 0. | 3789.5 | 0.0 | 0.0 |
| 13 | 4.1 | 29554.7 | 0.0 | 6900.3 | 0. | 0. | 4137.7 | 0.0 | 0.0 |
| 14 | 15.0 | 116696.3 | 0.0 | 28144.4 | 0. | 0. | 16337.5 | 0.0 | 0.0 |
| 15 | 19.5 | 168676.9 | 0.0 | 41476.0 | 0. | 0. | 23614.8 | 0.0 | 0.0 |
| 16 | 19.7 | 187952.8 | 0.0 | 46290.0 | 0. | 0. | 26313.4 | 0.0 | 0.0 |
| 17 | 19.9 | 203685.7 | 0.0 | 49464.9 | 0. | 0. | 28516.0 | 0.0 | 0.0 |
| 18 | 20.0 | 215537.9 | 0.0 | 50986.1 | 0. | 0. | 30175.3 | 0.0 | 0.0 |
| 19 | 20.0 | 223276.6 | 0.0 | 50847.9 | 0. | 0. | 31258.7 | 0.0 | 0.0 |
| 20 | 19.9 | 226768.1 | 0.0 | 49050.8 | 0. | 0. | 31747.5 | 0.0 | 0.0 |
| 21 | 19.7 | 225977.4 | 0.0 | 45602.1 | 0. | 0. | 31636.8 | 0.0 | 0.0 |
| 22 | 15.3 | 173714.0 | 0.0 | 32295.1 | 0. | 0. | 24320.0 | 0.0 | 0.0 |
| 23 | 4.2 | 47126.4 | 0.0 | 8222.4 | 0. | 0. | 6597.7 | 0.0 | 0.0 |
| 24 | 19.1 | 207724.9 | 0.0 | 33820.1 | 0. | 0. | 29081.5 | 0.0 | 0.0 |
| 25 | 18.6 | 189370.9 | 0.0 | 25538.8 | 0. | 0. | 26511.9 | 0.0 | 0.0 |
| 26 | 18.1 | 168128.2 | 0.0 | 15710.2 | 0. | 0. | 23537.9 | 0.0 | 0.0 |
| 27 | 7.9 | 67313.7 | 0.0 | 3460.7 | 0. | 0. | 9423.9 | 0.0 | 0.0 |
| 28 | 7.2 | 58543.9 | 0.0 | 1032.1 | 0. | 0. | 8196.1 | 0.0 | 0.0 |
| 29 | 2.4 | 18711.8 | 0.0 | 0.0 | 0. | 0. | 2619.7 | 0.0 | 0.0 |
| 30 | 16.8 | 119405.4 | 0.0 | 0.0 | 0. | 0. | 16716.8 | 0.0 | 0.0 |
| 31 | 1.2 | 7432.5 | 0.0 | 0.0 | 0. | 0. | 1040.6 | 0.0 | 0.0 |
| 32 | 12.1 | 71357.6 | 0.0 | 0.0 | 0. | 0. | 9990.1 | 0.0 | 0.0 |
| 33 | 2.7 | 14174.0 | 0.0 | 0.0 | 0. | 0. | 1984.4 | 0.0 | 0.0 |
| 34 | 0.1 | 378.5 | 0.0 | 0.0 | 0. | 0. | 53.0 | 0.0 | 0.0 |
| 35 | 15.2 | 68692.4 | 0.0 | 0.0 | 0. | 0. | 9616.9 | 0.0 | 0.0 |
| 36 | 14.3 | 46034.3 | 0.0 | 0.0 | 0. | 0. | 6444.8 | 0.0 | 0.0 |
| 37 | 11.4 | 21807.6 | 0.0 | 0.0 | 0. | 0. | 3053.1 | 0.0 | 0.0 |
| 38 | 2.0 | 2383.8 | 0.0 | 0.0 | 0. | 0. | 333.7 | 0.0 | 0.0 |
| 39 | 3.9 | 2912.7 | 0.0 | 0.0 | 0. | 0. | 407.8 | 0.0 | 0.0 |
| 40 | 1.2 | 436.3 | 0.0 | 0.0 | 0. | 0. | 61.1 | 0.0 | 0.0 |
| 41 | 1.6 | 219.3 | 0.0 | 0.0 | 0. | 0. | 30.7 | 0.0 | 0.0 |

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4238.462 | 4265.000 |
| 2 | 4255.004 | 4253.759 |
| 3 | 4272.186 | 4243.522 |
| 4 | 4289.946 | 4234.325 |
| 5 | 4308.221 | 4226.200 |
| 6 | 4326.947 | 4219.176 |
| 7 | 4346.058 | 4213.278 |
| 8 | 4365.485 | 4208.527 |
| 9 | 4385.161 | 4204.939 |
| 10 | 4405.015 | 4202.527 |
| 11 | 4424.977 | 4201.300 |
| 12 | 4444.977 | 4201.263 |
| 13 | 4464.944 | 4202.414 |
| 14 | 4484.807 | 4204.751 |
| 15 | 4504.496 | 4208.265 |
| 16 | 4523.941 | 4212.943 |
| 17 | 4543.074 | 4218.769 |
| 18 | 4561.826 | 4225.722 |
| 19 | 4580.132 | 4233.778 |
| 20 | 4597.926 | 4242.909 |
| 21 | 4615.146 | 4253.081 |
| 22 | 4631.731 | 4264.258 |
| 23 | 4647.622 | 4276.403 |
| 24 | 4662.763 | 4289.471 |
| 25 | 4677.100 | 4303.416 |
| 26 | 4689.857 | 4317.395 |

Circle Center At X = 4435.595 ; Y = 4537.291 ; and Radius = 336.160

*** FOS = 1.208 Theta (ki=1.0) = 1.71 ***
Lambda = 0.030

1

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4238.462 | 4265.000 |
| 2 | 4255.112 | 4253.920 |
| 3 | 4272.376 | 4243.822 |
| 4 | 4290.195 | 4234.740 |
| 5 | 4308.509 | 4226.703 |
| 6 | 4327.258 | 4219.739 |
| 7 | 4346.377 | 4213.872 |
| 8 | 4365.805 | 4209.120 |
| 9 | 4385.474 | 4205.499 |
| 10 | 4405.320 | 4203.022 |
| 11 | 4425.276 | 4201.698 |
| 12 | 4445.276 | 4201.530 |
| 13 | 4465.251 | 4202.519 |
| 14 | 4485.136 | 4204.661 |
| 15 | 4504.864 | 4207.951 |
| 16 | 4524.368 | 4212.375 |
| 17 | 4543.584 | 4217.921 |
| 18 | 4562.447 | 4224.569 |
| 19 | 4580.894 | 4232.296 |
| 20 | 4598.862 | 4241.078 |
| 21 | 4616.293 | 4250.885 |
| 22 | 4633.127 | 4261.683 |
| 23 | 4649.309 | 4273.437 |
| 24 | 4664.784 | 4286.107 |
| 25 | 4679.500 | 4299.651 |
| 26 | 4693.407 | 4314.024 |
| 27 | 4696.541 | 4317.662 |

Circle Center At X = 4438.179 ; Y = 4547.084 ; and Radius = 345.627

*** FOS = 1.208 Theta (ki=1.0) = 1.71 ***
Lambda = 0.030

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4269.231 | 4265.000 |
| 2 | 4285.852 | 4253.875 |
| 3 | 4303.107 | 4243.763 |
| 4 | 4320.936 | 4234.700 |
| 5 | 4339.274 | 4226.718 |

| | | |
|---|---|---|
| 6 | 4358.057 | 4219.846 |
| 7 | 4377.216 | 4214.109 |
| 8 | 4396.684 | 4209.526 |
| 9 | 4416.391 | 4206.115 |
| 10 | 4436.266 | 4203.887 |
| 11 | 4456.239 | 4202.851 |
| 12 | 4476.239 | 4203.010 |
| 13 | 4496.193 | 4204.363 |
| 14 | 4516.031 | 4206.906 |
| 15 | 4535.681 | 4210.630 |
| 16 | 4555.074 | 4215.521 |
| 17 | 4574.140 | 4221.562 |
| 18 | 4592.811 | 4228.731 |
| 19 | 4611.020 | 4237.003 |
| 20 | 4628.703 | 4246.348 |
| 21 | 4645.795 | 4256.732 |
| 22 | 4662.237 | 4268.120 |
| 23 | 4677.969 | 4280.469 |
| 24 | 4692.936 | 4293.736 |
| 25 | 4707.082 | 4307.874 |
| 26 | 4716.478 | 4318.459 |

Circle Center At X = 4463.521 ; Y = 4537.145 ; and Radius = 334.381

*** FOS = 1.209 Theta (ki=1.0) = 1.77 ***
Lambda = 0.031

1

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4253.847 | 4265.000 |
| 2 | 4270.308 | 4253.641 |
| 3 | 4287.441 | 4243.324 |
| 4 | 4305.182 | 4234.090 |
| 5 | 4323.461 | 4225.974 |
| 6 | 4342.209 | 4219.007 |
| 7 | 4361.353 | 4213.217 |
| 8 | 4380.818 | 4208.625 |
| 9 | 4400.531 | 4205.248 |
| 10 | 4420.416 | 4203.101 |
| 11 | 4440.395 | 4202.191 |
| 12 | 4460.392 | 4202.522 |
| 13 | 4480.331 | 4204.093 |
| 14 | 4500.133 | 4206.897 |
| 15 | 4519.723 | 4210.924 |
| 16 | 4539.026 | 4216.158 |
| 17 | 4557.968 | 4222.579 |
| 18 | 4576.475 | 4230.162 |
| 19 | 4594.475 | 4238.878 |
| 20 | 4611.900 | 4248.694 |
| 21 | 4628.684 | 4259.572 |
| 22 | 4644.760 | 4271.470 |
| 23 | 4660.067 | 4284.341 |
| 24 | 4674.547 | 4298.138 |
| 25 | 4688.143 | 4312.806 |
| 26 | 4691.964 | 4317.479 |

Circle Center At X = 4444.996 ; Y = 4524.244 ; and Radius = 322.095

*** FOS = 1.209 Theta (ki=1.0) = 1.80 ***
Lambda = 0.031

Failure Surface Specified By 27 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4238.462 | 4265.000 |
| 2 | 4255.222 | 4254.086 |
| 3 | 4272.569 | 4244.133 |
| 4 | 4290.449 | 4235.171 |
| 5 | 4308.805 | 4227.229 |
| 6 | 4327.578 | 4220.333 |
| 7 | 4346.710 | 4214.504 |
| 8 | 4366.139 | 4209.761 |
| 9 | 4385.805 | 4206.119 |
| 10 | 4405.644 | 4203.588 |
| 11 | 4425.594 | 4202.178 |
| 12 | 4445.592 | 4201.893 |
| 13 | 4465.575 | 4202.733 |
| 14 | 4485.478 | 4204.697 |
| 15 | 4505.239 | 4207.777 |
| 16 | 4524.796 | 4211.964 |

| | | |
|---|---|---|
| 17 | 4544.086 | 4217.245 |
| 18 | 4563.048 | 4223.603 |
| 19 | 4581.623 | 4231.017 |
| 20 | 4599.751 | 4239.465 |
| 21 | 4617.375 | 4248.920 |
| 22 | 4634.439 | 4259.351 |
| 23 | 4650.889 | 4270.726 |
| 24 | 4666.673 | 4283.009 |
| 25 | 4681.741 | 4296.160 |
| 26 | 4696.045 | 4310.138 |
| 27 | 4703.166 | 4317.927 |

Circle Center At X = 4440.659 ; Y = 4557.174 ; and Radius = 355.316

*** FOS = 1.209 Theta (ki=1.0) = 1.72 ***
Lambda = 0.030

1

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4253.847 | 4265.000 |
| 2 | 4270.202 | 4253.489 |
| 3 | 4287.258 | 4243.043 |
| 4 | 4304.945 | 4233.707 |
| 5 | 4323.191 | 4225.517 |
| 6 | 4341.922 | 4218.506 |
| 7 | 4361.062 | 4212.704 |
| 8 | 4380.533 | 4208.134 |
| 9 | 4400.255 | 4204.814 |
| 10 | 4420.149 | 4202.758 |
| 11 | 4440.134 | 4201.975 |
| 12 | 4460.128 | 4202.467 |
| 13 | 4480.050 | 4204.233 |
| 14 | 4499.819 | 4207.265 |
| 15 | 4519.354 | 4211.551 |
| 16 | 4538.577 | 4217.074 |
| 17 | 4557.408 | 4223.811 |
| 18 | 4575.771 | 4231.734 |
| 19 | 4593.592 | 4240.812 |
| 20 | 4610.798 | 4251.008 |
| 21 | 4627.319 | 4262.280 |
| 22 | 4643.088 | 4274.582 |
| 23 | 4658.041 | 4287.864 |
| 24 | 4672.116 | 4302.072 |
| 25 | 4685.257 | 4317.149 |
| 26 | 4685.306 | 4317.212 |

Circle Center At X = 4442.417 ; Y = 4515.542 ; and Radius = 313.576

*** FOS = 1.210 Theta (ki=1.0) = 1.80 ***
Lambda = 0.031

Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4276.924 | 4265.000 |
| 2 | 4292.993 | 4253.092 |
| 3 | 4309.843 | 4242.319 |
| 4 | 4327.396 | 4232.732 |
| 5 | 4345.567 | 4224.377 |
| 6 | 4364.271 | 4217.293 |
| 7 | 4383.418 | 4211.514 |
| 8 | 4402.917 | 4207.067 |
| 9 | 4422.677 | 4203.974 |
| 10 | 4442.602 | 4202.249 |
| 11 | 4462.599 | 4201.899 |
| 12 | 4482.573 | 4202.928 |
| 13 | 4502.428 | 4205.330 |
| 14 | 4522.071 | 4209.094 |
| 15 | 4541.408 | 4214.201 |
| 16 | 4560.347 | 4220.628 |
| 17 | 4578.799 | 4228.344 |
| 18 | 4596.675 | 4237.312 |
| 19 | 4613.892 | 4247.490 |
| 20 | 4630.367 | 4258.829 |
| 21 | 4646.021 | 4271.276 |
| 22 | 4660.782 | 4284.771 |
| 23 | 4674.578 | 4299.251 |
| 24 | 4687.344 | 4314.647 |
| 25 | 4689.303 | 4317.372 |

Circle Center At X = 4457.664 ; Y = 4492.106 ; and Radius = 290.249

*** FOS = 1.211 Theta (ki=1.0) = 1.75 ***
Lambda = 0.030

1

Failure Surface Specified By 26 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4269.231 | 4265.000 |
| 2 | 4285.961 | 4254.040 |
| 3 | 4303.299 | 4244.071 |
| 4 | 4321.188 | 4235.127 |
| 5 | 4339.567 | 4227.240 |
| 6 | 4358.374 | 4220.436 |
| 7 | 4377.545 | 4214.736 |
| 8 | 4397.015 | 4210.162 |
| 9 | 4416.718 | 4206.728 |
| 10 | 4436.587 | 4204.445 |
| 11 | 4456.555 | 4203.323 |
| 12 | 4476.555 | 4203.364 |
| 13 | 4496.519 | 4204.568 |
| 14 | 4516.379 | 4206.932 |
| 15 | 4536.067 | 4210.447 |
| 16 | 4555.518 | 4215.102 |
| 17 | 4574.665 | 4220.879 |
| 18 | 4593.444 | 4227.761 |
| 19 | 4611.791 | 4235.724 |
| 20 | 4629.643 | 4244.741 |
| 21 | 4646.940 | 4254.780 |
| 22 | 4663.624 | 4265.809 |
| 23 | 4679.638 | 4277.790 |
| 24 | 4694.928 | 4290.682 |
| 25 | 4709.443 | 4304.442 |
| 26 | 4722.842 | 4318.714 |

Circle Center At X = 4465.844 ; Y = 4546.835 ; and Radius = 343.639

*** FOS = 1.212 Theta (ki=1.0) = 1.79 ***
Lambda = 0.031

Failure Surface Specified By 28 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4261.539 | 4265.000 |
| 2 | 4278.767 | 4254.841 |
| 3 | 4296.476 | 4245.547 |
| 4 | 4314.624 | 4237.141 |
| 5 | 4333.165 | 4229.643 |
| 6 | 4352.055 | 4223.071 |
| 7 | 4371.247 | 4217.443 |
| 8 | 4390.693 | 4212.771 |
| 9 | 4410.348 | 4209.068 |
| 10 | 4430.161 | 4206.342 |
| 11 | 4450.085 | 4204.600 |
| 12 | 4470.071 | 4203.845 |
| 13 | 4490.069 | 4204.081 |
| 14 | 4510.032 | 4205.306 |
| 15 | 4529.909 | 4207.518 |
| 16 | 4549.653 | 4210.710 |
| 17 | 4569.214 | 4214.875 |
| 18 | 4588.545 | 4220.004 |
| 19 | 4607.599 | 4226.083 |
| 20 | 4626.329 | 4233.098 |
| 21 | 4644.688 | 4241.031 |
| 22 | 4662.632 | 4249.863 |
| 23 | 4680.118 | 4259.572 |
| 24 | 4697.101 | 4270.135 |
| 25 | 4713.541 | 4281.525 |
| 26 | 4729.397 | 4293.714 |
| 27 | 4744.630 | 4306.674 |
| 28 | 4758.978 | 4320.159 |

Circle Center At X = 4475.305 ; Y = 4607.802 ; and Radius = 403.991

*** FOS = 1.213 Theta (ki=1.0) = 1.74 ***
Lambda = 0.030

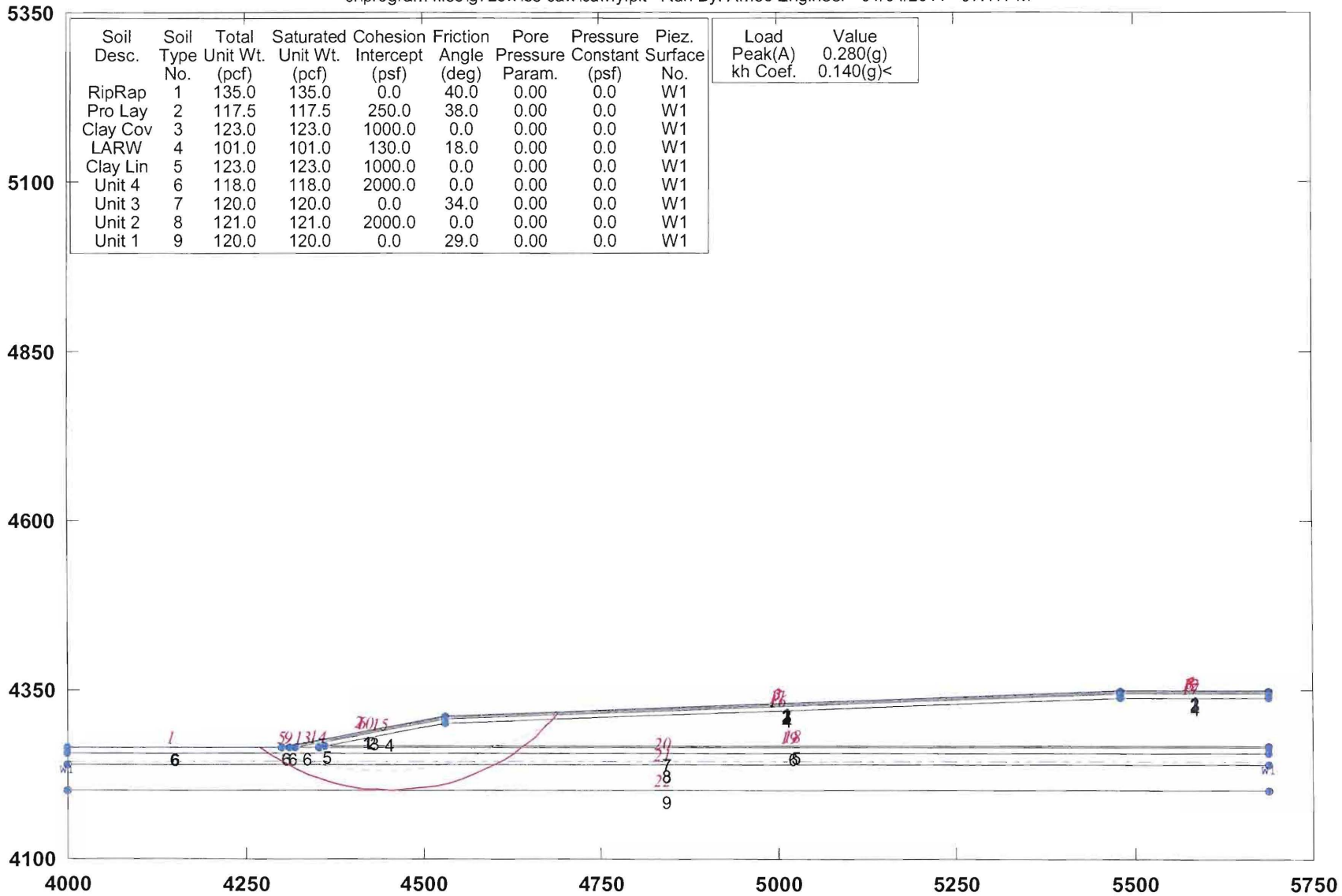
**** END OF GSTABL7 OUTPUT ****

# CAW Emb 38' 5(H):1(V) side-slopes, Yield/Deform, Deep Surf 121810 CAWFY.DTA

c:\program files\g72sw\es caw\cawfy.plt Run By: Amec Engineer 01/04/2011 07:17PM

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |

| Load | Value |
|---|---|
| Peak(A) | 0.280(g) |
| kh Coef. | 0.140(g)< |




**GSTABL7 v.2 FSmin=1.207**

**Factor Of Safety Is Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

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                    *** GSTABL7 ***

              ** GSTABL7 by Garry H. Gregory, P.E. **

   ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
              (All Rights Reserved-Unauthorized Use Prohibited)

*******************************************************************************
                    SLOPE STABILITY ANALYSIS SYSTEM
       Modified Bishop, Simplified Janbu, or GLE Method of Slices.
       (Includes Spencer & Morgenstern-Price Type Analysis)
       Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
       Nonlinear Undrained Shear Strength, Curved Phi Envelope,
       Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
       Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*******************************************************************************

Analysis Run Date:        01/04/2011
Time of Run:              07:17PM
Run By:                   Amec Engineer
Input Data Filename:      C:\Program Files\G72SW\ES CAW\cawfy.
Output Filename:          C:\Program Files\G72SW\ES CAW\cawfy.OUT
Unit System:              English

Plotted Output Filename:  C:\Program Files\G72SW\ES CAW\cawfy.PLT


PROBLEM DESCRIPTION:  CAW Emb 38' 5(H):1(V) side-slopes,
                      Yield/Deform, Deep Surf 121810 CAWFY.DTA


BOUNDARY COORDINATES

    4 Top   Boundaries
   22 Total Boundaries
```

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

```
User Specified Y-Origin =      4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)
```

1

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ISOTROPIC SOIL PARAMETERS

 9 Type(s) of Soil
```

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

Specified Peak Ground Acceleration Coefficient (A) = 0.280(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.140(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

Trial Failure Surface Specified By 25 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4269.231 | 4265.000 |
| 2 | 4285.429 | 4253.268 |
| 3 | 4302.371 | 4242.639 |
| 4 | 4319.982 | 4233.160 |
| 5 | 4338.185 | 4224.874 |
| 6 | 4356.897 | 4217.816 |
| 7 | 4376.040 | 4212.021 |
| 8 | 4395.525 | 4207.511 |
| 9 | 4415.267 | 4204.307 |
| 10 | 4435.178 | 4202.423 |
| 11 | 4455.170 | 4201.868 |
| 12 | 4475.155 | 4202.645 |
| 13 | 4495.044 | 4204.749 |
| 14 | 4514.749 | 4208.171 |
| 15 | 4534.183 | 4212.896 |
| 16 | 4553.259 | 4218.904 |
| 17 | 4571.893 | 4226.168 |
| 18 | 4590.003 | 4234.655 |
| 19 | 4607.508 | 4244.328 |
| 20 | 4624.332 | 4255.144 |
| 21 | 4640.397 | 4267.055 |
| 22 | 4655.636 | 4280.008 |
| 23 | 4669.979 | 4293.947 |
| 24 | 4683.363 | 4308.809 |
| 25 | 4690.125 | 4317.405 |

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

| Angle/Segment No. | Deflection(Deg) | Segment Length(ft) |
|---|---|---|
| 1 | 3.81 | 20.00 |
| 2 | 3.81 | 20.00 |
| 3 | 3.81 | 20.00 |
| 4 | 3.81 | 20.00 |
| 5 | 3.82 | 20.00 |
| 6 | 3.81 | 20.00 |
| 7 | 3.81 | 20.00 |
| 8 | 3.81 | 20.00 |
| 9 | 3.81 | 20.00 |
| 10 | 3.82 | 20.00 |
| 11 | 3.81 | 20.00 |
| 12 | 3.81 | 20.00 |
| 13 | 3.81 | 20.00 |
| 14 | 3.82 | 20.00 |

| | | |
|---|---|---|
| 15 | 3.81 | 20.00 |
| 16 | 3.81 | 20.00 |
| 17 | 3.82 | 20.00 |
| 18 | 3.81 | 20.00 |
| 19 | 3.81 | 20.00 |
| 20 | 3.81 | 20.00 |
| 21 | 3.82 | 20.00 |
| 22 | 3.81 | 20.00 |

Circle Center At X = 4453.506(ft) ; Y = 4502.353(ft); and Radius = 300.489(ft)

| Theta (deg) (ki=1.0) | FOS (Moment) (Equil.) | FOS (Force) (Equil.) | Lambda |
|---|---|---|---|
| 12.63 | 1.083 | 1.261 | 0.224 |
| 18.95 | 0.944 | 1.309 | 0.343 |
| 4.58 | 1.200 | 1.211 | 0.080 |
| 0.00 | 1.248 | 1.185 | 0.000 |
| 3.68 | 1.210 | 1.206 | 0.064 |
| 4.07 | 1.206 | 1.208 | 0.071 |
| 3.95 | 1.207 | 1.207 | 0.069 |

((Modified Bishop FS for Specified Surface = 1.305))

Factor Of Safety For The Preceding Specified Surface = 1.207
Theta (ki = 1.0) = 3.95 Deg Lambda = 0.069

Factor Of Safety Is Calculated By GLE (Spencer`s) Method (0-1)

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 0.45

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Center of Last Slice = 0.000(ft)

*** Line of Thrust and Slice Force Data ***

| Slice No. | X Coord. | Y Coord. | L/H | Side Force (lbs) | ki | Force Angle (Deg) | Vert. Shear Force(lbs) |
|---|---|---|---|---|---|---|---|
| 1 | 4281.66 | 4260.69 | 0.521 | 36070. | 0.450 | 1.78 | 504.4 |
| 2 | 4285.43 | 4259.48 | 0.530 | 46062. | 0.450 | 1.78 | 644.1 |
| 3 | 4300.00 | 4254.18 | 0.481 | 96582. | 0.450 | 1.78 | 1350.5 |
| 4 | 4301.79 | 4253.39 | 0.465 | 104862. | 0.450 | 1.78 | 1466.3 |
| 5 | 4302.37 | 4253.14 | 0.460 | 107633. | 0.450 | 1.78 | 1505.0 |
| 6 | 4309.13 | 4250.65 | 0.419 | 137508. | 0.450 | 1.78 | 1922.8 |
| 7 | 4310.00 | 4250.41 | 0.417 | 140590. | 0.450 | 1.78 | 1965.9 |
| 8 | 4318.00 | 4248.20 | 0.406 | 170244. | 0.450 | 1.78 | 2380.5 |
| 9 | 4319.98 | 4247.63 | 0.404 | 177946. | 0.450 | 1.78 | 2488.2 |
| 10 | 4338.19 | 4243.07 | 0.381 | 244248. | 0.450 | 1.78 | 3415.3 |
| 11 | 4353.00 | 4239.88 | 0.366 | 294986. | 0.450 | 1.78 | 4124.8 |
| 12 | 4356.90 | 4239.03 | 0.362 | 308949. | 0.450 | 1.78 | 4320.0 |
| 13 | 4361.00 | 4238.32 | 0.359 | 321302. | 0.450 | 1.78 | 4492.8 |
| 14 | 4376.04 | 4235.71 | 0.347 | 367957. | 0.450 | 1.78 | 5145.1 |
| 15 | 4395.52 | 4233.18 | 0.335 | 417779. | 0.450 | 1.78 | 5841.8 |
| 16 | 4415.27 | 4231.50 | 0.325 | 455749. | 0.450 | 1.78 | 6372.7 |
| 17 | 4435.18 | 4230.69 | 0.315 | 479868. | 0.450 | 1.78 | 6710.0 |
| 18 | 4455.17 | 4230.78 | 0.307 | 488838. | 0.450 | 1.78 | 6835.4 |
| 19 | 4475.15 | 4231.81 | 0.299 | 482059. | 0.450 | 1.78 | 6740.6 |
| 20 | 4495.04 | 4233.81 | 0.293 | 459705. | 0.450 | 1.78 | 6428.0 |
| 21 | 4514.75 | 4236.84 | 0.287 | 422638. | 0.450 | 1.78 | 5909.7 |
| 22 | 4530.00 | 4240.11 | 0.285 | 383125. | 0.450 | 1.78 | 5357.2 |
| 23 | 4534.18 | 4241.03 | 0.286 | 372484. | 0.450 | 1.78 | 5208.4 |
| 24 | 4553.26 | 4246.43 | 0.296 | 313265. | 0.450 | 1.78 | 4380.4 |
| 25 | 4571.89 | 4253.22 | 0.313 | 249239. | 0.450 | 1.78 | 3485.1 |
| 26 | 4590.00 | 4261.91 | 0.346 | 184415. | 0.450 | 1.78 | 2578.7 |
| 27 | 4597.87 | 4266.88 | 0.373 | 155288. | 0.450 | 1.78 | 2171.4 |
| 28 | 4605.10 | 4268.59 | 0.360 | 146859. | 0.450 | 1.78 | 2053.5 |
| 29 | 4607.51 | 4269.11 | 0.355 | 144325. | 0.450 | 1.78 | 2018.1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30 | 4624.33 | 4273.56 | 0.309 | 120247. | 0.450 | 1.78 | 1681.4 |
| 31 | 4625.49 | 4273.90 | 0.304 | 118255. | 0.450 | 1.78 | 1653.5 |
| 32 | 4637.63 | 4279.11 | 0.280 | 87229. | 0.450 | 1.78 | 1219.7 |
| 33 | 4640.32 | 4280.67 | 0.282 | 78398. | 0.450 | 1.78 | 1096.2 |
| 34 | 4640.40 | 4280.71 | 0.282 | 78209. | 0.450 | 1.78 | 1093.6 |
| 35 | 4655.64 | 4288.65 | 0.240 | 38976. | 0.450 | 1.78 | 545.0 |
| 36 | 4669.98 | 4294.75 | 0.036 | 9762. | 0.450 | 1.78 | 136.5 |
| 37 | 4681.33 | 4310.77 | 0.401 | -5024. | 0.450 | 1.78 | -70.2 |
| 38 | 4683.36 | 4311.38 | 0.309 | -4273. | 0.450 | 1.78 | -59.7 |
| 39 | 4687.28 | 4322.50 | 2.488 | -54. | 0.450 | 1.78 | -0.8 |
| 40 | 4688.50 | 4310.08 | -2.628 | 96. | 0.450 | 1.78 | 1.3 |
| 41 | 4690.12 | 4937.58 | 0.000 | -1. | 0.450 | 1.78 | 0.0 |

***Table 1 - Individual data on the 41 slices***

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 12.4 | 6598.1 | 0.0 | 0.0 | 0.0 | 0.0 | 923.7 | 0.0 | 0.0 |
| 2 | 3.8 | 4624.2 | 0.0 | 0.0 | 0.0 | 0.0 | 647.4 | 0.0 | 0.0 |
| 3 | 14.6 | 28243.9 | 0.0 | 0.0 | 0.0 | 0.0 | 3954.2 | 0.0 | 0.0 |
| 4 | 1.8 | 4628.6 | 0.0 | 0.0 | 0.0 | 0.0 | 648.0 | 0.0 | 0.0 |
| 5 | 0.6 | 1554.3 | 0.0 | 7.7 | 0.0 | 0.0 | 217.6 | 0.0 | 0.0 |
| 6 | 6.8 | 20545.8 | 0.0 | 1044.7 | 0.0 | 0.0 | 2876.4 | 0.0 | 0.0 |
| 7 | 0.9 | 2943.4 | 0.0 | 260.6 | 0.0 | 0.0 | 412.1 | 0.0 | 0.0 |
| 8 | 8.0 | 30264.1 | 0.0 | 3753.0 | 0.0 | 0.0 | 4237.0 | 0.0 | 0.0 |
| 9 | 2.0 | 8376.6 | 0.0 | 1307.1 | 0.0 | 0.0 | 1172.7 | 0.0 | 0.0 |
| 10 | 18.2 | 91756.5 | 0.0 | 17451.8 | 0.0 | 0.0 | 12845.9 | 0.0 | 0.0 |
| 11 | 14.8 | 93130.2 | 0.0 | 20669.6 | 0.0 | 0.0 | 13038.2 | 0.0 | 0.0 |
| 12 | 3.9 | 27061.4 | 0.0 | 6354.8 | 0.0 | 0.0 | 3788.6 | 0.0 | 0.0 |
| 13 | 4.1 | 29562.0 | 0.0 | 6902.1 | 0.0 | 0.0 | 4138.7 | 0.0 | 0.0 |
| 14 | 15.0 | 116697.2 | 0.0 | 28144.3 | 0.0 | 0.0 | 16337.6 | 0.0 | 0.0 |
| 15 | 19.5 | 168676.9 | 0.0 | 41476.0 | 0.0 | 0.0 | 23614.8 | 0.0 | 0.0 |
| 16 | 19.7 | 187957.5 | 0.0 | 46291.1 | 0.0 | 0.0 | 26314.0 | 0.0 | 0.0 |
| 17 | 19.9 | 203680.7 | 0.0 | 49463.7 | 0.0 | 0.0 | 28515.3 | 0.0 | 0.0 |
| 18 | 20.0 | 215537.9 | 0.0 | 50986.1 | 0.0 | 0.0 | 30175.3 | 0.0 | 0.0 |
| 19 | 20.0 | 223276.6 | 0.0 | 50848.0 | 0.0 | 0.0 | 31258.7 | 0.0 | 0.0 |
| 20 | 19.9 | 226766.9 | 0.0 | 49050.2 | 0.0 | 0.0 | 31747.4 | 0.0 | 0.0 |
| 21 | 19.7 | 225977.4 | 0.0 | 45601.9 | 0.0 | 0.0 | 31636.8 | 0.0 | 0.0 |
| 22 | 15.3 | 173714.9 | 0.0 | 32295.1 | 0.0 | 0.0 | 24320.1 | 0.0 | 0.0 |
| 23 | 4.2 | 47132.4 | 0.0 | 8223.5 | 0.0 | 0.0 | 6598.5 | 0.0 | 0.0 |
| 24 | 19.1 | 207721.8 | 0.0 | 33820.7 | 0.0 | 0.0 | 29081.1 | 0.0 | 0.0 |
| 25 | 18.6 | 189366.0 | 0.0 | 25538.5 | 0.0 | 0.0 | 26511.2 | 0.0 | 0.0 |
| 26 | 18.1 | 168133.8 | 0.0 | 15711.1 | 0.0 | 0.0 | 23538.7 | 0.0 | 0.0 |
| 27 | 7.9 | 67309.6 | 0.0 | 3460.5 | 0.0 | 0.0 | 9423.3 | 0.0 | 0.0 |
| 28 | 7.2 | 58544.3 | 0.0 | 1032.4 | 0.0 | 0.0 | 8196.2 | 0.0 | 0.0 |
| 29 | 2.4 | 18711.7 | 0.0 | 0.0 | 0.0 | 0.0 | 2619.6 | 0.0 | 0.0 |
| 30 | 16.8 | 119407.9 | 0.0 | 0.0 | 0.0 | 0.0 | 16717.1 | 0.0 | 0.0 |
| 31 | 1.2 | 7429.3 | 0.0 | 0.0 | 0.0 | 0.0 | 1040.1 | 0.0 | 0.0 |
| 32 | 12.1 | 71357.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9990.0 | 0.0 | 0.0 |
| 33 | 2.7 | 14174.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1984.4 | 0.0 | 0.0 |
| 34 | 0.1 | 378.5 | 0.0 | 0.0 | 0.0 | 0.0 | 53.0 | 0.0 | 0.0 |
| 35 | 15.2 | 68692.4 | 0.0 | 0.0 | 0.0 | 0.0 | 9616.9 | 0.0 | 0.0 |
| 36 | 14.3 | 46034.3 | 0.0 | 0.0 | 0.0 | 0.0 | 6444.8 | 0.0 | 0.0 |
| 37 | 11.4 | 21808.5 | 0.0 | 0.0 | 0.0 | 0.0 | 3053.2 | 0.0 | 0.0 |
| 38 | 2.0 | 2383.8 | 0.0 | 0.0 | 0.0 | 0.0 | 333.7 | 0.0 | 0.0 |
| 39 | 3.9 | 2912.6 | 0.0 | 0.0 | 0.0 | 0.0 | 407.8 | 0.0 | 0.0 |
| 40 | 1.2 | 436.5 | 0.0 | 0.0 | 0.0 | 0.0 | 61.1 | 0.0 | 0.0 |
| 41 | 1.6 | 219.2 | 0.0 | 0.0 | 0.0 | 0.0 | 30.7 | 0.0 | 0.0 |

- TABLE 2 - Base Stress Data on the 41 Slices -

| Slice No. * | Alpha (deg) | X-Coord. Slice Cntr (ft) | Base Leng. (ft) | Total Normal Stress (psf) | Total Vert. Stress (psf) | Mobilized Shear Stress (psf) |
|---|---|---|---|---|---|---|
| 1 | -35.92 | 4275.44 | 15.34 | 1821.11 | 430.05 | 1656.72 |
| 2 | -35.92 | 4283.54 | 4.66 | 2197.55 | 992.87 | 1227.85 |
| 3 | -32.10 | 4292.71 | 17.20 | 3150.39 | 1641.92 | 1760.24 |
| 4 | -32.10 | 4300.90 | 2.12 | 4191.19 | 2184.37 | 2341.77 |
| 5 | -32.10 | 4302.08 | 0.68 | 4381.43 | 2287.04 | 2441.77 |
| 6 | -28.29 | 4305.75 | 7.68 | 4483.59 | 2676.02 | 2429.12 |
| 7 | -28.29 | 4309.57 | 0.99 | 4390.33 | 2983.80 | 1656.72 |
| 8 | -28.29 | 4314.00 | 9.09 | 4789.79 | 3331.19 | 1656.72 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | -28.29 | 4318.99 | 2.25 | 5238.87 | 3721.71 | 1656.72 |
| 10 | -24.48 | 4329.08 | 20.00 | 5908.01 | 4587.70 | 1656.72 |
| 11 | -20.66 | 4345.59 | 15.83 | 7017.42 | 5881.84 | 1656.72 |
| 12 | -20.66 | 4354.95 | 4.17 | 7679.41 | 6496.67 | 1656.72 |
| 13 | -16.84 | 4358.95 | 4.29 | 7800.88 | 6896.65 | 1656.72 |
| 14 | -16.84 | 4368.52 | 15.71 | 8357.02 | 7426.23 | 1656.72 |
| 15 | -13.03 | 4385.78 | 20.00 | 9119.72 | 8433.82 | 1656.72 |
| 16 | -9.22 | 4405.40 | 20.00 | 9849.21 | 9397.63 | 1656.72 |
| 17 | -5.40 | 4425.22 | 20.00 | 10424.11 | 10184.26 | 1656.72 |
| 18 | -1.59 | 4445.17 | 20.00 | 10841.04 | 10776.95 | 1656.72 |
| 19 | 2.23 | 4465.16 | 20.00 | 11097.31 | 11163.84 | 1656.72 |
| 20 | 6.04 | 4485.10 | 20.00 | 11191.37 | 11338.27 | 1656.72 |
| 21 | 9.85 | 4504.90 | 20.00 | 11121.86 | 11298.88 | 1656.72 |
| 22 | 13.66 | 4522.37 | 15.70 | 10907.18 | 11068.03 | 1656.72 |
| 23 | 13.66 | 4532.09 | 4.30 | 10785.55 | 10948.44 | 1656.72 |
| 24 | 17.48 | 4543.72 | 20.00 | 10271.12 | 10386.33 | 1656.72 |
| 25 | 21.30 | 4562.58 | 20.00 | 9409.93 | 9468.46 | 1656.72 |
| 26 | 25.11 | 4580.95 | 20.00 | 8396.31 | 8406.58 | 1656.72 |
| 27 | 28.92 | 4593.93 | 8.98 | 7529.47 | 7492.22 | 1656.72 |
| 28 | 28.92 | 4601.49 | 8.27 | 6181.47 | 7078.76 | 3384.07 |
| 29 | 28.92 | 4606.31 | 2.75 | 5925.21 | 6815.95 | 3310.63 |
| 30 | 32.74 | 4615.92 | 20.00 | 5189.08 | 5970.15 | 2899.33 |
| 31 | 36.55 | 4624.91 | 1.44 | 4511.25 | 5168.16 | 2520.60 |
| 32 | 36.55 | 4631.56 | 15.11 | 4570.41 | 4721.92 | 1656.72 |
| 33 | 36.55 | 4638.97 | 3.36 | 4538.22 | 4220.63 | 828.36 |
| 34 | 36.55 | 4640.36 | 0.09 | 4146.78 | 4124.12 | 1223.80 |
| 35 | 40.37 | 4648.02 | 20.00 | 3528.99 | 3434.67 | 1057.52 |
| 36 | 44.18 | 4662.81 | 20.00 | 2411.01 | 2301.69 | 756.61 |
| 37 | 47.99 | 4675.66 | 16.96 | 1355.74 | 1285.50 | 472.59 |
| 38 | 47.99 | 4682.35 | 3.04 | 265.24 | 785.35 | 828.36 |
| 39 | 51.81 | 4685.32 | 6.34 | 0.00 | 459.45 | 828.36 |
| 40 | 51.81 | 4687.89 | 1.97 | 54.15 | 221.42 | 242.13 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 41 | 51.81 | 4689.31 | 2.63 | 70.69 | 83.47 | 49.13 |

```
        *** SEISMIC SLOPE DISPLACEMENT DATA ***
(Note: kv is set = zero for displacement calculations)
Seismic Yield Coefficient (ky) =  0.1922(g)
Calculated Newmark Seismic Displacement =   0.058(ft)

Non-Symmetrical Sliding Resistance Has Been Specified
for Downhill Sliding.

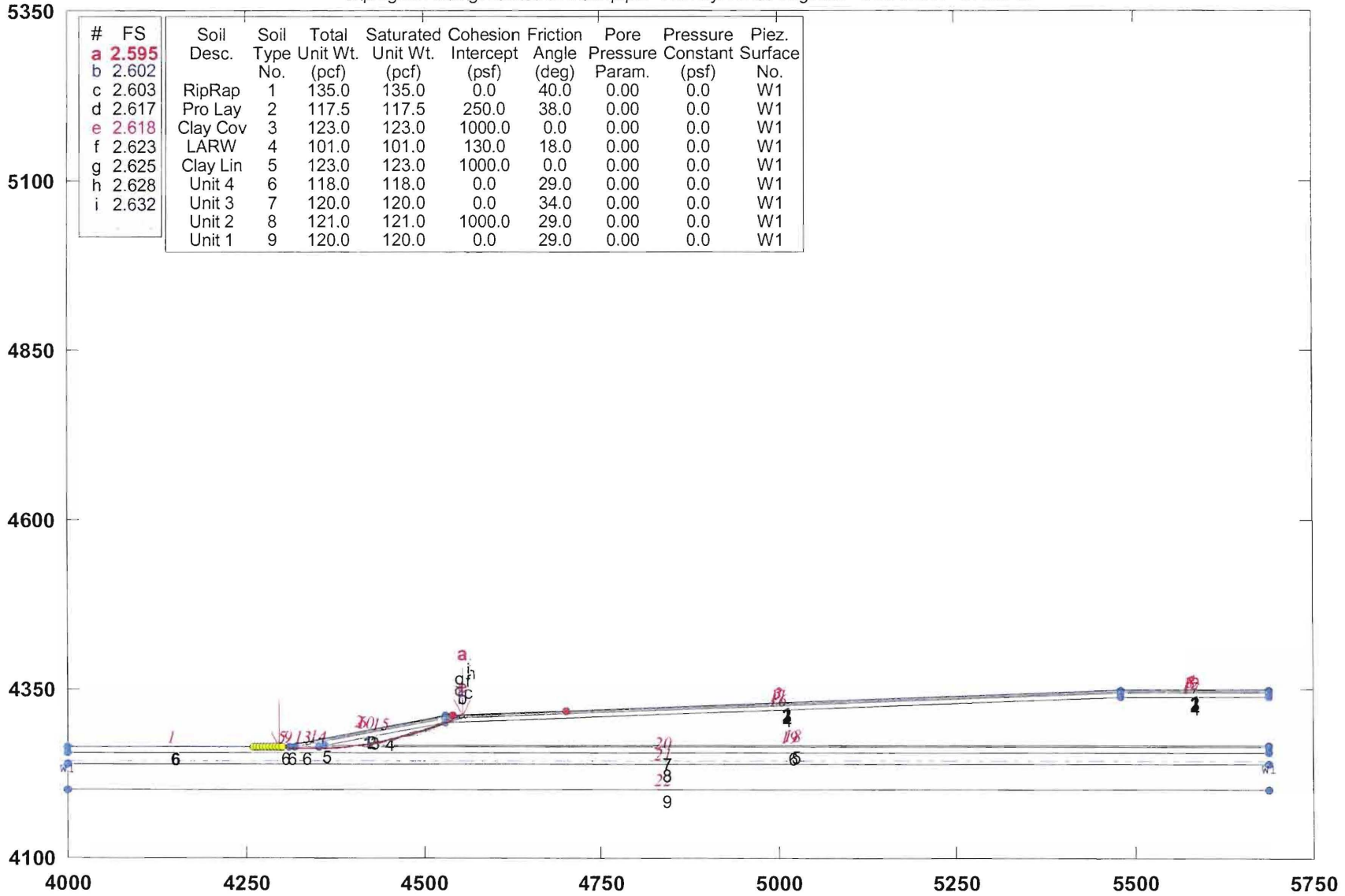
              **** END OF GSTABL7 OUTPUT ****
```

# CAW Emb 38' 5(H):1(V) side-slopes, Static, Shallow Clay unit 121810 CAWP

c:\program files\g72sw\es caw\cawp.pl2 Run By: Amec Engineer 01/04/2011 07:55PM

| # | FS |
|---|---|
| a | 2.595 |
| b | 2.602 |
| c | 2.603 |
| d | 2.617 |
| e | 2.618 |
| f | 2.623 |
| g | 2.625 |
| h | 2.628 |
| i | 2.632 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 1000.0 | 29.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |



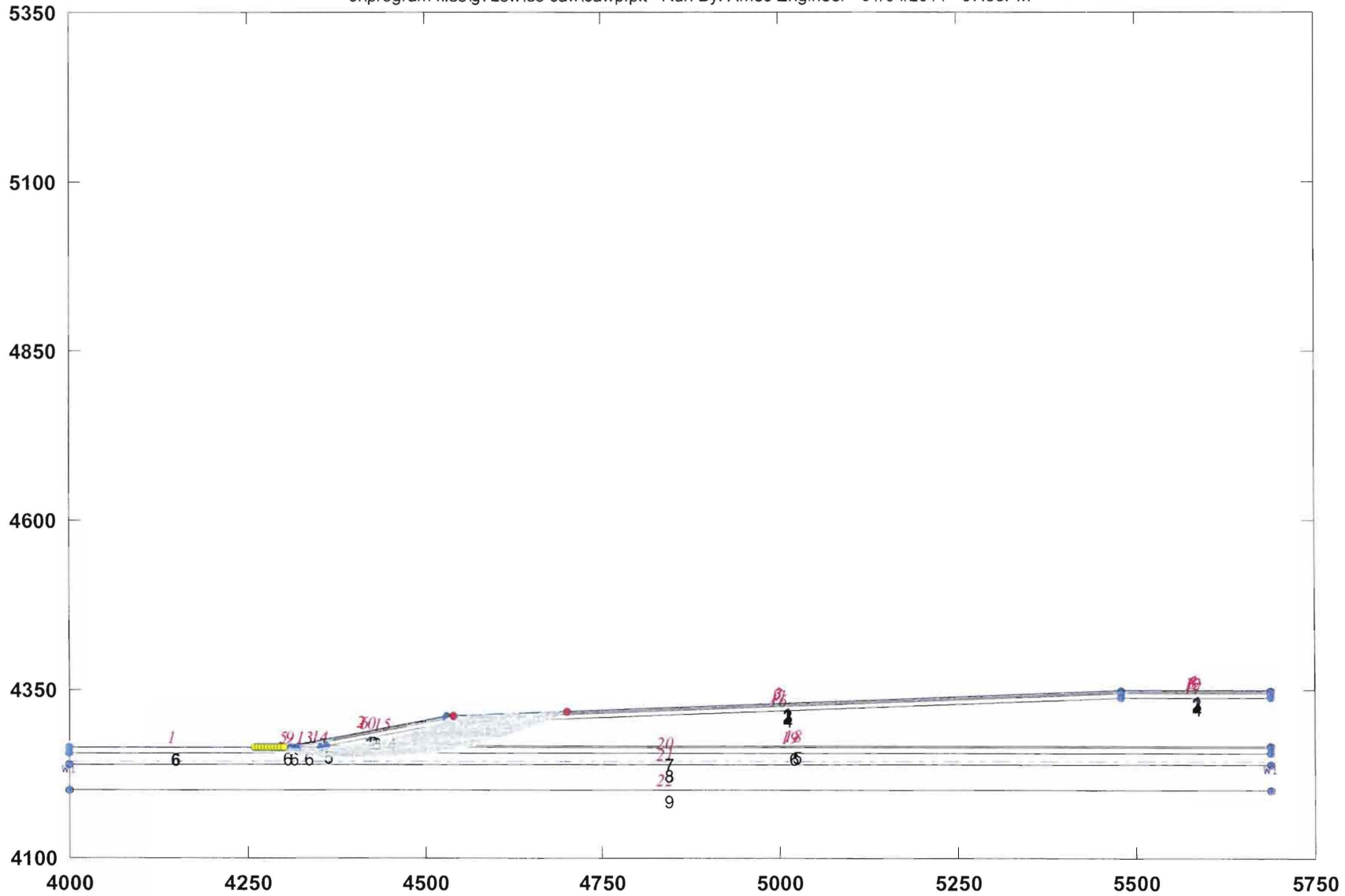

GSTABL7 v.2 FSmin=2.595

Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, Static, Shallow Clay unit 121810 CAWP

c:\program files\g72sw\es caw\cawp.plt Run By: Amec Engineer 01/04/2011 07:55PM




GSTABL7

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
(All Rights Reserved-Unauthorized Use Prohibited)

**********
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
**********

Analysis Run Date: 01/04/2011
Time of Run: 07:55PM
Run By: Amec Engineer
Input Data Filename: C:\Program Files\G72SW\ES CAW\cawp.
Output Filename: C:\Program Files\G72SW\ES CAW\cawp.OUT
Unit System: English

Plotted Output Filename: C:\Program Files\G72SW\ES CAW\cawp.PLT

PROBLEM DESCRIPTION: CAW Emb 38' 5(H):1(V) side-slopes,
Static, Shallow Clay unit 121810 CAWP

BOUNDARY COORDINATES

4 Top Boundaries
22 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

User Specified Y-Origin = 4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

9 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 1000.0 | 29.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X =4260.00(ft)
and X =4300.00(ft)

Each Surface Terminates Between X =4540.00(ft)
and X =4700.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 4250.00(ft)

6.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 2000

Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 4.532 FS Min = 2.595 FS Ave = 3.359
Standard Deviation = 0.385 Coefficient of Variation = 11.46 %

((Modified Bishop FS for Critical Surface = 2.585))

Failure Surface Specified By 46 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4295.555 | 4265.000 |
| 2 | 4301.523 | 4264.385 |
| 3 | 4307.499 | 4263.849 |

| | | |
|---|---|---|
| 4 | 4313.481 | 4263.390 |
| 5 | 4319.469 | 4263.010 |
| 6 | 4325.461 | 4262.708 |
| 7 | 4331.457 | 4262.485 |
| 8 | 4337.455 | 4262.340 |
| 9 | 4343.455 | 4262.274 |
| 10 | 4349.455 | 4262.286 |
| 11 | 4355.454 | 4262.376 |
| 12 | 4361.452 | 4262.545 |
| 13 | 4367.447 | 4262.792 |
| 14 | 4373.438 | 4263.118 |
| 15 | 4379.424 | 4263.522 |
| 16 | 4385.405 | 4264.004 |
| 17 | 4391.378 | 4264.565 |
| 18 | 4397.344 | 4265.204 |
| 19 | 4403.301 | 4265.920 |
| 20 | 4409.249 | 4266.714 |
| 21 | 4415.185 | 4267.586 |
| 22 | 4421.109 | 4268.536 |
| 23 | 4427.021 | 4269.563 |
| 24 | 4432.918 | 4270.667 |
| 25 | 4438.801 | 4271.848 |
| 26 | 4444.668 | 4273.106 |
| 27 | 4450.518 | 4274.440 |
| 28 | 4456.349 | 4275.852 |
| 29 | 4462.162 | 4277.338 |
| 30 | 4467.955 | 4278.901 |
| 31 | 4473.727 | 4280.540 |
| 32 | 4479.477 | 4282.254 |
| 33 | 4485.204 | 4284.043 |
| 34 | 4490.907 | 4285.907 |
| 35 | 4496.585 | 4287.845 |
| 36 | 4502.238 | 4289.857 |
| 37 | 4507.864 | 4291.943 |
| 38 | 4513.462 | 4294.102 |
| 39 | 4519.031 | 4296.334 |
| 40 | 4524.571 | 4298.639 |
| 41 | 4530.080 | 4301.016 |
| 42 | 4535.557 | 4303.465 |
| 43 | 4541.002 | 4305.985 |
| 44 | 4546.414 | 4308.577 |
| 45 | 4551.791 | 4311.239 |
| 46 | 4553.133 | 4311.925 |

Circle Center At X = 4345.539 ; Y = 4721.033 ; and Radius = 458.764

*** FOS = 2.595 Theta (ki=1.0) = 9.33 ***
Lambda = 0.164

Individual data on the 56 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.4 | 120.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 2 | 1.5 | 127.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 3 | 6.0 | 1350.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 4 | 2.5 | 958.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 5 | 3.5 | 1689.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 6 | 4.5 | 2764.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 7 | 1.5 | 1036.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 8 | 6.0 | 4916.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 9 | 6.0 | 5988.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 10 | 6.0 | 7006.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 11 | 6.0 | 7968.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 12 | 6.0 | 8874.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 13 | 3.5 | 5646.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 14 | 2.5 | 4076.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 15 | 5.5 | 9694.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 16 | 0.5 | 817.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 17 | 6.0 | 11155.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 18 | 6.0 | 11672.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 19 | 6.0 | 12131.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 20 | 6.0 | 12531.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 21 | 6.0 | 12871.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 22 | 4.1 | 8931.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 23 | 1.9 | 4221.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 24 | 6.0 | 13360.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 25 | 5.9 | 13502.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 26 | 1.9 | 4440.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 27 | 4.0 | 9168.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 28 | 5.9 | 13741.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 29 | 5.9 | 13829.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 30 | 5.9 | 13867.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 31 | 5.9 | 13854.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 32 | 5.9 | 13792.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 33 | 5.8 | 13679.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 34 | 5.8 | 13518.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 35 | 5.8 | 13309.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 36 | 5.8 | 13052.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 37 | 5.8 | 12747.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 38 | 5.8 | 12395.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 39 | 5.7 | 11998.6 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 40 | 5.7 | 11556.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 41 | 5.7 | 11069.5 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 42 | 5.7 | 10539.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 43 | 5.6 | 9968.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 44 | 5.6 | 9355.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 45 | 5.6 | 8701.1 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 46 | 5.5 | 8008.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 47 | 3.4 | 4527.8 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 48 | 2.1 | 2638.4 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 49 | 0.1 | 99.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 50 | 5.5 | 6064.0 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 51 | 5.4 | 4509.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 52 | 4.5 | 2523.2 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 53 | 1.0 | 403.7 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 54 | 2.4 | 791.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 55 | 3.0 | 533.9 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |
| 56 | 1.3 | 57.3 | 0.0 | 0.0 | 0. | 0. | 0.0 | 0.0 | 0.0 |

Failure Surface Specified By 47 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4286.666 | 4265.000 |
| 2 | 4292.634 | 4264.385 |
| 3 | 4298.610 | 4263.845 |
| 4 | 4304.592 | 4263.378 |
| 5 | 4310.579 | 4262.985 |
| 6 | 4316.571 | 4262.667 |
| 7 | 4322.566 | 4262.423 |
| 8 | 4328.563 | 4262.252 |
| 9 | 4334.562 | 4262.156 |
| 10 | 4340.562 | 4262.134 |
| 11 | 4346.562 | 4262.187 |
| 12 | 4352.561 | 4262.314 |
| 13 | 4358.558 | 4262.515 |
| 14 | 4364.551 | 4262.790 |
| 15 | 4370.541 | 4263.139 |
| 16 | 4376.526 | 4263.562 |
| 17 | 4382.505 | 4264.060 |
| 18 | 4388.478 | 4264.631 |
| 19 | 4394.443 | 4265.276 |
| 20 | 4400.400 | 4265.995 |
| 21 | 4406.347 | 4266.788 |
| 22 | 4412.284 | 4267.654 |
| 23 | 4418.210 | 4268.593 |
| 24 | 4424.124 | 4269.606 |
| 25 | 4430.025 | 4270.692 |
| 26 | 4435.912 | 4271.851 |
| 27 | 4441.784 | 4273.082 |
| 28 | 4447.641 | 4274.386 |
| 29 | 4453.480 | 4275.763 |
| 30 | 4459.303 | 4277.211 |
| 31 | 4465.107 | 4278.732 |
| 32 | 4470.892 | 4280.324 |
| 33 | 4476.656 | 4281.988 |
| 34 | 4482.400 | 4283.723 |
| 35 | 4488.122 | 4285.528 |
| 36 | 4493.821 | 4287.405 |
| 37 | 4499.496 | 4289.352 |
| 38 | 4505.147 | 4291.369 |
| 39 | 4510.772 | 4293.455 |
| 40 | 4516.372 | 4295.611 |
| 41 | 4521.944 | 4297.836 |
| 42 | 4527.488 | 4300.130 |
| 43 | 4533.003 | 4302.493 |
| 44 | 4538.489 | 4304.923 |
| 45 | 4543.944 | 4307.421 |
| 46 | 4549.368 | 4309.987 |
| 47 | 4553.356 | 4311.934 |

Circle Center At X = 4339.319 ; Y = 4747.050 ; and Radius = 484.917

*** FOS = 2.602 Theta (ki=1.0) = 9.26 ***
Lambda = 0.163

1

Failure Surface Specified By 48 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|

| | | |
|---|---|---|
| 1 | 4291.110 | 4265.000 |
| 2 | 4297.082 | 4264.412 |
| 3 | 4303.059 | 4263.895 |
| 4 | 4309.042 | 4263.449 |
| 5 | 4315.031 | 4263.076 |
| 6 | 4321.023 | 4262.774 |
| 7 | 4327.019 | 4262.544 |
| 8 | 4333.017 | 4262.386 |
| 9 | 4339.016 | 4262.299 |
| 10 | 4345.016 | 4262.285 |
| 11 | 4351.016 | 4262.342 |
| 12 | 4357.014 | 4262.471 |
| 13 | 4363.011 | 4262.671 |
| 14 | 4369.004 | 4262.944 |
| 15 | 4374.995 | 4263.288 |
| 16 | 4380.980 | 4263.704 |
| 17 | 4386.960 | 4264.191 |
| 18 | 4392.934 | 4264.750 |
| 19 | 4398.901 | 4265.380 |
| 20 | 4404.860 | 4266.082 |
| 21 | 4410.810 | 4266.855 |
| 22 | 4416.750 | 4267.699 |
| 23 | 4422.680 | 4268.614 |
| 24 | 4428.599 | 4269.600 |
| 25 | 4434.505 | 4270.657 |
| 26 | 4440.398 | 4271.784 |
| 27 | 4446.277 | 4272.982 |
| 28 | 4452.142 | 4274.250 |
| 29 | 4457.990 | 4275.588 |
| 30 | 4463.823 | 4276.997 |
| 31 | 4469.638 | 4278.475 |
| 32 | 4475.435 | 4280.022 |
| 33 | 4481.213 | 4281.639 |
| 34 | 4486.971 | 4283.324 |
| 35 | 4492.709 | 4285.079 |
| 36 | 4498.425 | 4286.901 |
| 37 | 4504.120 | 4288.792 |
| 38 | 4509.791 | 4290.752 |
| 39 | 4515.438 | 4292.779 |
| 40 | 4521.061 | 4294.873 |
| 41 | 4526.658 | 4297.035 |
| 42 | 4532.229 | 4299.263 |
| 43 | 4537.772 | 4301.558 |
| 44 | 4543.289 | 4303.919 |
| 45 | 4548.776 | 4306.346 |
| 46 | 4554.234 | 4308.839 |
| 47 | 4559.662 | 4311.396 |
| 48 | 4561.433 | 4312.257 |

Circle Center At X = 4343.251 ; Y = 4763.522 ; and Radius = 501.241

*** FOS = 2.603 Theta (ki=1.0) = 9.16 ***
Lambda = 0.161

Failure Surface Specified By 46 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4291.110 | 4265.000 |
| 2 | 4297.082 | 4264.414 |
| 3 | 4303.060 | 4263.904 |
| 4 | 4309.044 | 4263.472 |
| 5 | 4315.034 | 4263.117 |
| 6 | 4321.027 | 4262.839 |
| 7 | 4327.024 | 4262.639 |
| 8 | 4333.022 | 4262.515 |
| 9 | 4339.022 | 4262.469 |
| 10 | 4345.022 | 4262.500 |
| 11 | 4351.021 | 4262.608 |
| 12 | 4357.019 | 4262.794 |
| 13 | 4363.013 | 4263.057 |
| 14 | 4369.003 | 4263.396 |
| 15 | 4374.988 | 4263.813 |
| 16 | 4380.968 | 4264.308 |
| 17 | 4386.940 | 4264.879 |
| 18 | 4392.905 | 4265.527 |
| 19 | 4398.861 | 4266.251 |
| 20 | 4404.808 | 4267.053 |
| 21 | 4410.743 | 4267.931 |
| 22 | 4416.667 | 4268.885 |
| 23 | 4422.578 | 4269.916 |
| 24 | 4428.475 | 4271.022 |
| 25 | 4434.357 | 4272.205 |
| 26 | 4440.224 | 4273.463 |
| 27 | 4446.074 | 4274.797 |
| 28 | 4451.906 | 4276.206 |
| 29 | 4457.719 | 4277.689 |
| 30 | 4463.513 | 4279.248 |

| | | |
|---|---|---|
| 31 | 4469.287 | 4280.881 |
| 32 | 4475.039 | 4282.589 |
| 33 | 4480.768 | 4284.370 |
| 34 | 4486.474 | 4286.225 |
| 35 | 4492.156 | 4288.153 |
| 36 | 4497.812 | 4290.155 |
| 37 | 4503.442 | 4292.229 |
| 38 | 4509.045 | 4294.375 |
| 39 | 4514.620 | 4296.594 |
| 40 | 4520.166 | 4298.884 |
| 41 | 4525.681 | 4301.245 |
| 42 | 4531.166 | 4303.677 |
| 43 | 4536.619 | 4306.180 |
| 44 | 4542.040 | 4308.752 |
| 45 | 4547.426 | 4311.395 |
| 46 | 4548.075 | 4311.723 |

Circle Center At X = 4339.614 ; Y = 4728.219 ; and Radius = 465.751

*** FOS = 2.617 Theta (ki=1.0) = 9.22 ***
Lambda = 0.162

1

Failure Surface Specified By 49 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4277.777 | 4265.000 |
| 2 | 4283.746 | 4264.385 |
| 3 | 4289.721 | 4263.841 |
| 4 | 4295.702 | 4263.367 |
| 5 | 4301.688 | 4262.962 |
| 6 | 4307.679 | 4262.628 |
| 7 | 4313.673 | 4262.365 |
| 8 | 4319.670 | 4262.171 |
| 9 | 4325.669 | 4262.048 |
| 10 | 4331.669 | 4261.996 |
| 11 | 4337.669 | 4262.014 |
| 12 | 4343.668 | 4262.102 |
| 13 | 4349.667 | 4262.261 |
| 14 | 4355.662 | 4262.490 |
| 15 | 4361.655 | 4262.789 |
| 16 | 4367.644 | 4263.159 |
| 17 | 4373.627 | 4263.599 |
| 18 | 4379.606 | 4264.109 |
| 19 | 4385.578 | 4264.689 |
| 20 | 4391.542 | 4265.339 |
| 21 | 4397.499 | 4266.059 |
| 22 | 4403.447 | 4266.849 |
| 23 | 4409.385 | 4267.708 |
| 24 | 4415.312 | 4268.638 |
| 25 | 4421.229 | 4269.636 |
| 26 | 4427.133 | 4270.704 |
| 27 | 4433.024 | 4271.841 |
| 28 | 4438.902 | 4273.047 |
| 29 | 4444.765 | 4274.322 |
| 30 | 4450.612 | 4275.666 |
| 31 | 4456.444 | 4277.078 |
| 32 | 4462.258 | 4278.559 |
| 33 | 4468.055 | 4280.107 |
| 34 | 4473.833 | 4281.724 |
| 35 | 4479.592 | 4283.409 |
| 36 | 4485.331 | 4285.161 |
| 37 | 4491.049 | 4286.979 |
| 38 | 4496.745 | 4288.865 |
| 39 | 4502.418 | 4290.818 |
| 40 | 4508.068 | 4292.837 |
| 41 | 4513.694 | 4294.922 |
| 42 | 4519.295 | 4297.073 |
| 43 | 4524.871 | 4299.290 |
| 44 | 4530.420 | 4301.571 |
| 45 | 4535.942 | 4303.918 |
| 46 | 4541.436 | 4306.330 |
| 47 | 4546.901 | 4308.805 |
| 48 | 4552.337 | 4311.345 |
| 49 | 4553.580 | 4311.943 |

Circle Center At X = 4333.145 ; Y = 4773.446 ; and Radius = 511.452

*** FOS = 2.618 Theta (ki=1.0) = 9.18 ***
Lambda = 0.162

Failure Surface Specified By 51 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4273.333 | 4265.000 |
| 2 | 4279.304 | 4264.412 |
| 3 | 4285.281 | 4263.888 |
| 4 | 4291.264 | 4263.428 |
| 5 | 4297.250 | 4263.033 |
| 6 | 4303.241 | 4262.703 |
| 7 | 4309.235 | 4262.437 |
| 8 | 4315.232 | 4262.235 |
| 9 | 4321.230 | 4262.099 |
| 10 | 4327.230 | 4262.026 |
| 11 | 4333.230 | 4262.019 |
| 12 | 4339.229 | 4262.076 |
| 13 | 4345.228 | 4262.198 |
| 14 | 4351.225 | 4262.385 |
| 15 | 4357.220 | 4262.636 |
| 16 | 4363.211 | 4262.952 |
| 17 | 4369.199 | 4263.332 |
| 18 | 4375.183 | 4263.777 |
| 19 | 4381.161 | 4264.286 |
| 20 | 4387.134 | 4264.860 |
| 21 | 4393.100 | 4265.498 |
| 22 | 4399.059 | 4266.200 |
| 23 | 4405.009 | 4266.967 |
| 24 | 4410.952 | 4267.797 |
| 25 | 4416.885 | 4268.692 |
| 26 | 4422.808 | 4269.650 |
| 27 | 4428.720 | 4270.672 |
| 28 | 4434.621 | 4271.758 |
| 29 | 4440.509 | 4272.908 |
| 30 | 4446.385 | 4274.121 |
| 31 | 4452.248 | 4275.396 |
| 32 | 4458.097 | 4276.735 |
| 33 | 4463.931 | 4278.137 |
| 34 | 4469.749 | 4279.602 |
| 35 | 4475.551 | 4281.129 |
| 36 | 4481.337 | 4282.719 |
| 37 | 4487.105 | 4284.371 |
| 38 | 4492.855 | 4286.085 |
| 39 | 4498.586 | 4287.861 |
| 40 | 4504.298 | 4289.698 |
| 41 | 4509.989 | 4291.597 |
| 42 | 4515.660 | 4293.558 |
| 43 | 4521.310 | 4295.579 |
| 44 | 4526.937 | 4297.661 |
| 45 | 4532.541 | 4299.804 |
| 46 | 4538.122 | 4302.006 |
| 47 | 4543.679 | 4304.269 |
| 48 | 4549.211 | 4306.592 |
| 49 | 4554.718 | 4308.974 |
| 50 | 4560.199 | 4311.415 |
| 51 | 4562.095 | 4312.284 |

Circle Center At X = 4330.913 ; Y = 4818.819 ; and Radius = 556.804

*** FOS = 2.623 Theta (ki=1.0) = 8.99 ***
Lambda = 0.158

1

Failure Surface Specified By 46 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4286.666 | 4265.000 |
| 2 | 4292.637 | 4264.414 |
| 3 | 4298.615 | 4263.902 |
| 4 | 4304.599 | 4263.465 |
| 5 | 4310.588 | 4263.104 |
| 6 | 4316.582 | 4262.817 |
| 7 | 4322.578 | 4262.605 |
| 8 | 4328.576 | 4262.469 |
| 9 | 4334.576 | 4262.408 |
| 10 | 4340.576 | 4262.422 |
| 11 | 4346.575 | 4262.512 |
| 12 | 4352.573 | 4262.676 |
| 13 | 4358.568 | 4262.915 |
| 14 | 4364.560 | 4263.229 |
| 15 | 4370.547 | 4263.619 |
| 16 | 4376.529 | 4264.083 |
| 17 | 4382.504 | 4264.623 |
| 18 | 4388.473 | 4265.237 |
| 19 | 4394.433 | 4265.926 |
| 20 | 4400.384 | 4266.690 |
| 21 | 4406.326 | 4267.528 |
| 22 | 4412.256 | 4268.440 |

| | | |
|---|---|---|
| 23 | 4418.174 | 4269.427 |
| 24 | 4424.080 | 4270.488 |
| 25 | 4429.971 | 4271.623 |
| 26 | 4435.848 | 4272.831 |
| 27 | 4441.709 | 4274.112 |
| 28 | 4447.555 | 4275.467 |
| 29 | 4453.382 | 4276.896 |
| 30 | 4459.191 | 4278.396 |
| 31 | 4464.981 | 4279.970 |
| 32 | 4470.751 | 4281.616 |
| 33 | 4476.500 | 4283.334 |
| 34 | 4482.226 | 4285.125 |
| 35 | 4487.930 | 4286.986 |
| 36 | 4493.610 | 4288.919 |
| 37 | 4499.265 | 4290.923 |
| 38 | 4504.895 | 4292.998 |
| 39 | 4510.499 | 4295.143 |
| 40 | 4516.075 | 4297.358 |
| 41 | 4521.623 | 4299.643 |
| 42 | 4527.142 | 4301.997 |
| 43 | 4532.630 | 4304.420 |
| 44 | 4538.088 | 4306.912 |
| 45 | 4543.515 | 4309.471 |
| 46 | 4548.144 | 4311.726 |

Circle Center At X = 4336.458 ; Y = 4741.340 ; and Radius = 478.936

*** FOS = 2.625 Theta (ki=1.0) = 9.16 ***
Lambda = 0.161

Failure Surface Specified By 47 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4299.999 | 4265.000 |
| 2 | 4305.967 | 4264.383 |
| 3 | 4311.943 | 4263.841 |
| 4 | 4317.925 | 4263.374 |
| 5 | 4323.912 | 4262.981 |
| 6 | 4329.904 | 4262.664 |
| 7 | 4335.899 | 4262.420 |
| 8 | 4341.896 | 4262.252 |
| 9 | 4347.896 | 4262.159 |
| 10 | 4353.896 | 4262.140 |
| 11 | 4359.896 | 4262.196 |
| 12 | 4365.894 | 4262.328 |
| 13 | 4371.891 | 4262.534 |
| 14 | 4377.884 | 4262.814 |
| 15 | 4383.874 | 4263.170 |
| 16 | 4389.858 | 4263.601 |
| 17 | 4395.836 | 4264.106 |
| 18 | 4401.809 | 4264.686 |
| 19 | 4407.773 | 4265.340 |
| 20 | 4413.729 | 4266.068 |
| 21 | 4419.674 | 4266.871 |
| 22 | 4425.610 | 4267.748 |
| 23 | 4431.534 | 4268.699 |
| 24 | 4437.446 | 4269.724 |
| 25 | 4443.344 | 4270.823 |
| 26 | 4449.229 | 4271.995 |
| 27 | 4455.098 | 4273.241 |
| 28 | 4460.951 | 4274.560 |
| 29 | 4466.788 | 4275.951 |
| 30 | 4472.606 | 4277.416 |
| 31 | 4478.406 | 4278.952 |
| 32 | 4484.186 | 4280.561 |
| 33 | 4489.946 | 4282.242 |
| 34 | 4495.684 | 4283.995 |
| 35 | 4501.400 | 4285.819 |
| 36 | 4507.093 | 4287.715 |
| 37 | 4512.761 | 4289.681 |
| 38 | 4518.405 | 4291.718 |
| 39 | 4524.022 | 4293.826 |
| 40 | 4529.613 | 4296.003 |
| 41 | 4535.177 | 4298.250 |
| 42 | 4540.711 | 4300.566 |
| 43 | 4546.217 | 4302.952 |
| 44 | 4551.692 | 4305.405 |
| 45 | 4557.137 | 4307.927 |
| 46 | 4562.549 | 4310.517 |
| 47 | 4566.483 | 4312.459 |

Circle Center At X = 4352.380 ; Y = 4742.837 ; and Radius = 480.700

*** FOS = 2.628 Theta (ki=1.0) = 9.09 ***
Lambda = 0.160

1

Failure Surface Specified By 52 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4268.889 | 4265.000 |
| 2 | 4274.860 | 4264.412 |
| 3 | 4280.837 | 4263.886 |
| 4 | 4286.819 | 4263.423 |
| 5 | 4292.806 | 4263.023 |
| 6 | 4298.796 | 4262.687 |
| 7 | 4304.790 | 4262.413 |
| 8 | 4310.786 | 4262.202 |
| 9 | 4316.784 | 4262.054 |
| 10 | 4322.784 | 4261.969 |
| 11 | 4328.784 | 4261.947 |
| 12 | 4334.784 | 4261.988 |
| 13 | 4340.783 | 4262.093 |
| 14 | 4346.780 | 4262.260 |
| 15 | 4352.776 | 4262.491 |
| 16 | 4358.769 | 4262.784 |
| 17 | 4364.758 | 4263.141 |
| 18 | 4370.743 | 4263.560 |
| 19 | 4376.724 | 4264.042 |
| 20 | 4382.699 | 4264.587 |
| 21 | 4388.668 | 4265.195 |
| 22 | 4394.630 | 4265.865 |
| 23 | 4400.585 | 4266.598 |
| 24 | 4406.532 | 4267.394 |
| 25 | 4412.471 | 4268.251 |
| 26 | 4418.400 | 4269.172 |
| 27 | 4424.319 | 4270.154 |
| 28 | 4430.227 | 4271.199 |
| 29 | 4436.124 | 4272.306 |
| 30 | 4442.009 | 4273.475 |
| 31 | 4447.882 | 4274.706 |
| 32 | 4453.741 | 4275.998 |
| 33 | 4459.586 | 4277.351 |
| 34 | 4465.417 | 4278.766 |
| 35 | 4471.232 | 4280.242 |
| 36 | 4477.032 | 4281.779 |
| 37 | 4482.815 | 4283.377 |
| 38 | 4488.582 | 4285.036 |
| 39 | 4494.330 | 4286.755 |
| 40 | 4500.060 | 4288.535 |
| 41 | 4505.771 | 4290.375 |
| 42 | 4511.462 | 4292.275 |
| 43 | 4517.133 | 4294.234 |
| 44 | 4522.783 | 4296.253 |
| 45 | 4528.412 | 4298.332 |
| 46 | 4534.018 | 4300.469 |
| 47 | 4539.602 | 4302.665 |
| 48 | 4545.162 | 4304.919 |
| 49 | 4550.698 | 4307.232 |
| 50 | 4556.210 | 4309.603 |
| 51 | 4561.696 | 4312.032 |
| 52 | 4562.265 | 4312.291 |

Circle Center At X = 4327.858 ; Y = 4832.822 ; and Radius = 570.876

*** FOS = 2.632 Theta (ki=1.0) = 8.93 ***
Lambda = 0.157

Failure Surface Specified By 48 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4291.110 | 4265.000 |
| 2 | 4297.073 | 4264.329 |
| 3 | 4303.043 | 4263.732 |
| 4 | 4309.020 | 4263.209 |
| 5 | 4315.003 | 4262.761 |
| 6 | 4320.992 | 4262.386 |
| 7 | 4326.984 | 4262.086 |
| 8 | 4332.980 | 4261.860 |
| 9 | 4338.978 | 4261.708 |
| 10 | 4344.978 | 4261.631 |
| 11 | 4350.978 | 4261.628 |
| 12 | 4356.977 | 4261.700 |
| 13 | 4362.975 | 4261.846 |
| 14 | 4368.971 | 4262.066 |
| 15 | 4374.964 | 4262.360 |
| 16 | 4380.953 | 4262.729 |

| | | |
|---|---|---|
| 17 | 4386.936 | 4263.172 |
| 18 | 4392.914 | 4263.689 |
| 19 | 4398.884 | 4264.280 |
| 20 | 4404.847 | 4264.945 |
| 21 | 4410.802 | 4265.684 |
| 22 | 4416.747 | 4266.496 |
| 23 | 4422.681 | 4267.382 |
| 24 | 4428.604 | 4268.342 |
| 25 | 4434.514 | 4269.375 |
| 26 | 4440.411 | 4270.480 |
| 27 | 4446.294 | 4271.660 |
| 28 | 4452.162 | 4272.912 |
| 29 | 4458.014 | 4274.236 |
| 30 | 4463.849 | 4275.633 |
| 31 | 4469.667 | 4277.102 |
| 32 | 4475.465 | 4278.643 |
| 33 | 4481.245 | 4280.256 |
| 34 | 4487.003 | 4281.940 |
| 35 | 4492.741 | 4283.695 |
| 36 | 4498.456 | 4285.522 |
| 37 | 4504.148 | 4287.419 |
| 38 | 4509.817 | 4289.386 |
| 39 | 4515.460 | 4291.424 |
| 40 | 4521.078 | 4293.531 |
| 41 | 4526.669 | 4295.708 |
| 42 | 4532.233 | 4297.954 |
| 43 | 4537.769 | 4300.269 |
| 44 | 4543.275 | 4302.652 |
| 45 | 4548.752 | 4305.104 |
| 46 | 4554.198 | 4307.623 |
| 47 | 4559.612 | 4310.208 |
| 48 | 4563.974 | 4312.359 |

Circle Center At X = 4348.213 ; Y = 4745.746 ; and Radius = 484.125

*** FOS = 2.632 Theta (ki=1.0) = 9.19 ***
Lambda = 0.162

**** END OF GSTABL7 OUTPUT ****

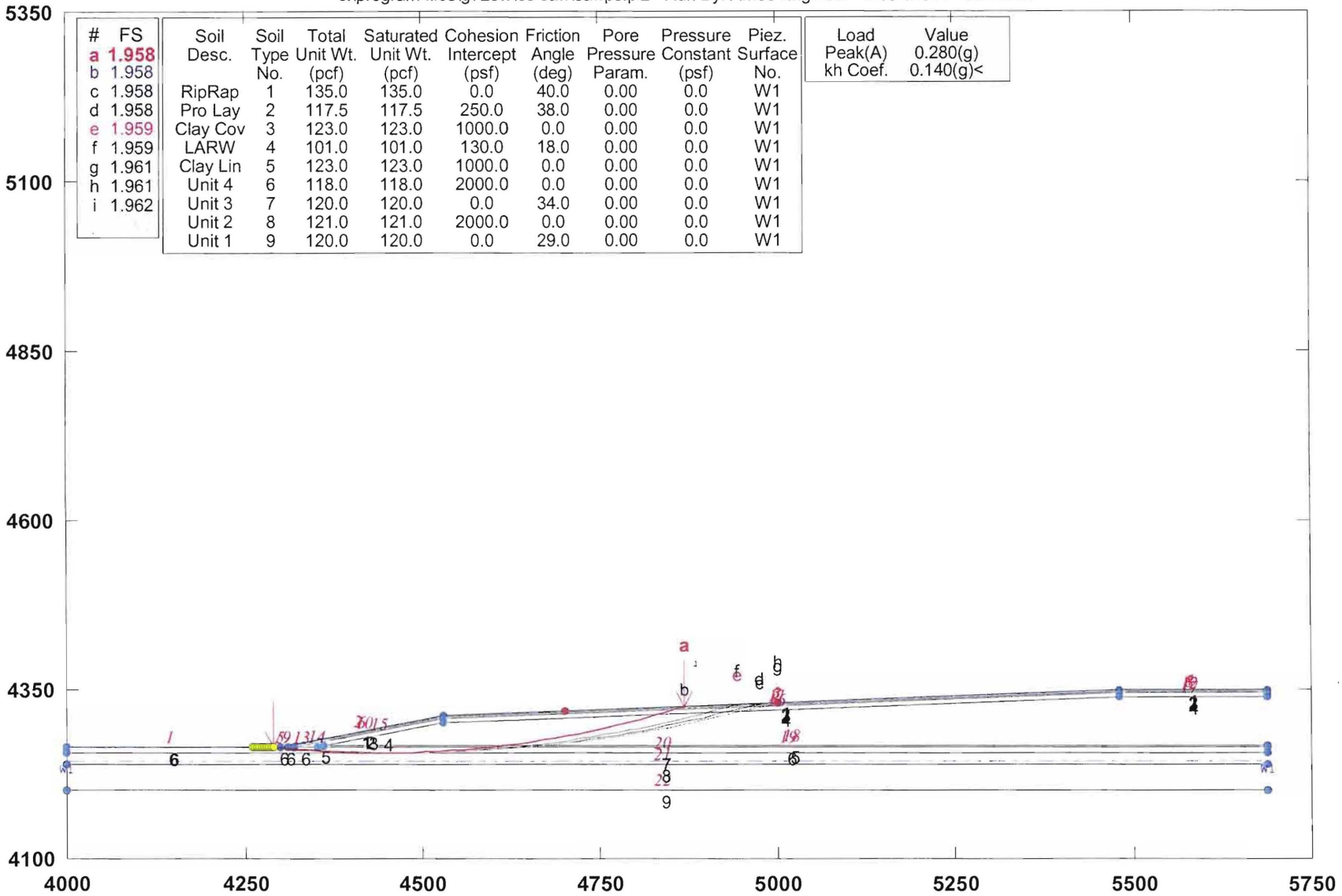
# CAW Emb 38' 5(H):1(V) side-slopes, Pseudostatic, ShalClay unit 121810 CAWPS

c:\program files\g72sw\es caw\cawps.pl2 Run By: Amec Engineer 01/04/2011 08:41PM

| # | FS |
|---|---|
| a | 1.958 |
| b | 1.958 |
| c | 1.958 |
| d | 1.958 |
| e | 1.959 |
| f | 1.959 |
| g | 1.961 |
| h | 1.961 |
| i | 1.962 |

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |

| Load | Value |
|---|---|
| Peak(A) | 0.280(g) |
| kh Coef. | 0.140(g)< |



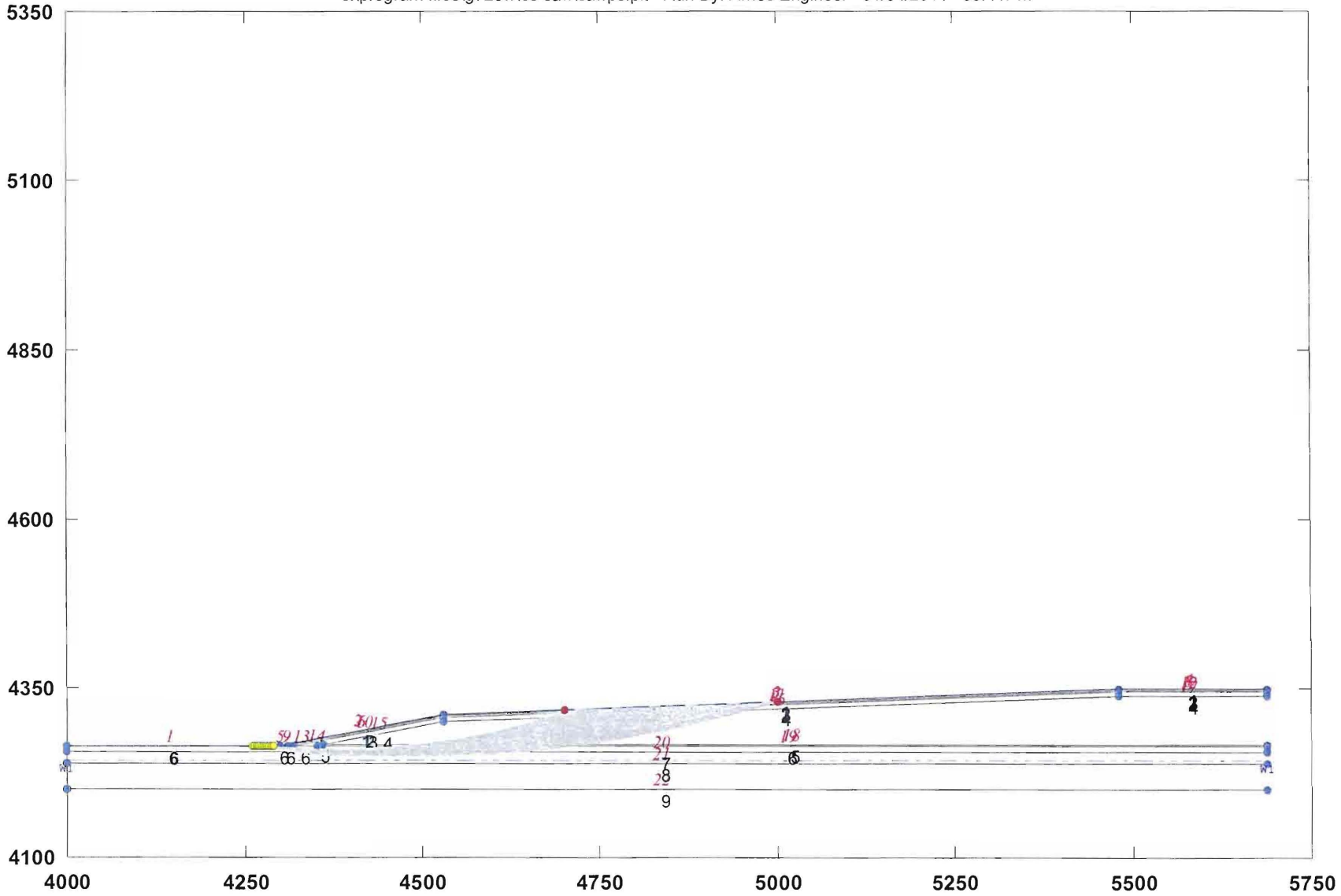

**GSTABL7 v.2 FSmin=1.958**

**Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

# CAW Emb 38' 5(H):1(V) side-slopes, Pseudostatic, ShalClay unit 121810 CAWPS

c:\program files\g72sw\es caw\cawps.plt Run By: Amec Engineer 01/04/2011 08:41PM




GSTABL7

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
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**********
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
**********

Analysis Run Date: 01/04/2011
Time of Run: 08:41PM
Run By: Amec Engineer
Input Data Filename: C:\Program Files\G72SW\ES CAW\cawps.
Output Filename: C:\Program Files\G72SW\ES CAW\cawps.OUT
Unit System: English

Plotted Output Filename: C:\Program Files\G72SW\ES CAW\cawps.PLT

PROBLEM DESCRIPTION: CAW Emb 38' 5(H):1(V) side-slopes,
Pseudostatic, ShalClay unit 121810 CAWPS

BOUNDARY COORDINATES

4 Top Boundaries
22 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

User Specified Y-Origin = 4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

9 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

Specified Peak Ground Acceleration Coefficient (A) = 0.280(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.140(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

3800 Trial Surfaces Have Been Generated.

380 Surface(s) Initiate(s) From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X =4260.00(ft)
and X =4290.00(ft)

Each Surface Terminates Between X =4700.00(ft)
and X =5000.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 4250.00(ft)

18.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are
Ordered - Most Critical First.

* * Safety Factors Are Calculated By GLE (Spencer`s) Method (0-1) * *

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 1.00

Forces from Reinforcement, Piers/Piles, Soil Nails, and Applied Forces
(if applicable) have been applied to the slice base(s)
on which they intersect.

Specified Tension Crack Water Force Factor = 0.000

Total Number of Trial Surfaces Attempted = 3800

WARNING! The Factor of Safety Calculation for one or More Trial Surfaces
Did Not Converge in 20 Iterations.

Number of Trial Surfaces with Non-Converged FS = 281

Number of Trial Surfaces with Misleading FS = 31

Number of Trial Surfaces With Valid FS = 3488

Percentage of Trial Surfaces With Non-Valid FS Solutions
of the Total Attempted = 8.2 %

Statistical Data On All Valid FS Values:
FS Max = 20.250 FS Min = 1.958 FS Ave = 2.233
Standard Deviation = 0.601 Coefficient of Variation = 26.93 %

((Modified Bishop FS for Critical Surface = 1.975))

Failure Surface Specified By 34 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.895 | 4263.042 |
| 3 | 4325.812 | 4261.324 |
| 4 | 4343.751 | 4259.845 |
| 5 | 4361.709 | 4258.607 |
| 6 | 4379.681 | 4257.609 |
| 7 | 4397.665 | 4256.851 |
| 8 | 4415.658 | 4256.334 |
| 9 | 4433.656 | 4256.058 |
| 10 | 4451.656 | 4256.022 |
| 11 | 4469.655 | 4256.228 |
| 12 | 4487.649 | 4256.674 |
| 13 | 4505.636 | 4257.361 |
| 14 | 4523.612 | 4258.288 |
| 15 | 4541.574 | 4259.456 |
| 16 | 4559.519 | 4260.864 |
| 17 | 4577.443 | 4262.512 |
| 18 | 4595.344 | 4264.400 |
| 19 | 4613.218 | 4266.527 |
| 20 | 4631.062 | 4268.893 |
| 21 | 4648.873 | 4271.497 |
| 22 | 4666.646 | 4274.339 |
| 23 | 4684.381 | 4277.419 |
| 24 | 4702.073 | 4280.736 |
| 25 | 4719.719 | 4284.290 |
| 26 | 4737.315 | 4288.079 |
| 27 | 4754.860 | 4292.103 |
| 28 | 4772.349 | 4296.361 |
| 29 | 4789.779 | 4300.853 |
| 30 | 4807.148 | 4305.578 |
| 31 | 4824.452 | 4310.534 |
| 32 | 4841.688 | 4315.722 |
| 33 | 4858.854 | 4321.140 |
| 34 | 4869.232 | 4324.569 |

Circle Center At X = 4445.295 ; Y = 5600.881 ; and Radius = 1344.877

*** FOS = 1.958 Theta (ki=1.0) = 3.68 ***
Lambda = 0.064

Individual data on the 44 slices

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.0 | 645.2 | 0.0 | 0.0 | 0. | 0. | 90.3 | 0.0 | 0.0 |
| 2 | 7.9 | 2262.9 | 0.0 | 0.0 | 0. | 0. | 316.8 | 0.0 | 0.0 |
| 3 | 2.1 | 1020.2 | 0.0 | 0.0 | 0. | 0. | 142.8 | 0.0 | 0.0 |
| 4 | 8.0 | 5312.8 | 0.0 | 0.0 | 0. | 0. | 743.8 | 0.0 | 0.0 |
| 5 | 7.8 | 7372.8 | 0.0 | 0.0 | 0. | 0. | 1032.2 | 0.0 | 0.0 |
| 6 | 17.9 | 24969.8 | 0.0 | 0.0 | 0. | 0. | 3495.8 | 0.0 | 0.0 |
| 7 | 9.2 | 17121.1 | 0.0 | 0.0 | 0. | 0. | 2397.0 | 0.0 | 0.0 |
| 8 | 8.0 | 17068.4 | 0.0 | 0.0 | 0. | 0. | 2389.6 | 0.0 | 0.0 |
| 9 | 0.7 | 1612.7 | 0.0 | 0.0 | 0. | 0. | 225.8 | 0.0 | 0.0 |
| 10 | 18.0 | 45387.6 | 0.0 | 0.0 | 0. | 0. | 6354.3 | 0.0 | 0.0 |
| 11 | 18.0 | 53823.9 | 0.0 | 0.0 | 0. | 0. | 7535.4 | 0.0 | 0.0 |
| 12 | 18.0 | 61754.4 | 0.0 | 0.0 | 0. | 0. | 8645.6 | 0.0 | 0.0 |
| 13 | 18.0 | 69172.0 | 0.0 | 0.0 | 0. | 0. | 9684.1 | 0.0 | 0.0 |
| 14 | 18.0 | 76068.9 | 0.0 | 0.0 | 0. | 0. | 10649.6 | 0.0 | 0.0 |
| 15 | 18.0 | 82441.3 | 0.0 | 0.0 | 0. | 0. | 11541.8 | 0.0 | 0.0 |
| 16 | 18.0 | 88285.3 | 0.0 | 0.0 | 0. | 0. | 12359.9 | 0.0 | 0.0 |
| 17 | 18.0 | 93595.1 | 0.0 | 0.0 | 0. | 0. | 13103.3 | 0.0 | 0.0 |
| 18 | 18.0 | 98369.7 | 0.0 | 0.0 | 0. | 0. | 13771.8 | 0.0 | 0.0 |
| 19 | 6.4 | 36024.3 | 0.0 | 0.0 | 0. | 0. | 5043.4 | 0.0 | 0.0 |
| 20 | 11.6 | 65495.4 | 0.0 | 0.0 | 0. | 0. | 9169.4 | 0.0 | 0.0 |
| 21 | 17.9 | 100326.8 | 0.0 | 0.0 | 0. | 0. | 14045.8 | 0.0 | 0.0 |
| 22 | 17.9 | 98278.2 | 0.0 | 0.0 | 0. | 0. | 13759.0 | 0.0 | 0.0 |
| 23 | 17.9 | 95712.0 | 0.0 | 0.0 | 0. | 0. | 13399.7 | 0.0 | 0.0 |
| 24 | 5.0 | 26457.3 | 0.0 | 0.0 | 0. | 0. | 3704.0 | 0.0 | 0.0 |
| 25 | 12.8 | 66120.7 | 0.0 | 0.0 | 0. | 0. | 9256.9 | 0.0 | 0.0 |
| 26 | 3.6 | 18069.8 | 0.0 | 0.0 | 0. | 0. | 2529.8 | 0.0 | 0.0 |
| 27 | 14.3 | 71012.1 | 0.0 | 0.0 | 0. | 0. | 9941.7 | 0.0 | 0.0 |
| 28 | 17.8 | 85710.8 | 0.0 | 0.0 | 0. | 0. | 11999.5 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 29 | 17.8 | 81922.4 | 0.0 | 0.0 | 0. | 0. | 11469.1 | 0.0 | 0.0 |
| 30 | 17.7 | 77708.2 | 0.0 | 0.0 | 0. | 0. | 10879.1 | 0.0 | 0.0 |
| 31 | 17.7 | 73074.0 | 0.0 | 0.0 | 0. | 0. | 10230.4 | 0.0 | 0.0 |
| 32 | 17.6 | 68021.6 | 0.0 | 0.0 | 0. | 0. | 9523.0 | 0.0 | 0.0 |
| 33 | 17.6 | 62559.5 | 0.0 | 0.0 | 0. | 0. | 8758.3 | 0.0 | 0.0 |
| 34 | 17.5 | 56696.2 | 0.0 | 0.0 | 0. | 0. | 7937.5 | 0.0 | 0.0 |
| 35 | 17.5 | 50439.2 | 0.0 | 0.0 | 0. | 0. | 7061.5 | 0.0 | 0.0 |
| 36 | 17.4 | 43798.7 | 0.0 | 0.0 | 0. | 0. | 6131.8 | 0.0 | 0.0 |
| 37 | 17.4 | 36780.2 | 0.0 | 0.0 | 0. | 0. | 5149.2 | 0.0 | 0.0 |
| 38 | 17.3 | 29395.9 | 0.0 | 0.0 | 0. | 0. | 4115.4 | 0.0 | 0.0 |
| 39 | 6.7 | 9323.1 | 0.0 | 0.0 | 0. | 0. | 1305.2 | 0.0 | 0.0 |
| 40 | 10.6 | 12009.4 | 0.0 | 0.0 | 0. | 0. | 1681.3 | 0.0 | 0.0 |
| 41 | 15.4 | 10894.1 | 0.0 | 0.0 | 0. | 0. | 1525.2 | 0.0 | 0.0 |
| 42 | 1.8 | 736.4 | 0.0 | 0.0 | 0. | 0. | 103.1 | 0.0 | 0.0 |
| 43 | 3.5 | 1150.7 | 0.0 | 0.0 | 0. | 0. | 161.1 | 0.0 | 0.0 |
| 44 | 6.9 | 929.8 | 0.0 | 0.0 | 0. | 0. | 130.2 | 0.0 | 0.0 |

Failure Surface Specified By 34 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.895 | 4263.042 |
| 3 | 4325.812 | 4261.324 |
| 4 | 4343.751 | 4259.845 |
| 5 | 4361.709 | 4258.607 |
| 6 | 4379.681 | 4257.609 |
| 7 | 4397.665 | 4256.851 |
| 8 | 4415.658 | 4256.334 |
| 9 | 4433.656 | 4256.058 |
| 10 | 4451.656 | 4256.022 |
| 11 | 4469.655 | 4256.228 |
| 12 | 4487.649 | 4256.674 |
| 13 | 4505.636 | 4257.361 |
| 14 | 4523.612 | 4258.288 |
| 15 | 4541.574 | 4259.456 |
| 16 | 4559.519 | 4260.864 |
| 17 | 4577.443 | 4262.512 |
| 18 | 4595.344 | 4264.400 |
| 19 | 4613.218 | 4266.527 |
| 20 | 4631.062 | 4268.893 |
| 21 | 4648.873 | 4271.497 |
| 22 | 4666.646 | 4274.339 |
| 23 | 4684.381 | 4277.419 |
| 24 | 4702.073 | 4280.736 |
| 25 | 4719.719 | 4284.290 |
| 26 | 4737.315 | 4288.079 |
| 27 | 4754.860 | 4292.103 |
| 28 | 4772.349 | 4296.361 |
| 29 | 4789.779 | 4300.853 |
| 30 | 4807.148 | 4305.578 |
| 31 | 4824.452 | 4310.534 |
| 32 | 4841.688 | 4315.722 |
| 33 | 4858.854 | 4321.140 |
| 34 | 4869.232 | 4324.569 |

Circle Center At X = 4445.295 ; Y = 5600.881 ; and Radius = 1344.877

*** FOS = 1.958 Theta (ki=1.0) = 3.68 ***
Lambda = 0.064

1

Failure Surface Specified By 40 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.925 | 4263.344 |
| 3 | 4325.864 | 4261.865 |
| 4 | 4343.817 | 4260.563 |
| 5 | 4361.782 | 4259.438 |
| 6 | 4379.757 | 4258.490 |
| 7 | 4397.740 | 4257.720 |
| 8 | 4415.730 | 4257.126 |
| 9 | 4433.726 | 4256.710 |
| 10 | 4451.724 | 4256.472 |
| 11 | 4469.724 | 4256.411 |
| 12 | 4487.724 | 4256.528 |
| 13 | 4505.721 | 4256.822 |
| 14 | 4523.715 | 4257.293 |
| 15 | 4541.703 | 4257.942 |
| 16 | 4559.684 | 4258.768 |
| 17 | 4577.656 | 4259.771 |
| 18 | 4595.618 | 4260.952 |
| 19 | 4613.566 | 4262.309 |
| 20 | 4631.501 | 4263.843 |

| | | |
|---|---|---|
| 21 | 4649.419 | 4265.554 |
| 22 | 4667.320 | 4267.442 |
| 23 | 4685.202 | 4269.506 |
| 24 | 4703.062 | 4271.746 |
| 25 | 4720.898 | 4274.162 |
| 26 | 4738.711 | 4276.754 |
| 27 | 4756.497 | 4279.521 |
| 28 | 4774.255 | 4282.464 |
| 29 | 4791.983 | 4285.582 |
| 30 | 4809.679 | 4288.874 |
| 31 | 4827.342 | 4292.340 |
| 32 | 4844.970 | 4295.980 |
| 33 | 4862.562 | 4299.794 |
| 34 | 4880.114 | 4303.781 |
| 35 | 4897.627 | 4307.941 |
| 36 | 4915.098 | 4312.274 |
| 37 | 4932.525 | 4316.778 |
| 38 | 4949.907 | 4321.455 |
| 39 | 4967.242 | 4326.302 |
| 40 | 4975.983 | 4328.839 |

Circle Center At X = 4466.906 ; Y = 6081.588 ; and Radius = 1825.181

*** FOS = 1.958 Theta (ki=1.0) = 5.68 ***
Lambda = 0.099

Failure Surface Specified By 40 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.925 | 4263.344 |
| 3 | 4325.864 | 4261.865 |
| 4 | 4343.817 | 4260.563 |
| 5 | 4361.782 | 4259.438 |
| 6 | 4379.757 | 4258.490 |
| 7 | 4397.740 | 4257.720 |
| 8 | 4415.730 | 4257.126 |
| 9 | 4433.726 | 4256.710 |
| 10 | 4451.724 | 4256.472 |
| 11 | 4469.724 | 4256.411 |
| 12 | 4487.724 | 4256.528 |
| 13 | 4505.721 | 4256.822 |
| 14 | 4523.715 | 4257.293 |
| 15 | 4541.703 | 4257.942 |
| 16 | 4559.684 | 4258.768 |
| 17 | 4577.656 | 4259.771 |
| 18 | 4595.618 | 4260.952 |
| 19 | 4613.566 | 4262.309 |
| 20 | 4631.501 | 4263.843 |
| 21 | 4649.419 | 4265.554 |
| 22 | 4667.320 | 4267.442 |
| 23 | 4685.202 | 4269.506 |
| 24 | 4703.062 | 4271.746 |
| 25 | 4720.898 | 4274.162 |
| 26 | 4738.711 | 4276.754 |
| 27 | 4756.497 | 4279.521 |
| 28 | 4774.255 | 4282.464 |
| 29 | 4791.983 | 4285.582 |
| 30 | 4809.679 | 4288.874 |
| 31 | 4827.342 | 4292.340 |
| 32 | 4844.970 | 4295.980 |
| 33 | 4862.562 | 4299.794 |
| 34 | 4880.114 | 4303.781 |
| 35 | 4897.627 | 4307.941 |
| 36 | 4915.098 | 4312.274 |
| 37 | 4932.525 | 4316.778 |
| 38 | 4949.907 | 4321.455 |
| 39 | 4967.242 | 4326.302 |
| 40 | 4975.983 | 4328.839 |

Circle Center At X = 4466.906 ; Y = 6081.588 ; and Radius = 1825.181

*** FOS = 1.958 Theta (ki=1.0) = 5.68 ***
Lambda = 0.099

1

Failure Surface Specified By 38 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |

| | | |
|---|---|---|
| 2 | 4307.918 | 4263.271 |
| 3 | 4325.853 | 4261.735 |
| 4 | 4343.802 | 4260.391 |
| 5 | 4361.766 | 4259.240 |
| 6 | 4379.740 | 4258.281 |
| 7 | 4397.724 | 4257.516 |
| 8 | 4415.715 | 4256.943 |
| 9 | 4433.711 | 4256.563 |
| 10 | 4451.710 | 4256.376 |
| 11 | 4469.710 | 4256.383 |
| 12 | 4487.709 | 4256.583 |
| 13 | 4505.705 | 4256.975 |
| 14 | 4523.695 | 4257.561 |
| 15 | 4541.678 | 4258.339 |
| 16 | 4559.651 | 4259.311 |
| 17 | 4577.614 | 4260.475 |
| 18 | 4595.562 | 4261.832 |
| 19 | 4613.496 | 4263.381 |
| 20 | 4631.411 | 4265.123 |
| 21 | 4649.307 | 4267.057 |
| 22 | 4667.181 | 4269.182 |
| 23 | 4685.031 | 4271.500 |
| 24 | 4702.855 | 4274.008 |
| 25 | 4720.652 | 4276.708 |
| 26 | 4738.418 | 4279.598 |
| 27 | 4756.153 | 4282.678 |
| 28 | 4773.853 | 4285.949 |
| 29 | 4791.517 | 4289.410 |
| 30 | 4809.143 | 4293.060 |
| 31 | 4826.729 | 4296.898 |
| 32 | 4844.273 | 4300.925 |
| 33 | 4861.772 | 4305.140 |
| 34 | 4879.226 | 4309.542 |
| 35 | 4896.631 | 4314.132 |
| 36 | 4913.986 | 4318.908 |
| 37 | 4931.289 | 4323.870 |
| 38 | 4943.603 | 4327.544 |

Circle Center At X = 4460.103 ; Y = 5933.819 ; and Radius = 1677.466

*** FOS = 1.959 Theta (ki=1.0) = 2.92 ***
Lambda = 0.051

Failure Surface Specified By 38 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.918 | 4263.271 |
| 3 | 4325.853 | 4261.735 |
| 4 | 4343.802 | 4260.391 |
| 5 | 4361.766 | 4259.240 |
| 6 | 4379.740 | 4258.281 |
| 7 | 4397.724 | 4257.516 |
| 8 | 4415.715 | 4256.943 |
| 9 | 4433.711 | 4256.563 |
| 10 | 4451.710 | 4256.376 |
| 11 | 4469.710 | 4256.383 |
| 12 | 4487.709 | 4256.583 |
| 13 | 4505.705 | 4256.975 |
| 14 | 4523.695 | 4257.561 |
| 15 | 4541.678 | 4258.339 |
| 16 | 4559.651 | 4259.311 |
| 17 | 4577.614 | 4260.475 |
| 18 | 4595.562 | 4261.832 |
| 19 | 4613.496 | 4263.381 |
| 20 | 4631.411 | 4265.123 |
| 21 | 4649.307 | 4267.057 |
| 22 | 4667.181 | 4269.182 |
| 23 | 4685.031 | 4271.500 |
| 24 | 4702.855 | 4274.008 |
| 25 | 4720.652 | 4276.708 |
| 26 | 4738.418 | 4279.598 |
| 27 | 4756.153 | 4282.678 |
| 28 | 4773.853 | 4285.949 |
| 29 | 4791.517 | 4289.410 |
| 30 | 4809.143 | 4293.060 |
| 31 | 4826.729 | 4296.898 |
| 32 | 4844.273 | 4300.925 |
| 33 | 4861.772 | 4305.140 |
| 34 | 4879.226 | 4309.542 |
| 35 | 4896.631 | 4314.132 |
| 36 | 4913.986 | 4318.908 |
| 37 | 4931.289 | 4323.870 |
| 38 | 4943.603 | 4327.544 |

Circle Center At X = 4460.103 ; Y = 5933.819 ; and Radius = 1677.466

*** FOS = 1.959 Theta (ki=1.0) = 2.92 ***
Lambda = 0.051

1

Failure Surface Specified By 41 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.931 | 4263.411 |
| 3 | 4325.875 | 4261.988 |
| 4 | 4343.831 | 4260.731 |
| 5 | 4361.798 | 4259.640 |
| 6 | 4379.774 | 4258.715 |
| 7 | 4397.758 | 4257.957 |
| 8 | 4415.748 | 4257.364 |
| 9 | 4433.743 | 4256.938 |
| 10 | 4451.741 | 4256.677 |
| 11 | 4469.741 | 4256.583 |
| 12 | 4487.741 | 4256.656 |
| 13 | 4505.739 | 4256.895 |
| 14 | 4523.735 | 4257.300 |
| 15 | 4541.726 | 4257.872 |
| 16 | 4559.710 | 4258.609 |
| 17 | 4577.688 | 4259.513 |
| 18 | 4595.656 | 4260.583 |
| 19 | 4613.614 | 4261.819 |
| 20 | 4631.559 | 4263.221 |
| 21 | 4649.491 | 4264.788 |
| 22 | 4667.407 | 4266.521 |
| 23 | 4685.307 | 4268.419 |
| 24 | 4703.188 | 4270.483 |
| 25 | 4721.049 | 4272.712 |
| 26 | 4738.889 | 4275.106 |
| 27 | 4756.707 | 4277.665 |
| 28 | 4774.500 | 4280.388 |
| 29 | 4792.267 | 4283.276 |
| 30 | 4810.006 | 4286.328 |
| 31 | 4827.716 | 4289.543 |
| 32 | 4845.396 | 4292.922 |
| 33 | 4863.044 | 4296.464 |
| 34 | 4880.659 | 4300.169 |
| 35 | 4898.239 | 4304.037 |
| 36 | 4915.782 | 4308.066 |
| 37 | 4933.287 | 4312.258 |
| 38 | 4950.752 | 4316.612 |
| 39 | 4968.177 | 4321.126 |
| 40 | 4985.560 | 4325.802 |
| 41 | 4999.877 | 4329.795 |

Circle Center At X = 4470.889 ; Y = 6204.602 ; and Radius = 1948.019

*** FOS = 1.961 Theta (ki=1.0) = 5.67 ***
Lambda = 0.099

Failure Surface Specified By 41 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.931 | 4263.411 |
| 3 | 4325.875 | 4261.988 |
| 4 | 4343.831 | 4260.731 |
| 5 | 4361.798 | 4259.640 |
| 6 | 4379.774 | 4258.715 |
| 7 | 4397.758 | 4257.957 |
| 8 | 4415.748 | 4257.364 |
| 9 | 4433.743 | 4256.938 |
| 10 | 4451.741 | 4256.677 |
| 11 | 4469.741 | 4256.583 |
| 12 | 4487.741 | 4256.656 |
| 13 | 4505.739 | 4256.895 |
| 14 | 4523.735 | 4257.300 |
| 15 | 4541.726 | 4257.872 |
| 16 | 4559.710 | 4258.609 |
| 17 | 4577.688 | 4259.513 |
| 18 | 4595.656 | 4260.583 |
| 19 | 4613.614 | 4261.819 |
| 20 | 4631.559 | 4263.221 |
| 21 | 4649.491 | 4264.788 |
| 22 | 4667.407 | 4266.521 |
| 23 | 4685.307 | 4268.419 |

| | | |
|---|---|---|
| 24 | 4703.188 | 4270.483 |
| 25 | 4721.049 | 4272.712 |
| 26 | 4738.889 | 4275.106 |
| 27 | 4756.707 | 4277.665 |
| 28 | 4774.500 | 4280.388 |
| 29 | 4792.267 | 4283.276 |
| 30 | 4810.006 | 4286.328 |
| 31 | 4827.716 | 4289.543 |
| 32 | 4845.396 | 4292.922 |
| 33 | 4863.044 | 4296.464 |
| 34 | 4880.659 | 4300.169 |
| 35 | 4898.239 | 4304.037 |
| 36 | 4915.782 | 4308.066 |
| 37 | 4933.287 | 4312.258 |
| 38 | 4950.752 | 4316.612 |
| 39 | 4968.177 | 4321.126 |
| 40 | 4985.560 | 4325.802 |
| 41 | 4999.877 | 4329.795 |

Circle Center At X = 4470.889 ; Y = 6204.602 ; and Radius = 1948.019

*** FOS = 1.961 Theta (ki=1.0) = 5.71 ***
Lambda = 0.100

1

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.903 | 4263.120 |
| 3 | 4325.827 | 4261.466 |
| 4 | 4343.770 | 4260.039 |
| 5 | 4361.730 | 4258.837 |
| 6 | 4379.704 | 4257.863 |
| 7 | 4397.688 | 4257.116 |
| 8 | 4415.681 | 4256.595 |
| 9 | 4433.678 | 4256.302 |
| 10 | 4451.678 | 4256.235 |
| 11 | 4469.678 | 4256.396 |
| 12 | 4487.673 | 4256.784 |
| 13 | 4505.663 | 4257.398 |
| 14 | 4523.643 | 4258.240 |
| 15 | 4541.611 | 4259.309 |
| 16 | 4559.564 | 4260.604 |
| 17 | 4577.500 | 4262.126 |
| 18 | 4595.415 | 4263.875 |
| 19 | 4613.307 | 4265.848 |
| 20 | 4631.172 | 4268.047 |
| 21 | 4649.008 | 4270.472 |
| 22 | 4666.812 | 4273.122 |
| 23 | 4684.581 | 4275.996 |
| 24 | 4702.312 | 4279.094 |
| 25 | 4720.003 | 4282.415 |
| 26 | 4737.650 | 4285.959 |
| 27 | 4755.252 | 4289.726 |
| 28 | 4772.805 | 4293.715 |
| 29 | 4790.306 | 4297.924 |
| 30 | 4807.752 | 4302.354 |
| 31 | 4825.141 | 4307.004 |
| 32 | 4842.470 | 4311.874 |
| 33 | 4859.736 | 4316.961 |
| 34 | 4876.937 | 4322.266 |
| 35 | 4886.189 | 4325.248 |

Circle Center At X = 4447.936 ; Y = 5682.764 ; and Radius = 1426.534

*** FOS = 1.962 Theta (ki=1.0) = 3.60 ***
Lambda = 0.063

Failure Surface Specified By 35 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.903 | 4263.120 |
| 3 | 4325.827 | 4261.466 |
| 4 | 4343.770 | 4260.039 |
| 5 | 4361.730 | 4258.837 |
| 6 | 4379.704 | 4257.863 |
| 7 | 4397.688 | 4257.116 |
| 8 | 4415.681 | 4256.595 |

| | | |
|---|---|---|
| 9 | 4433.678 | 4256.302 |
| 10 | 4451.678 | 4256.235 |
| 11 | 4469.678 | 4256.396 |
| 12 | 4487.673 | 4256.784 |
| 13 | 4505.663 | 4257.398 |
| 14 | 4523.643 | 4258.240 |
| 15 | 4541.611 | 4259.309 |
| 16 | 4559.564 | 4260.604 |
| 17 | 4577.500 | 4262.126 |
| 18 | 4595.415 | 4263.875 |
| 19 | 4613.307 | 4265.848 |
| 20 | 4631.172 | 4268.047 |
| 21 | 4649.008 | 4270.472 |
| 22 | 4666.812 | 4273.122 |
| 23 | 4684.581 | 4275.996 |
| 24 | 4702.312 | 4279.094 |
| 25 | 4720.003 | 4282.415 |
| 26 | 4737.650 | 4285.959 |
| 27 | 4755.252 | 4289.726 |
| 28 | 4772.805 | 4293.715 |
| 29 | 4790.306 | 4297.924 |
| 30 | 4807.752 | 4302.354 |
| 31 | 4825.141 | 4307.004 |
| 32 | 4842.470 | 4311.874 |
| 33 | 4859.736 | 4316.961 |
| 34 | 4876.937 | 4322.266 |
| 35 | 4886.189 | 4325.248 |

Circle Center At X = 4447.936 ; Y = 5682.764 ; and Radius = 1426.534

*** FOS = 1.962 Theta (ki=1.0) = 3.60 ***
Lambda = 0.063

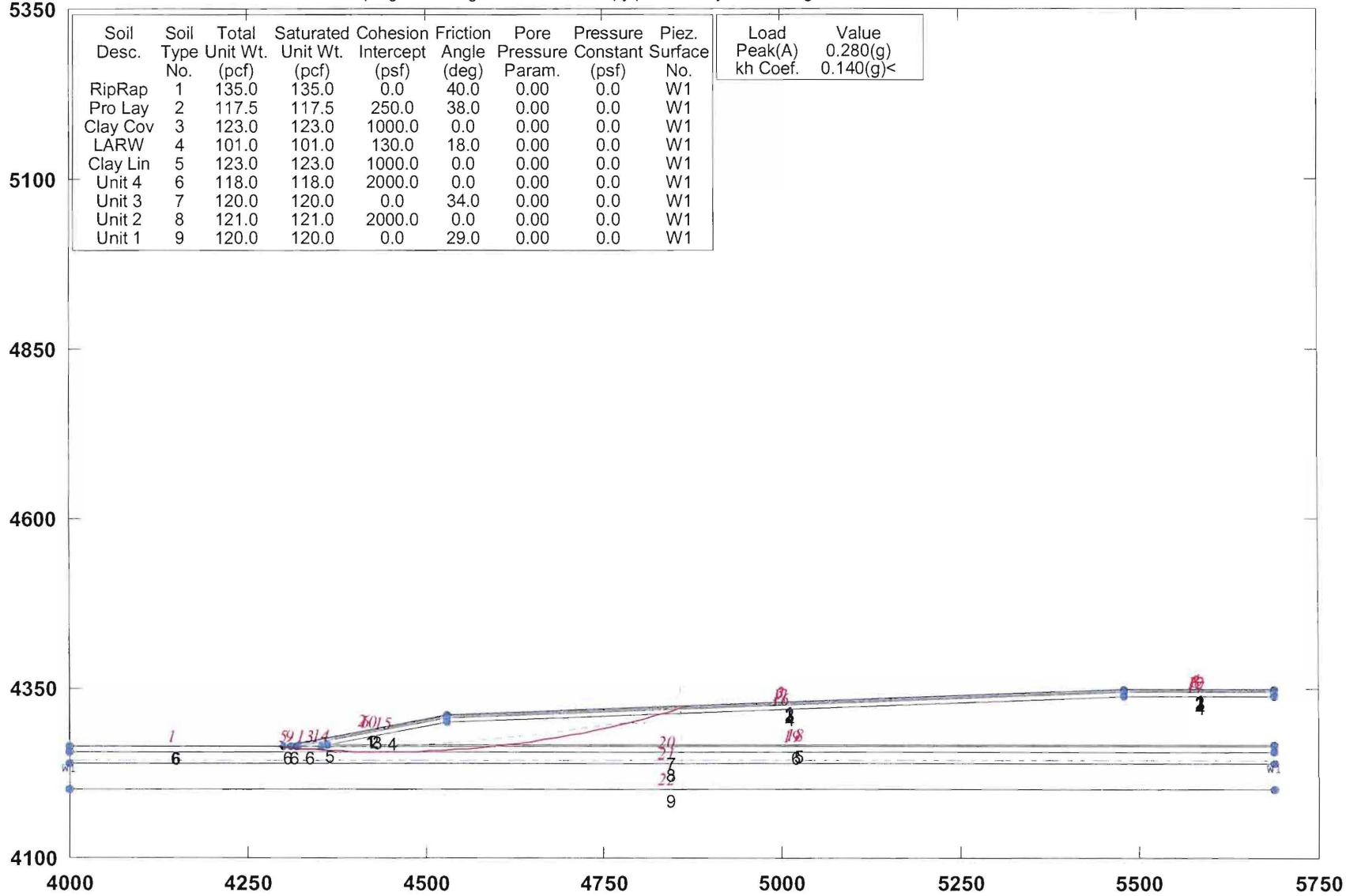
**** END OF GSTABL7 OUTPUT ****

# CAW Emb 38' 5(H):1(V) side-slopes, Yield/Deform, ShalClay unit 121810 CAWPY

c:\program files\g72sw\es caw\cawpy.plt Run By: Amec Engineer 01/04/2011 08:43PM

| Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|---|
| RipRap | 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | W1 |
| Pro Lay | 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | W1 |
| Clay Cov | 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| LARW | 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | W1 |
| Clay Lin | 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 4 | 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 3 | 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | W1 |
| Unit 2 | 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | W1 |
| Unit 1 | 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | W1 |

| Load | Value |
|---|---|
| Peak(A) | 0.280(g) |
| kh Coef. | 0.140(g)< |




**GSTABL7 v.2 FSmin=1.958**

**Factor Of Safety Is Calculated By GLE (Spencer`s) Method (0-1)**

GSTABL7

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
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**********
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
**********

Analysis Run Date: 01/04/2011
Time of Run: 08:43PM
Run By: Amec Engineer
Input Data Filename: C:\Program Files\G72SW\ES CAW\cawpy.
Output Filename: C:\Program Files\G72SW\ES CAW\cawpy.OUT
Unit System: English

Plotted Output Filename: C:\Program Files\G72SW\ES CAW\cawpy.PLT

PROBLEM DESCRIPTION: CAW Emb 38' 5(H):1(V) side-slopes,
Yield/Deform, ShalClay unit 121810 CAWPY

BOUNDARY COORDINATES

4 Top Boundaries
22 Total Boundaries

| Boundary No. | X-Left (ft) | Y-Left (ft) | X-Right (ft) | Y-Right (ft) | Soil Type Below Bnd |
|---|---|---|---|---|---|
| 1 | 4000.00 | 4265.00 | 4300.00 | 4265.00 | 6 |
| 2 | 4300.00 | 4265.00 | 4530.00 | 4311.00 | 1 |
| 3 | 4530.00 | 4311.00 | 5480.00 | 4349.00 | 1 |
| 4 | 5480.00 | 4349.00 | 5689.00 | 4349.00 | 1 |
| 5 | 4300.00 | 4265.00 | 4310.00 | 4265.00 | 6 |
| 6 | 4310.00 | 4265.00 | 4530.00 | 4309.00 | 2 |
| 7 | 4530.00 | 4309.00 | 5480.00 | 4347.00 | 2 |
| 8 | 5480.00 | 4347.00 | 5689.00 | 4347.00 | 2 |
| 9 | 4310.00 | 4265.00 | 4318.00 | 4265.00 | 6 |
| 10 | 4318.00 | 4265.00 | 4530.00 | 4307.50 | 3 |
| 11 | 4530.00 | 4307.50 | 5480.00 | 4345.50 | 3 |
| 12 | 5480.00 | 4345.50 | 5689.00 | 4345.50 | 3 |
| 13 | 4318.00 | 4265.00 | 4353.00 | 4265.00 | 6 |
| 14 | 4353.00 | 4265.00 | 4361.00 | 4267.00 | 5 |
| 15 | 4361.00 | 4267.00 | 4530.00 | 4300.50 | 4 |
| 16 | 4530.00 | 4300.50 | 5480.00 | 4338.50 | 4 |
| 17 | 5480.00 | 4338.50 | 5689.00 | 4338.50 | 4 |
| 18 | 4361.00 | 4267.00 | 5689.00 | 4267.00 | 5 |
| 19 | 4353.00 | 4265.00 | 5689.00 | 4265.00 | 6 |
| 20 | 4000.00 | 4256.00 | 5689.00 | 4256.00 | 7 |
| 21 | 4000.00 | 4239.00 | 5689.00 | 4239.00 | 8 |
| 22 | 4000.00 | 4201.00 | 5689.00 | 4201.00 | 9 |

User Specified Y-Origin = 4100.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

ISOTROPIC SOIL PARAMETERS

9 Type(s) of Soil

| Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No. |
|---|---|---|---|---|---|---|---|
| 1 | 135.0 | 135.0 | 0.0 | 40.0 | 0.00 | 0.0 | 1 |
| 2 | 117.5 | 117.5 | 250.0 | 38.0 | 0.00 | 0.0 | 1 |
| 3 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 4 | 101.0 | 101.0 | 130.0 | 18.0 | 0.00 | 0.0 | 1 |
| 5 | 123.0 | 123.0 | 1000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 6 | 118.0 | 118.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 120.0 | 120.0 | 0.0 | 34.0 | 0.00 | 0.0 | 1 |
| 8 | 121.0 | 121.0 | 2000.0 | 0.0 | 0.00 | 0.0 | 1 |
| 9 | 120.0 | 120.0 | 0.0 | 29.0 | 0.00 | 0.0 | 1 |

1

1 PIEZOMETRIC SURFACE(S) SPECIFIED

Unit Weight of Water = 62.40 (pcf)

Piezometric Surface No. 1 Specified by 2 Coordinate Points
Pore Pressure Inclination Factor = 0.50

| Point No. | X-Water (ft) | Y-Water (ft) |
|---|---|---|
| 1 | 4000.00 | 4243.00 |
| 2 | 5689.00 | 4243.00 |

Specified Peak Ground Acceleration Coefficient (A) = 0.280(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.140(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

Trial Failure Surface Specified By 34 Coordinate Points

| Point No. | X-Surf (ft) | Y-Surf (ft) |
|---|---|---|
| 1 | 4290.001 | 4265.000 |
| 2 | 4307.895 | 4263.042 |
| 3 | 4325.812 | 4261.324 |
| 4 | 4343.751 | 4259.845 |
| 5 | 4361.709 | 4258.607 |
| 6 | 4379.681 | 4257.609 |
| 7 | 4397.665 | 4256.851 |
| 8 | 4415.658 | 4256.333 |
| 9 | 4433.656 | 4256.058 |
| 10 | 4451.656 | 4256.022 |
| 11 | 4469.655 | 4256.228 |
| 12 | 4487.649 | 4256.674 |
| 13 | 4505.636 | 4257.361 |
| 14 | 4523.612 | 4258.288 |
| 15 | 4541.574 | 4259.456 |
| 16 | 4559.519 | 4260.864 |
| 17 | 4577.443 | 4262.512 |
| 18 | 4595.344 | 4264.400 |
| 19 | 4613.218 | 4266.527 |
| 20 | 4631.062 | 4268.893 |
| 21 | 4648.873 | 4271.497 |
| 22 | 4666.646 | 4274.338 |
| 23 | 4684.381 | 4277.418 |
| 24 | 4702.073 | 4280.736 |
| 25 | 4719.719 | 4284.290 |
| 26 | 4737.314 | 4288.079 |
| 27 | 4754.860 | 4292.103 |
| 28 | 4772.349 | 4296.361 |
| 29 | 4789.779 | 4300.853 |
| 30 | 4807.148 | 4305.578 |
| 31 | 4824.452 | 4310.534 |
| 32 | 4841.688 | 4315.722 |
| 33 | 4858.854 | 4321.140 |
| 34 | 4869.232 | 4324.569 |

DEFLECTION ANGLE & SEGMENT DATA FOR SPECIFIED SURFACE(Excluding Last Segment)

| Angle/Segment No. | Deflection(Deg) | Segment Length(ft) |
|---|---|---|
| 1 | 0.77 | 18.00 |
| 2 | 0.76 | 18.00 |
| 3 | 0.77 | 18.00 |
| 4 | 0.76 | 18.00 |
| 5 | 0.76 | 18.00 |
| 6 | 0.77 | 18.00 |
| 7 | 0.77 | 18.00 |
| 8 | 0.76 | 18.00 |
| 9 | 0.77 | 18.00 |

| | | |
|---|---|---|
| 10 | 0.76 | 18.00 |
| 11 | 0.77 | 18.00 |
| 12 | 0.77 | 18.00 |
| 13 | 0.77 | 18.00 |
| 14 | 0.77 | 18.00 |
| 15 | 0.77 | 18.00 |
| 16 | 0.77 | 18.00 |
| 17 | 0.76 | 18.00 |
| 18 | 0.77 | 18.00 |
| 19 | 0.77 | 18.00 |
| 20 | 0.77 | 18.00 |
| 21 | 0.77 | 18.00 |
| 22 | 0.77 | 18.00 |
| 23 | 0.77 | 18.00 |
| 24 | 0.76 | 18.00 |
| 25 | 0.77 | 18.00 |
| 26 | 0.76 | 18.00 |
| 27 | 0.77 | 18.00 |
| 28 | 0.77 | 18.00 |
| 29 | 0.76 | 18.00 |
| 30 | 0.77 | 18.00 |
| 31 | 0.76 | 18.00 |

Circle Center At X = 4445.297(ft) ; Y = 5600.861(ft); and Radius = 1344.857(ft)

| Theta (deg) (ki=1.0) | FOS (Moment) (Equil.) | FOS (Force) (Equil.) | Lambda |
|---|---|---|---|
| 14.20 | 1.697 | 1.960 | 0.253 |
| 21.30 | 0.000 | 1.963 | 0.390 |
| 12.74 | 1.790 | 1.959 | 0.226 |
| 8.81 | 1.969 | 1.957 | 0.155 |
| 7.82 | 2.002 | 1.957 | 0.137 |
| 9.57 | 1.940 | 1.958 | 0.169 |
| 9.08 | 1.958 | 1.958 | 0.160 |

{(Modified Bishop FS for Specified Surface = 1.980)}

Factor Of Safety For The Preceding Specified Surface = 1.958
Theta (ki = 1.0) = 9.08 Deg Lambda = 0.160

Factor Of Safety Is Calculated By GLE (Spencer`s) Method (0-1)

Forces from Reinforcement, Piers/Piles, Applied Forces, and Soil Nails
(if applicable) have been applied to the slice base(s)
on which they intersect.

Selected ki function = Constant (1.0)

Selected Lambda Coefficient = 0.40

Tension Crack Water Force = 0.00(lbs)

Specified Tension Crack Water Force Factor = 0.000

Depth of Tension Crack (zo) at Center of Last Slice = 0.000(ft)

*** Line of Thrust and Slice Force Data ***

| Slice No. | X Coord. | Y Coord. | L/H | Side Force (lbs) | ki | Force Angle (Deg) | Vert. Shear Force(lbs) |
|---|---|---|---|---|---|---|---|
| 1 | 4300.00 | 4264.77 | 0.792 | 10412. | 0.400 | 3.66 | 266.3 |
| 2 | 4307.89 | 4264.60 | 0.439 | 18579. | 0.400 | 3.66 | 475.2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | 4310.00 | 4264.55 | 0.412 | 20722. | 0.400 | 3.66 | 530.0 |
| 4 | 4318.00 | 4264.40 | 0.357 | 28802. | 0.400 | 3.66 | 736.6 |
| 5 | 4325.81 | 4264.27 | 0.334 | 36595. | 0.400 | 3.66 | 936.0 |
| 6 | 4343.75 | 4264.06 | 0.303 | 53735. | 0.400 | 3.66 | 1374.3 |
| 7 | 4353.00 | 4264.00 | 0.293 | 62066. | 0.400 | 3.66 | 1587.4 |
| 8 | 4361.00 | 4263.97 | 0.287 | 69111. | 0.400 | 3.66 | 1767.6 |
| 9 | 4361.71 | 4263.97 | 0.286 | 69728. | 0.400 | 3.66 | 1783.4 |
| 10 | 4379.68 | 4264.00 | 0.274 | 84394. | 0.400 | 3.66 | 2158.5 |
| 11 | 4397.67 | 4264.16 | 0.264 | 97597. | 0.400 | 3.66 | 2496.1 |
| 12 | 4415.66 | 4264.44 | 0.255 | 109168. | 0.400 | 3.66 | 2792.1 |
| 13 | 4433.66 | 4264.87 | 0.247 | 118966. | 0.400 | 3.66 | 3042.7 |
| 14 | 4451.66 | 4265.43 | 0.239 | 126874. | 0.400 | 3.66 | 3244.9 |
| 15 | 4469.65 | 4266.14 | 0.232 | 132787. | 0.400 | 3.66 | 3396.2 |
| 16 | 4487.65 | 4267.01 | 0.225 | 136638. | 0.400 | 3.66 | 3494.7 |
| 17 | 4505.64 | 4268.02 | 0.219 | 138362. | 0.400 | 3.66 | 3538.8 |
| 18 | 4523.61 | 4269.21 | 0.212 | 137931. | 0.400 | 3.66 | 3527.8 |
| 19 | 4530.00 | 4269.68 | 0.210 | 137102. | 0.400 | 3.66 | 3506.5 |
| 20 | 4541.57 | 4270.55 | 0.213 | 135553. | 0.400 | 3.66 | 3466.9 |
| 21 | 4559.52 | 4271.98 | 0.217 | 132091. | 0.400 | 3.66 | 3378.4 |
| 22 | 4577.44 | 4273.49 | 0.218 | 127780. | 0.400 | 3.66 | 3268.1 |
| 23 | 4595.34 | 4275.07 | 0.217 | 122800. | 0.400 | 3.66 | 3140.8 |
| 24 | 4600.39 | 4275.53 | 0.216 | 121182. | 0.400 | 3.66 | 3099.4 |
| 25 | 4613.22 | 4277.31 | 0.226 | 110762. | 0.400 | 3.66 | 2832.9 |
| 26 | 4616.79 | 4277.84 | 0.228 | 107711. | 0.400 | 3.66 | 2754.8 |
| 27 | 4631.06 | 4279.44 | 0.229 | 101006. | 0.400 | 3.66 | 2583.4 |
| 28 | 4648.87 | 4281.56 | 0.227 | 91811. | 0.400 | 3.66 | 2348.2 |
| 29 | 4666.65 | 4283.80 | 0.225 | 81983. | 0.400 | 3.66 | 2096.8 |
| 30 | 4684.38 | 4286.16 | 0.220 | 71685. | 0.400 | 3.66 | 1833.4 |
| 31 | 4702.07 | 4288.61 | 0.212 | 61101. | 0.400 | 3.66 | 1562.7 |
| 32 | 4719.72 | 4291.15 | 0.200 | 50427. | 0.400 | 3.66 | 1289.7 |
| 33 | 4737.31 | 4293.74 | 0.181 | 39881. | 0.400 | 3.66 | 1020.0 |
| 34 | 4754.86 | 4296.31 | 0.151 | 29681. | 0.400 | 3.66 | 759.1 |
| 35 | 4772.35 | 4298.69 | 0.096 | 20072. | 0.400 | 3.66 | 513.4 |
| 36 | 4789.78 | 4300.30 | -0.027 | 11303. | 0.400 | 3.66 | 289.1 |
| 37 | 4807.15 | 4296.43 | -0.554 | 3640. | 0.400 | 3.66 | 93.1 |
| 38 | 4824.45 | 4323.91 | 1.092 | -2635. | 0.400 | 3.66 | -67.4 |
| 39 | 4831.13 | 4318.86 | 0.601 | -4666. | 0.400 | 3.66 | -119.3 |
| 40 | 4841.69 | 4320.24 | 0.583 | -4092. | 0.400 | 3.66 | -104.7 |
| 41 | 4857.09 | 4341.12 | 5.867 | -470. | 0.400 | 3.66 | -12.0 |
| 42 | 4858.85 | 4353.02 | 10.577 | -297. | 0.400 | 3.66 | -7.6 |
| 43 | 4862.35 | 4136.31 | -93.001 | 50. | 0.400 | 3.66 | 1.3 |
| 44 | 4869.23 | 52433.00 | 0.000 | 0. | 0.400 | 3.66 | 0.0 |

***Table 1 - Individual data on the 44 slices***

| Slice No. | Width (ft) | Weight (lbs) | Water Force Top (lbs) | Water Force Bot (lbs) | Tie Force Norm (lbs) | Tie Force Tan (lbs) | Earthquake Force Hor (lbs) | Earthquake Force Ver (lbs) | Surcharge Load (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.0 | 645.2 | 0.0 | 0.0 | 0.0 | 0.0 | 90.3 | 0.0 | 0.0 |
| 2 | 7.9 | 2262.9 | 0.0 | 0.0 | 0.0 | 0.0 | 316.8 | 0.0 | 0.0 |
| 3 | 2.1 | 1020.2 | 0.0 | 0.0 | 0.0 | 0.0 | 142.8 | 0.0 | 0.0 |
| 4 | 8.0 | 5312.8 | 0.0 | 0.0 | 0.0 | 0.0 | 743.8 | 0.0 | 0.0 |
| 5 | 7.8 | 7371.9 | 0.0 | 0.0 | 0.0 | 0.0 | 1032.1 | 0.0 | 0.0 |
| 6 | 17.9 | 24970.5 | 0.0 | 0.0 | 0.0 | 0.0 | 3495.9 | 0.0 | 0.0 |
| 7 | 9.2 | 17122.6 | 0.0 | 0.0 | 0.0 | 0.0 | 2397.2 | 0.0 | 0.0 |
| 8 | 8.0 | 17068.4 | 0.0 | 0.0 | 0.0 | 0.0 | 2389.6 | 0.0 | 0.0 |
| 9 | 0.7 | 1612.7 | 0.0 | 0.0 | 0.0 | 0.0 | 225.8 | 0.0 | 0.0 |
| 10 | 18.0 | 45387.6 | 0.0 | 0.0 | 0.0 | 0.0 | 6354.3 | 0.0 | 0.0 |
| 11 | 18.0 | 53823.9 | 0.0 | 0.0 | 0.0 | 0.0 | 7535.4 | 0.0 | 0.0 |
| 12 | 18.0 | 61755.4 | 0.0 | 0.0 | 0.0 | 0.0 | 8645.8 | 0.0 | 0.0 |
| 13 | 18.0 | 69173.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9684.2 | 0.0 | 0.0 |
| 14 | 18.0 | 76068.9 | 0.0 | 0.0 | 0.0 | 0.0 | 10649.6 | 0.0 | 0.0 |
| 15 | 18.0 | 82441.3 | 0.0 | 0.0 | 0.0 | 0.0 | 11541.8 | 0.0 | 0.0 |
| 16 | 18.0 | 88282.1 | 0.0 | 0.0 | 0.0 | 0.0 | 12359.5 | 0.0 | 0.0 |
| 17 | 18.0 | 93594.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13103.2 | 0.0 | 0.0 |
| 18 | 18.0 | 98368.6 | 0.0 | 0.0 | 0.0 | 0.0 | 13771.6 | 0.0 | 0.0 |
| 19 | 6.4 | 36027.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5043.8 | 0.0 | 0.0 |
| 20 | 11.6 | 65492.7 | 0.0 | 0.0 | 0.0 | 0.0 | 9169.0 | 0.0 | 0.0 |
| 21 | 17.9 | 100327.9 | 0.0 | 0.0 | 0.0 | 0.0 | 14045.9 | 0.0 | 0.0 |
| 22 | 17.9 | 98280.3 | 0.0 | 0.0 | 0.0 | 0.0 | 13759.2 | 0.0 | 0.0 |
| 23 | 17.9 | 95712.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13399.7 | 0.0 | 0.0 |
| 24 | 5.0 | 26457.3 | 0.0 | 0.0 | 0.0 | 0.0 | 3704.0 | 0.0 | 0.0 |
| 25 | 12.8 | 66120.7 | 0.0 | 0.0 | 0.0 | 0.0 | 9256.9 | 0.0 | 0.0 |
| 26 | 3.6 | 18070.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2529.8 | 0.0 | 0.0 |
| 27 | 14.3 | 71014.6 | 0.0 | 0.0 | 0.0 | 0.0 | 9942.0 | 0.0 | 0.0 |
| 28 | 17.8 | 85711.7 | 0.0 | 0.0 | 0.0 | 0.0 | 11999.6 | 0.0 | 0.0 |
| 29 | 17.8 | 81921.9 | 0.0 | 0.0 | 0.0 | 0.0 | 11469.1 | 0.0 | 0.0 |
| 30 | 17.7 | 77712.1 | 0.0 | 0.0 | 0.0 | 0.0 | 10879.7 | 0.0 | 0.0 |
| 31 | 17.7 | 73074.9 | 0.0 | 0.0 | 0.0 | 0.0 | 10230.5 | 0.0 | 0.0 |
| 32 | 17.6 | 68021.6 | 0.0 | 0.0 | 0.0 | 0.0 | 9523.0 | 0.0 | 0.0 |
| 33 | 17.6 | 62554.3 | 0.0 | 0.0 | 0.0 | 0.0 | 8757.6 | 0.0 | 0.0 |
| 34 | 17.5 | 56699.3 | 0.0 | 0.0 | 0.0 | 0.0 | 7937.9 | 0.0 | 0.0 |
| 35 | 17.5 | 50439.2 | 0.0 | 0.0 | 0.0 | 0.0 | 7061.5 | 0.0 | 0.0 |
| 36 | 17.4 | 43798.4 | 0.0 | 0.0 | 0.0 | 0.0 | 6131.8 | 0.0 | 0.0 |
| 37 | 17.4 | 36782.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5149.5 | 0.0 | 0.0 |
| 38 | 17.3 | 29395.1 | 0.0 | 0.0 | 0.0 | 0.0 | 4115.3 | 0.0 | 0.0 |
| 39 | 6.7 | 9325.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1305.5 | 0.0 | 0.0 |
| 40 | 10.6 | 12007.7 | 0.0 | 0.0 | 0.0 | 0.0 | 1681.1 | 0.0 | 0.0 |
| 41 | 15.4 | 10894.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1525.2 | 0.0 | 0.0 |
| 42 | 1.8 | 736.4 | 0.0 | 0.0 | 0.0 | 0.0 | 103.1 | 0.0 | 0.0 |
| 43 | 3.5 | 1150.7 | 0.0 | 0.0 | 0.0 | 0.0 | 161.1 | 0.0 | 0.0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 44 | 6.9 | 929.7 | 0.0 | 0.0 | 0.0 | 0.0 | 130.2 | 0.0 | 0.0 |

- TABLE 2 - Base Stress Data on the 44 Slices -

| Slice No. * | Alpha (deg) | X-Coord. Slice Cntr (ft) | Base Leng. (ft) | Total Normal Stress (psf) | Total Vert. Stress (psf) | Mobilized Shear Stress (psf) |
|---|---|---|---|---|---|---|
| 1 | -6.24 | 4295.00 | 10.06 | 0.00 | 64.15 | 1021.66 |
| 2 | -6.24 | 4303.95 | 7.94 | 464.45 | 284.94 | 1021.66 |
| 3 | -5.48 | 4308.95 | 2.12 | 647.50 | 482.35 | 1021.66 |
| 4 | -5.48 | 4314.00 | 8.04 | 826.53 | 661.07 | 1021.66 |
| 5 | -5.48 | 4321.91 | 7.85 | 1105.36 | 939.41 | 1021.66 |
| 6 | -4.71 | 4334.78 | 18.00 | 1537.13 | 1387.22 | 1021.66 |
| 7 | -3.94 | 4348.38 | 9.27 | 1979.18 | 1846.90 | 1021.66 |
| 8 | -3.94 | 4357.00 | 8.02 | 2260.16 | 2128.51 | 1021.66 |
| 9 | -3.94 | 4361.35 | 0.71 | 2400.56 | 2269.21 | 1021.66 |
| 10 | -3.18 | 4370.70 | 18.00 | 2634.25 | 2521.55 | 1021.66 |
| 11 | -2.41 | 4388.67 | 18.00 | 3082.82 | 2990.24 | 1021.66 |
| 12 | -1.65 | 4406.66 | 18.00 | 3502.65 | 3430.84 | 1021.66 |
| 13 | -0.88 | 4424.66 | 18.00 | 3893.76 | 3842.91 | 1021.66 |
| 14 | -0.11 | 4442.66 | 18.00 | 4256.10 | 4226.04 | 1021.66 |
| 15 | 0.66 | 4460.66 | 18.00 | 4589.59 | 4580.02 | 1021.66 |
| 16 | 1.42 | 4478.65 | 18.00 | 4894.50 | 4904.65 | 1021.66 |
| 17 | 2.19 | 4496.64 | 18.00 | 5170.57 | 5199.69 | 1021.66 |
| 18 | 2.95 | 4514.62 | 18.00 | 5417.97 | 5464.93 | 1021.66 |
| 19 | 3.72 | 4526.81 | 6.40 | 5564.94 | 5627.76 | 1021.66 |
| 20 | 3.72 | 4535.79 | 11.60 | 5583.79 | 5646.82 | 1021.66 |
| 21 | 4.49 | 4550.55 | 18.00 | 5498.42 | 5573.77 | 1021.66 |
| 22 | 5.25 | 4568.48 | 18.00 | 5373.79 | 5460.04 | 1021.66 |
| 23 | 6.02 | 4586.39 | 18.00 | 5221.26 | 5317.28 | 1021.66 |
| 24 | 6.79 | 4597.87 | 5.08 | 5104.33 | 5209.63 | 1021.66 |
| 25 | 6.79 | 4606.80 | 12.92 | 5040.57 | 5117.08 | 510.83 |
| 26 | 7.55 | 4615.00 | 3.60 | 4941.00 | 5019.35 | 510.83 |
| 27 | 7.55 | 4623.92 | 14.40 | 4829.57 | 4931.47 | 868.01 |
| 28 | 8.32 | 4639.97 | 18.00 | 4656.75 | 4761.79 | 839.33 |
| 29 | 9.08 | 4657.76 | 18.00 | 4445.36 | 4551.42 | 804.24 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 30 | 9.85 | 4675.51 | 18.00 | 4211.88 | 4317.26 | 765.49 |
| 31 | 10.62 | 4693.23 | 18.00 | 3956.65 | 4059.67 | 723.13 |
| 32 | 11.39 | 4710.90 | 18.00 | 3679.79 | 3778.90 | 677.18 |
| 33 | 12.15 | 4728.52 | 18.00 | 3381.70 | 3475.44 | 627.70 |
| 34 | 12.92 | 4746.09 | 18.00 | 3062.65 | 3149.78 | 574.74 |
| 35 | 13.68 | 4763.60 | 18.00 | 2722.84 | 2802.24 | 518.34 |
| 36 | 14.45 | 4781.06 | 18.00 | 2362.52 | 2433.29 | 458.54 |
| 37 | 15.22 | 4798.46 | 18.00 | 1981.96 | 2043.40 | 395.37 |
| 38 | 15.98 | 4815.80 | 18.00 | 1581.43 | 1633.11 | 328.89 |
| 39 | 16.75 | 4827.79 | 6.98 | 1291.42 | 1336.11 | 280.76 |
| 40 | 16.75 | 4836.41 | 11.02 | 987.52 | 1089.53 | 510.83 |
| 41 | 17.52 | 4849.39 | 16.15 | 561.10 | 674.52 | 510.83 |
| 42 | 17.52 | 4857.97 | 1.85 | 340.70 | 398.31 | 263.68 |
| 43 | 18.28 | 4860.60 | 3.68 | 259.49 | 312.91 | 231.27 |
| 44 | 18.28 | 4865.79 | 7.25 | 117.84 | 128.18 | 50.51 |

```
*** SEISMIC SLOPE DISPLACEMENT DATA ***
(Note: kv is set = zero for displacement calculations)
Seismic Yield Coefficient (ky) =  0.3636(g)
Calculated Newmark Seismic Displacement =   0.016(ft)

Non-Symmetrical Sliding Resistance Has Been Specified
for Downhill Sliding.

**** END OF GSTABL7 OUTPUT ****
```

# Addendum

Response to Interrogatory CAW R313-25-8(4)-16/1:
Seismic Hazard Evaluation

October 25, 2011

Energy*Solutions*, Inc.
423 West 300 South, Suite 200
Salt Lake City, Utah 84101

Attention: Mr. Sean McCandless
Compliance and Permitting Manager

**SUBJECT: Cover Letter**
**Response to Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation**
**Energy*Solutions* Clive Facility**
**Class A West Embankment**
**Clive, Tooele County, Utah**
**AMEC Project No.: 10-817-05290**

Reference: State of Utah, Department of Environmental Quality, Undated, Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation / Seismic Stability Analysis Update. Dated August 25, 2011.

AMEC Earth & Environmental, Inc. is pleased to submit this attached report of a geotechnical response to the referenced Utah Department of Environmental Quality Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation. The objective of this consultation was to perform a deterministic seismic hazard analysis (DSHA) for the Energy*Solutions* site in Utah's west desert that incorporated Next Generation Attenuation (NGA) models that were developed in 2008. In addition the analysis incorporated a new fault source, the Carrington fault.

Our DSHA analysis included a review of readily available relevant publications and past reports for the site to identify key parameters needed for the analysis. The analysis accounted for variability of $V_{s,30}$ values by comparing recent onsite CPT derived values to the western US $V_{s,30}$ gridded values in the site region, and applying an arbitrary 10% variability. We have described our results in detail as well as presented them in a tabular format.

The effects of background seismicity were evaluated by comparing the NGA ground motions for the largest and nearest fault sources to the National Seismic Hazard Mapping results. In summary the deterministic peak ground acceleration (PGA) value of 0.23g was found to be slightly lower than the background seismicity PGA value of 0.26g with a return period of 9950 yrs. These values are slightly lower than the PGA of 0.28g presented in the AMEC report dated February 15, 2011 (AMEC Job No. 10-817-05290).

Previous embankment stability calculations were based on a PGA of 0.28g, which is slightly higher than the updated maximum 84$^{th}$ PGA calculated in the present study. Therefore, because the updated PGA is slightly lower than but not significantly different from the PGA used in seismic

stability calculations of the embankments in our report dated February 15, 2011, we consider that these previous results for embankment stability are appropriate and remain applicable.

The reviewer for the State identified inconsistencies/inaccuracies within the February 15, 2011 report that were deemed appropriate for revision. While it is our opinion that the attached report provides appropriate information for the State of Utah to complete its review of the seismic hazard evaluation we have proceeded to incorporate the requested revisions.

1. The terminology "recurrence interval" used on Page 5 has been replaced with "return period", the revised page 5 is attached.
2. The interpreted boundary age of the Unit 2 sediments has been revised to "30,000" years before present. Which in turn, the Unit 1 sands silts, and clays most likely represent "pre-Bonneville" deposits. The revised page 7 is attached.
3. The Reference section has been amended with additional references and is attached.
4. The terminology of "line" sources used in Appendix A, on page A-2 has been replaced with "planes", the revised page A-2 of Appendix A is attached.
5. A bold note has been placed on Appendix A, Table A-2 indicating that this table has been replaced by the current report which updates the seismic hazard analysis for NGA models and other details. The revised Appendix A, Table A-2 is attached.

Respectfully Submitted,
**AMEC Earth & Environmental, Inc.**

Eric A. Boone, P.E.
Senior Geotechnical Engineer

Jeffrey R Keaton, PhD, PE, PG, D.GE
Senior Principal Engineering Geologist, VP
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Attachments: AMEC Earth and Environmental Report, Dated October 25, 2011
Revised pages from: AMEC, 2011 Update Report. Pages 5 & 7; References page; Appendix A, page A-2; and Appendix A, Table A-2.

Pechmann (2004) and Campbell and Bozorgnia (2003) relations, respectively. A maximum magnitude of 6.6 on the Cedar Mountains fault produces an 84$^{th}$ percentile acceleration of 0.242g for the Abrahamson and Silva (1997) relation.

Based on this review and update of earthquake ground motion at the Energy*Solutions*, Inc. site, a conservative, but reasonable deterministic maximum peak horizontal acceleration is 0.24g for rock site conditions. This maximum acceleration exceeds the 0.181g 84$^{th}$ percentile value predicted by the Pankow and Pechmann (2004) attenuation relation for any of the fault sources in the site region, and is approximately equal to the largest maximum 84$^{th}$ percentile value predicted by Campbell and Bozorgnia (2003) and the second largest 84$^{th}$ percentile value predicted by Abrahamson and Silva (1997). The probabilistic peak horizontal acceleration of 0.24g for the weighted mean hazard curve on Appendix A: Figure A-5 corresponds to an average return period of approximately 8,825 years.

The 2005 study also evaluated whether the foundation soils and embankment either amplify or attenuate this site acceleration. A one-dimensional response analysis was completed using the software program SHAKE2000. As described in the 2005 study a small amplification of the peak horizontal ground acceleration value was calculated. Based on this consideration, it was found that the free field bedrock accelerations of 0.24g may increase up to a value of 0.28g in the free field through the foundation soil. However, the presence of the embankment tends to attenuate the free field ground motions to slightly above 0.25g. The range appropriate for stability analysis was therefore from 0.25g to 0.28g.

## 2.2 SITE CONDITIONS

### 2.2.1 Background

The 2005 study completed supplemental field and laboratory evaluations of the foundation soils below the enlarged CAC Embankment footprint. The findings of the supplemental site characterization are summarized in Appendix B-1 of the 2005 report; a copy is attached in Appendix B-1 of this update report. Previously AMEC (formerly AGRA) completed a geotechnical site characterization for the existing Class A Embankment and submitted our findings in a report dated October 26, 1999. A copy of this site characterization is also included in Appendix B-2 of the report for the 2005 study. This site characterization supplemented the previous hydrogeology site characterization by Bingham Engineering, which included soil engineering property tests and shear wave velocity measurements down to 100 feet. For the purpose of the seismic wave propagation study, the depth to bedrock below the site was estimated at a depth of about 400 to 500 feet, as shown on Figure 4, Hydrogeologic Site Characterization. However, we understand that an exploratory borehole drilled to the north of the Energy*Solutions*, Inc. site in Section 29 did not encounter bedrock within a depth of 700 feet below the ground surface.

Based on detailed geologic studies completed on other projects within the Basin and Range, we expect that the upper clays (Unit 4) represent the lake-bed clay deposited within the deep Lake Bonneville cycle(s) from about 12,000 to 30,000 years before present. The sequence of silty sands (Unit 3) below the upper clays were either alluvial, colluvial or lacustrine deposits which may have occurred during fluctuations in the Lake Bonneville level or during periods when the lake was not present (similar to current conditions). The lower (Unit 2) silts and clays most likely represent an older period of lacustrine deposition, predating 30,000 years before present and termed as the "Cutler Dam Lake cycle" in the geologic literature. The (Unit 1) sands, silts and clays most likely represent pre-Bonneville deposits from an Interglacial period. These deposits may date as old as 100,000 to 150,000 years before present. The significance of these probable ages is that numerous earthquakes have occurred during this geologic time period surrounding the site vicinity and the probability of liquefaction with depth would be considered to be quite low based on age of the deposits alone.

Based on geologic cross sections developed for the hydrogeologic site conditions, the anticipated depth to bedrock below the site is at least 400 feet (see previous note on bedrock depth). A cross section of these generalized soil/bedrock conditions are shown on Figure 4. The geology of the surrounding area is described in the Utah Geologic Survey (UGS) Map 166 (Doelling, et al, 1994). This map and the accompanying text should be referenced for more detail than the very general description that follows herein.

In general, the bedrock exposed along the Grayback Hills to the north consists of hard, durable limestone of the Triassic Age (180 to 225 million years before present), including the Thaynes, Dinwoody Formations, and volcanoclastic rock (volcanic rock incorporating sediments, some of which contain cobbles; aged about 35 million years before present). These rocks generally form the "basin and range" blocks that have been faulted during the Quaternary (3 million years ago to present). The basin and range faulting created the typical north-south trending mountain ranges filled with thick sequences of sediment in the intervening valleys. From about 10,000 to 30,000 years before present, prehistoric Lake Bonneville covered the entire area. There were numerous lake stages and elevations during this period, along with a few intervening dry periods, similar to conditions today. In a very general manner, the collective "Bonneville" deposits consist of fine sands, silts, and clays along the valley bottoms, and granular sands and gravels deposited along lake benches and spits.

### 2.2.3 Groundwater

Groundwater was encountered during the 2005 study at a depths ranging from 37.3 feet in Boring B-2 at the time of drilling to a depth of 26 feet indicated by CPT. The depth of 26 feet generally agrees with the levels measured in nearby monitor wells. A depth of 22 feet was used in our analyses and accounts for a possible rise in groundwater.

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The probabilistic seismic hazard evaluation is based on two types of earthquake sources – areas and planes. The area sources are defined by historical earthquake epicenter distributions and clusters, and an understanding of regional geology and tectonic features (seismotectonic provinces). The plane sources are faults with evidence of movements during Quaternary time. Only those faults with published information on earthquake recurrence were included in the USGS probabilistic model. Some faults were included in the 2003 update of the ground motion but were not used in the 1996 evaluation. Such is the case with faults in Skull Valley, located approximately 30 km southeast of the Envirocare site. Data reports from the USGS website on fault sources within approximately 70 km of the Envirocare site are contained in the Sub-Appendix A.

The remaining sections of this appendix contain discussions of historical earthquakes, Quaternary faults, results of the USGS seismic hazard mapping project, results of a probabilistic seismic hazard assessment for the background earthquake at the Envirocare site, and recommended earthquake ground motion expressed as peak horizontal acceleration for rock site conditions.

## HISTORICAL EARTHQUAKES

Earthquake catalogs for the site region were obtained from the seismological observatories at the University of Utah and the University of Nevada, and plotted using geographic information system (GIS) tools (Figure A-1). The Utah catalog begins in 1850, whereas the Nevada catalog begins in 1852. The two catalogs combined contain 1277 epicenters within 100 km of the Envirocare site. The earliest earthquake occurred in 1915 and the latest in September 2005; the smallest was M 0.0 and the largest M 5.2; the closest was 9.9 km from the site and the farthest was 99.9 km. Selected data for 26 earthquakes are presented in Table A-1, which is sorted by increasing distance from the site. These 26 earthquakes are located within 100 km of the site, but a magnitude and distance filter was applied to the catalogs to produce the data shown in Table A-1 because most of the epicenters represent small earthquakes more than 50 km from the site. Earthquakes of M ≥ 1 are listed in Table A-1 within 30 km of the site, M ≥ 3 within 50 km, and M ≥ 4 within 100 km.

The catalogs probably are reasonably complete for earthquakes of M ≥ 6; however, completeness for M ≥ 4 is problematic prior to the 1960s or 1970s. Table A-1 shows that the closest earthquake to the site occurred in 1998 at a distance of nearly 10 km with M 2.0. The closest earthquake of M ≥ 4 occurred in 1915 at a distance of approximately 44 km. Only one M ≥ 5 earthquake is reported within 100 km of the site since 1850; it occurred in 1962 at a distance of about 86 km.

## QUATERNARY FAULTS

Most of the faults in the site region that cut deposits of Quaternary age were identified a number of years ago. Most of them had not been studied in detail by the time the USGS was conducting their 1996 seismic hazard mapping project, and the USGS omitted them as line sources because key parameters (maximum magnitude and recurrence or slip rate) were not available. Subsequently, a systematic inventory of Quaternary faults was completed in the Western United States, and more complete information was available for the 2002 USGS update. In addition, faults in the Skull Valley were discovered and characterized (Swan and others, 2004).

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**Table A-2. Deterministic ground motion estimates for rock site conditions at the Envirocare site.**

| Fault Name (USGS Number) | Horizontal Distance To Site (km) | Fault Dip (+, -, 0) | Maximum/ Characteristic Magnitude | Basis for Magnitude | Pankow & Pechman | | | ll & Bozorgnia, 2003 | | Abrahamson & Silva, 1997 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Dist (rjb) | PHA ( Mean | | PHA (g) Mean | PHA (g) 1 Sigma | Dist (rrup) | PHA (g) Mean | PHA (g) 1 Sigma |
| Cedar Mountains (east side) (2385) | 23 | - | 6.6 | Wong | 23.0 | 0.083 | | 0.103 | 0.173 | 23.0 | 0.149 | 0.242 |
| Puddle Valley (2383) | 30 | 0 | 6.5 | Threshold | 30.0 | 0.061 | | 0.080 | 0.139 | 30.0 | 0.107 | 0.177 |
| Skull Valley (mid-valley) (2387) | 30 | + | 6.8 | Wong | 19.5 | 0.108 | | 0.120 | 0.198 | 24.6 | 0.150 | 0.238 |
| Skull Valley (mid-valley) (2387) | 30 | + | 6.5 | Swan | 19.5 | 0.092 | | 0.099 | 0.168 | 24.6 | 0.133 | 0.219 |
| Lakeside Mountains (west side) (2384) | 31 | + | 6.5 | Threshold | 20.5 | 0.088 | | 0.096 | 0.163 | 25.4 | 0.129 | 0.212 |
| Springline (n/a) | 35 | + | 6.8 | Wong | 24.5 | 0.087 | | 0.103 | 0.173 | 28.7 | 0.128 | 0.203 |
| Stansbury (2395) | 35 | + | 7.0 | Swan | 24.5 | 0.097 | | 0.118 | 0.195 | 28.7 | 0.140 | 0.215 |
| East Lakeside Mountains (2368) | 57 | - | 6.9 | SRL | 57.0 | 0.039 | | 0.052 | 0.092 | 57.0 | 0.066 | 0.102 |
| Silver Island Mountains (west side) (2381) | 65 | - | 6.5 | Threshold | 65.0 | 0.028 | | n/a | n/a | 65.0 | 0.046 | 0.075 |
| Clover (2396) | 68 | 0 | 6.5 | Threshold | 68.0 | 0.026 | | n/a | n/a | 68.0 | 0.043 | 0.071 |
| Saint John Station (2397) | 70 | + | 6.5 | Threshold | 59.5 | 0.030 | | n/a | n/a | 61.4 | 0.049 | 0.080 |
| East Great Salt Lake (Fremont Island section) (2369b) | 75 | + | 7.5 | Wong | 64.5 | 0.047 | | n/a | n/a | 66.2 | 0.079 | 0.121 |

Table A-2 has been superseded by October 25, 2011 Update to the Seismic Hazard Evaluation

Notes: USGS Number: USGS Quaternary Fault and Fold Database; data reports for each fault are included in the Sub-Appendix A
Fault Dip: + = dip toward site; - = dip away from site; 0 = fault strike toward site; dip assumed to be 55 degrees for all faults
Maximum/Characteristic Magnitude: Moment Magnitudes; mean or expected values; minimum surface rupture magnitude assumed to be 6.5
Basis for Magnitude: Wong = Wong et al., 2002; Threshold = fault rupture minimum; Swan = Swan et al., 2004; SRL = surface rupture length (Wells & Coppersmith, 1994)
Dist (rjb): Joyner-Boore distance; horizontal distance to vertical projection of fault; faults assumed to extend to 15 km depth; km
Dist (rseis): Seismogenic distance; shortest distance to fault at or below 'seismogenic' depth, which is taken to be 3 km; km
Dist (rrup): Rupture distance; shortest distance to rupturing part of fault; km

This revised Table A-2 has been obtained from AMEC, April 28, 2006, Round 2 Interrogatories and Response, Class A Embankment Height Study, Energy Solutions Facility, Near Clive, Utah. See Page 4 Section 2 of this update report (AMEC, 2/15/11) for further details regarding seismic hazard analysis.

October 25, 2011
Job No 10-817-05290

Mr. Sean McCandless
Compliance and Permitting Manager
Energy*Solutions,* Inc.
423 West 300 South, Suite 200
Salt Lake City, Utah 84101

**Re: Response to Interrogatory CAW R313-25-8(4)-16/1: Seismic Hazard Evaluation**
Energy*Solutions* Clive Facility
Class A West Embankment
Clive, Tooele County, Utah

Dear Mr. McCandless:

AMEC previously performed geotechnical investigations at the site and summarized the results in a report dated December 13, 2005 (AMEC Job No. 4-817-004769). Changes in the waste embankment configuration required re-evaluation of the findings and conclusions presented in the 2005 report; therefore, we issued an updated report dated February 15, 2011 (AMEC Job No. 10-817-05290). These reports were subsequently submitted to the State of Utah for their review and comments.

This letter provides our responses to the comments received from the State of Utah in their Interrogatory CAW R313-25-8(8)-16/1 dated August 25th 2011 that are related to the seismic hazard at the site. Specifically, this letter address several review comments regarding procedures used in our prior seismic hazard evaluation, the peak ground acceleration (PGA) value used in seismic slope stability analyses of the embankment, and the results summarized in our 2011 report. Other review comments regarding misuse of terminology and inconsistencies/inaccurate descriptions in the 2010 report can be corrected and the report re-issued, if it is deemed necessary. However, we believe that this letter provides appropriate information for the State of Utah to complete its review of the seismic hazard evaluation of the site. The State of Utah review comments are briefly stated below.

The professional opinions presented in this letter have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this letter.

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***Review Comments:***

- Use updated 2008 USGS National Seismic Hazard Maps (NSHM) and 2008 fault model
- Include the recently discovered Carrington fault in computing ground motions at the site
- Use state-of-practice Next Generation Attenuation (NGA) relationships for the western United States

**Seismic Hazard Evaluation**

Site-specific Deterministic Seismic Hazard Analyses (DSHA) were performed using equal weighting (0.25) for the Next Generation Attenuation (NGA) relationships of Abrahamson and Silva (2008), Boore and Atkinson (2008), Campbell and Bozorgnia (2008) and Chiou and Youngs (2008). The DSHA was performed using the spreadsheet developed by Ms. Linda Al-Atik of University of California, Berkeley and Dr. Norm Abrahamson of Pacific Gas and Electric (PG&E) and as published on Pacific Earthquake Engineering Research (PEER) Center NGA Project website. Quaternary faults in the Energy*Solutions* area are shown in Figure 1, and epicenters of earthquakes are plotted in Figure 2.

Ground Motion Parameters

Site-specific seismic shear-wave velocity measurements were available from seismic cone penetration tests (CPT-04 and SCPT-99-1) performed at the site to depths of about 98 feet below ground surface. The average shear wave velocities in CPT-04 and SCPT-99-1 were calculated to be about 299 and 312 meters per second (m/s). A value of 305 m/s for shear wave velocity within upper 100 feet below ground surface ($V_{s,30}$) was used in the seismic hazard analysis. In addition, we find the $V_{s,30}$ obtained from the site specific data is consistent with the regional value of 268 m/s for $V_{s,30}$ obtained from the USGS Global $Vs^{30}$ Map (http://earthquake.usgs.gov/hazards/apps/vs30).

For the Abrahamson-Silva and Chiou-Youngs attenuation equations, we estimated the depth to a shear wave velocity of 1,000 meters per second beneath the site ($Z_{1.0}$) using the Abramson-Silva (2008) soil depth model (relationship between $V_{s,30}$ and $Z_{1.0}$). For the Campbell and Bozorgnia attenuation relationship, we computed the depth to a shear wave velocity of 2,500 meters per second ($Z_{2.5}$) using Campbell-Bozorgnia (2007) relationship between $Z_{1.0}$ and $Z_{2.5}$. The $V_{s,30}$ and corresponding $Z_{1.0}$ and $Z_{2.5}$ values computed in this manner are presented below.

| $V_{s,30}$ (m/s) | $Z_{1.0}$ (m) | $Z_{2.5}$ (km) |
|---|---|---|
| 268 | 495.5 | 2.3 |
| 305 | 417 | 2.02 |
| 335 | 367 | 1.84 |

Seismic Sources

The fault and background seismic sources used in the DSHA are presented in Table 1. Also presented in the table are the fault parameters used in the attenuation relationships, including fault type, dip angle, position of the site (on hanging wall or footwall side), and seismic source-to-site distance measurements ($r_{jb}$, $r_{rup}$ and $r_x$) defined in the NGA relationships. The locations of these faults relative to the project site are shown in Figure 1.

The recently discovered Carrington fault (Dinter and Pechmann, 2005) is included in our updated seismic hazard analysis. The fault parameters were based on information from the Utah Geological Survey Working Group on Utah Earthquake Probabilities (Meeting # 4, February 16 and 17, 2011) and include the Carrington fault.

In addition to the fault-specific seismic sources included in the analysis, we evaluated the potential hazard from earthquakes occurring on unknown faults, or background seismicity. The approach for assessing the ground motion hazard from background earthquakes is discussed below.

DSHA Results (Fault Sources)

The median and 84$^{th}$ percentile deterministic ground motion values for the 12 faults closest to the site are presented in Table 1. As seen from the table, the maximum peak ground acceleration (PGA) at the site for these faults is 0.23 g, resulting from the 84$^{th}$ percentile ground motion from the Stansbury fault. The second largest PGA is 0.21g, representing the 84$^{th}$ percentile result for on the Skull Valley fault zone. The 84$^{th}$ percentile PGA for the Carrington fault is about 0.15g. Note that these ground motion values were computed for $V_{s,30}$ of 305 m/s and corresponding $Z_{1.0}$ and $Z_{2.5}$ values listed in Table 1. In order the evaluate the sensitivity of the ground motion values to site-specific shear wave velocity, we also checked the USGS modeled $V_{s,30}$ of 268 m/s and an increased value of 335 m/s, representing about a 10 percent variance in $V_{s,30}$, and corresponding $Z_{1.0}$ and $Z_{2.5}$ values presented above. The site-specific PGA values using $V_{s,30}$ = 268 m/s for Stansbury, Skull Valley and Carrington faults were computed to be about 0.24g, 0.22g and 0.16g, respectively, whereas the PGA values using $V_{s,30}$ = 335 m/s for these three faults were 0.22g, 0.20g, and 0.14g, respectively. Therefore, based on this small difference of about 0.01g, we note that site-specific PGA is not sensitive to a 10 percent variation in shear-wave velocity value.

DSHA Results (Background Seismicity)

Ground motions from the background earthquake were estimated using the NGA relationships as described above for the fault sources. A maximum earthquake magnitude of 6.5 was used for the background earthquake; this magnitude is consistent recommended maximum values for background earthquakes in the Basin and Range and Wasatch Front region based studies by dePolo (1994) and Pechmann and Arabasz (1995), as well as the Arabasz and Pechmann contribution to the 2011 Utah Working Group. The seismic activity of the “traditional” Wasatch Front Region was defined by Pechmann and Arabasz (1995) as a truncated exponential equation based on historical seismicity within a rectangular area of 86,800 km$^2$ and a maximum magnitude of 7¾, which is conservatively appropriate for earthquakes generated by the Wasatch fault which is located within the traditional Wasatch Front Region. This seismic activity equation for the mean condition is plotted as Curve A in Figure 3 and presented below:

$$\text{AF(A)} = 3.2 \times 10^{(-0.72\,(M_L - 3.0))} - 1.2 \times 10^{-3}$$

where AF(A) is annual frequency of curve A and $M_L$ is local earthquake magnitude.

The Arabasz and Pechmann contribution to the 2011 Utah Working Group meeting presented in-progress research that indicates the seismic activity curve from their 1995 study will be revised slightly downward. The present analysis uses the Pechmann and Arabasz (1995) equation.

The earthquake catalogs from the University of Utah Seismograph Stations and the University of Nevada Seismological Laboratory were used to plot epicenters shown in Figure 2. Earthquakes that occurred between 1962 and 2011 within 100 mi (160.9 km) of the site were used for an updated analysis of earthquake activity (gray circle symbols in Figure 3). The area of a circle with a 100-mile radius is 81,332 $km^2$. A truncated exponential regression of the earthquake activity using a maximum magnitude of 6.5 for the background earthquake (dePolo, 1994) is plotted as Curve B in Figure 3 and is presented below:

$$\text{AF(B)} = 1.198 \times 10^{(-0.913\,(M_L - 4.0))} - 6.242 \times 10^{-3}$$

Two earthquakes of M 6 occurred within 100 miles of the Energy*Solutions* site between 1962 and 2011, as shown in Figure 2: the 1975 Pocatello Valley, Idaho earthquake and the 2008 Wells, Nevada earthquake. The earthquake catalog in the Utah area begins in 1850 and is likely to be complete for earthquakes of M 6 and greater since 1850. The red triangle symbol in Figure 3 represents the annual rate for M 6 earthquakes based on the 161-year period (1850-2011) in lieu of the 49-year period (1962-2011) for calculating the annual earthquake rate for M 6 earthquakes. The Hansel Valley, Utah earthquake is the only other earthquake of M 6 or greater included in the earthquake catalog within 100 miles of the site; this M 6.6 earthquake produced surface fault rupture on a mapped fault, and therefore should not be included in calculating the background earthquake rate. It can be seen in Figure 3 that the longer time period results in the M 6 data point plotting on the regression curve for the historical seismicity based on a time interval of 1962-2011. It should be noted that the earthquake catalogs used in calculating activity curve B included aftershocks of the 1975 Pocatello Valley and 2008 Wells earthquakes that were within 100 miles of the Energy*Solutions* site; therefore, the resulting earthquake activity rate curve is conservative and exceeds the Pechmann and Arabasz (1995) rate for earthquakes < M 5..

Curve C in Figure 3 is based on the regression coefficients from Curve A and a maximum magnitude of 6.5 which is an appropriate maximum magnitude for the background earthquake. The Pechmann and Arabasz (1995) earthquake activity relationship is based on an earthquake catalog that includes the 1975 Pocatello Valley earthquake, but removes aftershocks. The 2008 Wells earthquake occurred after the Pechmann and Arabasz (1995) study, but is located outside the traditional Wasatch Front Region, anyway.

Curves D, E, and F in Figure 3 are normalized to an area of 1000 $km^2$. The normalization process allows curves derived from different areas to be compared directly. In the deterministic approach to calculating background earthquake ground motions, the source distance is taken as the radius of a circle with an area of 1000 $km^2$, or 17.84 km. The earthquake magnitude used in deterministic

calculation of ground motions is taken as that which has a 1% exceedance probability in a 100-year exposure time, which corresponds to an annual frequency of 1.005 x $10^{-4}$, or an average return period of 9950 years:

$$AF = \frac{-\ln(1-p)}{t} = \frac{-\ln(1-0.01)}{100} = 1.005 \times 10^{-4} = \frac{1}{9950}$$

where AF is annual frequency, p is annual exceedance probability, and t is time in years. This exceedance probability approach produces calculated ground motions from the background earthquake that are semi-probabilistic in nature and conservative.

A magnitude of 6.5 corresponds to the 9950-yr return period earthquake for the traditional Wasatch Front region including surface faulting earthquakes (i.e., $M_{max}$ = 7.75) normalized to an area of 1000 $km^2$ (intersection of Curve D and 9950-yr return period in Figure 3). The PGA value for M 6.5 at 17.8 km is 0.21g using $V_{s,30}$ = 305 m/s and the 84$^{th}$ percentile results from NGA calculations, as shown in Table 1.

The 9950-yr return period background earthquake (i.e., $M_{max}$ = 6.5) is M 6.1 for both the traditional Wasatch Front region and the regression based on historical seismicity 1962-2011 normalized to a 1000 $km^2$ area (Curves E and F in Figure 3). The resulting 84$^{th}$ percentile PGA results are 0.17g for $V_{s,30}$ = 305 m/s, as shown in Table 1.

Curves G and H in Figure 3 are normalized to an area of 100 $km^2$, where the source distance is taken as the radius of a circle with an area of 100 $km^2$, or 5.64 km. Curve G is based on the historical seismicity from 1962-2011 and shows a 9950-yr return period background earthquake magnitude of 5.2. This background earthquake (M 5.2 at a distance of 5.64 km) has an 84$^{th}$ percentile PGA of 0.26g for $V_{s,30}$ = 305 m/s, as shown in Table 1.

<u>Discussion and Conclusions</u>

Based on the DSHA results presented above and in Table 1, the maximum 84$^{th}$ percentile PGA from a fault-specific earthquake source is computed to be 0.23g for a maximum magnitude earthquake (M 7.5) occurring on Stansbury fault.

Based on our analysis of the background seismicity, the maximum 84$^{th}$ percentile PGA for a return period of 9950 years is computed to be 0.26g for a M 5.2 earthquake occurring at a distance of 5.6 km. Therefore, the largest 84$^{th}$ percentile PGA computed for the Energy*Solutions* site based on deterministic procedures and using NGA models for fault-specific and background earthquakes is estimated to be about 0.26g.

Previous embankment stability calculations were based on a PGA of 0.28g, which is slightly higher than the updated maximum 84$^{th}$ PGA calculated in the present study. Therefore, because the updated PGA is slightly lower than but not significantly different from the PGA used in seismic stability calculations of the embankments and to develop other results presented in our report dated February 15, 2011 (AMEC Job No. 10-817-05290), we consider that these previous results are appropriate and applicable.

It has been a pleasure to be of professional service to you. Please contact us with questions or if we can be of further assistance.

Sincerely,

**AMEC Earth & Environmental, Inc.**

Hari Ponnaboyina
Senior Engineer

Jeffrey R. Keaton, PhD, PE, PG
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**Attachments:**

Table 1 – Summary of Fault Parameters and DSHA Results
Figure 1 – Quaternary Faults Near Energy Solutions Site
Figure 2 – Earthquake Epicenters in the Energy Solutions Area
Figure 3 – Earthquake Activity in the Energy Solutions Area

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## Table 1. Summary of Fault Parameters and DSHA Results

| Earthquake Source | Fault Parameters | | | | | | | | | Distance (km) | | | Vs30 | $Z_{1.0}$ | $Z_{2.5}$ | Average PGA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | $M_{max}$ | HW | Dip | Rake | TOR | DWR | DTR | $x_{surf}$ | $r_{map}$ | $r_{jb}$ | $r_{rup}$ | m/s | m | km | $PGA_{med}$ | $PGA_{84th}$ |
| Cedar Mountains | NM | 6.6 | No | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 23.0 | 23.0 | 23.0 | 305 | 417 | 2.02 | 0.11 | 0.18 |
| Puddle Valley | NM | 6.5 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 30.0 | 19.5 | 24.6 | 305 | 417 | 2.02 | 0.11 | 0.18 |
| Lakeside Mountain | NM | 6.5 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 31.0 | 20.5 | 25.4 | 305 | 417 | 2.02 | 0.10 | 0.18 |
| Skull Valley | NM | 7.1 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 34.5 | 24.0 | 28.3 | 305 | 417 | 2.02 | 0.13 | 0.21 |
| Springline | NM | 6.8 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 35.0 | 24.5 | 28.7 | 305 | 417 | 2.02 | 0.11 | 0.18 |
| Stansbury | NM | 7.5* | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 37.0 | 26.5 | 30.4 | 305 | 417 | 2.02 | 0.14 | 0.23 |
| Carrington | NM | 7.1 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 47.0 | 36.5 | 39.5 | 305 | 417 | 2.02 | 0.09 | 0.15 |
| East Lakeside Mountain | NM | 6.9 | No | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 57.0 | 57.0 | 57.0 | 305 | 417 | 2.02 | 0.06 | 0.10 |
| Silver Island Mountains | NM | 6.5 | No | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 65.0 | 65.0 | 65.0 | 305 | 417 | 2.02 | 0.04 | 0.06 |
| Clover | NM | 6.5 | No | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 68.0 | 68.0 | 68.0 | 305 | 417 | 2.02 | 0.04 | 0.06 |
| Saint John Station | NM | 6.5 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 70.0 | 59.5 | 61.4 | 305 | 417 | 2.02 | 0.04 | 0.07 |
| East Great Salt Lake | NM | 7.5 | Yes | 55 | -90 | 0 | 18.3 | 15 | 10.5 | 75.0 | 64.5 | 66.2 | 305 | 417 | 2.02 | 0.07 | 0.12 |
| Background, Curve D | NM | 6.5 | No | 90 | -90 | 0 | 18.3 | 15 | 10.5 | 17.8 | 17.8 | 17.8 | 305 | 417 | 2.02 | 0.13 | 0.21 |
| Background, Curve E, F | NM | 6.1 | No | 90 | -90 | 0 | 18.3 | 15 | 10.5 | 17.8 | 17.8 | 17.8 | 305 | 417 | 2.02 | 0.10 | 0.17 |
| Background, Curve G | NM | 5.2 | No | 90 | -90 | 0 | 18.3 | 15 | 10.5 | 5.6 | 5.6 | 5.6 | 305 | 417 | 2.02 | 0.15 | 0.26 |
| Background, Curve H | NM | 5.1 | No | 90 | -90 | 0 | 18.3 | 15 | 10.5 | 5.6 | 5.6 | 5.6 | 305 | 417 | 2.02 | 0.14 | 0.24 |

Notes:
Fault Type: NM = Normal
HW: Hanging wall condition; Yes = On Hanging Wall, No = Not On Hanging Wall
DWR = Down dip Width of Rupture
DTR = Depth to Bottom of Rupture
rmap = Map Distance
rjb = Boore-Joyner Distance
rrup = Fault Rupture Distance
Mmax - Magnitude is the Average maximum magnitude based on empirical relationships of Wells and Coppersmith (1994).
* Based on unsegmented rupture model from Utah Working Group.
Fault geometry is based on the geometry of the closest fault segment to the site, NOT the average geometry of the combined rupture segment.
Background earthquake Curves D, E, F, G, and H correspond to designations shown in Figure 3.

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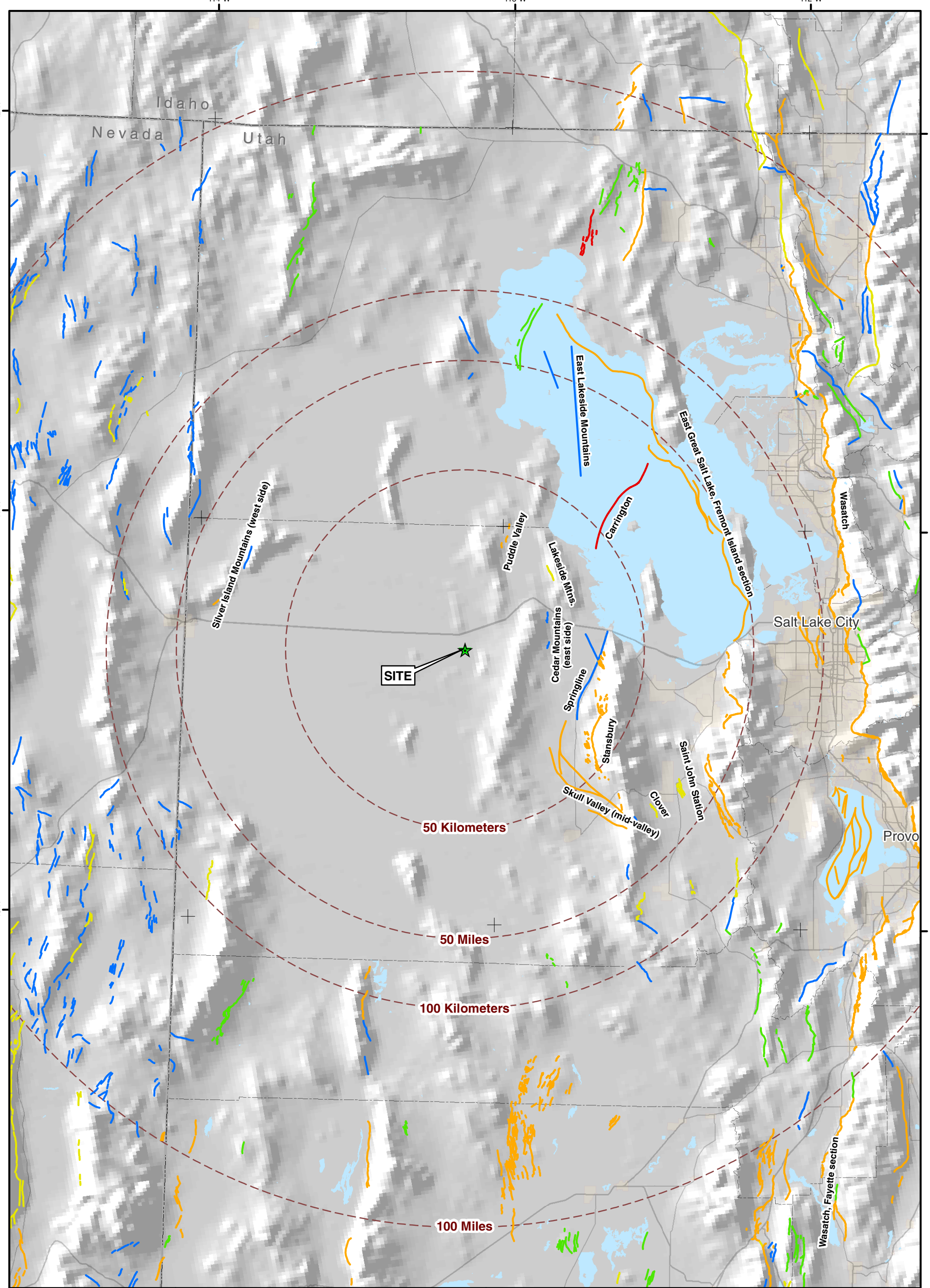



Explanation
Fault line color denotes age of most recent displacement

- Historic
- Holocene/Late Pleistocene
- Late Quaternary
- Mid Quaternary
- Quaternary

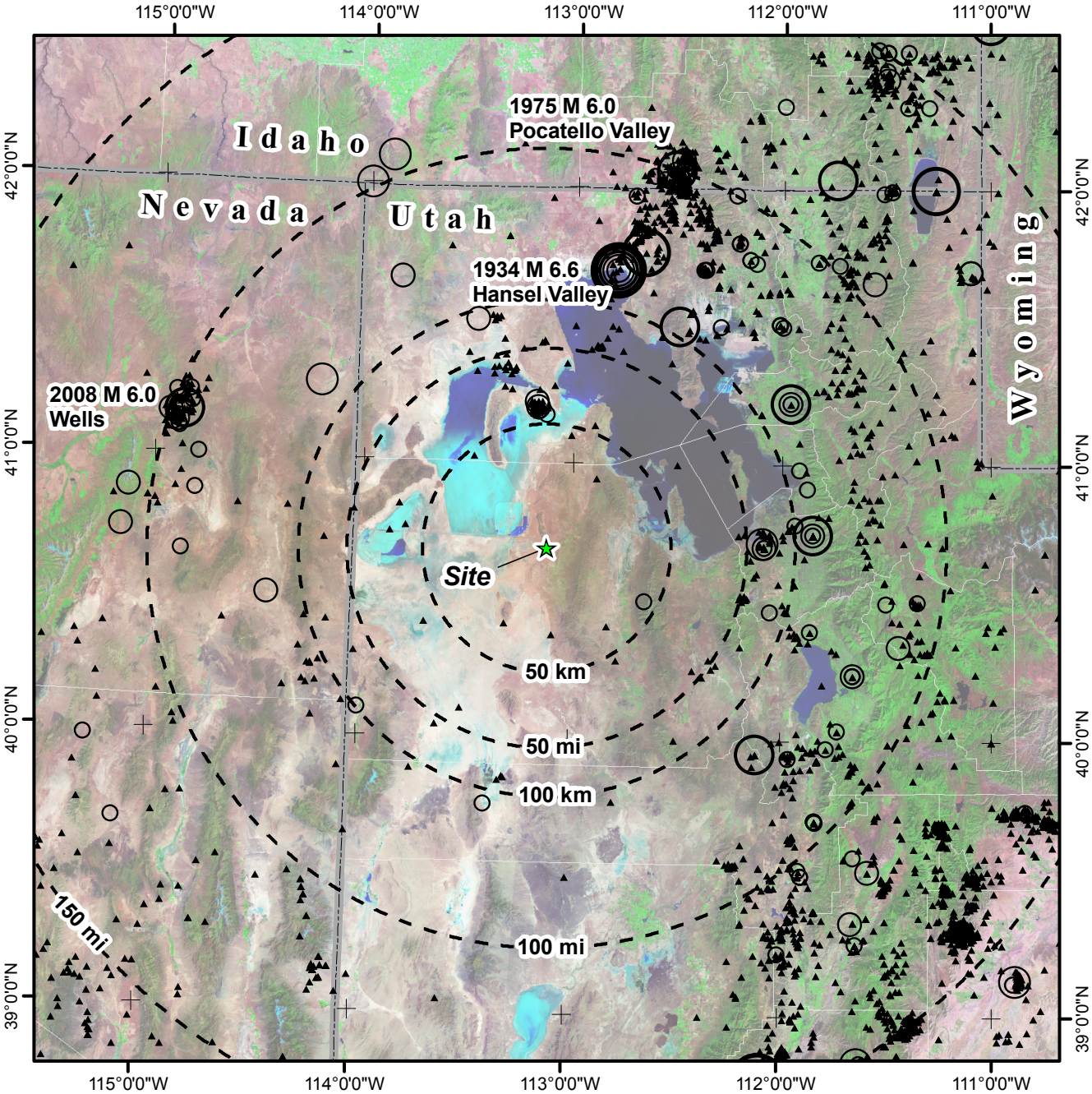
Data Sources:
U.S. Geological Survey Q-faults database:
URL: http://earthquake.usgs.gov/hazards/qfaults/
URS, 2011: Carrington Fault

0 10 20 Miles

N

QUATERNARY FAULTS NEAR
ENERGY SOLUTIONS SITE
Clive, Tooele County, Utah

| By: _____ | Date: 10/10/2011 | Project No. 10-817-05290.2 |
|---|---|---|
| amec | | Figure 1 |




Sources: University of Utah Seismograph Stations and University of Nevada Seismological Laboratory

0 25 50 75 100 mi

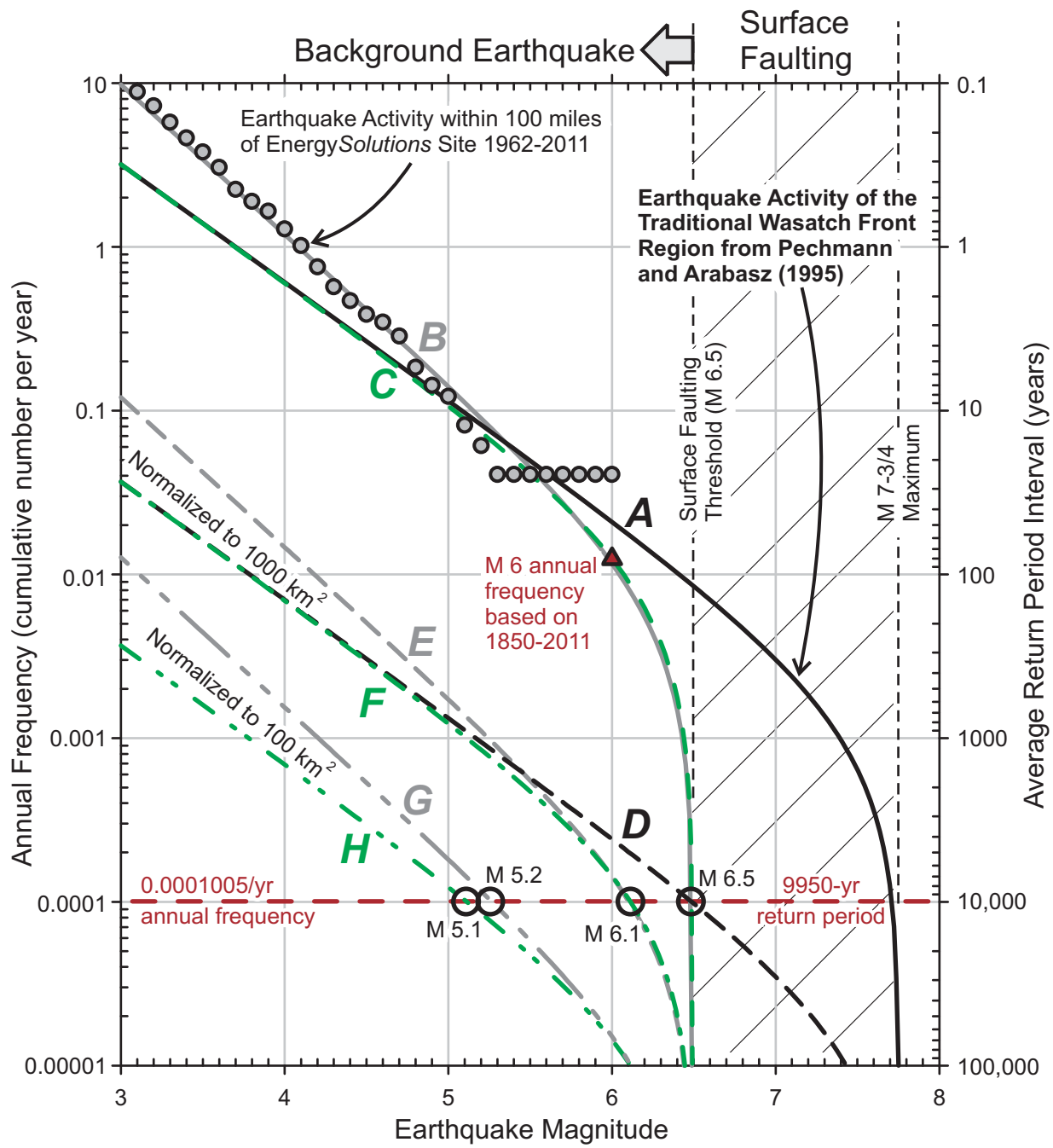
0 50 100 150 km

**Earthquake Epicenters**
**1850 - 2011**

- M <= 4.0
- 4.0 < M <= 4.5
- 4.5 < M <= 5.0
- 5.0 < M <= 5.5
- 5.5 < M <= 6.0
- 6.0 < M <= 6.5
- 6.5 < M <= 7.0

**EARTHQUAKE EPICENTERS IN THE ENERGY SOLUTIONS AREA**
**Tooele County, Utah**

| By: JRK | Date: 10/10/2011 | Project No. 10-817-05290.2 |
|---|---|---|
| amec | | Figure 2 |




Curve A: Traditional Wasatch Front region (86,800 km$^2$) from Pechmann and Arabasz (1995); Mmax = 7.75
Curve B: Regression of historical seismicity from 1962 to 2011 within 100 mi of site (81,332 km$^2$); Mmax = 6.5
Curve C: Curve A (86,800 km$^2$) modified to Mmax = 6.5.
Curve D: Curve A normalized to 1000 km$^2$; Mmax = 7.75
Curve E: Curve B normalized to 1000 km$^2$; Mmax = 6.5
Curve F: Curve C normalized to 1000 km$^2$; Mmax = 6.5
Curve G: Curve B normalized to 100 km$^2$; Mmax = 6.5
Curve H: Curve C normalized to 100 km$^2$; Mmax = 6.5

EARTHQUAKE ACTIVITY IN THE ENERGY SOLUTIONS AREA
Clive, Tooele County, Utah

| By: JRK | Date: 10/10/2011 | Project No. 10-817-05290.2 |
|---|---|---|
| amec | | Figure 3 |

# Addendum

Response to Interrogatory CAW R313-25-8(4)-16/2a
Seismic Hazard Evaluation

December 23, 2011
Job No 10-817-05290

Mr. Sean McCandless
Compliance and Permitting Manager
Energy*Solutions,* Inc.
423 West 300 South, Suite 200
Salt Lake City, Utah 84101

**Re: Response to Interrogatory CAW R313-25-8(4)-16/2:**
**Seismic Hazard Evaluation**
Energy*Solutions* Clive Facility
Class A West Embankment
Clive, Tooele County, Utah

Dear Mr. McCandless:

AMEC previously performed geotechnical investigations at the site and summarized the results in a report dated December 13, 2005 (AMEC Job No. 4-817-004769). Changes in the waste embankment configuration required re-evaluation of the findings and conclusions presented in the 2005 report; therefore, we issued an updated report dated February 15, 2011 (AMEC Job No. 10-817-05290). These reports were subsequently submitted to the State of Utah for their review and comments. In a letter dated October 25, 2011, we provided our responses to comments received from State of Utah in their Interrogatory CAW R313-25-8(4)-16/1. The October 25th letter specifically addressed review comments regarding procedures used in our prior seismic hazard evaluation, the peak ground acceleration (PGA) value used in seismic slope stability analyses of the embankment, and the results summarized in our February 2011 report. Additional interrogatory comments were received from the State of Utah on December 8, 2011, as presented in their interrogatory CAW R313-25-8(4)-16/2. This letter is an update to our October 25th letter and provides responses to current comments.

The professional opinions presented in this letter have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this letter.

***Interrogatory CAW R313-25-8(4)-16/2 - Review Comments***

- Justify using the outdated “semi-probabilistic” approach reported in the response or

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preferably perform a probabilistic seismic hazard analysis (PSHA). In addition,

a. If an attempt is made to justify the semi-probabilistic, explain and justify the basis for using the radius of the circular area of 18.74 km in the deterministic calculations
b. Decluster the earthquake catalog as is done in standard probabilistic approaches and as was done by Pechmann and Arabasz (1995) and use that catalog in any ground motion calculations.
c. Correctly label the vertical axis in Figure 3 and correctly interpret the information presented in Figure 3 (cumulative frequency plot).

**Response to Interrogatory *CAW R313-25-8(4)-16/2* - Seismic Hazard Evaluation**

Following receipt of the first interrogatory review comments, AMEC provided Energy*Solutions* with a plan based on a deterministic approach for updating the earthquake ground motion at the site near Clive, Utah. Comments from the reviewer provided by email on September 7, 2011, stated "Performing a deterministic seismic hazard analysis is appropriate for the facility." We used a deterministic approach in our letter dated October 25, 2011, and called the deterministic approach for the background earthquake "semi-probabilistic" because we use the rate of earthquakes calculated from the catalog of historical seismicity to estimate earthquake magnitudes and distances that correspond to cumulative annual frequency values needed for defining seismic hazard at the site. The interrogatory comment received on December 8, 2011, suggests that the reviewer either forgot that a deterministic approach was judged to be appropriate for the facility or was confused by our use of "semi-probabilistic" to refer to deterministic calculations that are based on the historical seismicity rate in an otherwise deterministic approach.

Interrogatory CAW R313-25-8(4)-16/2 (Interrogatory 2) demands justification of the semi-probabilistic deterministic approach that we used and indicates a preference that a probabilistic seismic hazard analysis (PSHA) be performed. In preparing a response to Interrogatory 2, we addressed the issues raised, elaborated on the deterministic approach for the background earthquake, and also used EZ-Frisk to analyze the seismic hazard at the site. EZ-Frisk is not well suited for the Energy*Solutions* site because it does not include the Carrington fault as a source or the SEA99 attenuation relation for extensional tectonic settings with the 2004 modification by Pankow and Pechmann. We address these issues below in subsequent sections of this letter and defend the results of the deterministic analysis presented in our October 25, 2011, letter.

Interrogatory 2 states "*In lieu of performing a PSHA to assess the ground motions from background earthquakes as they had previously done for this site, AMEC has attempted to take what they call a "semi-probabilistic" approach. The justification for taking such an approach is however unstated. Semi-probabilistic approaches are not standard practice and have been abandoned since the late 1990's*." As mentioned above, a deterministic approach to defining seismic hazard at the Energy*Solutions* site is appropriate for evaluating the stability of an earth embankment structure that uses peak acceleration only. The semi-probabilistic approach is a deterministic approach with the historical seismicity being used to give a rate of occurrence of earthquake magnitudes that allows estimation of pairs of magnitude and distance for calculating ground motion. This is standard practice for earth embankments; one notable agency, the State of California Division of Safety of Dams, requires deterministic analyses for dams in their jurisdiction. They will allow probabilistic methods to be used to help guide the deterministic approach, but they do not accept probabilistic analysis results per se. AMEC had used a probabilistic approach in the

past to supplement the deterministic results; however, the PSHA model used was EZ-Frisk, which has limitations for use at the Energy*Solutions* site. These limitations are related to the Carrington fault source and attenuation relationships appropriate for extensional tectonic settings. Furthermore, since the structure at the site is an earth embankment, we believe that the appropriate approach is deterministic. No further justification is warranted

Interrogatory 2 states "*In some aspects, the "semi-probabilistic" approach has similarities with the methodology used by the U.S. Bureau of Reclamation (USBR) since the early 1980's but long since abandoned since the late 1990's. As pointed out by Pechmann and Arabasz (1995) for the Wasatch Front region, this approach which they call "semi-deterministic" yields peak horizontal accelerations that are a factor of 1.5 to 5.7 lower than values obtained by a more complete PSHA. The USBR performs a PSHA to address the hazard from background earthquakes.*" The major factor between deterministic and probabilistic approaches is in the weight given to a range of magnitudes and the tails of the probability distribution in probabilistic methods, whereas the conventional approach of using a single magnitude for the maximum earthquake and limiting attenuation in the deterministic method to the 84th percentile. The background earthquake has been a dilemma for those locations that are not close to active fault earthquake sources. The maximum magnitude for a background earthquake typically is taken at the threshold magnitude of surface-faulting earthquakes with the understanding that in the western US active faults tend to have geologic evidence of past earthquakes (fault scarps) which can be evaluated within a certain distance of the site as a limiting factor or boundary condition for the seismic hazard. For this reason, the deterministic approach used a minimum source-to-site distance for fault sources, but a somewhat arbitrary, non-zero distance for the background earthquake. The "semi-probabilistic" approach used in our October 25, 2011, letter is based on the rate of historical seismicity normalized to an arbitrary, but relatively small area (1,000 $km^2$). This area is expressed as a circle with a radius that serves as a distance for attenuating ground motion; the magnitude used in the calculation is determined by the intersection of the desired cumulative annual frequency and the normalized rate curve. A variety of areas could be used, each taken to be circular with the radius serving as an attenuation distance.

Interrogatory 2 states that the approach used in our October 25, 2011, letter appears flawed for three reasons. Interrogatory 2 states "*The statement is made on page 4 of the AMEC report that the "resulting earthquake activity rate curve is conservative and exceeds the Pechmann and Arabasz (1995) rate of earthquakes < 5." This difference may have resulted because AMEC did not decluster their earthquake catalog as is done in standard probabilistic approaches and as was done by Pechmann and Arabasz (1995). At the magnitude range of importance M > 5, the rate of activity is lower than Pechmann and Arabasz (1995) which may be appropriate for this area west of the Wasatch Front.*" The deterministic approach used in our October 25, 2011, letter is suitable for an earth embankment structure. The earthquake catalog was not declustered because use of the catalog with aftershock events produced a higher rate of seismic activity and a conservative estimate of magnitudes and distances for the "semi-probabilistic" deterministic calculations. The reviewer recognizes this conservatism in the last sentence quoted above. For this reason, we subdivided the area within 100 miles of the site into an eastern part with most of the seismicity and a western part with little seismicity, as discussed below. As expected, the seismic hazard level at the site based on this refinement is reduced. The catalog was declustered, as demanded; as expected the seismic hazard level was reduced. From an engineering perspective, it is common to use an approach that produces a conservative but reasonable result that may be an approximation

of scientific reality. We believe that the approach described in our October 25, 2011, letter was such a conservative approximation suitable for the Energy*Solutions* facility.

Interrogatory 2 states "*For a 1000 km2 area, the radius of 17.84 km is used. The recurrence interval of an earthquake of M 6.5 and greater from the AMEC analysis is 9950 years but that earthquake can occur anywhere within the 1000 km2 area. Specifying the earthquake occurs at 17.84 km effectively places the event at the further distance from the site for that probability. Note the vertical axis on Figure 3 is mislabeled. It is "Recurrence Interval" not "Return Period".*" The selection of magnitude and distance pairs is considered to be "semi-probabilistic" so that a non-zero distance can be selected rationally. In some ways, it is analogous to calculating the equivalent distance at which earthquakes of different magnitudes would need to occur to produce the seismic hazard result developed with PSHA procedures. The deterministic approach uses minimum distance from specific seismic sources to the site being evaluated; however, for non-specific sources (i.e., the background earthquake), the "semi-probabilistic" approach used in our October 25, 2011, report is reasonable and understandable. The calculated ground motion is based on the 84th percentile acceleration, which is consistent with the deterministic approach.

We revised the earthquake activity based on the declustered catalog and separation of the seismicity within 100 miles of the site into the more active east and less active west, as discussed below. The updated figure has the supplemental vertical axis labeled correctly. We use return period and recurrence interval more or less interchangeably, which is consistent with the definition of the terms on the USGS earthquake hazard website (http://earthquake.usgs.gov/learn/glossary/).

Interrogatory 2 states "*The recurrence curves shown on Figure 3 are cumulative frequency plots. AMEC is interpreting earthquake magnitudes from these plots but is ignoring the fact that these magnitudes represent events that have the specified magnitude value and larger. As stated above, the magnitude on Curve B that has a recurrence interval of 9950 years is a M 6.5 and greater.*" Curve B is intended to represent the background earthquake for the area within 100 miles of the Energy*Solutions* site; it uses the rate of smaller earthquakes in that part of the Wastach Front Region and a limiting maximum magnitude consistent with the concept of the background earthquake. In other words, Curve B, by definition, does not extend to magnitudes larger than the threshold of surface-faulting which is taken to be M 6.5.

Ground Motion Prediction Equations

Site-specific Probabilistic and Deterministic Seismic Hazard Analyses (PSHA and DSHA) were performed using the Next Generation Attenuation (NGA) relationships developed for the Western United States (WUS) and an attenuation relationship appropriate for extensional tectonic regimes originally developed by Spudich et al. (1999; SEA99) which was subsequently modified by Pankow and Pechman (2004).Considering that the NGA relationships were developed mostly using earthquake records from California or from similar compression tectonic regimes, it is expected that the ground motions at the site computed using the NGA relationships would be higher than those computed using attenuation relationships for extensional tectonic regimes. Therefore, in this revised seismic hazard analysis, we have used an equal weighting of 0.5 for NGA and Pankow and Pechman (2004) relationships. The NGA relationships used in this study include relationships of Abrahamson and Silva (2008), Boore and Atkinson (2008), Campbell and Bozorgnia (2008) and

Chiou and Youngs (2008). Each of the NGA relationship was given an equal weighting of 0.125 in computing the ground motions.

The DSHA was performed using the spreadsheet developed by Ms. Linda Al-Atik of University of California, Berkeley and Dr. Norm Abrahamson of Pacific Gas and Electric (PG&E) and as published on Pacific Earthquake Engineering Research (PEER) Center NGA Project website. The results were also checked against those computed using commercial software EZ-Frisk 7.62 (Risk Engineering, 2011).The spreadsheet includes the 2009 corrections for hanging wall term in the Abrahamson and Silva (2008) relationship; however, EZ-Frisk 7.62 currently uses the 2008 version of the relationship and overpredicts ground motions for a source with normal or a reverse fault mechanism by 10-20 percent. A request was made to Risk Engineering in late 2009 to correct the error in this relationship; however, the error has not been corrected yet.

Deterministic “Semi-Probabilistic” Results for Background Earthquake

Discussions in our October 25, 2011, letter were supplemented by an updated analysis that uses a declustered seismicity catalog and subdivides the area within 100 miles of the Energy*Solutions* site into an east part and a west part (Figure 1). The red “+” symbols in Figure 1 denote declustered earthquake epicenters that were used in the current analysis in the more active eastern part of the Energy*Solutions* site region, which is denoted by red hachure lines. The blue “+” symbols in Figure 1 denote declustered epicenters in the west part, denotes by blue hachure lines. The boundary separating east and west was selected arbitrarily, but approximates the East Great Salt Lake fault zone on the west side of the Promontory Range and Antelope Island, more or less bisecting the Great Salt Lake.

Earthquake activity in the Energy*Solutions* site area is shown in Figure 2. Curve A in Figure 2 is the earthquake activity in the traditional Wasatch Front Region (Pechmann and Arabasz, 1995) covering 86,800 $km^2$ along the Wasatch Front. The red square symbols denote the cumulative annual frequency of earthquakes within the east part of the 100-mile-radius circle in Figure 1. Curve B in Figure 2 is a truncated exponential regression curve through the red square symbols using M0 = 4 and Mmax = 7.75 (see the AMEC letter dated October 25, 2011, for explanation of other symbols). The seismic activity of the east part of the 100-mile-radius circle around the Energy*Solutions* site represented by Curve B in Figure 2 is nearly superimposed on Curve A. The near superposition of Curves A and B indicates that the declustering of the catalog was reasonable and the east part of the 100-mile-radius circle is representative of the seismicity of the greater Wasatch Front Region.

The blue circle symbols in Figure 2 denote the cumulative annual frequency of earthquakes within the west part of the 100-mile radius circle around the site. Curve C is the truncated exponential regression with Mmax = 6.5. The largest earthquake in the west part of the 100-mile-radius circle is a M 6 event in 2008 in Wells, NV; no surface faulting was associated with it or other earthquakes in the west part of the 100-mile-radius circle.

Curve D in Figure 2 is Curve B (the east part of 100-mile-radius circle in Figure 1) normalized to an area of 1000 $km^2$. Curve E in Figure 2 is Curve C (the west part) normalized to 1000 $km^2$. These curves can be compared to Figure 3 in our October 25, 2011, letter; the reviewer's speculation about the lower earthquake rate to the west of the Wasatch Front is accurate, as displayed in Figure 2. Curve F in Figure 2 is Curve C normalized to 100 $km^2$. Curve G is Curve C normalized to an area of 192 $km^2$, whereas Curve H is Curve C normalized to 1685 $km^2$. Curve G intersects the 0.001005/yr cumulative annual frequency value at M 5.0, whereas Curve H intersects at M 6.0. Attenuation distances for deterministic calculations can be taken as the radii of circles with the normalizing areas (i.e., 7.8 km for M 5.0 and 23.2 km for M 6.0). This approach leads to maximum 84th percentile peak ground acceleration (PGA) values of 0.24 g based on NGA relationships and 0.21 g based on the Pankow and Pechmann (2004) relationship. For comparison purposes, an earthquake of M 6.5 occurring at 8.5 km would produce median PGA of 0.28 g using NGA relationships; M 6.5 at 8 km would produce median PGA of 0.28 g using Pankow and Pechmann's relationship. Similarly, M 6.5 occurring at 18 km would produce 84th percentile PGA of 0.28 g using NGA relationships; M 6.5 at 16 km would produce 84th percentile PGA of 0.28 g using Pankow and Pechmann's relationship. PGA of 0.28 g is the value used for stability analyses of the embankments in previous geotechnical studies.

Probabilistic Results (Background Seismicity)

A PSHA was performed with EZ-Frisk for the Energy*Solutions* site using NGA and Pankow and Pechmann (2004) attenuation relationships and using the background seismicity sources as defined in the 2008 USGS fault model and as listed below.

- Extensional Gridded (Normal Fault Mechanism, Characteristic magnitude-frequency distribution model)
- Extensional Gridded, Char, (Strike Slip Fault Mechanism, Characteristic magnitude-frequency distribution model)
- Extensional Gridded, ( Normal Fault Mechanism, Gutenberg-Richter magnitude-frequency distribution model)
- Extensional Gridded, ( Strike Slip Fault Mechanism, Gutenberg-Richter magnitude-frequency distribution model)

With coaching from Risk Engineering representatives, we modified EZ-Frisk to include the Carrington fault and the Pankow and Pechmann (2004) attenuation model. The 2008 USGS background seismicity model is intended to include the entire Western United States including California and Washington (relatively more seismically active regions compared to Utah) and therefore the PSHA results for background seismicity at the Energy*Solutions* site should be anticipated to be higher than would be estimated from smaller source zones in areas that are seismically quieter than the average of the western United States. The PSHA results are tabulated below. The computed peak ground acceleration for a 9950-yr return period is 0.273g. For comparison purposes, PGA was also computed using the NGA relationships and Pankow and Pechman (2004) relationship and the values are 0.304g and 0.245g, respectively.

| Exceedance Probability in 50 Years | Return Period (Years) | Median PGA (g) | AS08 | BA08 | CB08 | CY08 | PP04 |
|---|---|---|---|---|---|---|---|
| 0.0051 | 9950 | **0.273** | 0.353 | 0.259 | 0.263 | 0.310 | 0.245 |
| 0.0100 | 4975 | **0.205** | 0.263 | 0.198 | 0.202 | 0.223 | 0.186 |
| 0.0200 | 2475 | **0.149** | 0.190 | 0.147 | 0.149 | 0.154 | 0.137 |
| Weight factors of 0.5 for Pankow-Pechman (2004) and 0.125 for each NGA relationships | | | | | | | |

Discussion and Conclusions

Based on the DSHA results presented in our October 25, 2011, report, and described above in the "Deterministic" section, the maximum 84th percentile PGA from a fault-specific earthquake source is computed to be 0.23g for a maximum magnitude earthquake (M 7.5) occurring on Stansbury fault. Our analysis of the background seismicity shows the maximum 84$^{th}$ percentile PGA for a return period of 9950 years is reduced to 0.24g for a M 5.2 earthquake occurring at a distance of 9.4 km (compared to 0.26g for a M 5.2 earthquake at a distance of 5.6 km in our October 25, 2011, letter). Therefore, the largest 84$^{th}$ percentile PGA computed for the Energy*Solutions* site based on deterministic procedures and using NGA models for fault-specific and background earthquakes is estimated to be about 0.24g.

PSHA results presented above show a median PGA value of 0.27g for an average return period of 9950 years. This PGA value was computed with EZ-Frisk after it was modified to include the Carrington fault and the Pankow and Pechmann (2004) attenuation relationship.

Previous embankment stability calculations were based on a PGA of 0.28g, which is higher than the updated maximum 84th PGA calculated with deterministic procedures in the present study; it is also slightly higher than the median PGA value calculated with PSHA procedures. Therefore, because the updated PGA is slightly lower than but not significantly different from the PGA used in seismic stability calculations of the embankments and to develop other results presented in our report dated February 15, 2011 (AMEC Job No. 10-817-05290), we consider that these previous results are appropriate and applicable.

It has been a pleasure to be of professional service to you. Please contact us with questions or if we can be of further assistance.

Sincerely,

**AMEC Environment & Infrastructure, Inc.**

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(5 copies submitted)

**Attachments:**

Figure 1 – Earthquake Epicenters in the Energy Solutions Area
Figure 2 – Earthquake Activity in the Energy Solutions Area

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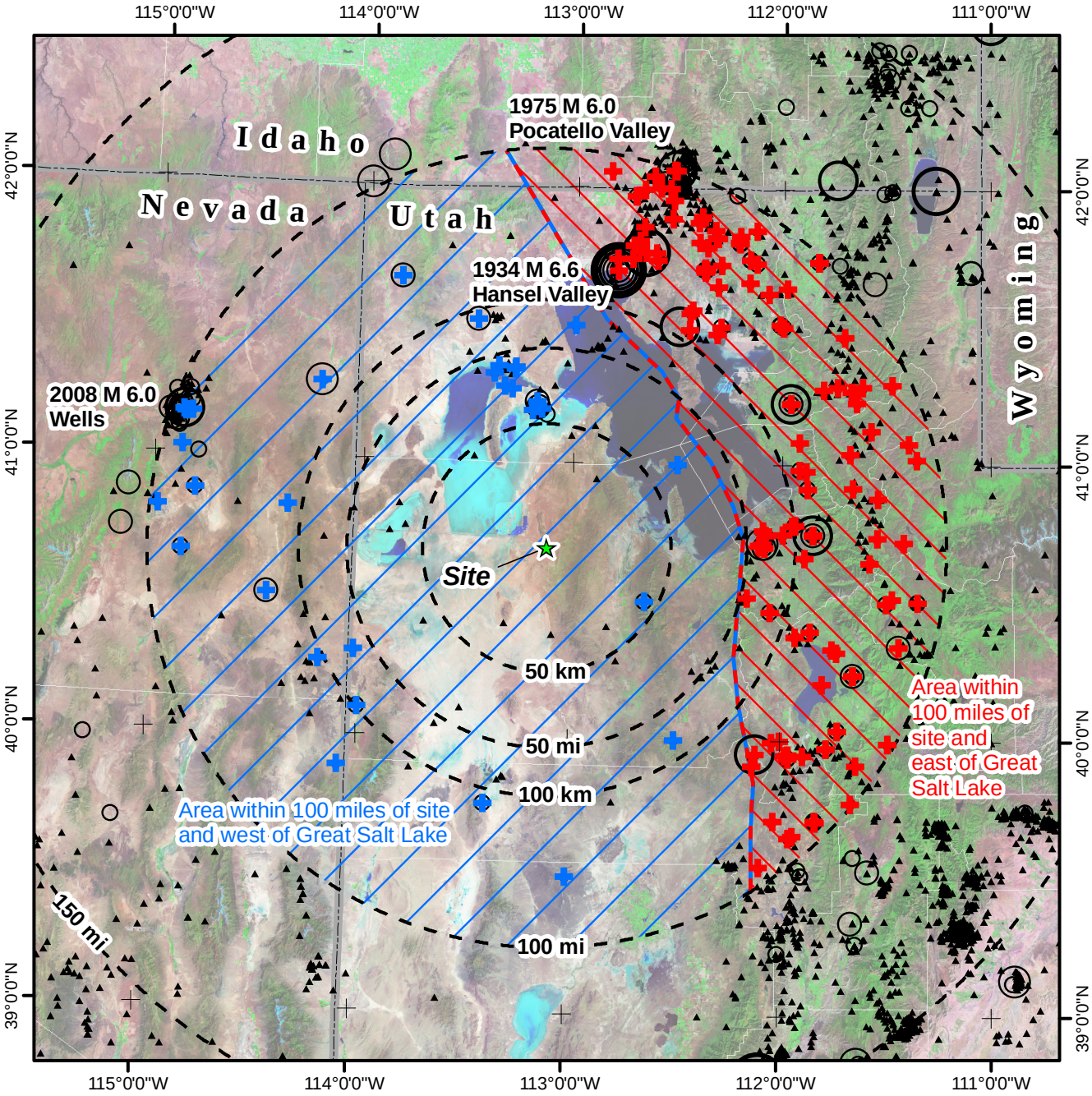



Declusterd epicenters for East area
Declusterd epicenters for West area

Sources: University of Utah Seismograph Stations and University of Nevada Seismological Laboratory

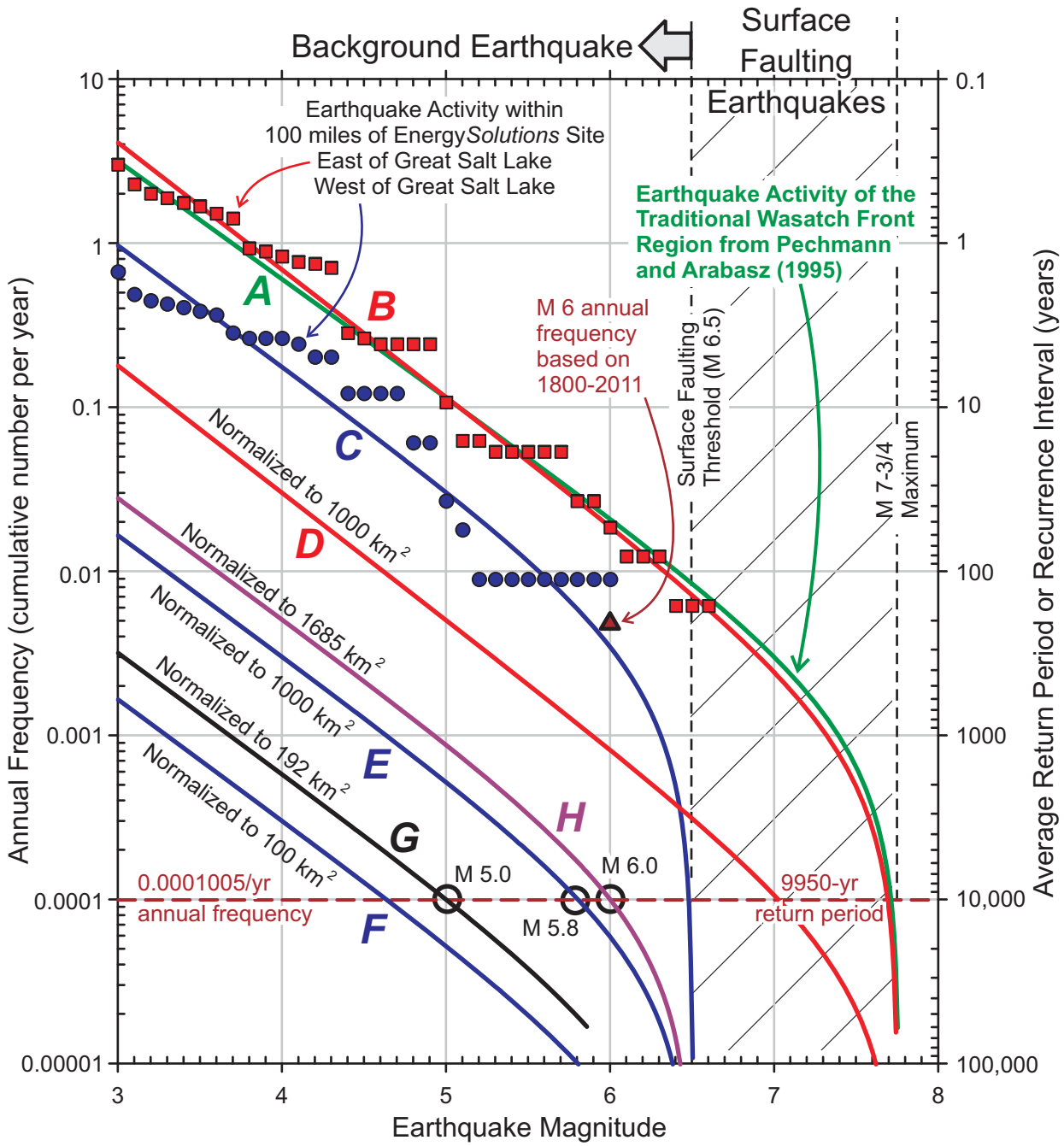
0 25 50 75 100 mi
0 50 100 150 km

**Earthquake Epicenters 1850 - 2011**

- M <= 4.0
- 4.0 < M <= 4.5
- 4.5 < M <= 5.0
- 5.0 < M <= 5.5
- 5.5 < M <= 6.0
- 6.0 < M <= 6.5
- 6.5 < M <= 7.0

**EARTHQUAKE EPICENTERS IN THE ENERGY SOLUTIONS AREA**
**Tooele County, Utah**

| By: JRK | Date: 12/23/2011 | Project No. 10-817-05290.2 |
|---|---|---|
| amec | | Figure 1 |




Curve A: Traditional Wasatch Front region (86,800 km$^2$) from Pechmann and Arabasz (1995); Mmax = 7.75
Curve B: Historical seismicity within 100 mi of site east of Great Salt Lake (22,911 km$^2$); Mmax = 7.75
Curve C: Historical seismicity within 100 mi of site west of Great Salt Lake (58,457 km$^2$); Mmax = 6.5.
Curve D: Curve B normalized to 1000 km$^2$; Mmax = 7.75
Curve E: Curve C normalized to 1000 km$^2$; Mmax = 6.5
Curve F: Curve C normalized to 100 km$^2$; Mmax = 6.5
Curve G: Curve C normalized to 192 km$^2$; Mmax = 6.5
Curve H: Curve C normalized to 1685 km$^2$; Mmax = 6.5

EARTHQUAKE ACTIVITY IN THE ENERGY SOLUTIONS AREA
Clive, Tooele County, Utah

| By: JRK | Date: 12/23/2011 | Project No. 10-817-05290.2 |
|---|---|---|
| amec | | Figure 2 |

# Attachment 6

# Class A West Well Spacing Analysis

# CLIVE FACILITY

# WELL SPACING EVALUATION
# CLASS A WEST EMBANKMENT

**April 28, 2011**

**For**
**Utah Division of Radiation Control**
**195 North 1950 West**
**Salt Lake City, UT 84114-4850**

**Energy*Solutions*, LLC**
**423 West 300 South, Suite 200**
**Salt Lake City, UT 84101**

## 1.0 INTRODUCTION

Energy*Solutions* proposes to construct the Class A West (CAW) embankment in the northwest quarter of Section 32 at its Clive facility. The proposed CAW embankment would encompass the existing Class A and Class A North (CAN) embankments (Figure 1).

This report presents the results of a monitoring well spacing evaluation performed for the CAW embankment. A compliance monitoring well network was developed for the CAW embankment. The network includes 18 existing wells from the Class A and CAN compliance well networks and also includes 9 proposed new monitoring wells (Figure 1). The monitoring well network is designed to verify regulatory compliance with the State of Utah Ground Water Protection Levels (GWPLs) and to provide early warning of potential releases. The spacing of the new wells is consistent with the spacing of the existing wells and also meets the requirement of the Clive facility's Ground Water Quality Discharge Permit (GWQDP) for wells to be located no further than 90 feet from the edge of the waste (Part I.F.1.e).

The monitoring well network was evaluated to determine the optimum location for new monitoring wells to detect potential releases with at least 95% efficiency. The well spacing evaluation was conducted using the Monitoring Efficiency Model (MEMO) developed by Golder Associates, Inc (1992). The MEMO model generates multiple groundwater plumes emanating from a user-defined source area, and determines whether each potential plume would be detected. The efficiency of the monitoring well network is calculated by MEMO as the ratio of the number of plumes that would be detected divided by the total number of potential source releases. The objective of the modeling is to design a monitoring network that will detect at least 95% of the potential plumes before they arrive at the boundary. The modeling is performed using iodine-129 (I-129) and technetium-99 (Tc-99) as the surrogate contaminants. These radionuclides were selected because of their potential presence in CAW embankment Class A waste, their conservative transport characteristics (they are relatively mobile), and because of their long half-lives relative to the modeled time period of 500 years.

This report summarizes the model code, documents input parameters, and presents results. An optimized spacing is presented for the monitoring well network surrounding the proposed CAW embankment. Model input/output files are included in Attachment A, and well spacing model output is shown graphically in figures in Attachment B.

## 2.0 MODEL CODE

MEMO is a contaminant transport model that provides a simple computerized method for optimizing monitoring well locations for groundwater monitoring networks at waste management areas. MEMO was developed for the U.S. Department of Energy for evaluation and optimization of the monitoring well network at the Hanford Nuclear Weapons Site near Richland, Washington. The model incorporates the facility and source geometry, site hydrogeology, fate and transport characteristics of a specified contaminant, and initial monitoring well locations to arrive at a quantified well efficiency value.

The efficiency determination is based on whether a plume is detected by the monitoring well network before it crosses a specified buffer zone boundary. MEMO identifies areas within a potential contaminant source area where chemical releases would or would not be detected by downgradient monitoring wells. Monitoring efficiency is defined as the number of leaks detected compared to the number of non-detected leaks. For example, 90 out of 100 leaks detected at downgradient monitoring well locations would result in a monitoring efficiency of 90%.

MEMO incorporates the analytical solution developed by Domenico and Robbins (1985) and Domenico (1987) to predict the configuration of the plume as it migrates downgradient from a continuous source. The code is an analytical solution to the advection-dispersion partial-differential equation of contaminant transport processes in groundwater. The model incorporates one dimensional groundwater velocity, longitudinal and transverse dispersion, the first order degradation rates, finite contaminant source dimensions, and a steady-state source to solve for contaminant concentrations as a function of space and time. Additional information on the analytical solution used in MEMO is available in the well spacing evaluations for the Mixed Waste and CAN Embankments performed by Whetstone Associates (Whetstone Associates, 2009a and 2009b).

The use of a steady-state (continuous) source is a common approach to modeling plume detection. A continuous rather than a finite source of leachate assures that releases from leaks near the upgradient end of the waste management area do not disperse to below the detection limit (Golder Associates, 1992). As the initial concentration of contaminant in the groundwater at the source increases, the downgradient width of the plume also increases. The expansion of a given contaminant plume decreases with time, and at a critical time the plume will reach steady-state conditions and stop growing in size.

The calculation of monitoring efficiency assumes that that the probability of a release is equally likely at any given location within the source area. In reality, failure is more likely to occur in specific areas of the cell, such as the transition from the top slope to the side slope. MEMO

output includes plan view maps showing zones from which plumes would or would not be detected, so specific areas of interest can be evaluated.

## 3.0 INPUT PARAMETERS

Input required for the MEMO model includes site geometry, dispersion, initial contaminant concentration, time, and nature of source area.

### 3.1 Site Geometry and Coordinate Data

The coordinates used in the MEMO model are equivalent to the Clive site coordinates (based on a local benchmark at 10,000E, 10,000N). Model coordinates are shown in Table 10 and discussed below. The footprint of the CAW Embankment and the locations of surrounding monitoring wells (existing and proposed) are shown in Figure 1.

#### *3.1.1 Source Area Geometry*

Two potential source areas were defined for the MEMO simulations: (1) the entire footprint of the CAW embankment ($5.8x10^{+6}$ square feet [$ft^2$], 133 acres); and (2) the area underlying the top-slope of the embankment ($4.1x10^{+6}$ $ft^2$, 95 acres). MEMO simulated individual 1-foot (ft) wide point sources within the potential source areas on a 21-ft grid spacing. For the entire footprint, the 21-ft source grid spacing resulted in 13,217 individual point sources for the maximum contaminant velocities evaluated in the model. For the full top slope footprint, the 21-ft source grid spacing resulted in 9,362 individual point sources for maximum contaminant velocities. MEMO generated a plume using the Domenico analytical model at each grid point, then evaluated whether the plume was detected by the monitoring network. Each point source and resulting plume were evaluated separately, so a single model run evaluated 13,217 separate plume detections for the entire footprint source or 9,362 separate plume detections for the full top-slope source.

For the conditions of average contaminant velocity, the CAW embankment is sufficiently large that the travel time from upgradient areas of the embankment to monitoring wells is greater than the 500-year compliance period. For well spacing analysis of these conditions, the source area geometry was adjusted to remove the area of the embankment where point sources did not reach the well within 500 years. The 21-ft point source spacing was maintained; however, the number of individual point sources was less than those listed above for the entire footprint and top slope. Refer to Section 3.4 for addition information on adjustment of the source area geometry.

The selection of source area geometry is considered to be conservative because of the extremely narrow (1-ft wide) point source area. In general, a wider source area will produce a wider plume, which is more likely to be detected. Also, if failure were to occur, it would be more likely to occur at several points or along the entire interface between the top-slope and side-slope, resulting in a line source with a larger plume width that is significantly more likely to be detected.

### *3.1.2 Buffer Zone Geometry*

The buffer zone geometry is defined by a boundary and a grid spacing along that boundary. The buffer zone boundary is defined as the limit to which a plume may extend before it should be detected by a monitoring well. Plumes that are detected at the monitoring wells before passing the buffer zone boundary are considered to have been detected. The model solves for concentration at each grid point along the buffer zone boundary, at a spacing defined by the user. A grid spacing that is too coarse could cause plumes to be missed, while a grid spacing that is too fine could cause excessive numerical computation or the model might fail to run.

In previous MEMO modeling of the Class A and lle.(2) cell at the site (Envirocare, 2000 and 2002), the buffer zone boundary was determined to be located 100 ft from the edge of the waste. As discussed in previous submittals (Envirocare, 2000 and 2002), the MEMO model allows only a single dilution contour to be calculated for each model run, while both the method detection limit (MDL) contour and Ground Water Protection Level (GWPL) contour are of interest. The MDL contour would provide the earliest indicator of a possible release from the cell, and the GWPL contour indicates the point at which the release would exceed the compliance standard. To evaluate both contour intervals simultaneously, numerical simulations were run to first determine the time for the GWPL to contact the buffer zone, then to determine how much farther the MDL contour would migrate in that time period. That migration distance (approximately 90 feet) was added to the buffer zone boundary to represent the location and time at which the MDL is detected at the buffer zone boundary and the modeled constituent meets or exceeds the GWPL at a line located 100 feet from the edge of the waste. This approach is consistent with previous MEMO modeling at the facility.

The buffer zone grid spacing was set at 40 ft for the CAW embankment. MEMO failed to run using a grid spacing finer than 40 ft in combination with the 21-ft source area grid spacing. Golder Associates (1992) recommends that the spacing of the buffer array and the spacing of the source grid be "of the same order of magnitude."

### *3.1.3 Monitoring Well Locations*

The CAW embankment monitoring well network includes 18 existing wells from the Class A and CAN networks and also includes 9 proposed new monitoring wells (Figure 1). The locations of the monitoring wells were input into the MEMO model, using Clive site coordinates. Numerous simulations were run, using manual iteration to optimize the new well spacing and to obtain the target efficiency of 95%. As discussed in Section 1, the spacing of the new wells is generally consistent with the spacing of the existing wells while meeting requirements listed in the GWQDP. The optimized monitoring well coordinates are described in Section 4.

## 3.2 Contaminant Velocity

Groundwater velocity in geologic materials is controlled by hydraulic conductivity, hydraulic gradient in the vicinity of the study area, and effective porosity of the geologic material. Based on Darcy's Law, the average groundwater velocity can be calculated using the following equation:

$$v = \frac{k * i}{\theta_e}$$

Where:

$K$ = Hydraulic conductivity [L/T]
$i$ = Hydraulic gradient [L/L]
$\theta_e$ = Effective soil porosity

The transport of contaminants in groundwater may be retarded, or slowed, by physical processes such as sorption, filtration, or precipitation. The contaminant velocity is given by the following equation:

$$v_c = \frac{k * i}{\theta_e R_d}$$

Where:

$R_d$ = Constituent retardation factor

Note that when the retardation factor ($R_d$) equals one, the preceding equation describes the aquifer velocity. In this case, the contaminant is unretarded and travels at the rate of groundwater flow.

The hydrogeologic data used in determining hydraulic conductivity, gradient, effective porosity, and retardation are described in Section 3.2.1 through 3.2.4. The calculation of contaminant velocity is given in Section 3.2.5.

### *3.2.1 Hydraulic Conductivity*

The hydraulic conductivity used in the model was derived from 83 slug tests conducted in 39 wells surrounding the CAW embankment (Table 1). The wells are completed in the Unit 2 Clay.

The geometric mean hydraulic conductivity of the 39 wells is $1.09 \times 10^{-3}$ centimeters per second (cm/sec) (3.10 ft/day), while the arithmetic average is $1.57 \times 10^{-3}$ cm/sec (4.46 ft/day).

As shown in Table 2, the upper 90% confidence level of the mean results in hydraulic conductivity values of $1.42 \times 10^{-3}$ cm/sec (4.02 ft/day) and 1.93xl0$^{-3}$ cm/sec (5.48 ft/day) for the geometric mean and arithmetic mean, respectively.

### *3.2.2 Hydraulic Gradient and Direction*

Using monthly groundwater elevation data from November 2009 to November 2010, the hydraulic gradient below the Class A and CAN embankments averaged $5.51 \times 10^{-4}$ and $5.63 \times 10^{-4}$ ft/ft, respectively, based on freshwater heads (Table 3). The maximum allowable gradient below the Class A and CAN embankments is $1.00 \times 10^{-3}$, as specified in the GWQDP. Both the average and GWQDP maximum gradients were used in the well spacing evaluation for the CAW embankment.

The principal direction of groundwater flow in the shallow aquifer below the proposed CAW embankment is approximately N40°E. This groundwater flow direction has been used in recent well spacing analyses for both the CAN and Mixed Waste (MW) embankments (Whetstone Associates, 2009a and 2009b). Although the MEMO model allows for changes in flow directions by defining multiple gradient zones within the model domain, the hydraulic gradient and flow direction are relatively uniform below the CAW embankment and were entered into the MEMO model as a single gradient zone. In addition to the base case (N40°E) gradient zone, sensitivity analyses were conducted using flow directions of due north (N0°E) and due east (N90°E).

### *3.2. Aquifer Porosity*

The effective porosity value of 0.29 has been used in previous modeling exercises and is regarded by Utah DEQ as a representative value.

### *3.2.4 Retardation Factor (R)*

The retardation factor is constituent-specific, and can be calculated from the sorption coefficient ($K_d$) according to the following equation:

$$R_d = 1 + \frac{\rho K_d}{\theta_e * C}$$

Where:

$Rd$ = Retardation factor
$\rho$ = Soil density (kilograms per cubic meter [kg/m$^3$])
$K_d$ = Soil-water distribution coefficient (liters per kilogram [L/kg])
$\theta_e$ = Effective soil porosity
C = Conversion factor (1,000 L/ m$^3$)

The bulk density of the aquifer materials below the CAW embankment is 1,600 kg/m3. Because the MEMO model evaluation addresses only the saturated zone, the bulk density of 1,600 kg/m3 is applicable. This bulk density value was used in the well spacing analyses for the CAN and MW embankments (Whetstone Associates, 2009a and 2009b).

The $K_d$ values for I-129 (0.12 L/kg) and Tc-99 (0.11 L/kg) are very low, indicating that these nuclides are relatively mobile. These radionuclides and $K_d$ values were used in the well spacing analyses for the CAN and MW embankments (Whetstone Associates, 2009a and 2009b). When $K_d$ values approach zero, the resulting retardation factor approaches 1.0 indicating conservative (non-retarded) transport in groundwater. The calculated retardation factors are shown in Table 4.

#### *3.2.5 Contaminant Velocity Calculation*

Contaminant velocities were calculated using the hydraulic conductivity, hydraulic gradient, porosity, and retardation coefficients described above. The calculated velocities are shown in Table 5.

The most conservative well spacing analysis uses contaminant velocities based on the maximum allowable hydraulic gradient and 90% confidence interval above the measured arithmetic mean hydraulic conductivity, and results in transport velocities of 0.0114 ft/day for I-129 and 0.0118 ft/day for Tc-99 (Table 5). More representative contaminant velocities are based on the average of the measured hydraulic gradient and the measured geometric mean hydraulic conductivity, which results in transport velocities of 0.00362 ft/day for I-129 and 0.00375 ft/day for Tc-99. A higher transport velocity results in less lateral spreading of the plume and a closer optimum well spacing. Well spacing analyses are performed using the most conservative higher transport velocities and the more representative average velocities.

### 3.3 Source Term

#### *3.3.1 Width of Line Source*

The width of the line source depends on the type of leak and on the amount of lateral spreading in the vadose zone prior to the arrival of the compound at the water table. A longer line source would result in a greater probability of plume detection. The default width of a line source in the

MEMO model is 20 ft. In the simulations of the CAW embankment, the line source width was set at 1 ft. The release width of 1 ft is considered to be very conservative because any release from the bottom liner will tend to disperse laterally as it migrates vertically through the vadose zone to the water table.

### *3.3.2 Dispersivity*

Dispersion is the physical process of groundwater mixing at the plume boundaries, causing the periphery of the plume to be reduced in concentration. The Domenico solution in the MEMO model uses longitudinal ($\alpha_x$) and transverse ($\alpha_y$) dispersivities to describe the mechanical spreading and mixing caused by dispersion. Dispersivity of the aquifer is one of the primary parameters that control the fate and transport of contaminants. Dispersivity is scale-dependent, with longer flow paths resulting in higher dispersivity. Gelhar et al. (1992) produced the seminal work on aquifer dispersivity to date and determined that longitudinal dispersivity is typically 10% of the longitudinal flow distance ($\alpha_x = 0.1X$), while transverse dispersivity is typically 10% of longitudinal dispersivity ($\alpha_y = 0.1\alpha_x$).

For the MEMO well-spacing model of the CAW embankment, the longitudinal dispersivity ($\alpha_x$) was set at 129.1 ft, which is one tenth the average distance from the center of the top slope to the line of compliance wells. The average distance is calculated as the average of: 1) the distance from the center of the top slope to the east line of compliance wells, and 2) the distance from the center of the top slope to the north line of compliance wells. Transverse dispersivity ($\alpha_y$) was set at 10% of longitudinal dispersivity, or 12.9 ft, as shown in Table 6.

### *3.3.3 Diffusion Coefficient*

Diffusion is an important mechanism for the transport of solutes through the saturated zone, in the absence of significant advective flux (Saripalli et al., 2002). Molecular diffusion is mixing caused by random molecular motion due to the thermal kinetic energy of the solute in groundwater. Diffusion coefficients of salts and gasses in groundwater typically range from about $4x10^{-6}$ to $lxl0^{-4}$ square centimeters per second ($cm^2$/sec) (Lerman, 1971; Figure 10.8 in Domenico and Schwartz, 1990). The diffusion coefficients for I-129 and Tc-99 are shown in Table 7. These values were also used in the well spacing analyses performed for the CAN and MW embankments. Derivation of the diffusion coefficients is documented in the reports for the CAN and MW well spacing analyses (Whetstone Associates, 2009a and 2009b).

### *3.3.4 First Order Decay Constant*

Radioactive material decays according to first order kinetics. The decay constants used in the MEMO modeling for the CAW embankment are consistent with the decay constants calculated for I-129 and Tc-99 in the previous CAN and MW well spacing analyses (Whetstone Associates,

2009a and 2009b). Based on isotope half lives of $1.57x10^{+7}$ and $2.12x10^{+5}$ years for 1-129 and Tc-99, respectively, the calculated first order decay constants were $1.21x10^{-10}$ and $8.99x10^{-9}$ per day, as shown in Table 7.

### *3.3.5 Dilution Contour Values*

The dilution concentration contour is defined as the ratio of the detection limit concentration to the source concentration. The detection limits for I-129 and Tc-99 are 5 and 10 picoCuries per liter (pCi/L), respectively, based on typical minimum detectable activities (MDAs) reported for Clive groundwater samples by the analytical laboratory performing radiological analysis.

The source concentrations for I-129 and Tc-99 shown in Table 8 are the time-weighted average concentrations at the water table presented in the Class A Combined Disposal Cell Infiltration and Transport Modeling Report (Whetstone Associates, 2006). Modeling indicated that concentrations of I-129 and Tc-99 at the water table below the top slope area would be zero for the first 95 – 105 years and would exceed GWPLs at the water table 215 years following cell closure, based on environmentally conservative modeling assumptions. Modeled concentrations of I-129 and Tc-99 would peak at the water table at 588 and 555 years, respectively, after closure.

Based on MDAs and modeled time-weighted average concentrations, the dilution concentration contour values used in the CAW well spacing analysis are $1.38x10^{-6}$ for I-129 and $1.00x10^{-6}$ for Tc-99. The calculated dilution contour value for Tc-99 is $7.32x10^{-8}$ (Table 8), which is less than the lowest dilution concentration contour ($1.00x10^{-6}$) allowed in the MEMO model. Therefore, $1.00x10^{-6}$ was used as the dilution concentration contour value for Tc-99.

## 3.4 Advection Time

To select the appropriate advection time input parameter, it is important to understand the MEMO model solution methods. The MEMO model provides two solution options: (1) buffer zone with advection time limit and (2) advection time only. The "buffer zone with advection time limit" solution method is the model default, in which detections are based on the migration of each plume to a specified limiting distance (the buffer zone boundary). The solution is performed as follows:

- The model first generates a source grid within the specified source areas, using the user-defined source grid spacing (21 feet, Section 3.1.1).
- The buffer zone boundary (defined as the limit to which a plume may extend before it should be detected by a monitoring well) is broken into an array of buffer points using the user-defined buffer zone spacing (40 feet, Section 3.1.2).

- For each point in the source grid, a critical time ($t_c$) is calculated when the plume dilution contour first crosses the buffer zone boundary (i.e., the concentration at a buffer zone point exceeds the specified dilution concentration). Each buffer zone point is checked for each plume, to ensure the minimum time is calculated.
- The concentration at each monitoring well is calculated at time $t_c$. If the concentration at any monitoring well meets or exceeds the specified concentration, then the leak has been successfully detected. Conversely, if the concentration at all monitoring wells is below the specified concentration at time $t_c$, then the plume is assumed to be "non-detect" and the area surrounding that point on the source grid is identified as a non-detect area.
- The process is repeated for all points in the source grid.

The dilution contour for plumes in the farthest upgradient portion of the source area may not reach the buffer zone boundary, in cases where (1) the plume migrates very slowly or (2) the constituent decays rapidly relative to the plume travel time. Plumes that do not reach the buffer zone boundary are considered to be not detected by the model, and are not differentiated from "non-detect' source areas where the constituent arrives at the buffer zone boundary but is not detected by the monitoring well network.

Figure 2 shows an example of non-detect zones for the CAW embankment resulting from the first case described above. Two options exist to correct for the plumes that never arrive: (1) modify the source area to exclude the farthest upgradient areas or (2) increase the advection time to allow sufficient time for all plumes to reach the buffer zone boundary. Note that if the constituent being modeled has a short half-life, or if the constituent is diluted such that it never arrives at the buffer zone, only the first option will work. In that case, the source geometry is modified to exclude the farthest upgradient areas from (which source plumes would not arrive at the buffer zone boundary). Note that by excluding these areas from the source, no credit is taken for these areas in the monitoring efficiency calculation. That is, the calculation is based on the remaining (reduced) number of source grid points, so that non-detects from the remaining source points carry more weight.

For the CAW modeling, I-129 and Tc-99 have long half lives and would arrive at the buffer zone boundary from anywhere within the source area given a sufficiently long advective transport time. However, the Utah Division of Water Quality performance-based groundwater standard for radiological constituents in Clive facility compliance wells is 500 years. Therefore, the transport time was set to 500 years (182,500 days), and the first option listed above, modification of the source area, was selected to perform sensitivity analysis modeling in cases where the embankment footprint or top slope source area initially included non-detect zones (runs using average contaminant velocities).

## 4.0 WELL SPACING ANALYSIS RESULTS

The MEMO model was run to optimize the CAW well spacing, as described in the following sections. Sensitivity analyses were performed using a range of contaminant transport velocities and groundwater flow directions of due north and due east. The efficiency results of all CAW well spacing runs are summarized in Table 9.

### 4.1 Optimized Well Network

Figure 1 presents the final optimized well spacing for the CAW embankment. The network consists of 18 existing Class A and CAN wells and 9 new wells as listed in Table 10. The spacing and location of the new wells are based on the following criteria: 1) meet the 95% detection efficiency, 2) each well located no further than 90 feet off the edge of the waste, 3) retain the existing spacing to the extent possible, and 4) not interfere with the location of existing facilities and features (e.g., Northwest Corner Pond).

The well spacing was optimized by running the MEMO model numerous times to determine the monitoring well network that produced an efficiency of 95% or greater and that also met the other criteria listed above. The CAW embankment can be efficiently monitored with well network shown on Figure 1. The optimal distance between the nine new wells to be added to the network is 388.0 feet along the east edge of the embankment and 350.0 feet along the north edge of the embankment. The optimized locations of monitoring wells are listed in Table 10. Note that well GW-142 is located 365.0 feet west of GW-143. The additional 15 feet was necessary to keep GW-142 off the Northwest Corner Pond berm. This change was included in the well spacing analysis.

The MEMO model output for the entire CAW footprint is shown graphically in Figures 3 and 4 for I-129 (CAWI129a) and Tc-99 (CAWTc99a), respectively. The MEMO model output for the top slope source area is shown graphically in Figures 5 and 6 (CAWI129d and CAWTc99d, respectively). These results are for simulation of monitoring under the base case conditions of a N40°E (50 degrees in model) groundwater flow direction and highest calculated contaminant velocities. Detection efficiencies ranging from 96.2 to 99.9% met the 95% efficiency criterion (Table 9).

### 4.2 Sensitivity Analysis

A sensitivity analysis was conducted to evaluate the effects of uncertainty in groundwater flow direction and contaminant transport velocity on the CAW well spacing. The MEMO model was run using groundwater flow directions of N0°E (due north, 90 degrees in model) and N90°E (due east, 0 degrees in model). For all three modeled flow directions, well spacing was evaluated for both a conservative high contaminant velocity and an average velocity condition. For each well

spacing evaluation performed using the average contaminant velocity, MEMO was run twice – first for the entire CAW embankment footprint or top slope source area, and second, with up-gradient non-detection zones removed from the source area. As discussed in Section 3.4, these zones are removed because contaminant transport time from source to buffer zone boundary exceeds 500 years.

Table 9 lists the detection efficiencies of the sensitivity analysis simulations. All efficiencies are greater than 95%, indicating that the CAW monitoring well network will meet the 95% criterion if the groundwater flow direction deviates from N40°E or if contaminant transport velocities are slower (more representative, less conservative) than base-case highest calculated velocities. The results of the sensitivity analysis are shown graphically in Attachment B figures.

## 5.0 CONCLUSIONS

A monitoring well network consisting of 18 existing Class A and CAN wells and 9 new wells will provide leak detection with greater than 95% efficiency for the proposed CAW embankment. The new wells (GW-142 to GW-150) will be located on the east and north sides of the embankment (Figure 1). The optimal distance between new wells is 388.0 feet along the east edge of the embankment and 350.0 feet along the north edge. The location of well GW-142 was adjusted an additional 15 feet west (total distance of 365.0 feet from GW-143) prior to the spacing analysis. This will keep GW-142 off the Northwest Corner Pond berm.

The optimized well spacing will be protective of human health and the environment and will meet the GWQDP requirements for compliance monitoring wells. This optimal well spacing results in monitoring well network efficiencies of 96.3% for I-129 from the entire footprint, 96.2% for Tc-99 from the entire footprint, 99.9% for I-129 from the top slope source area, and 99.8% for Tc-99 from the top slope source area. A sensitivity analysis demonstrates that monitoring efficiencies will remain greater than 95% if the groundwater flow direction varies from that used in the base-case model or if contaminant transport velocities are slower than the conservatively high velocities used in the base case.

The nine new wells in the optimized well spacing will replace existing monitoring wells along the north and east sides of the CAN embankment. Deep aquifer monitoring well GW-139D will require abandonment to construct the CAW embankment, and therefore, Energy*Solutions* proposes to install deep aquifer monitoring well GW-148D, shown on Figure 1, as its replacement.

## 6.0 REFERENCES

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# TABLES

## Table 1. Hydraulic Conductivity Data from Slug Testing

| Well | Cell | Total Depth (ft bgs) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Average Well Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|
| GW-25 | 11.e(2) | 33.5 | 2.316 | 8.17E-04 | 1.05E-03 |
| | | | 3.326 | 1.17E-03 | |
| | | | 3.568 | 1.26E-03 | |
| | | | 2.557 | 9.02E-04 | |
| | | | 3.154 | 1.11E-03 | |
| GW-26 | 11.e(2) | 29.5 | 0.95 | 3.35E-04 | 3.31E-04 |
| | | | 0.92 | 3.26E-04 | |
| GW-27 | 11.e(2) | 29.5 | 0.125 | 4.42E-05 | 3.49E-05 |
| | | | 0.074 | 2.60E-05 | |
| | | | 0.098 | 3.44E-05 | |
| GW-81 | Class A | 34.0 | 1.49 | 5.26E-04 | 5.23E-04 |
| | | | 1.47 | 5.19E-04 | |
| GW-82 | Class A | 34.0 | 1.82 | 6.42E-04 | 5.77E-04 |
| | | | 1.45 | 5.12E-04 | |
| GW-83 | Class A | 34.0 | 8.54 | 3.01E-03 | 3.05E-03 |
| | | | 8.76 | 3.09E-03 | |
| GW-84 | Class A | 34.0 | 10.95 | 3.86E-03 | 3.75E-03 |
| | | | 10.3 | 3.63E-03 | |
| GW-85 | Class A | 34.0 | 11.14 | 3.93E-03 | 3.94E-03 |
| | | | 11.18 | 3.94E-03 | |
| GW-86 | Class A | 34.0 | 4.8 | 1.69E-03 | 1.65E-03 |
| | | | 4.57 | 1.61E-03 | |
| GW-88 | Class A | 38.4 | 2.66 | 9.38E-04 | 9.84E-04 |
| | | | 2.92 | 1.03E-03 | |
| GW-89 | Class A | 34.0 | 1.67 | 5.89E-04 | 6.26E-04 |
| | | | 1.88 | 6.63E-04 | |
| GW-90 | Class A | 34.0 | 8.86 | 3.13E-03 | 2.94E-03 |
| | | | 7.78 | 2.74E-03 | |
| GW-91 | Class A | 34.0 | 5.73 | 2.02E-03 | 1.98E-03 |
| | | | 5.48 | 1.93E-03 | |
| GW-92 | Class A | 34.0 | 2.45 | 8.64E-04 | 8.68E-04 |
| | | | 2.47 | 8.71E-04 | |
| GW-93 | Class A | 34.0 | 17.04 | 6.01E-03 | 5.96E-03 |
| | | | 16.72 | 5.90E-03 | |
| GW-94 | Class A | 34.0 | 12.73 | 4.49E-03 | 4.67E-03 |
| | | | 13.71 | 4.84E-03 | |

## Table 1. Hydraulic Conductivity Data from Slug Testing

| Well | Cell | Total Depth (ft bgs) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Average Well Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|
| GW-95 | Class A | 29.0 | 1.04 | 3.67E-04 | 3.62E-04 |
| | | | 1.01 | 3.56E-04 | |
| GW-99 | Class A | 29.0 | 0.85 | 3.00E-04 | 2.95E-04 |
| | | | 0.82 | 2.89E-04 | |
| GW-100 | Class A | 29.0 | 1.78 | 6.28E-04 | 6.44E-04 |
| | | | 1.87 | 6.60E-04 | |
| GW-101 | Class A | 34.0 | 2.36 | 8.33E-04 | 7.54E-04 |
| | | | 1.91 | 6.74E-04 | |
| GW-102 | Class A | 34.0 | 2.37 | 8.36E-04 | 8.52E-04 |
| | | | 2.46 | 8.68E-04 | |
| GW-106 | CAN | 38.5 | 1.75 | 6.19E-04 | 6.07E-04 |
| | | | 1.68 | 5.94E-04 | |
| GW-107 | CAN | 38.8 | 1.41 | 4.96E-04 | 5.21E-04 |
| | | | 1.54 | 5.45E-04 | |
| GW-108 | CAN | 39.0 | 1.82 | 6.41E-04 | 6.27E-04 |
| | | | 1.74 | 6.13E-04 | |
| GW-109 | CAN | 38.5 | 1.84 | 6.50E-04 | 6.27E-04 |
| | | | 1.71 | 6.04E-04 | |
| GW-110 | CAN | 38.5 | 2.27 | 8.00E-04 | 7.71E-04 |
| | | | 2.1 | 7.41E-04 | |
| GW-111 | CAN | 38.5 | 5.39 | 1.90E-03 | 1.73E-03 |
| | | | 4.39 | 1.55E-03 | |
| GW-112 | CAN | 38.5 | 5.95 | 2.10E-03 | 2.20E-03 |
| | | | 6.49 | 2.29E-03 | |
| GW-113 | CAN | 38.5 | 3.12 | 1.10E-03 | 1.03E-03 |
| | | | 2.69 | 9.50E-04 | |
| GW-114 | CAN | 38.5 | 3.03 | 1.07E-03 | 1.13E-03 |
| | | | 3.37 | 1.19E-03 | |
| GW-115 | CAN | 38.5 | 3.94 | 1.39E-03 | 1.42E-03 |
| | | | 4.11 | 1.45E-03 | |
| GW-116 | CAN | 38.5 | 6.72 | 2.37E-03 | 2.43E-03 |
| | | | 7.06 | 2.49E-03 | |
| GW-117 | CAN | 38.5 | 5.75 | 2.03E-03 | 2.13E-03 |
| | | | 6.32 | 2.23E-03 | |
| GW-125 | CAN | 38.0 | 8.67 | 3.06E-03 | 3.17E-03 |
| | | | 9.608 | 3.39E-03 | |
| | | | 8.689 | 3.07E-03 | |

## Table 1. Hydraulic Conductivity Data from Slug Testing

| Well | Cell | Total Depth (ft bgs) | Hydraulic Conductivity (ft/day) | Hydraulic Conductivity (cm/sec) | Average Well Hydraulic Conductivity (cm/sec) |
|---|---|---|---|---|---|
| GW-137 | CAN | 35.5 | 4.82 | 1.70E-03 | 2.06E-03 |
| | | | 6.86 | 2.42E-03 | |
| GW-138 | CAN | 39.0 | 6.49 | 2.29E-03 | 2.25E-03 |
| | | | 6.26 | 2.21E-03 | |
| GW-139 | CAN | 38.7 | 3.97 | 1.40E-03 | 1.41E-03 |
| | | | 4.01 | 1.41E-03 | |
| GW-140 | CAN | 39.4 | 2.29 | 8.08E-04 | 8.08E-04 |
| | | | 2.29 | 8.08E-04 | |
| GW-141 | CAN | 35.5 | 1.81 | 6.39E-04 | 6.44E-04 |
| | | | 1.84 | 6.49E-04 | |
| | | | | Arithmetic Mean K (cm/s) | 1.57E-03 |
| | | | | Mean +90% Confidence Level | 1.93E-03 |
| | | | | Geometric Mean K (cm/s) | 1.09E-03 |
| | | | | Geometric Mean +90% Confidence Level | 1.42E-03 |

## Table 2. Descriptive Statistics for Hydraulic Conductivity Test Results

| Summary Stats (cm/sec) | | Summary Stats log(cm/sec) | |
|---|---|---|---|
| Mean | 1.57E-03 | Mean | -2.961 |
| Standard Error | 2.14E-04 | Standard Error | 0.066 |
| Median | 1.03E-03 | Median | -2.989 |
| Mode | 6.27E-04 | Mode | -3.203 |
| Standard Deviation | 1.33E-03 | Standard Deviation | 0.415 |
| Sample Variance | 1.78E-06 | Sample Variance | 0.172 |
| Kurtosis | 2.12E+00 | Kurtosis | 3.077 |
| Skewness | 1.49E+00 | Skewness | -0.993 |
| Range | 5.92E-03 | Range | 2.232 |
| Minimum | 3.49E-05 | Minimum | -4.458 |
| Maximum | 5.96E-03 | Maximum | -2.225 |
| Sum | 6.14E-02 | Sum | -115.468 |
| Count | 39 | Count | 39 |
| Confidence Level (90.0%) | 3.60E-04 | Confidence Level (90.0%) | 0.112 |
| Mean + 90% CI | 1.93E-03 | | |
| GeoMean +90% CI | 1.42E-03 | | |

## Table 3. Horizontal Hydraulic Gradient

| Date | Class A | Class A North |
|---|---|---|
| Nov-09 | 6.08E-04 | 5.80E-04 |
| Dec-09 | 5.45E-04 | 5.25E-04 |
| Jan-10 | 5.52E-04 | 5.37E-04 |
| Feb-10 | 5.73E-04 | 5.43E-04 |
| Mar-10 | 5.81E-04 | 5.25E-04 |
| Apr-10 | 5.81E-04 | 5.58E-04 |
| May-10 | 5.19E-04 | 5.62E-04 |
| Jun-10 | 5.45E-04 | 5.48E-04 |
| Jul-10 | 5.55E-04 | 5.68E-04 |
| Aug-10 | 5.32E-04 | 5.67E-04 |
| Sep-10 | 5.34E-04 | 5.87E-04 |
| Oct-10 | 5.23E-04 | 5.95E-04 |
| Nov-10 | 5.20E-04 | 6.23E-04 |
| Average | 5.51E-04 | 5.63E-04 |
| GWQDP Limit | 1.00E-03 | 1.00E-03 |

Groundwater Quality Discharge Permit (GWQDP) limit from Part 1.H.2(d).

## Table 4. Calculated Retardation Factors

| Constituent | $K_d$ (L/kg) | $\rho$ (kg/m$^3$) | $\theta_e$ | $R_d$ |
|---|---|---|---|---|
| I-129 | 0.12 | 1,600 | 0.29 | 1.662 |
| Tc-99 | 0.11 | 1,600 | 0.29 | 1.607 |

## Table 5. Calculated Contaminant Velocities

| Constituent | Effective Porosity $\theta_e$ | Hydraulic Gradient $i$ (ft/ft) | | Hydraulic Conductivity $k$ (ft/day) | | Retardation Factor $R_d$ | Seepage Velocity $v$ (ft/day) | Contaminant Velocity $v_c$ (ft/day) |
|---|---|---|---|---|---|---|---|---|
| I-129 | 0.29 | Permit Maximum | 1.00E-03 | Arithmetric mean +90% CI | 5.48 | 1.662 | 1.89E-02 | 1.14E-02 |
| I-129 | 0.29 | Permit Maximum | 1.00E-03 | Geometric mean +90% CI | 4.02 | 1.662 | 1.39E-02 | 8.33E-03 |
| I-129 | 0.29 | Permit Maximum | 1.00E-03 | Geometric mean | 3.10 | 1.662 | 1.07E-02 | 6.44E-03 |
| I-129 | 0.29 | Average | 5.63E-04 | Arithmetric mean +90% CI | 5.48 | 1.662 | 1.06E-02 | 6.40E-03 |
| I-129 | 0.29 | Average | 5.63E-04 | Geometric mean +90% CI | 4.02 | 1.662 | 7.79E-03 | 4.69E-03 |
| I-129 | 0.29 | Average | 5.63E-04 | Geometric mean | 3.10 | 1.662 | 6.02E-03 | 3.62E-03 |
| | | | | | | | | |
| Tc-99 | 0.29 | Permit Maximum | 1.00E-03 | Arithmetric mean +90% CI | 5.48 | 1.607 | 1.89E-02 | 1.18E-02 |
| Tc-99 | 0.29 | Permit Maximum | 1.00E-03 | Geometric mean +90% CI | 4.02 | 1.607 | 1.39E-02 | 8.62E-03 |
| Tc-99 | 0.29 | Permit Maximum | 1.00E-03 | Geometric mean | 3.10 | 1.607 | 1.07E-02 | 6.66E-03 |
| Tc-99 | 0.29 | Average | 5.63E-04 | Arithmetric mean +90% CI | 5.48 | 1.607 | 1.06E-02 | 6.62E-03 |
| Tc-99 | 0.29 | Average | 5.63E-04 | Geometric mean +90% CI | 4.02 | 1.607 | 7.79E-03 | 4.85E-03 |
| Tc-99 | 0.29 | Average | 5.63E-04 | Geometric mean | 3.10 | 1.607 | 6.02E-03 | 3.75E-03 |

CI = Confidence interval

## Table 6. Dispersivity Values

| Longitudinal Transport Distance x (ft) | Longitudinal Dispersivity $\alpha_x$ (ft) | Transverse Dispersivity $\alpha_y$ (ft) |
|---|---|---|
| 1,291 | 129.1 | 12.9 |

## Table 7. Diffusion Coefficients, Half-Lives, and Decay Constants

| Constituent | Effective Diffusion Coefficient ($ft^2$/day) | Half Life $t_{1/2}$ (years) | Decay Constant $\lambda$ (/day) | Half Live Data Source |
|---|---|---|---|---|
| I-129 | 1.19E-03 | 1.57E+07 | 1.21E-10 | Chart of the Nuclides Knolls Atomic Power Laboratory Naval Reactors, DOE, Rev. 1996 |
| Tc-99 | 9.03E-04 | 2.11E+05 | 8.99E-09 | National Nuclear Data Center, Brookhaven National Laboratory, August 1996 |

## Table 8. Source Concentrations and Derivation of Dilution Contours

| | I-129 | Tc-99 |
|---|---|---|
| Time-weighted average concentration ($C_o$, pC/L) | 3.63E+06 | 1.37E+08 |
| Minimum Detectable Activity (MDA, pCi/L) | 5 | 10 |
| Dilution Contour (MDA/$C_o$) | 1.38E-06 | 7.32E-08[a] |

[a] 1.00E-06 is lowest dilution contoured allowed by MEMO model, so it was used as the Tc-99 dilution contour.

## Table 9. Summary of Monitoring Efficiency Modeling for the Class A West Embankment

| Model Run | Constituent | Type | Source Area | Flow Direction | Contaminant Velocity (ft/day) | Upgradient Non-Arrival Zones[a] | Undetected Leaks | Monitoring Efficiency (%) |
|---|---|---|---|---|---|---|---|---|
| CAWI129a | I-129 | Base Case | Footprint | N40°E | 1.14E-02 | None | 485 / 13217 | 96.3 |
| CAWI129b | I-129 | Sensitivity | Footprint | N40°E | 3.62E-03 | Included | 2732 / 13217 | 79.3 |
| CAWI129c | I-129 | Sensitivity | Footprint | N40°E | 3.62E-03 | Excluded | 502 / 10922 | 95.4 |
| CAWI129d | I-129 | Base Case | Top Slope | N40°E | 1.14E-02 | None | 14 / 9362 | 99.9 |
| CAWI129e | I-129 | Sensitivity | Top Slope | N40°E | 3.62E-03 | Included | 1449 / 9362 | 84.5 |
| CAWI129f | I-129 | Sensitivity | Top Slope | N40°E | 3.62E-03 | Excluded | 20 / 7878 | 99.7 |
| CAWI129g | I-129 | Sensitivity | Footprint | N90°E | 1.14E-02 | None | 183 / 13217 | 98.6 |
| CAWI129h | I-129 | Sensitivity | Footprint | N90°E | 3.62E-03 | Included | 1623 / 13217 | 87.7 |
| CAWI129i | I-129 | Sensitivity | Footprint | N90°E | 3.62E-03 | Excluded | 191 / 11717 | 98.4 |
| CAWI129j | I-129 | Sensitivity | Footprint | N0°E | 1.14E-02 | None | 190 / 13217 | 98.6 |
| CAWI129k | I-129 | Sensitivity | Footprint | N0°E | 3.62E-03 | Included | 2300 / 13217 | 82.6 |
| CAWI129L | I-129 | Sensitivity | Footprint | N0°E | 3.62E-03 | Excluded | 203 / 11012 | 98.2 |
| CAWI129m | I-129 | Sensitivity | Top Slope | N90°E | 1.14E-02 | None | 0 / 9362 | 100.0 |
| CAWI129n | I-129 | Sensitivity | Top Slope | N90°E | 3.62E-03 | Included | 748 / 9362 | 92.0 |
| CAWI129o | I-129 | Sensitivity | Top Slope | N90°E | 3.62E-03 | Excluded | 5 / 8551 | 99.9 |
| CAWI129p | I-129 | Sensitivity | Top Slope | N0°E | 1.14E-02 | None | 0 / 9362 | 100.0 |
| CAWI129q | I-129 | Sensitivity | Top Slope | N0°E | 3.62E-03 | Included | 1502 / 9362 | 84.0 |
| CAWI129r | I-129 | Sensitivity | Top Slope | N0°E | 3.62E-03 | Excluded | 0 / 7757 | 100.0 |
| | | | | | | | | |
| CAWTc99a | Tc-99 | Base Case | Footprint | N40°E | 1.18E-02 | None | 500 / 13217 | 96.2 |
| CAWTc99b | Tc-99 | Sensitivity | Footprint | N40°E | 3.75E-03 | Included | 2449 / 13217 | 81.5 |
| CAWTc99c | Tc-99 | Sensitivity | Footprint | N40°E | 3.75E-03 | Excluded | 505 / 11201 | 95.5 |
| CAWTc99d | Tc-99 | Base Case | Top Slope | N40°E | 1.18E-02 | None | 18 / 9362 | 99.8 |
| CAWTc99e | Tc-99 | Sensitivity | Top Slope | N40°E | 3.75E-03 | Included | 1223 / 9362 | 86.9 |
| CAWTc99f | Tc-99 | Sensitivity | Top Slope | N40°E | 3.75E-03 | Excluded | 21 / 8133 | 99.7 |
| CAWTc99g | Tc-99 | Sensitivity | Footprint | N90°E | 1.18E-02 | None | 195 / 13217 | 98.5 |
| CAWTc99h | Tc-99 | Sensitivity | Footprint | N90°E | 3.75E-03 | Included | 1298 / 13217 | 90.2 |
| CAWTc99i | Tc-99 | Sensitivity | Footprint | N90°E | 3.75E-03 | Excluded | 204 / 12041 | 98.3 |
| CAWTc99j | Tc-99 | Sensitivity | Footprint | N0°E | 1.18E-02 | None | 214 / 13217 | 98.4 |
| CAWTc99k | Tc-99 | Sensitivity | Footprint | N0°E | 3.75E-03 | Included | 2014 / 13217 | 84.8 |
| CAWTc99L | Tc-99 | Sensitivity | Footprint | N0°E | 3.75E-03 | Excluded | 236 / 11377 | 97.9 |
| CAWTc99m | Tc-99 | Sensitivity | Top Slope | N90°E | 1.18E-02 | None | 0 / 9362 | 100.0 |
| CAWTc99n | Tc-99 | Sensitivity | Top Slope | N90°E | 3.75E-03 | Included | 427 / 9362 | 95.4 |
| CAWTc99o | Tc-99 | Sensitivity | Top Slope | N90°E | 3.75E-03 | Excluded | 0 / 8810 | 100.0 |
| CAWTc99p | Tc-99 | Sensitivity | Top Slope | N0°E | 1.18E-02 | None | 0 / 9362 | 100.0 |
| CAWTc99q | Tc-99 | Sensitivity | Top Slope | N0°E | 3.75E-03 | Included | 1211 / 9362 | 87.1 |
| CAWTc99r | Tc-99 | Sensitivity | Top Slope | N0°E | 3.75E-03 | Excluded | 7 / 8103 | 99.9 |

[a] Refer to discussion in Sections 3.4 and 4.2.

**Table 10. Optimized Monitoring Well Network for the Class A West Embankment**

| Well | Model Well Designation[a] | Clive Coordinates | |
|---|---|---|---|
| | | Northing (feet) | Easting (feet) |
| **Existing Wells:** | | | |
| GW-88 | 10 | 13,695.79 | 12,709.21 |
| GW-89 | 11 | 13,302.32 | 12,703.06 |
| GW-90 | 12 | 12,910.76 | 12,697.17 |
| GW-91 | 13 | 12,516.05 | 12,690.76 |
| GW-92 | 14 | 12,117.04 | 12,683.66 |
| GW-25 | 15 | 12,137.43 | 11,817.42 |
| GW-26 | 16 | 12,150.89 | 11,078.35 |
| GW-27 | 17 | 12,171.23 | 10,243.49 |
| GW-93 | 18 | 12,127.21 | 12,295.96 |
| GW-94 | 19 | 12,143.73 | 11,496.85 |
| GW-95 | 20 | 12,159.57 | 10,666.92 |
| GW-99 | 21 | 12,565.38 | 10,250.19 |
| GW-100 | 22 | 12,958.43 | 10,259.09 |
| GW-101 | 23 | 13,351.91 | 10,267.65 |
| GW-102 | 24 | 13,746.02 | 10,276.70 |
| GW-106 | 25 | 14,061.30 | 10,292.39 |
| GW-107 | 26 | 14,454.18 | 10,303.03 |
| GW-108 | 27 | 14,800.39 | 10,312.87 |
| **New Wells:** | | | |
| GW-142 | 1 | 14,902.99 | 10,613.15 |
| GW-143 | 2 | 14,895.54 | 10,978.15 |
| GW-144 | 3 | 14,888.39 | 11,328.15 |
| GW-145 | 4 | 14,881.24 | 11,678.15 |
| GW-146 | 5 | 14,874.09 | 12,028.15 |
| GW-147 | 6 | 14,866.94 | 12,378.15 |
| GW-148 | 7 | 14,859.79 | 12,728.15 |
| GW-149 | 8 | 14,471.79 | 12,721.91 |
| GW-150 | 9 | 14,083.79 | 12,715.67 |

[a] Well designation used in MEMO model runs, Attachments A and B.

# FIGURES

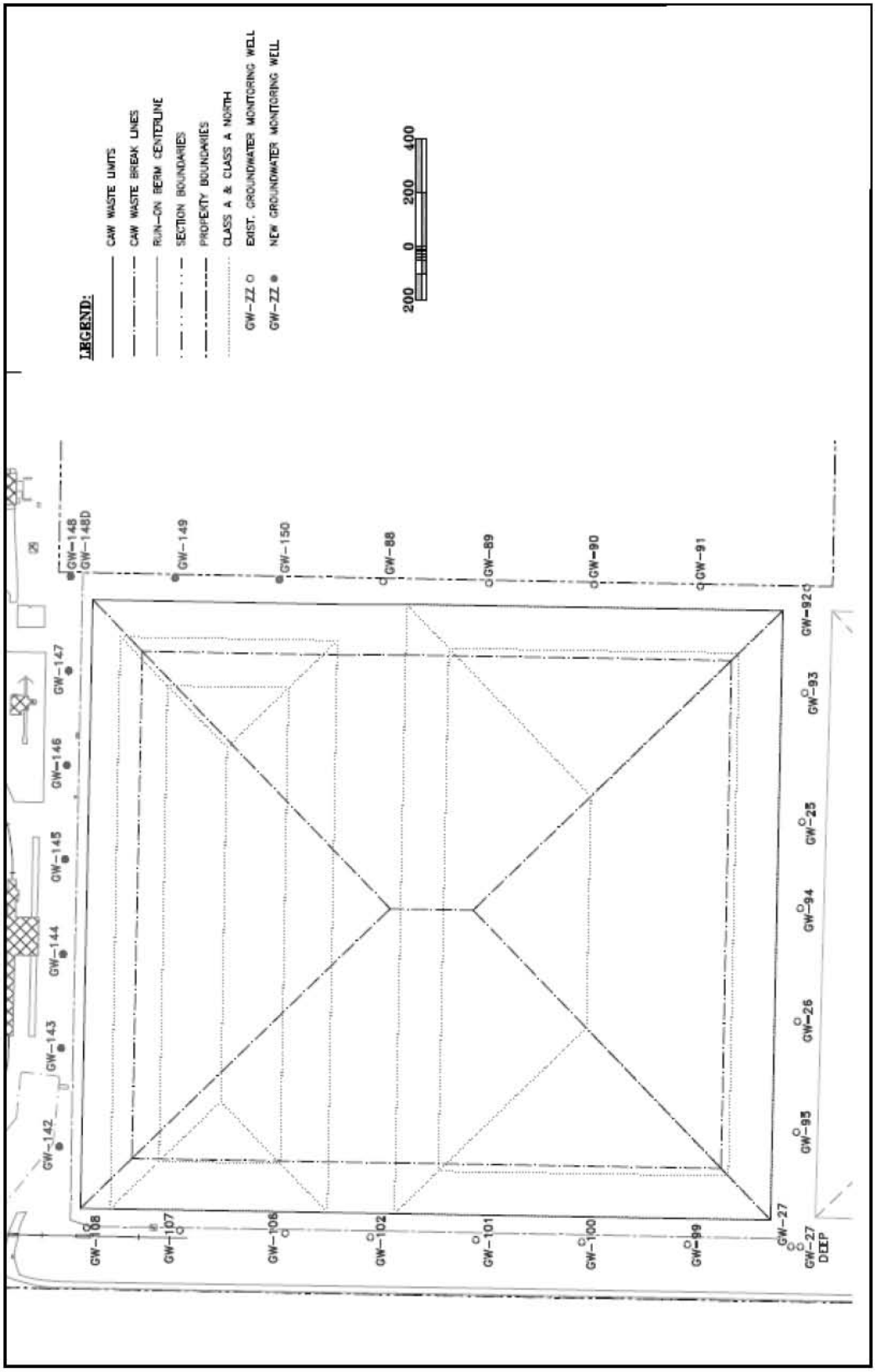



**Figure 1. Class A West (CAW) Embankment Optimized Monitoring Well Network with Efficiency Exceeding 95%**

**Figure 2. Model Results Showing Upgradient Non-Arrival Zone, Model Run CAWI129b, Average Contaminant Velocity, Entire Footprint Source, N40°E Hydraulic Gradient**

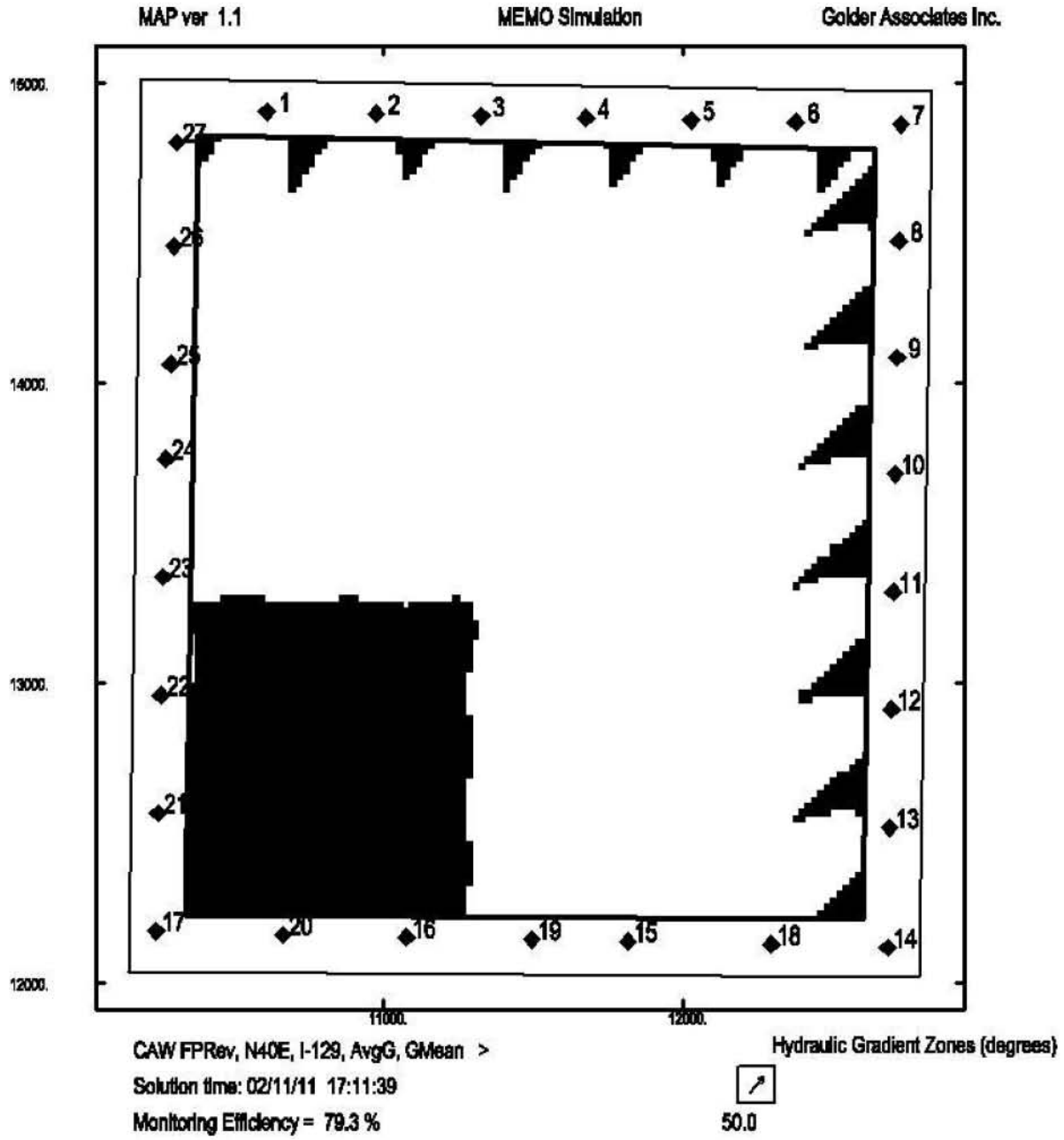


**Figure 3. Model Results for I-129, Base Case Conditions, Entire CAW Footprint, Maximum Contaminant Velocity, N40°E Hydraulic Gradient**

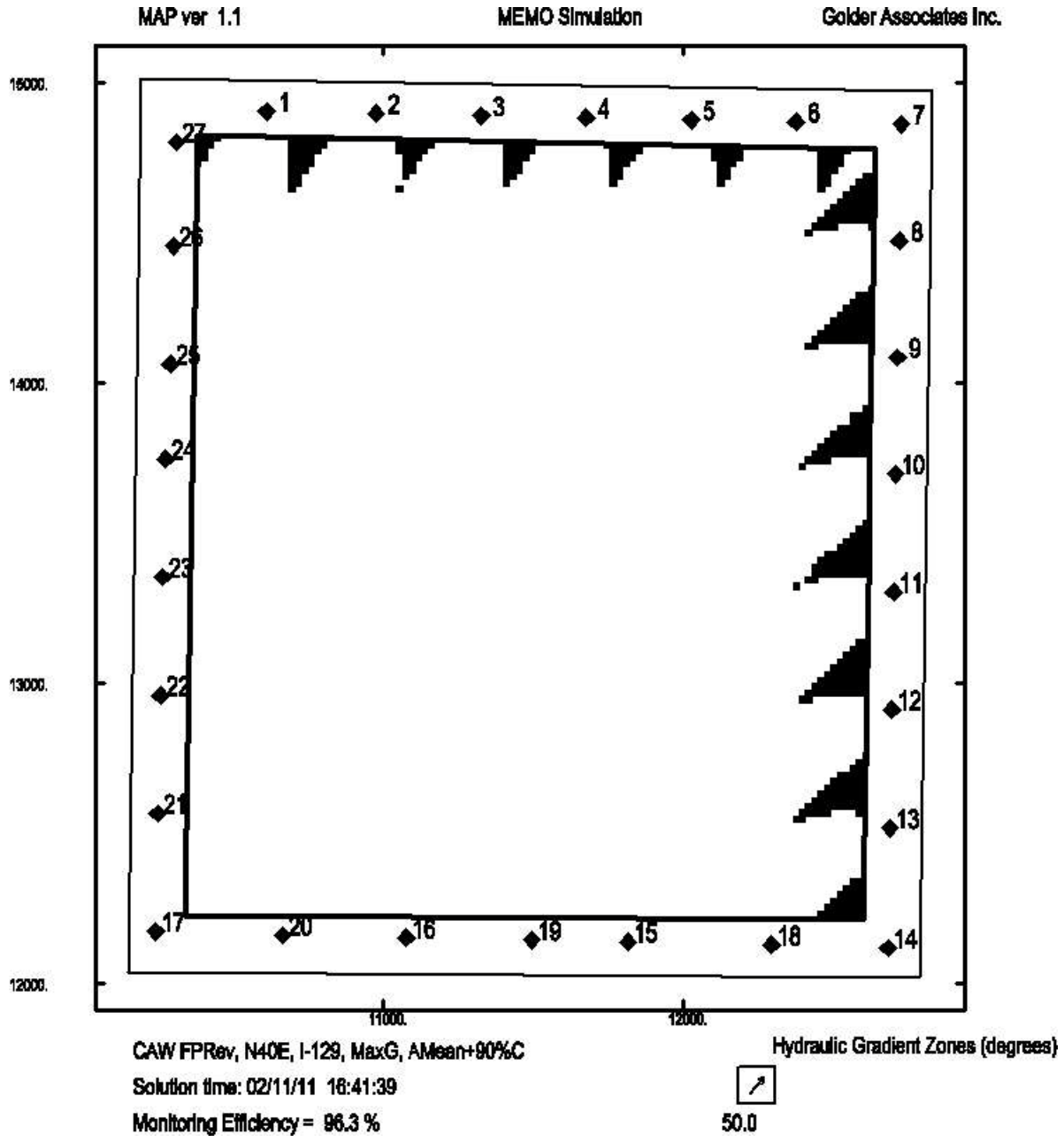


**Figure 4. Model Results for Tc-99, Base Case Conditions, Entire CAW Footprint, Maximum Contaminant Velocity, N40°E Hydraulic Gradient**

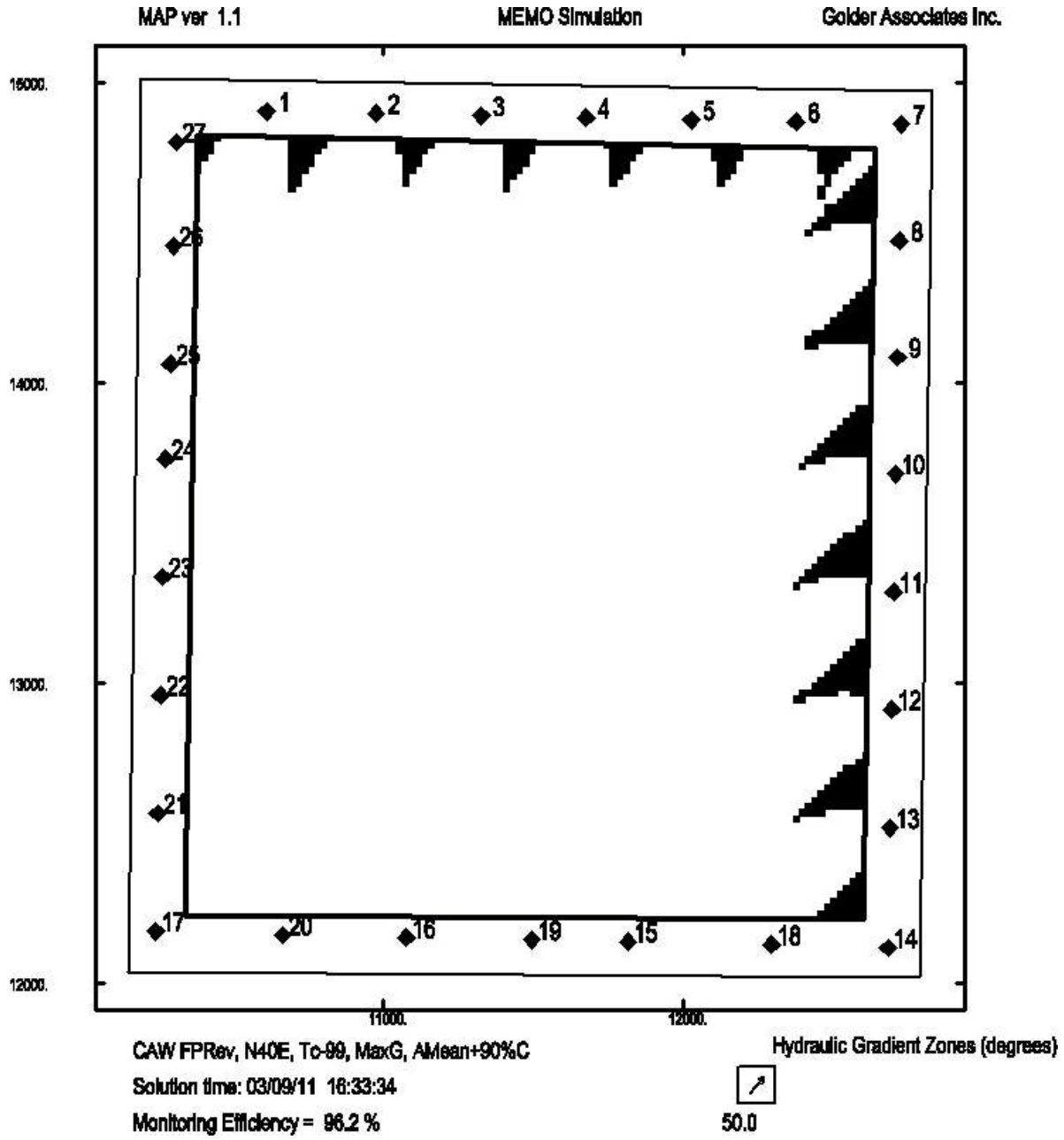


**Figure 5. Model Results for I-129, Base Case Conditions, CAW Top Slope, Maximum Contaminant Velocity, N40°E Hydraulic Gradient**

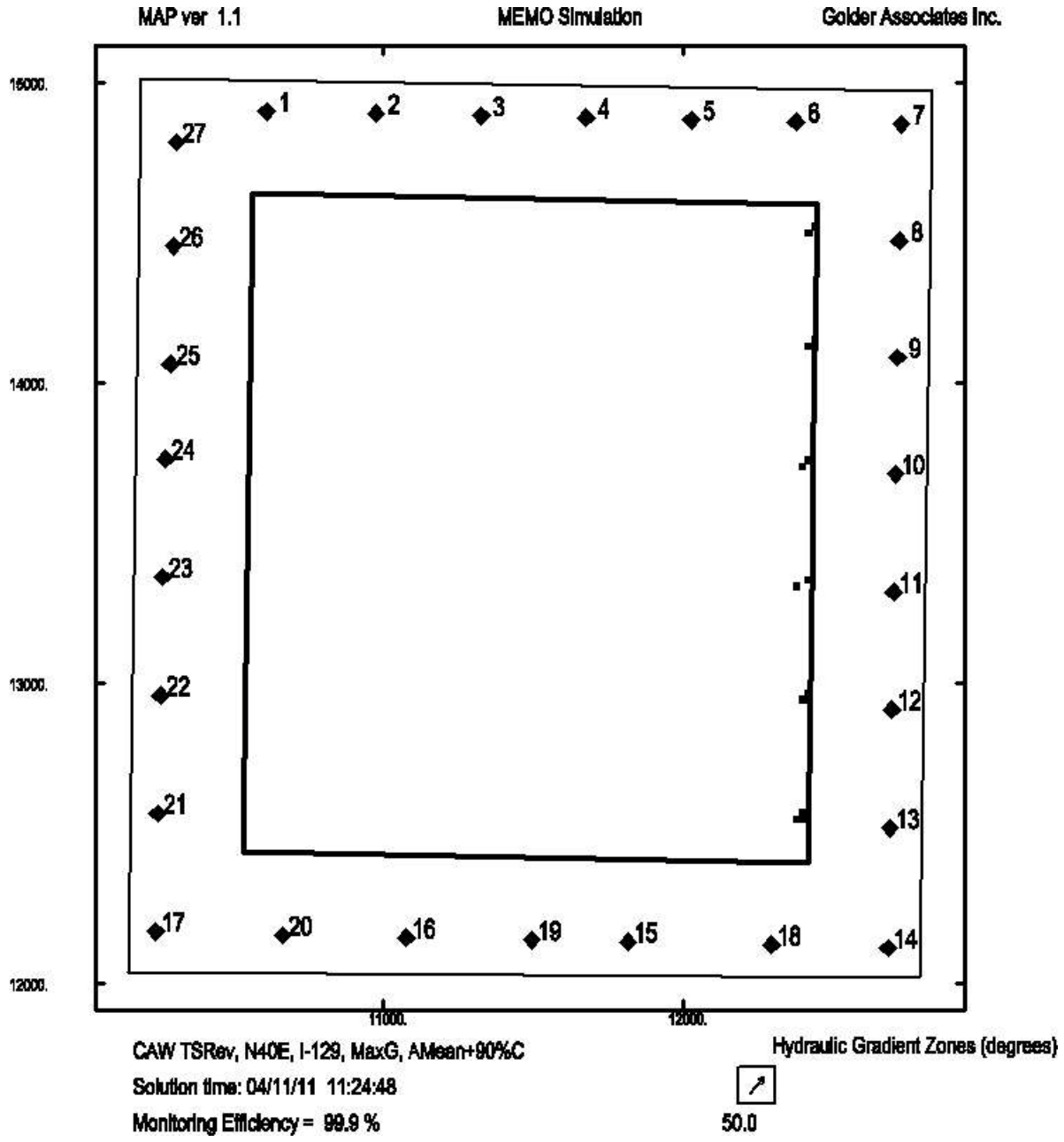
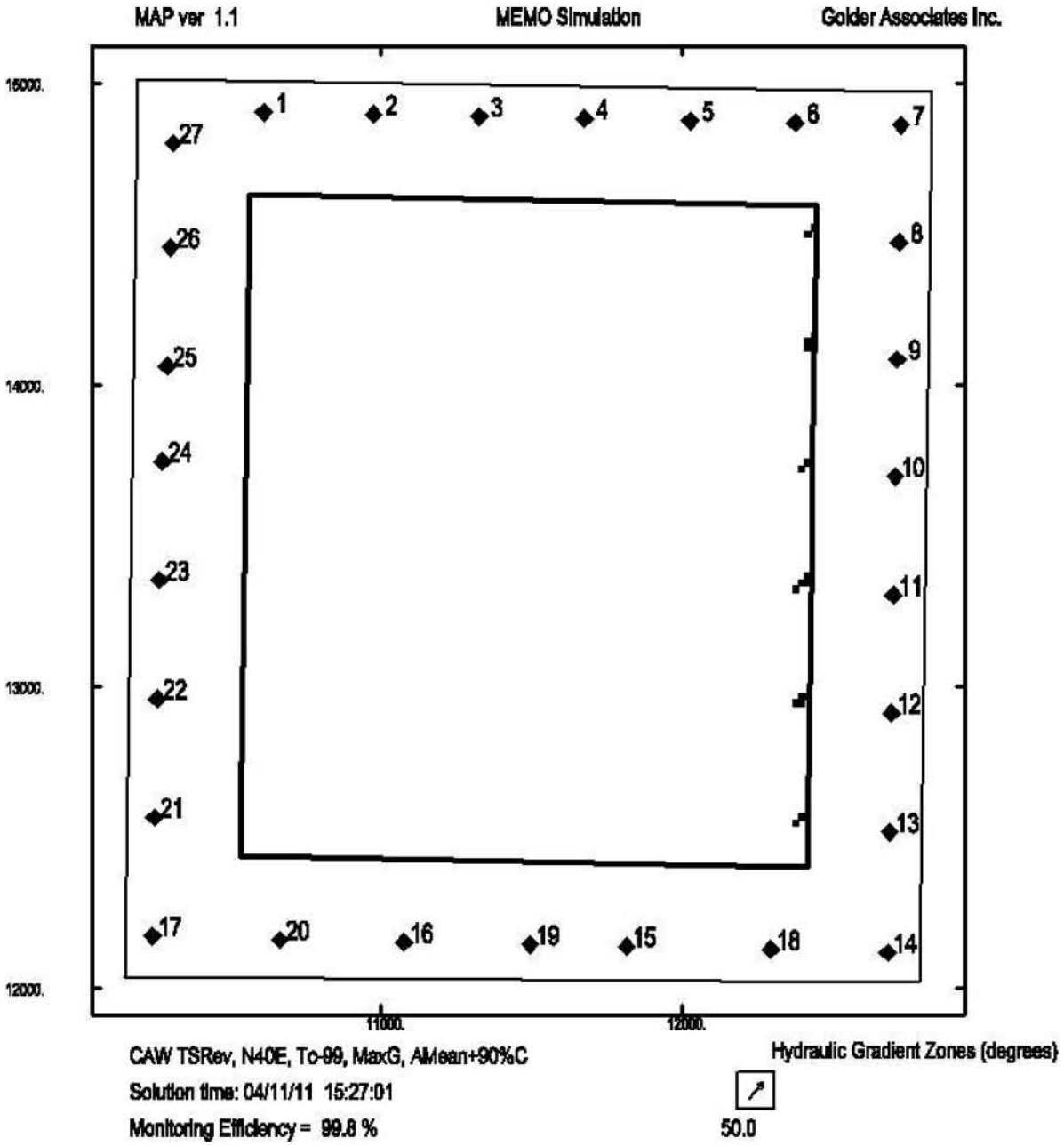


**Figure 6. Model Results for Tc-99, Base Case Conditions, CAW Top Slope, Maximum Contaminant Velocity, N40°E Hydraulic Gradient**



# ATTACHMENT A

# MEMO MODEL INPUT/OUTPUT FILES

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 02/11/11 at 16:41:39        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, I-129, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    1.140000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         485
 Monitoring efficiency = 96.3 %.
  *   END OF MAP FILE
1
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 02/11/11 at 17:11:39        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, I-129, AvgG, GMean   > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        2732
 Monitoring efficiency = 79.3 %.
  *   END OF MAP FILE
2
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 02/11/11 at 18:00:46        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, I-129, AvgG, GMean     >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.77       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       11291.05       12218.56         1
  7       11291.05       13295.35         1
  8       10358.82       13295.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       10922
  # of undetected leaks =         502
 Monitoring efficiency = 95.4 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 11:24:48         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N40E, I-129, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    1.140000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =          14
 Monitoring efficiency = 99.9 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 11:38:34        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N40E, I-129, AvgG, GMean   > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =        1449
 Monitoring efficiency = 84.5 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 13:13:46        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N40E, I-129, AvgG, GMean   > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       11304.20       12425.71         1
  7       11304.20       13291.44         1
  8       10548.48       13291.44         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        7878
  # of undetected leaks =          20
 Monitoring efficiency = 99.7 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 02/14/11 at 14:11:23         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N90E, I-129, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    1.140000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         183
 Monitoring efficiency = 98.6 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 02/14/11 at 14:17:32         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N90E, I-129, AvgG, GMean >   >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        1623
 Monitoring efficiency = 87.7 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 02/14/11 at 15:40:40         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N90E, I-129, AvgG, GMean >   >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
  7       10348.94       12700.35         1
  8       10778.94       12700.35         1
  9       10778.94       14323.89         1
 10       10375.91       14323.89         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       11717
  # of undetected leaks =         191
 Monitoring efficiency = 98.4 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 02/14/11 at 15:53:41         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N0E, I-129, MaxG, AMean+90%C >
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    1.140000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         190
 Monitoring efficiency = 98.6 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 02/14/11 at 16:01:17        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N0E, I-129, AvgG, GeoMeanHC >>
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        2300
 Monitoring efficiency = 82.6 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 02/14/11 at 16:41:54        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N0E, I-129, AvgG, GeoMeanHC >>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       12160.71       12212.34         1
  7       12160.71       12952.34         1
  8       10831.05       12961.85         1
  9       10831.05       12221.85         1
 10       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       11012
  # of undetected leaks =         203
 Monitoring efficiency = 98.2 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 13:45:31         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N90E, I-129, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    1.140000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =           0
 Monitoring efficiency =100.0 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 13:51:13         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N90E, I-129, AvgG, GMeanHC > >
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =         748
 Monitoring efficiency = 92.0 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 14:07:03         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N90E, I-129, AvgG, GMeanHC > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
  7       10538.57       12701.44         1
  8       10778.94       12701.44         1
  9       10778.94       14320.04         1
 10       10565.77       14320.04         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        8551
  # of undetected leaks =           5
 Monitoring efficiency = 99.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 14:23:51         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N0E, I-129, MaxG, AMean+90%C>>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    1.140000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =           0
 Monitoring efficiency =100.0 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 14:32:44        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N0E, I-129, AvgG, GMeanHC > >>
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =        1502
 Monitoring efficiency = 84.0 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 14:37:43        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N0E, I-129, AvgG, GMeanHC > >>
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       12163.93       12408.16         1
  7       12163.93       12952.34         1
  8       10834.20       12961.85         1
  9       10834.20       12435.31         1
 10       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.380000E-06      129.100000       12.900000    1.190000E-03
        1.000000    1.210000E-10    3.620000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        7757
  # of undetected leaks =           0
 Monitoring efficiency =100.0 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 03/09/11 at 16:33:34         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         500
 Monitoring efficiency = 96.2 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 03/09/11 at 16:36:28        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, Tc-99, AvgG, GMean   > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        2449
 Monitoring efficiency = 81.5 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 17:28:01        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N40E, Tc-99, AvgG, GMean     >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.77       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       11231.05       12218.99         1
  7       11231.05       13225.35         1
  8       10357.66       13225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       11201
  # of undetected leaks =         505
 Monitoring efficiency = 95.5 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 15:27:01        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N40E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =          18
 Monitoring efficiency = 99.8 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 15:32:12        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N40E, Tc-99, AvgG, GMean   > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =        1223
 Monitoring efficiency = 86.9 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 17:00:04        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N40E, Tc-99, AvgG, GMean   > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       11234.20       12427.14         1
  7       11234.20       13216.44         1
  8       10547.22       13216.44         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
```

```
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          50.00
    2       12850.00       15030.00         1          50.00
    3       12850.00       12010.00         1          50.00
    4       10140.00       12010.00         1          50.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        8133
  # of undetected leaks =          21
 Monitoring efficiency = 99.7 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 03/09/11 at 17:37:34        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N90E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         195
 Monitoring efficiency = 98.5 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 03/09/11 at 17:58:18         ++
++++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N90E, Tc-99, AvgG, GMean >   >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        1298
 Monitoring efficiency = 90.2 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/12/11 at 09:46:39        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW FPRev, N90E, Tc-99, AvgG, GMean >   >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
  7       10348.94       12725.35         1
  8       10678.94       12725.35         1
  9       10678.94       14311.89         1
 10       10375.91       14311.89         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       12041
  # of undetected leaks =         204
 Monitoring efficiency = 98.3 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 03/09/11 at 18:07:56        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N0E, Tc-99, MaxG, AMean+90%C >
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =         214
 Monitoring efficiency = 98.4 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 03/10/11 at 14:06:48        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N0E, Tc-99, AvgG, GeoMeanHC >>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       13217
  # of undetected leaks =        2014
 Monitoring efficiency = 84.8 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 17:42:29        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW FPRev, N0E, Tc-99, AvgG, GeoMeanHC >>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10384.21       14823.89         1
  2       12641.27       14777.79         1
  3       12624.26       13865.49         1
  4       12624.12       13609.08         1
  5       12600.71       12209.19         1
  6       12135.71       12212.52         1
  7       12135.71       12852.52         1
  8       10851.05       12861.70         1
  9       10851.05       12221.70         1
 10       10341.05       12225.35         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =       11377
  # of undetected leaks =         236
 Monitoring efficiency = 97.9 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 15:43:55         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N90E, Tc-99, MaxG, AMean+90%C>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =           0
 Monitoring efficiency =100.0 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 16:23:21        ++
+++++++++++++++++++++++++++++++++++++++++++


---------------------------------------------
< CAW TSRev, N90E, Tc-99, AvgG, GMeanHC > >
---------------------------------------------


*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =         427
 Monitoring efficiency = 95.4 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/12/11 at 10:08:00        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N90E, Tc-99, AvgG, GMeanHC > >
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
  7       10538.97       12724.49         1
  8       10692.97       12724.49         1
  9       10719.41       14302.08         1
 10       10565.41       14302.08         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1            .00
    2       12850.00       15030.00         1            .00
    3       12850.00       12010.00         1            .00
    4       10140.00       12010.00         1            .00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        8810
  # of undetected leaks =           0
 Monitoring efficiency =100.0 %.
  *   END OF MAP FILE
```

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                  ++
++                                        ++
++     Monitoring Analysis Package        ++
++        MAP Version   1.1               ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 04/11/11 at 17:08:41         ++
++++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N0E, Tc-99, MaxG, AMean+90%C>>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    1.180000E-02
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =           0
 Monitoring efficiency =100.0 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 17:13:13        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N0E, Tc-99, AvgG, GMeanHC > >>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
 12       12697.17       12910.76
 13       12690.76       12516.05
 14       12683.66       12117.04
 15       11817.42       12137.43
```

```
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        9362
  # of undetected leaks =        1211
 Monitoring efficiency = 87.1 %.
  *   END OF MAP FILE
```

```
+++++++++++++++++++++++++++++++++++++++++++
++        MEMO Data File                 ++
++                                       ++
++     Monitoring Analysis Package       ++
++        MAP Version   1.1              ++
++                                       ++
++       GOLDER ASSOCIATES INC.          ++
++                                       ++
++    Run on 04/11/11 at 17:20:53        ++
+++++++++++++++++++++++++++++++++++++++++++



---------------------------------------------
< CAW TSRev, N0E, Tc-99, AvgG, GMeanHC > >>
---------------------------------------------



*   SCALE FACTOR
      1.000000
*   SOURCE GRID PARAMETERS (x0,y0,grid spacing,max x incr,max y incr)
  10341.050000    12209.190000       21.000000
       110         125
*   POTENTIAL SOURCE AREA COORDINATES (#,x,y,unit#)
  1       10569.01       14632.08         1
  2       12449.80       14593.66         1
  3       12436.26       13867.29         1
  4       12436.12       13610.70         1
  5       12415.89       12401.00         1
  6       12135.71       12408.73         1
  7       12135.71       12852.52         1
  8       10851.05       12861.70         1
  9       10851.05       12434.97         1
 10       10532.17       12439.49         1
*   ARRAY SPACING FOR BUFFER ZONE COORDINATES (max. spacing)
     40.000000
*   INPUT BUFFER ZONE COORDINATES (#,x,y)
  1       10194.21       15013.89
  2       12831.27       14967.79
  3       12790.71       12019.19
  4       10151.05       12035.35
*   MONITORING WELL COORDINATES (#,x,y)
  1       10613.15       14902.99
  2       10978.15       14895.54
  3       11328.15       14888.39
  4       11678.15       14881.24
  5       12028.15       14874.09
  6       12378.15       14866.94
  7       12728.15       14859.79
  8       12721.91       14471.79
  9       12715.67       14083.79
 10       12709.21       13695.79
 11       12703.06       13302.32
```

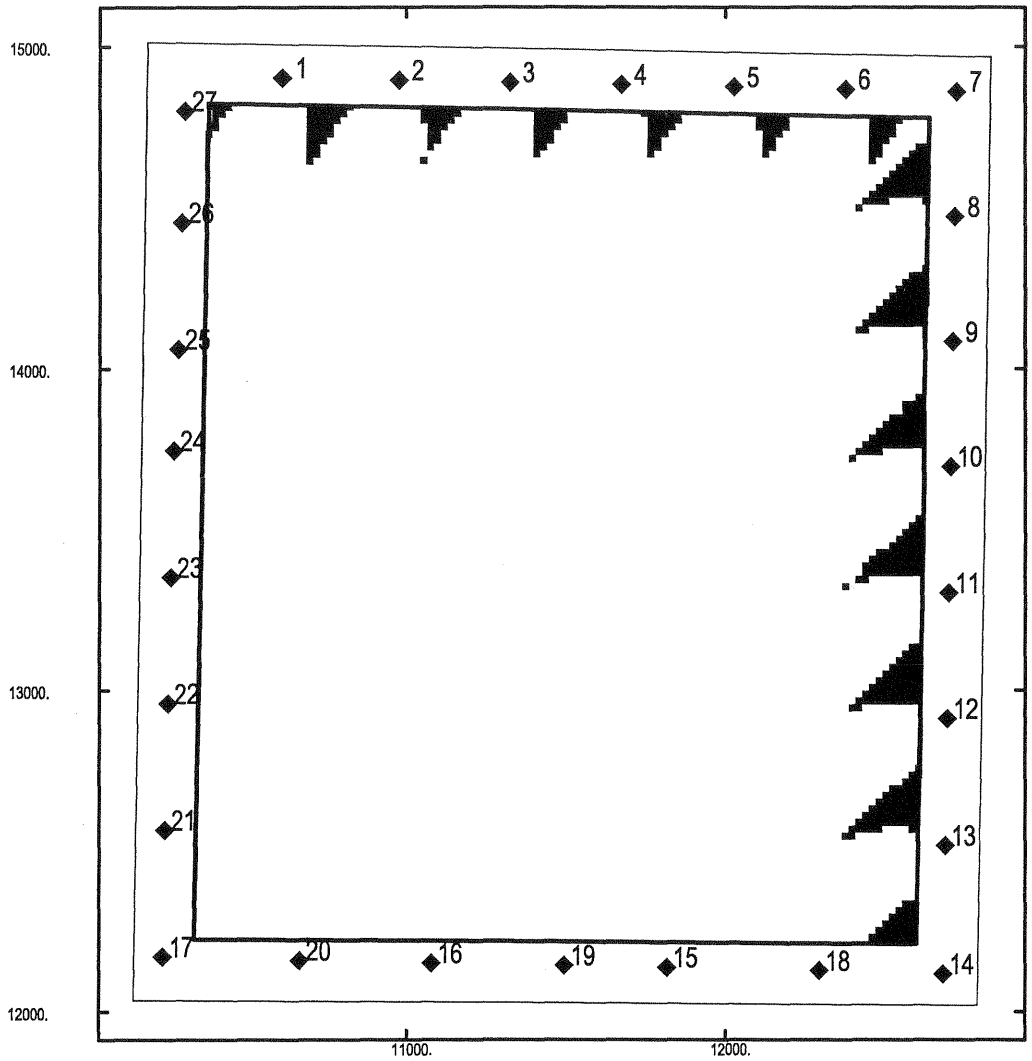
```
   12       12697.17       12910.76
   13       12690.76       12516.05
   14       12683.66       12117.04
   15       11817.42       12137.43
   16       11078.35       12150.89
   17       10243.49       12171.23
   18       12295.96       12127.21
   19       11496.85       12143.73
   20       10666.92       12159.57
   21       10250.19       12565.38
   22       10259.09       12958.43
   23       10267.65       13351.91
   24       10276.70       13746.02
   25       10292.39       14061.30
   26       10303.03       14454.18
   27       10312.87       14800.39
  *   CONTAM. TRAN. PARAMETERS (CD/C0,ldisp,tdisp,diffc,source
width,lmb,cvel)
    1.000000E-06      129.100000       12.900000    9.030000E-04
        1.000000    8.990000E-09    3.750000E-03
  *   GRADIENT ZONE COORDINATES (#,x,y,unit#,angle)
    1       10140.00       15030.00         1          90.00
    2       12850.00       15030.00         1          90.00
    3       12850.00       12010.00         1          90.00
    4       10140.00       12010.00         1          90.00
  *   SOLUTION RESULTS
  Maximum advection time =   182500.000000
  Accuracy of solution =    1.000000E-07
  Solution basis = buffer zone/advection time
  Total # of source points =        8103
  # of undetected leaks =           7
 Monitoring efficiency = 99.9 %.
  *   END OF MAP FILE
```

# ATTACHMENT B

# MEMO MODEL OUTPUT PLOTS

# CAWI129a.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N40E, I-129, MaxG, AMean+90%C

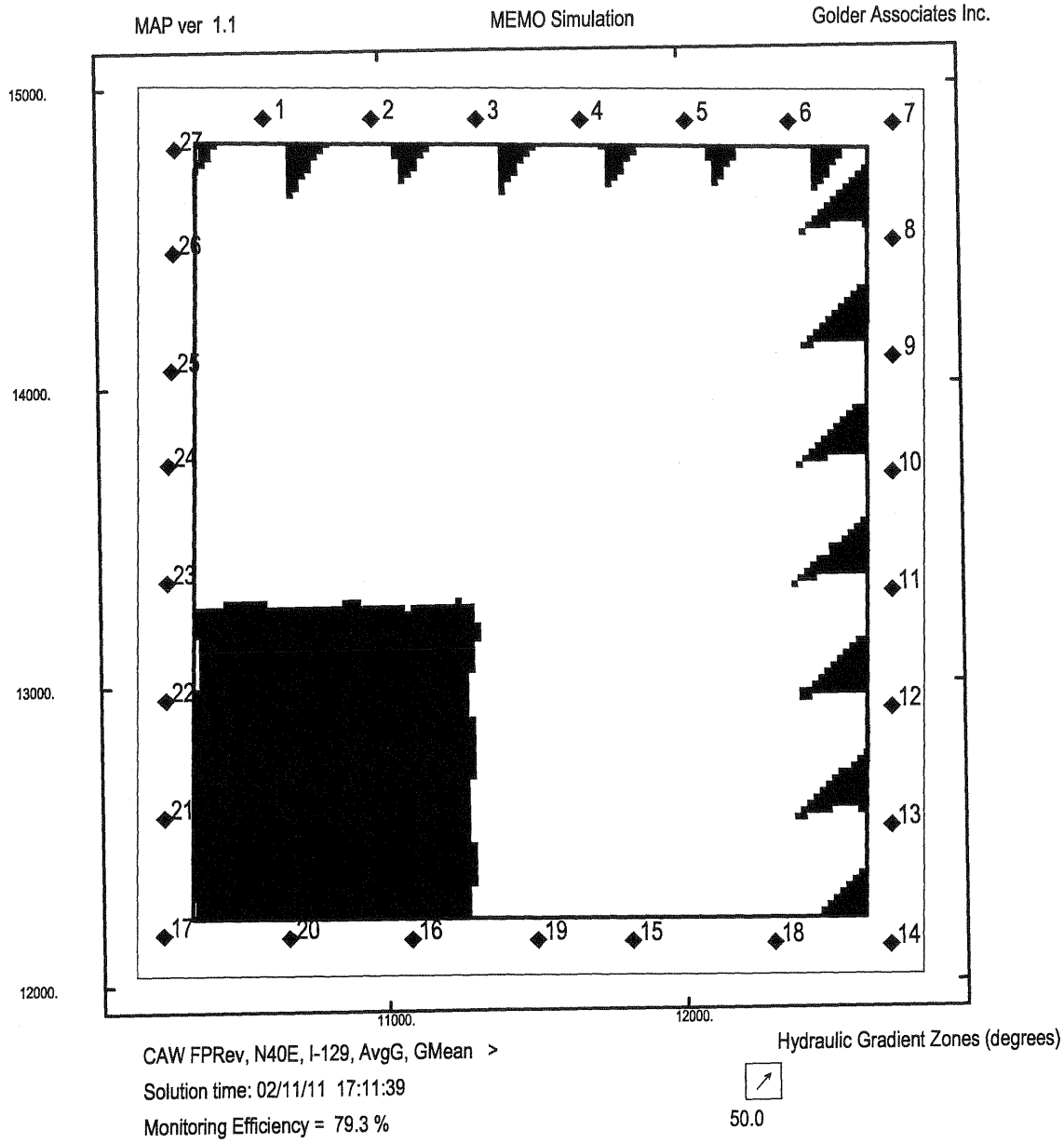
Solution time: 02/11/11 16:41:39

Monitoring Efficiency = 96.3 %

Hydraulic Gradient Zones (degrees)

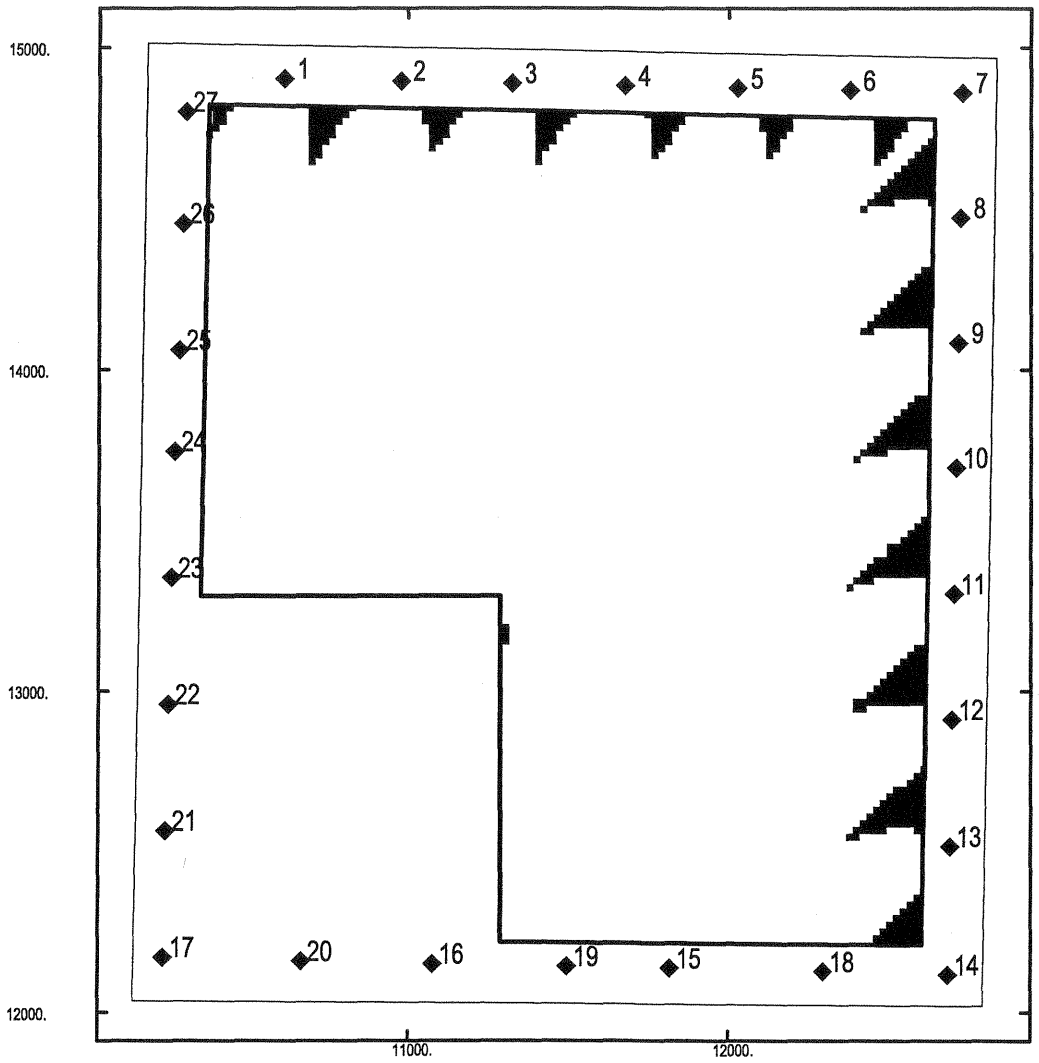
50.0

# CAWI129b.PLT



# CAWI129c.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N40E, I-129, AvgG, GMean

Solution time: 02/11/11 18:00:46

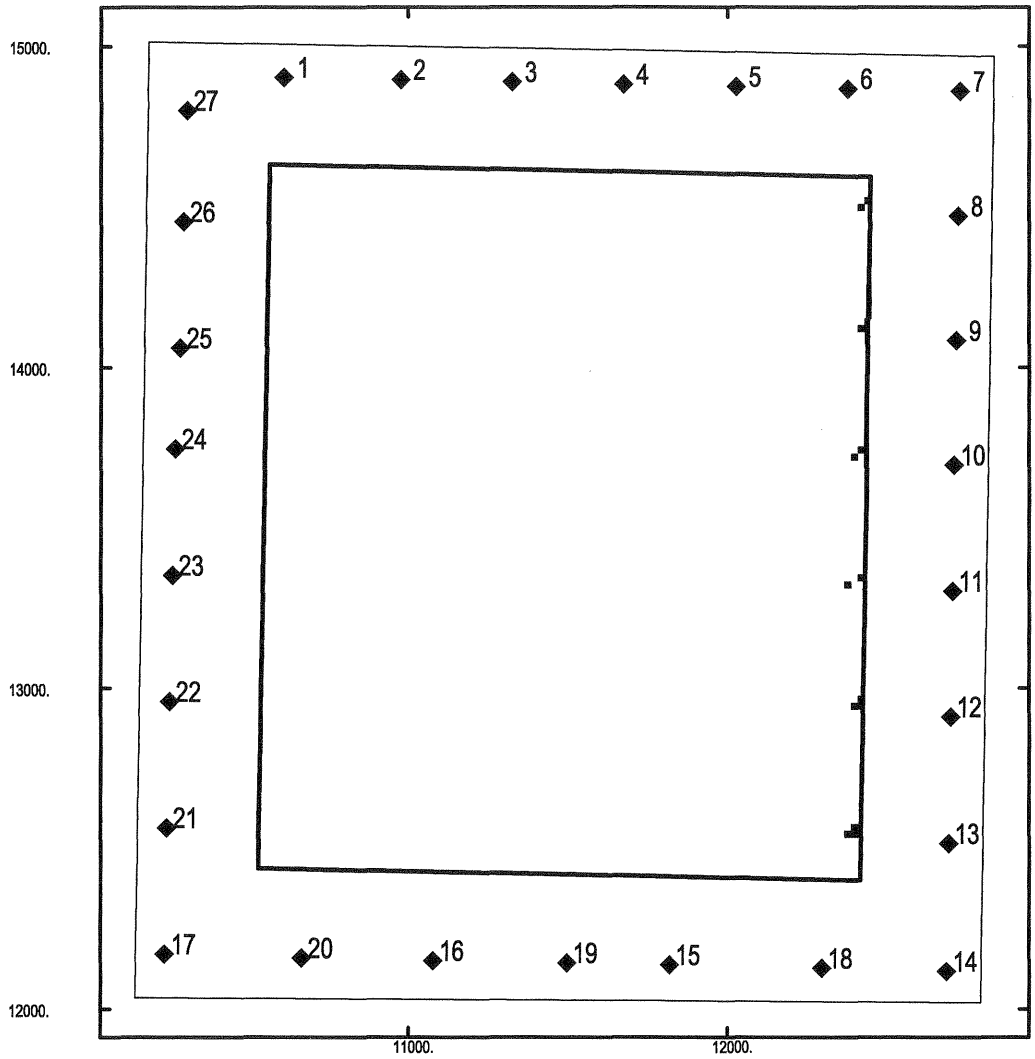
Monitoring Efficiency = 95.4 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWI129d.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N40E, I-129, MaxG, AMean+90%C

Solution time: 04/11/11 11:24:48

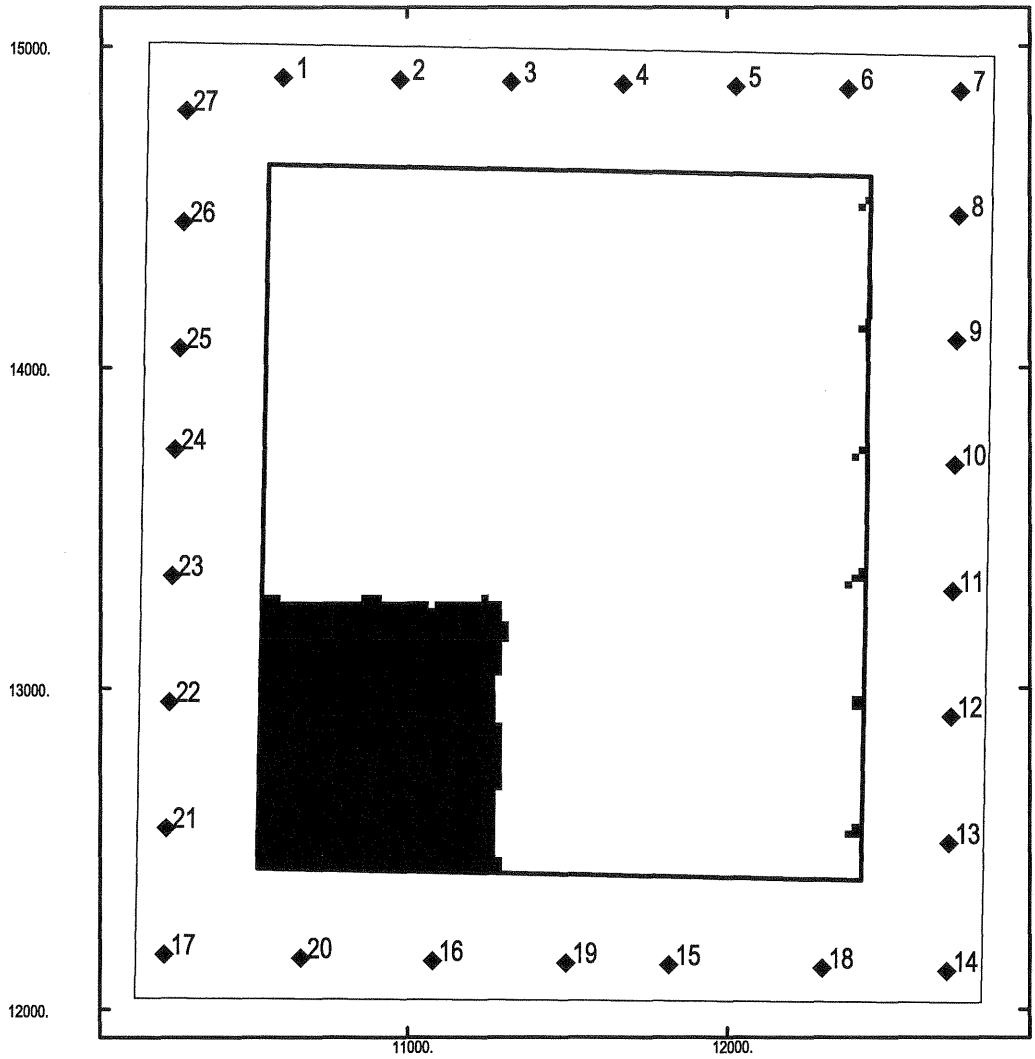
Monitoring Efficiency = 99.9 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWI129e.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N40E, I-129, AvgG, GMean >

Solution time: 04/11/11 11:38:34

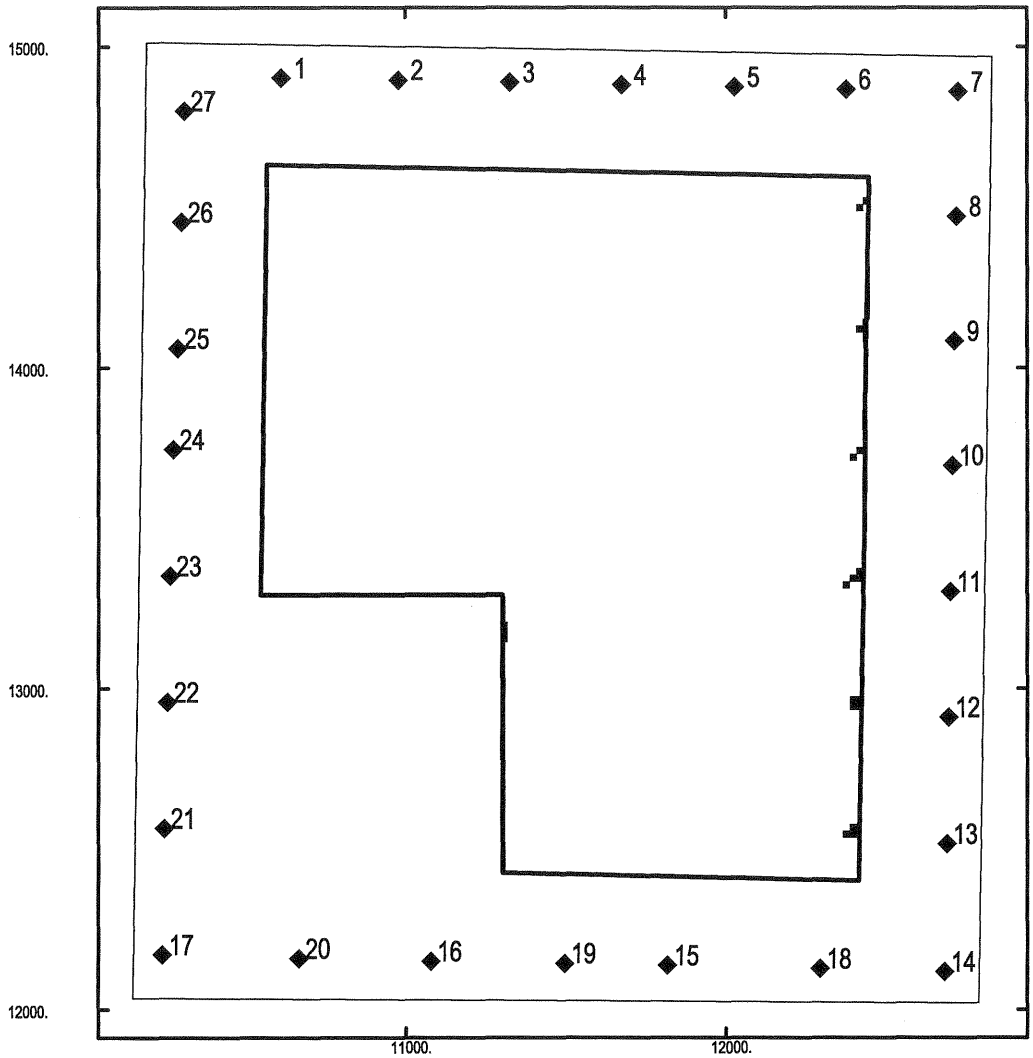
Monitoring Efficiency = 84.5 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWI129f.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N40E, I-129, AvgG, GMean >

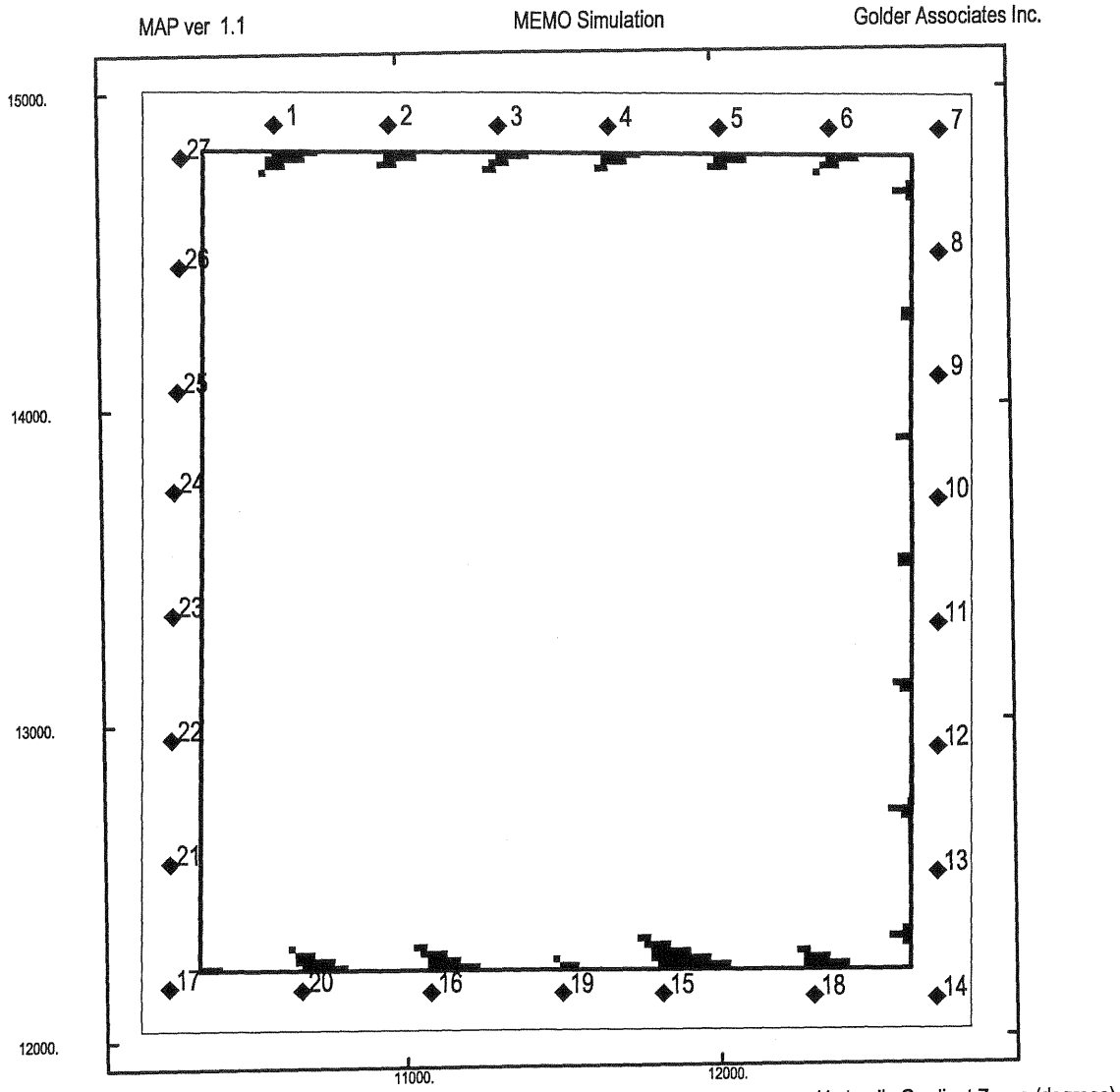
Solution time: 04/11/11 13:13:46

Monitoring Efficiency = 99.7 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWI129g.PLT




CAW FPRev, N90E, I-129, MaxG, AMean+90%C

Solution time: 02/14/11 14:11:23

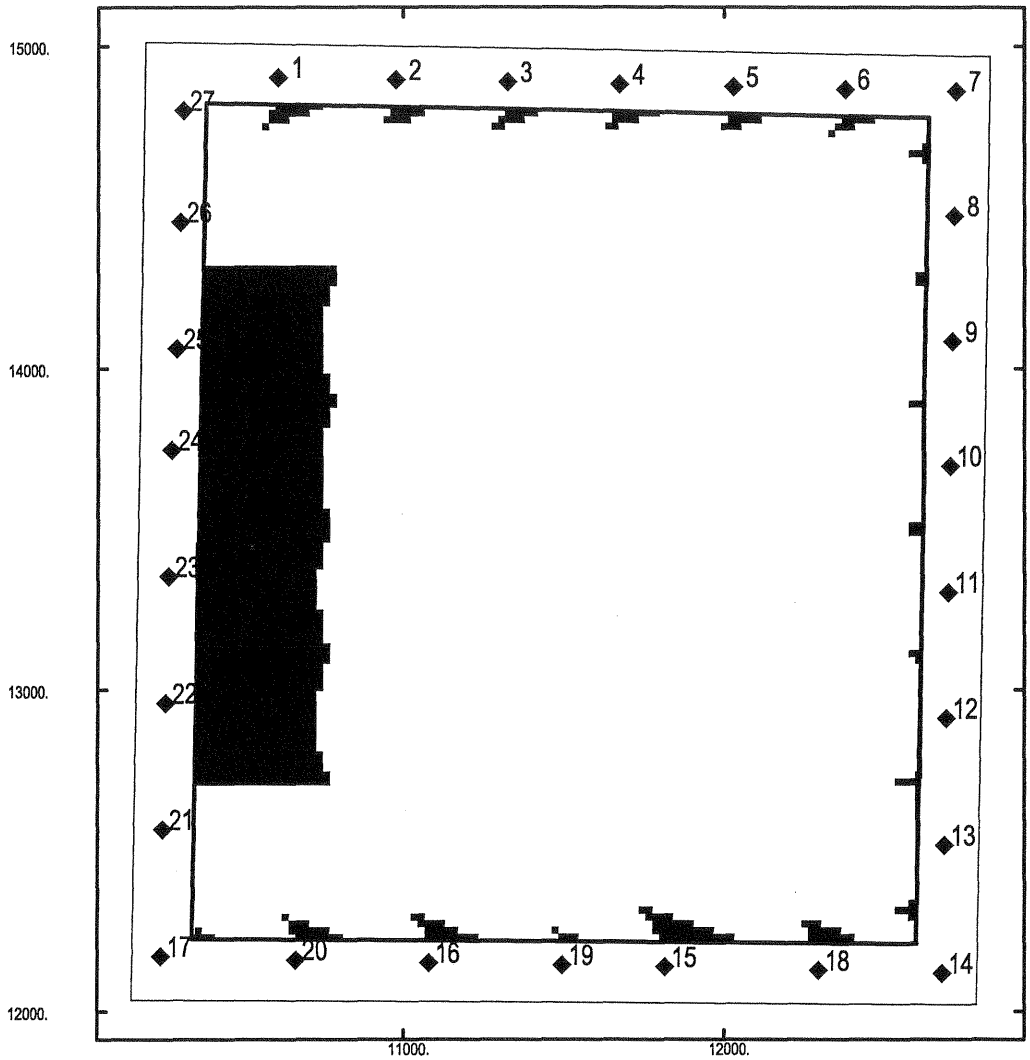
Monitoring Efficiency = 98.6 %

Hydraulic Gradient Zones (degrees)

.0

# CAWI129h.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N90E, I-129, AvgG, GMean >

Solution time: 02/14/11 14:17:32

Monitoring Efficiency = 87.7 %

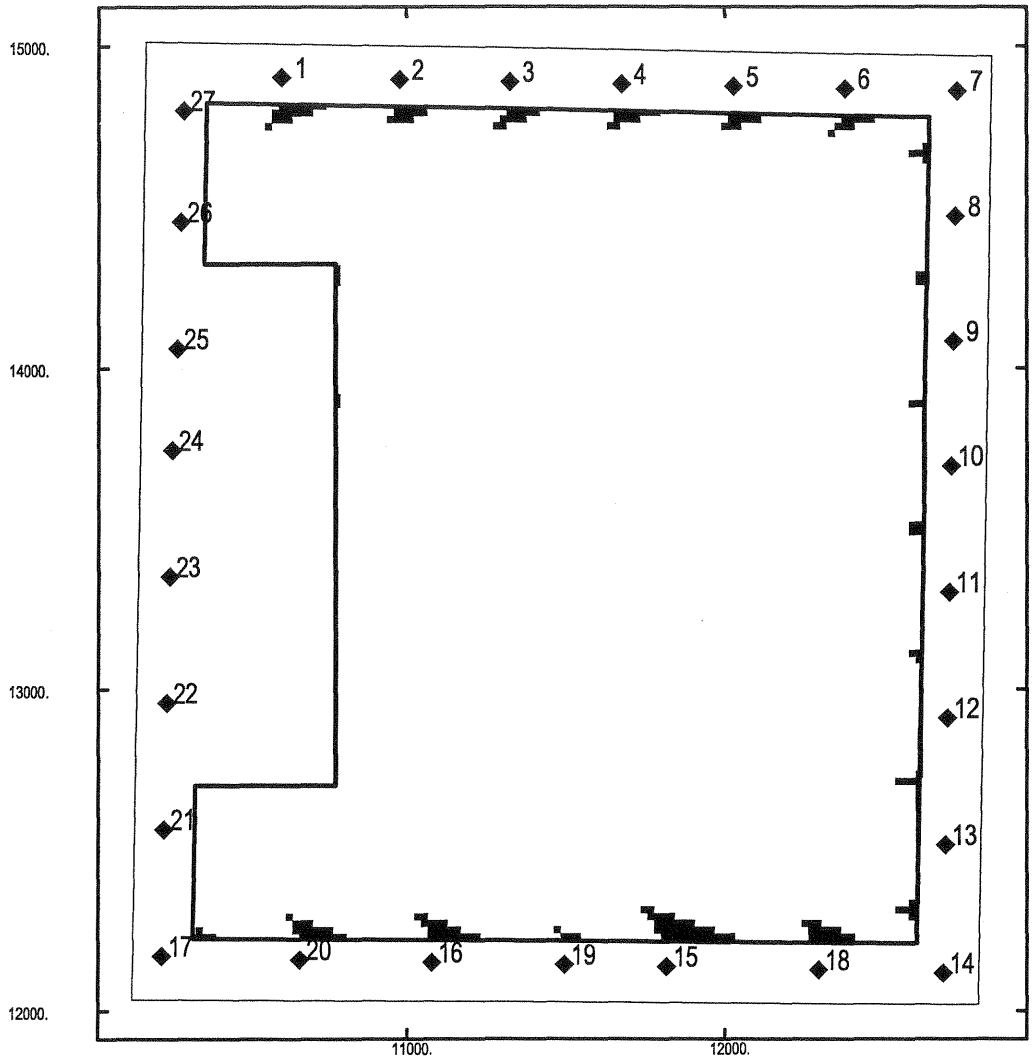
Hydraulic Gradient Zones (degrees)

→

.0

# CAWI129i.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N90E, I-129, AvgG, GMean >

Solution time: 02/14/11 15:40:40

Monitoring Efficiency = 98.4 %

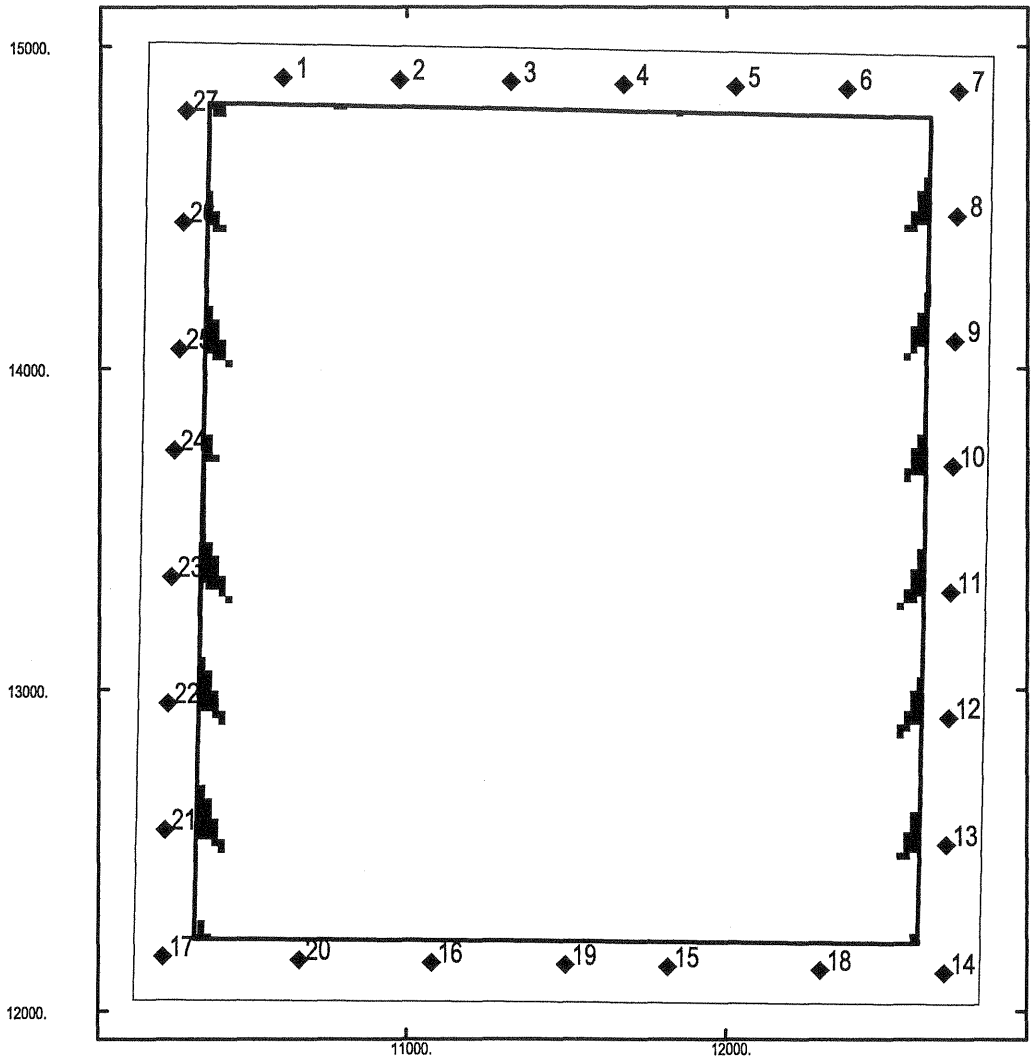
Hydraulic Gradient Zones (degrees)

→

.0

# CAWI129j.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N0E, I-129, MaxG, AMean+90%C

Solution time: 02/14/11 15:53:41

Monitoring Efficiency = 98.6 %

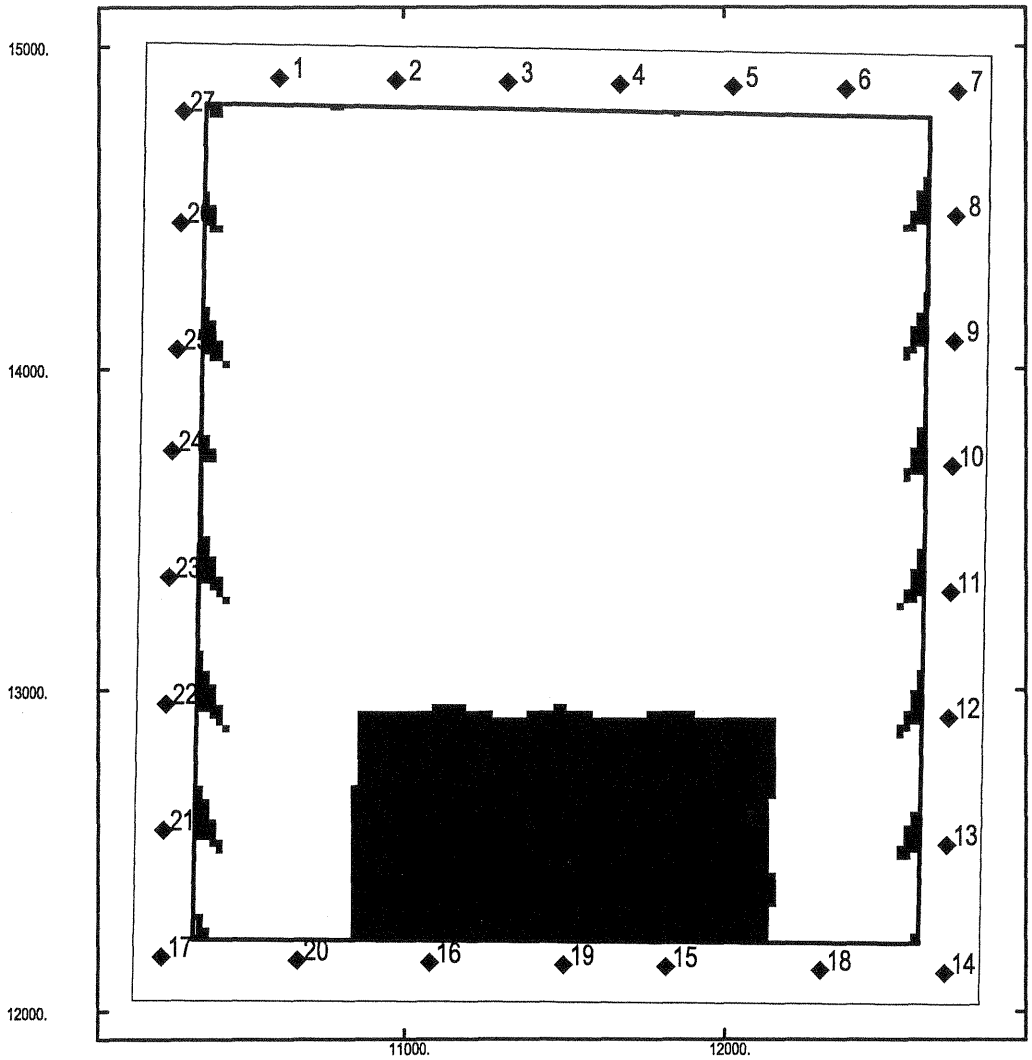
Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWI129k.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N0E, I-129, AvgG, GeoMeanHC >

Solution time: 02/14/11 16:01:17

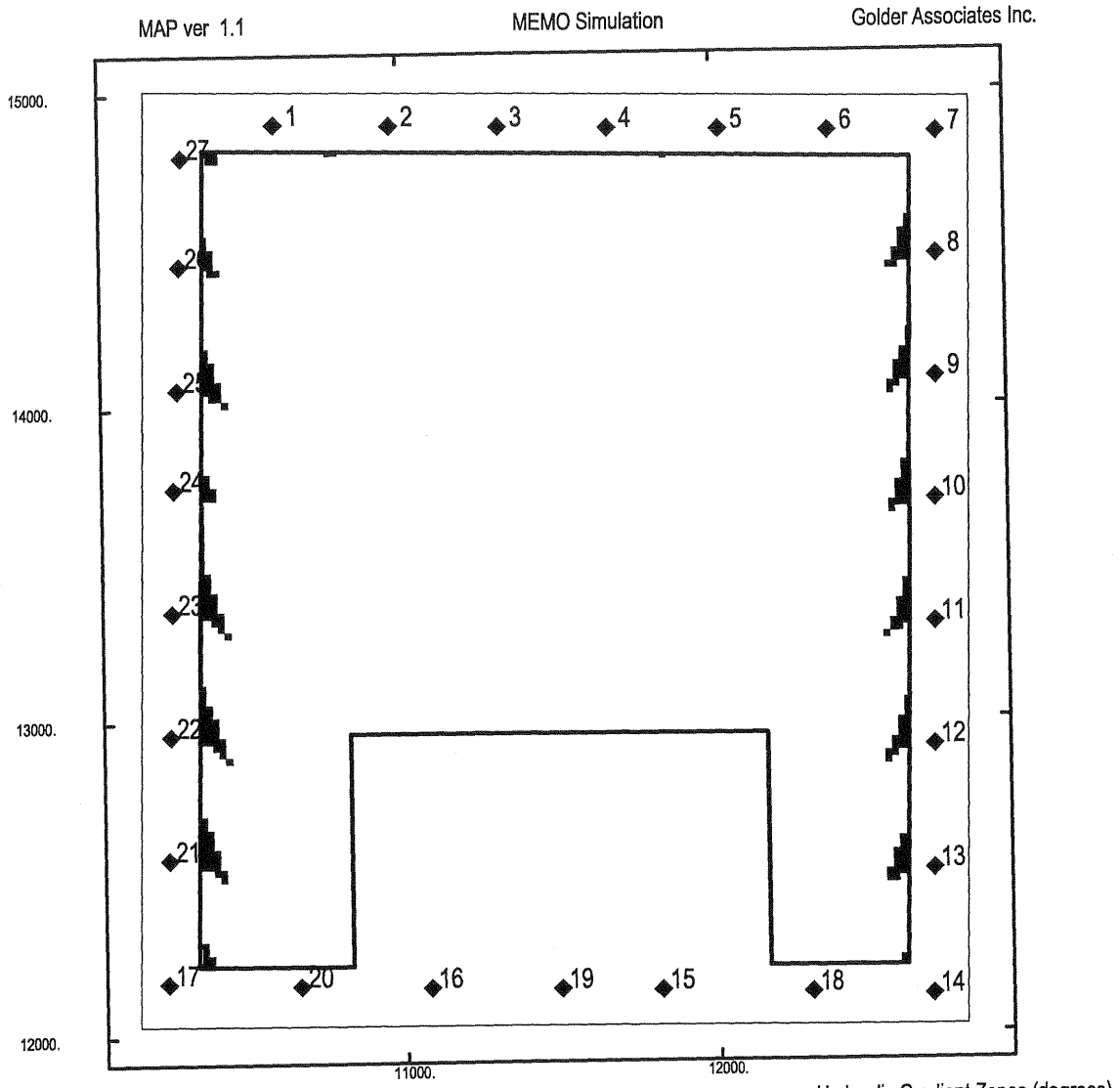
Monitoring Efficiency = 82.6 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWI129L.PLT




CAW FPRev, N0E, I-129, AvgG, GeoMeanHC >

Solution time: 02/14/11 16:41:54

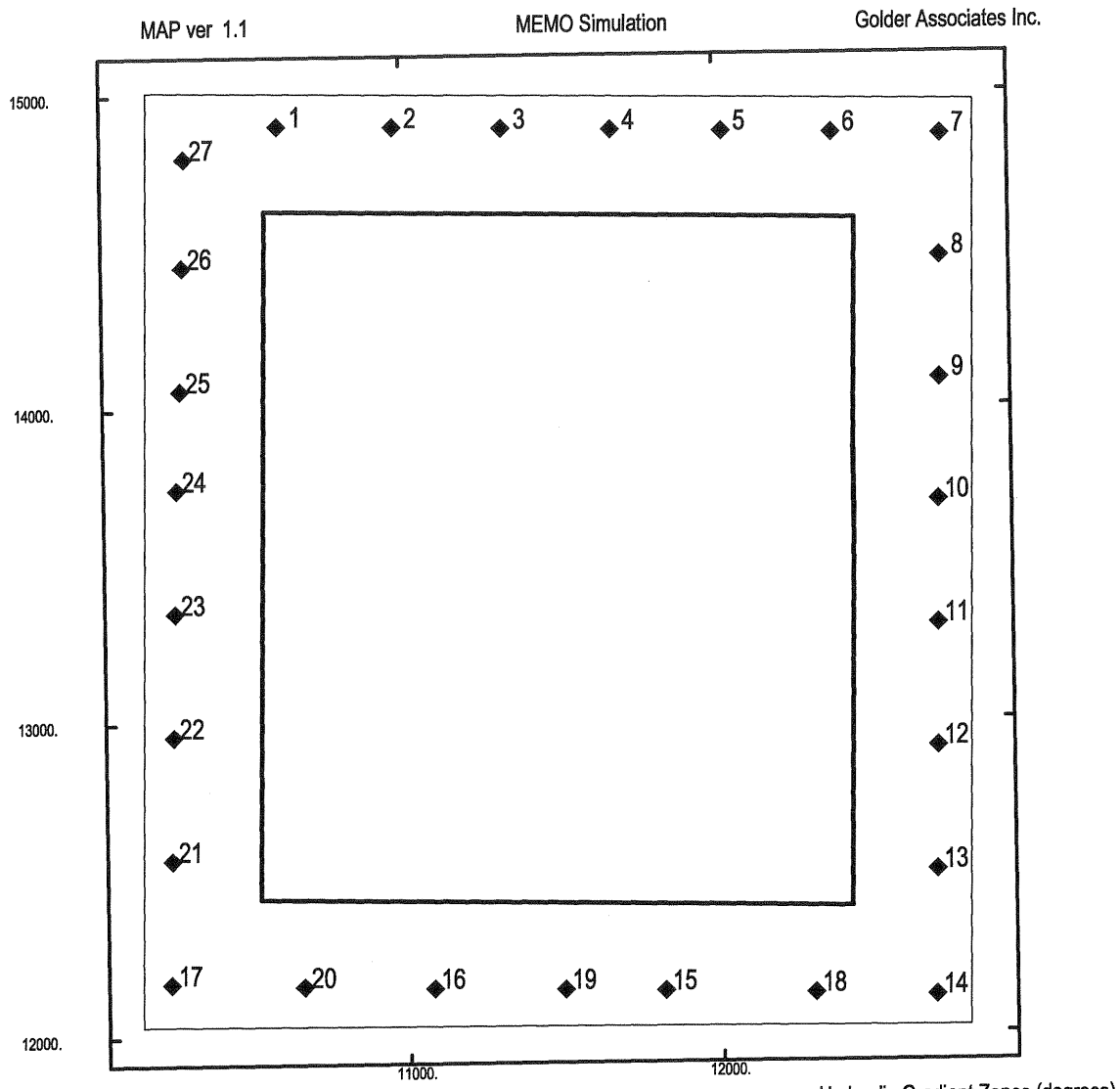
Monitoring Efficiency = 98.2 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWI129m.PLT




CAW TSRev, N90E, I-129, MaxG, AMean+90%C

Solution time: 04/11/11 13:45:31

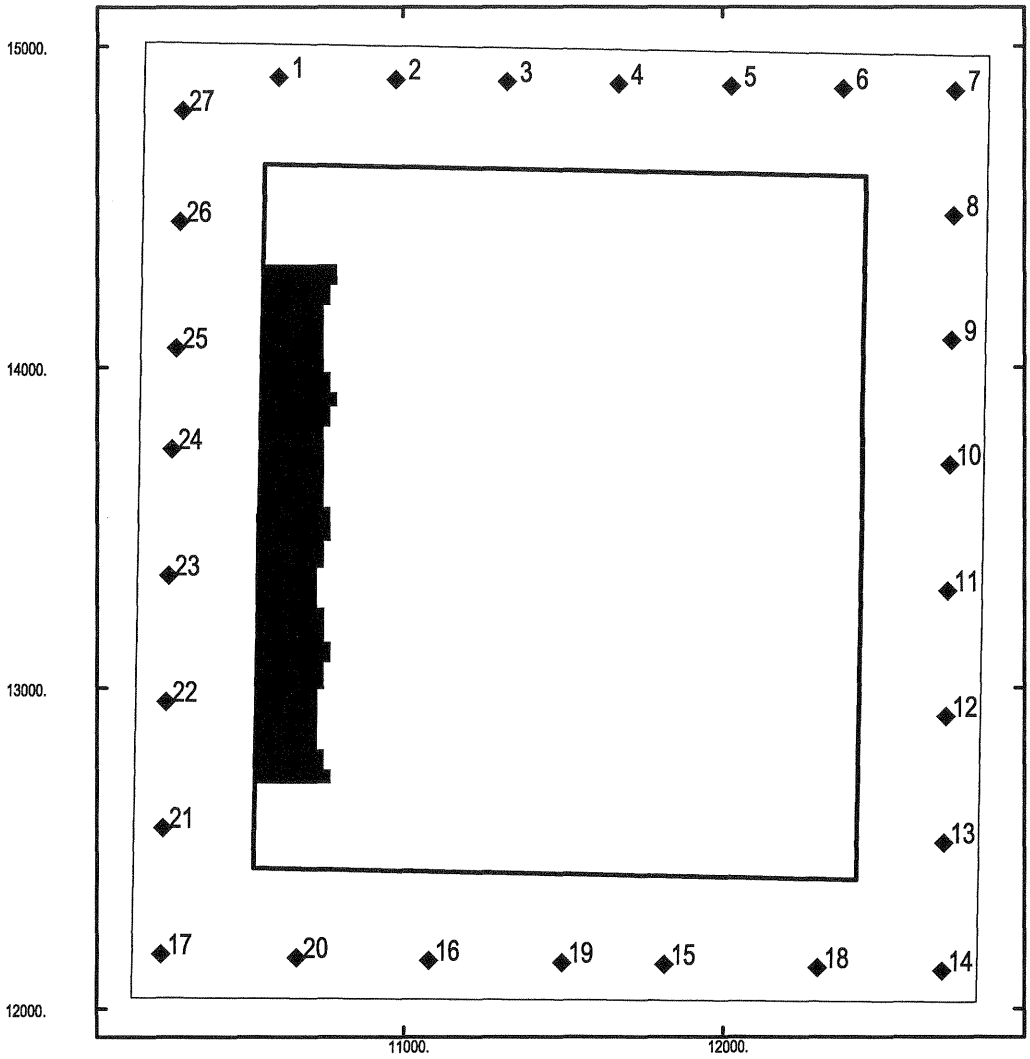
Monitoring Efficiency = 100.0 %

Hydraulic Gradient Zones (degrees)

.0

# CAWI129n.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N90E, I-129, AvgG, GMeanHC >

Solution time: 04/11/11 13:51:13

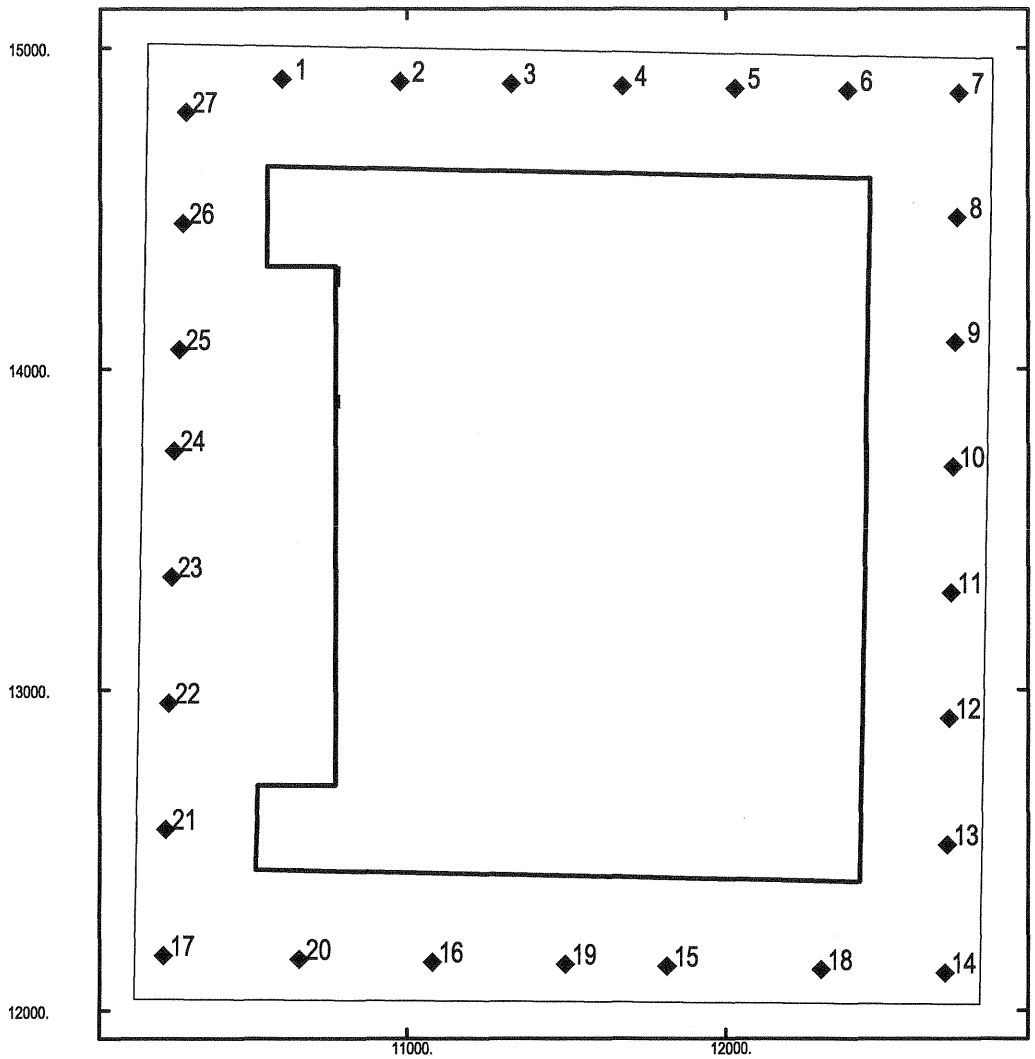
Monitoring Efficiency = 92.0 %

Hydraulic Gradient Zones (degrees)

.0

# CAWI129o.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N90E, I-129, AvgG, GMeanHC >

Solution time: 04/11/11 14:07:03

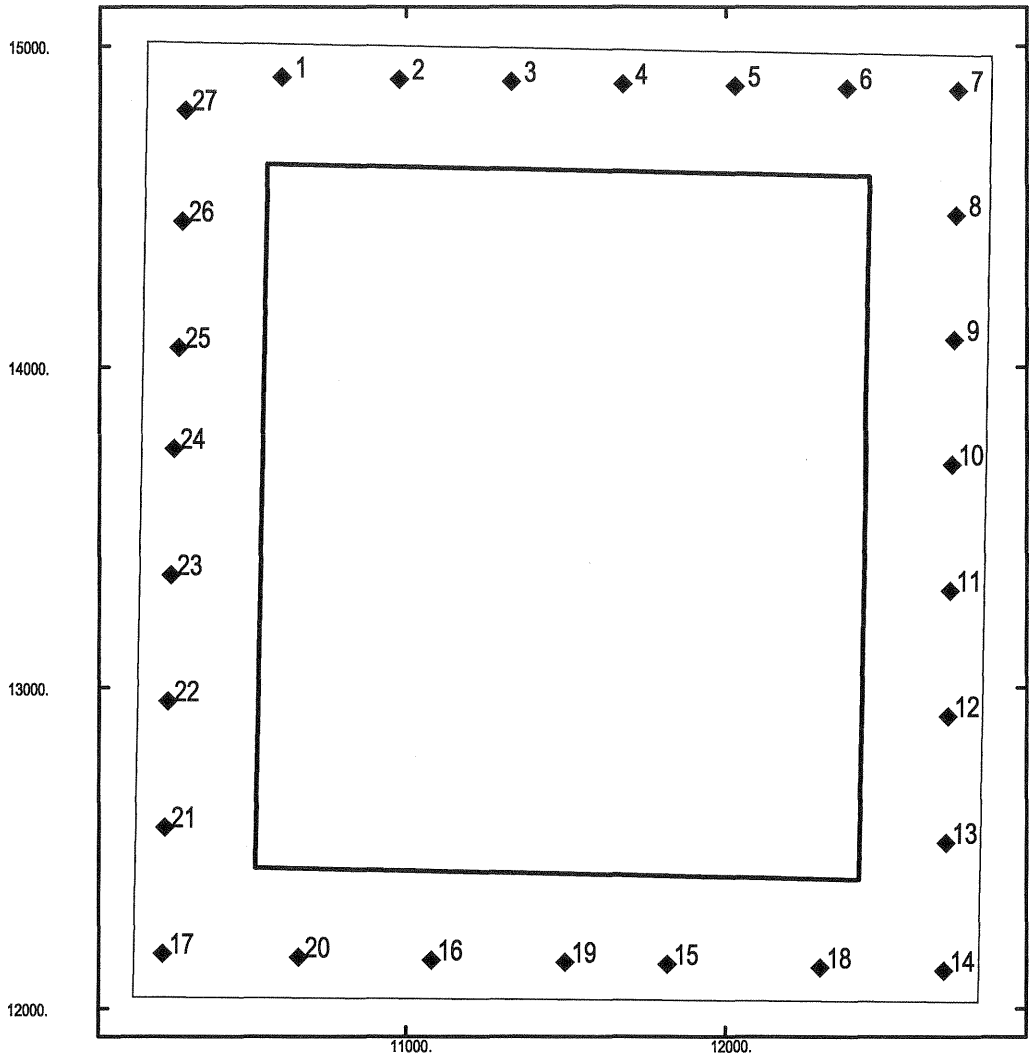
Monitoring Efficiency = 99.9 %

Hydraulic Gradient Zones (degrees)

.0

# CAWI129p.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N0E, I-129, MaxG, AMean+90%C>

Solution time: 04/11/11 14:23:51

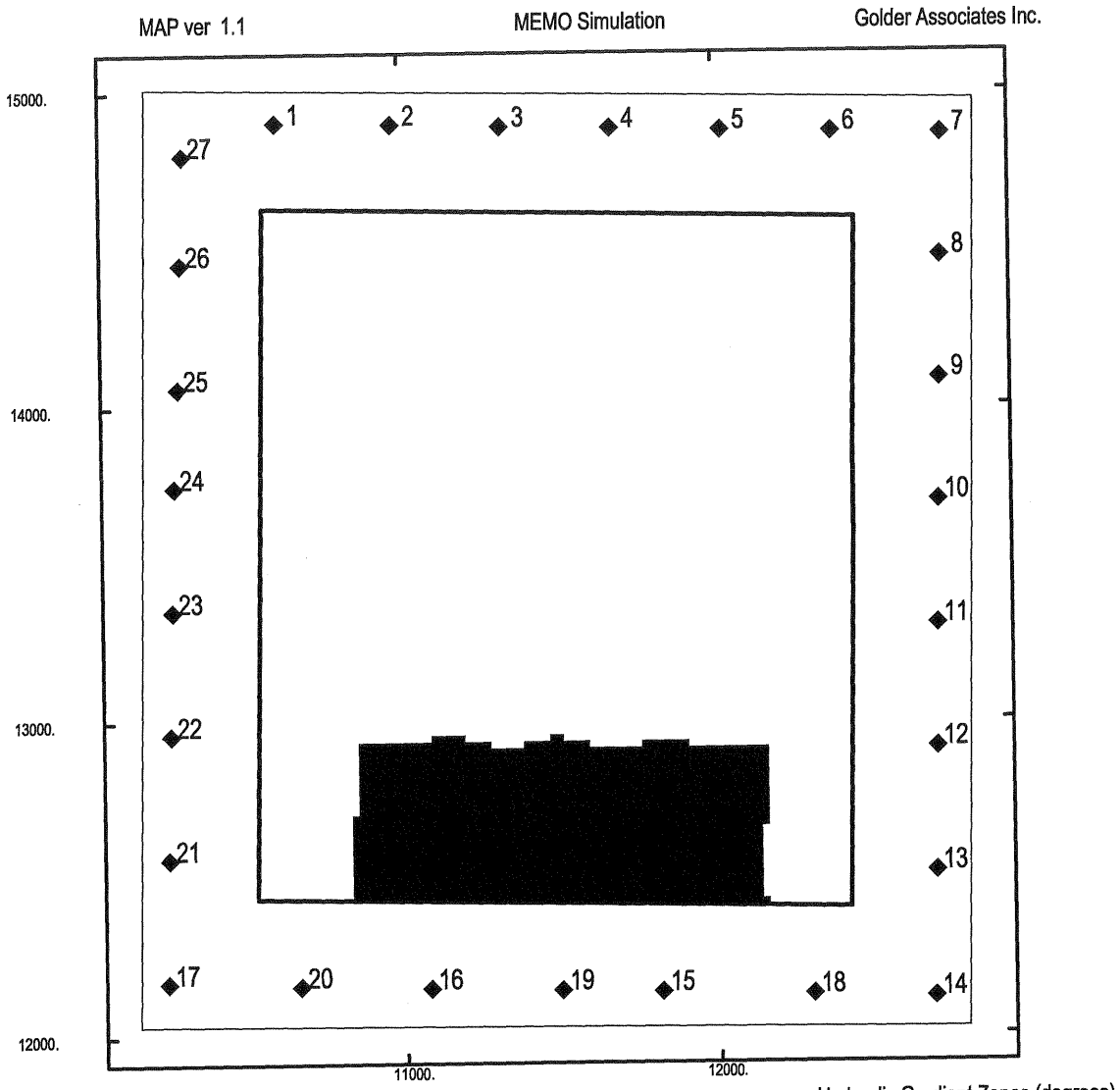
Monitoring Efficiency = 100.0 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWI129q.PLT




CAW TSRev, N0E, I-129, AvgG, GMeanHC > >

Solution time: 04/11/11 14:32:44

Monitoring Efficiency = 84.0 %

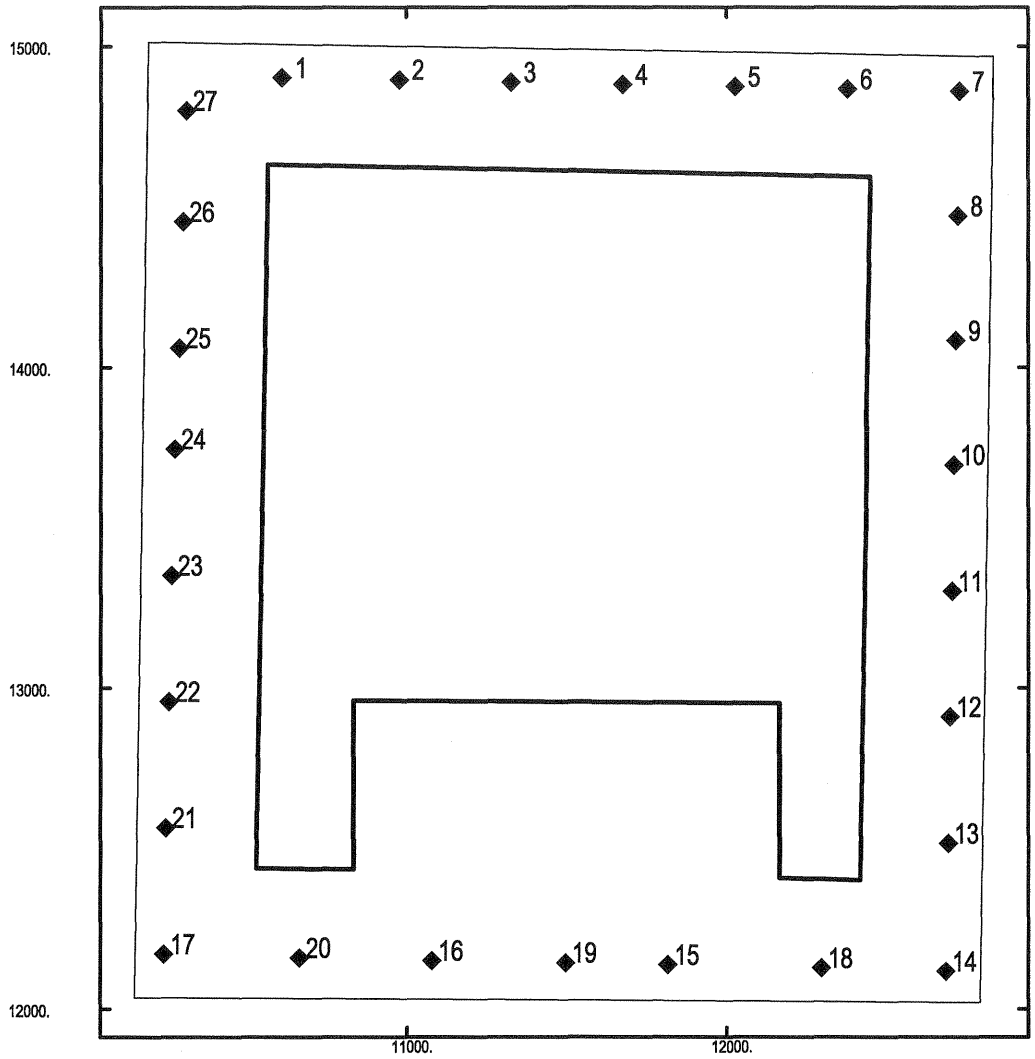
Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWI129r.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW TSRev, N0E, I-129, AvgG, GMeanHC > >

Solution time: 04/11/11 14:37:43

Monitoring Efficiency = 100.0 %

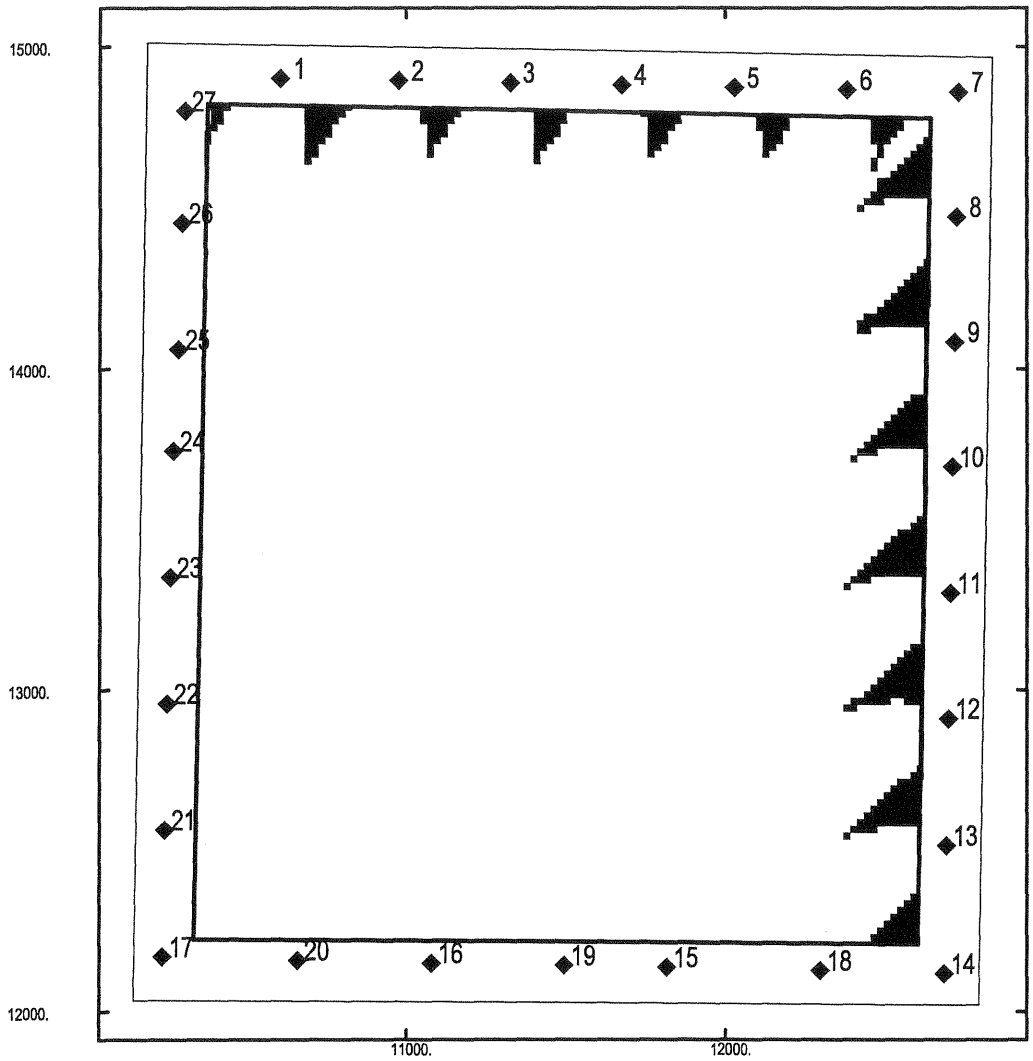
Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWTc99a.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N40E, Tc-99, MaxG, AMean+90%C

Solution time: 03/09/11 16:33:34

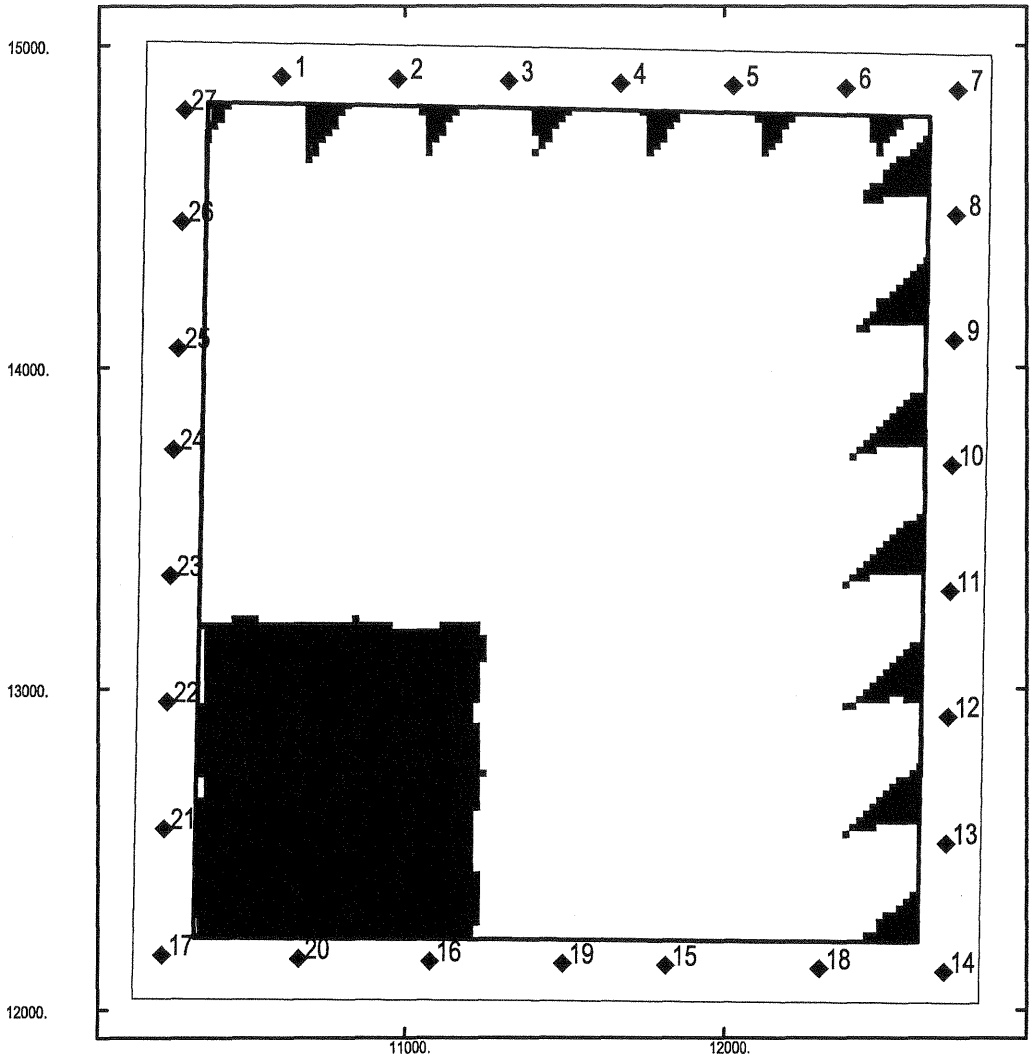
Monitoring Efficiency = 96.2 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWTc99b.PLT

MAP ver 1.1 MEMO Simulation Golder Associates Inc.




CAW FPRev, N40E, Tc-99, AvgG, GMean >

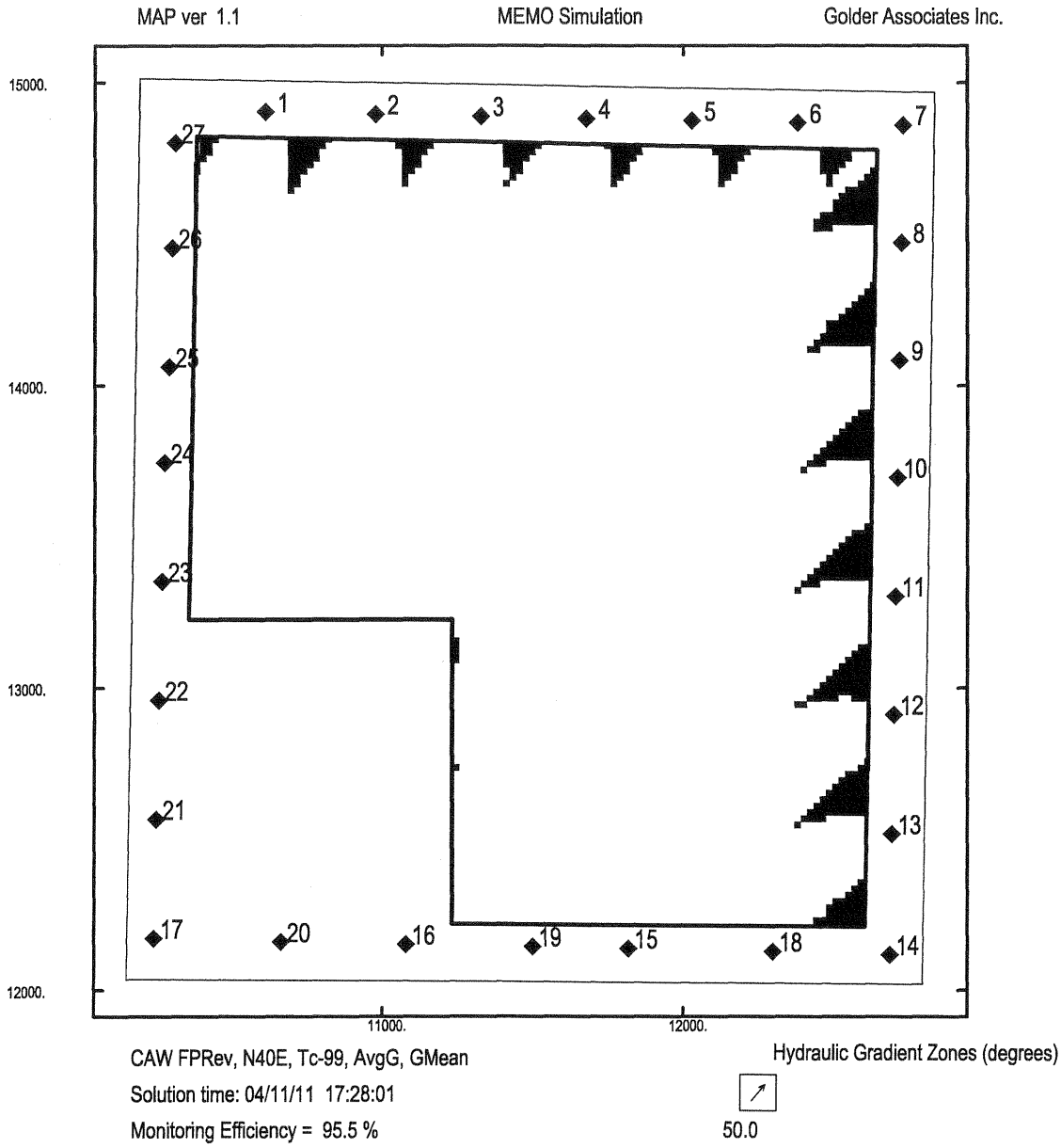
Solution time: 03/09/11 16:36:28

Monitoring Efficiency = 81.5 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWTc99c.PLT



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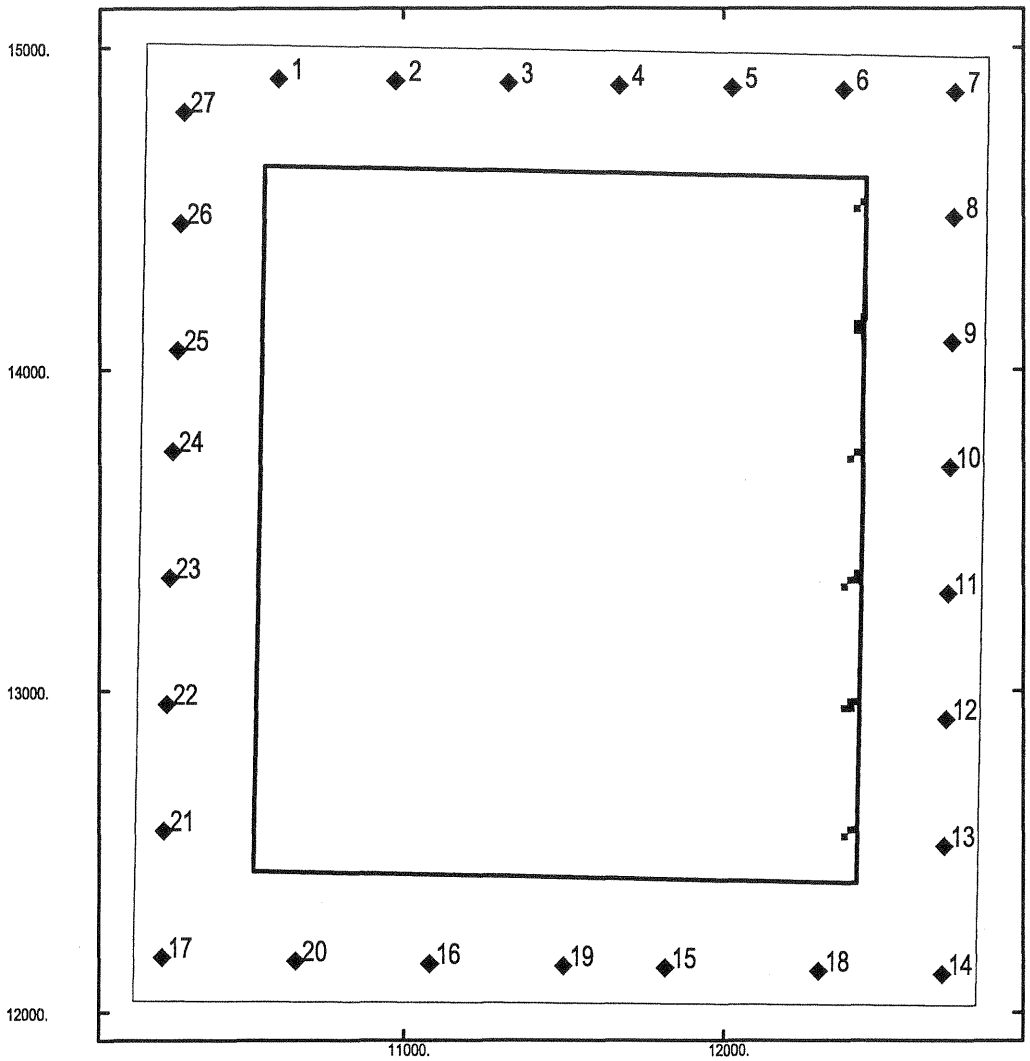


CAW TSRev, N40E, Tc-99, MaxG, AMean+90%C

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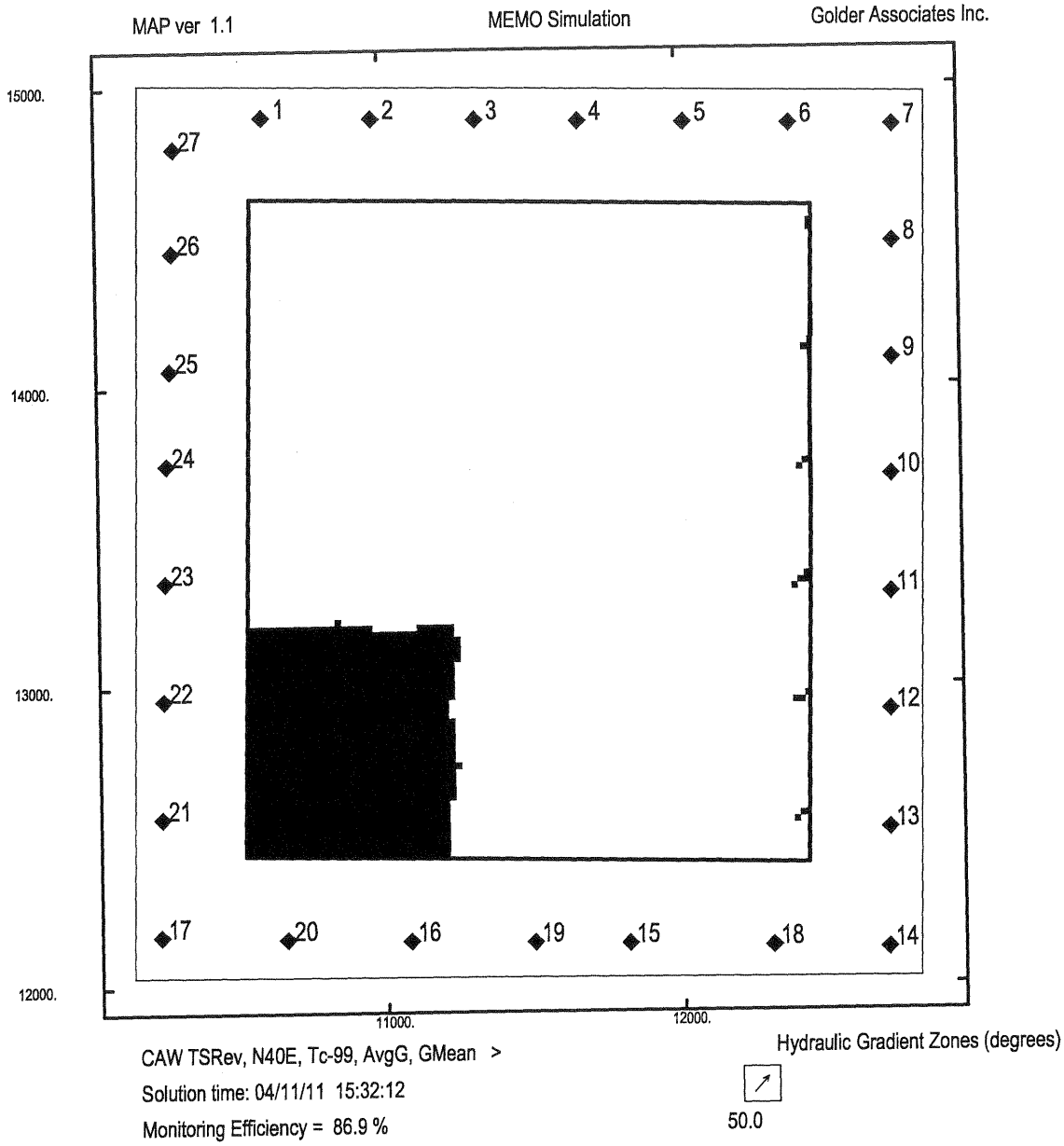
Monitoring Efficiency = 99.8 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWTc99e.PLT



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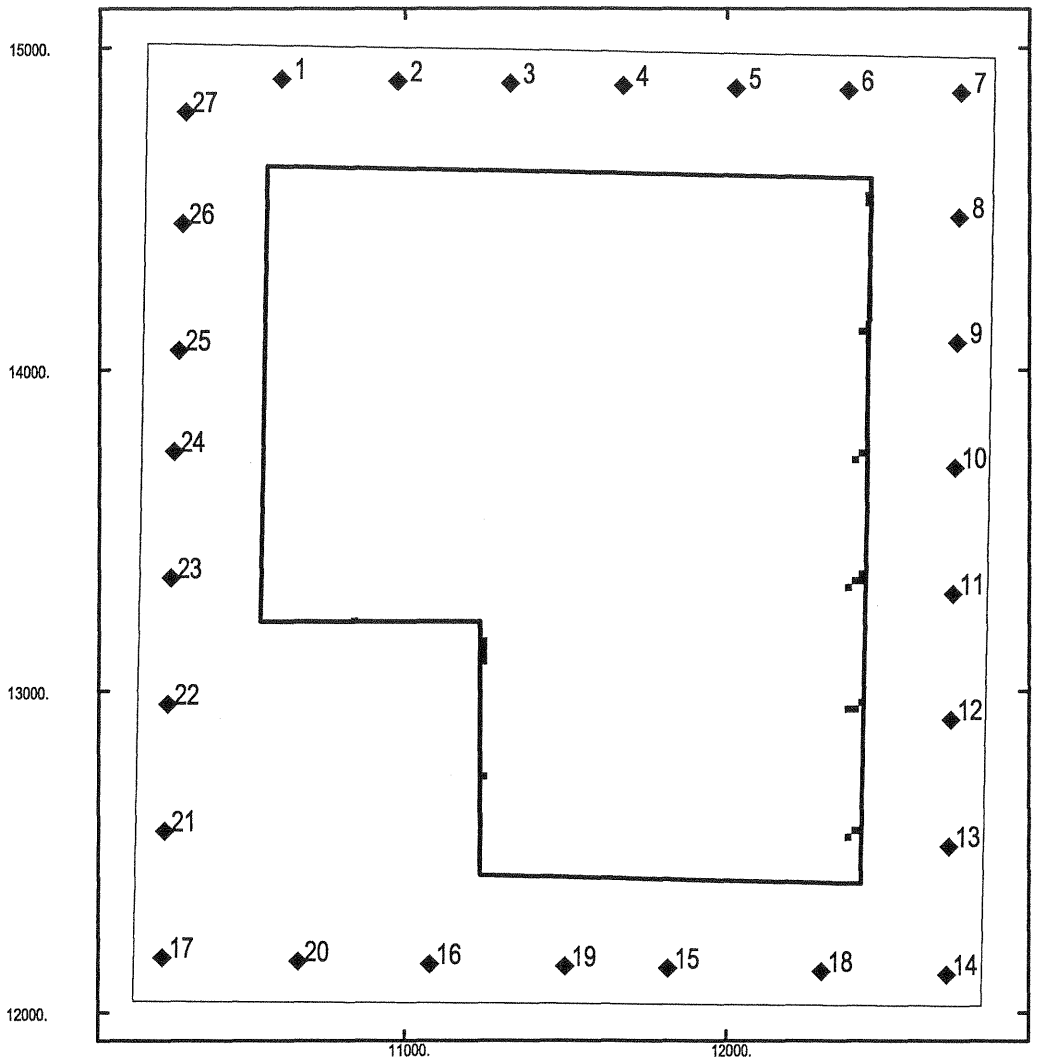


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Solution time: 04/11/11 17:00:04

Monitoring Efficiency = 99.7 %

Hydraulic Gradient Zones (degrees)

50.0

# CAWTc99g.PLT

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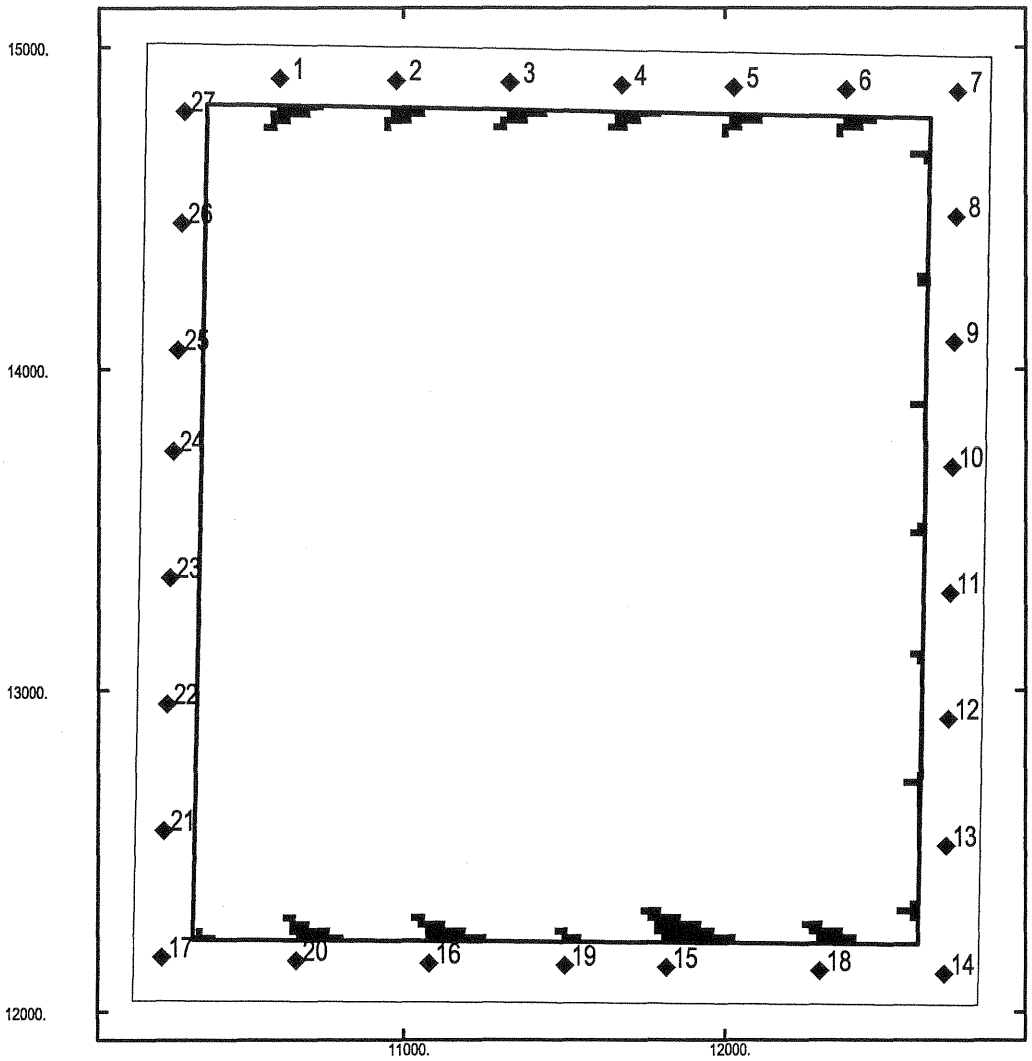


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Solution time: 03/09/11 17:37:34

Monitoring Efficiency = 98.5 %

Hydraulic Gradient Zones (degrees)

→

.0

# CAWTc99h.PLT

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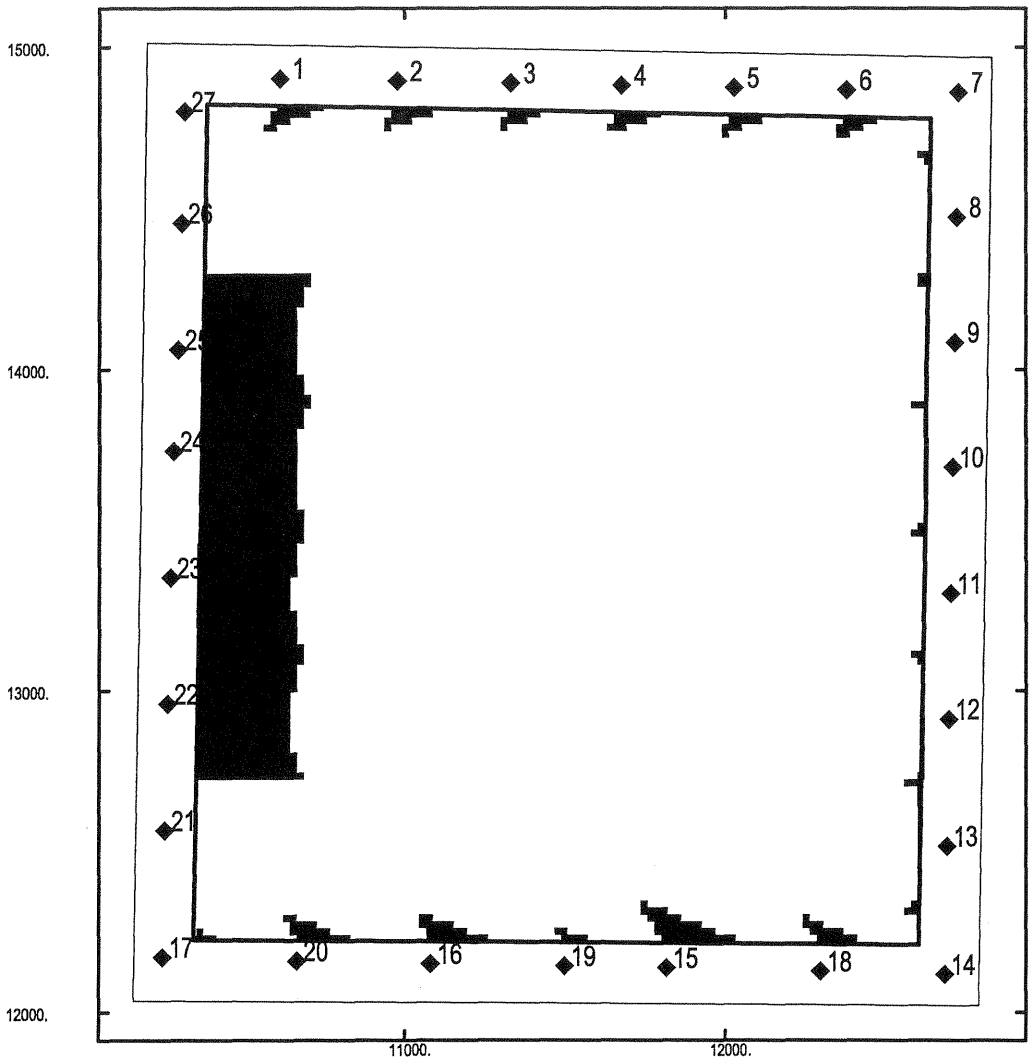


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Solution time: 03/09/11 17:58:18

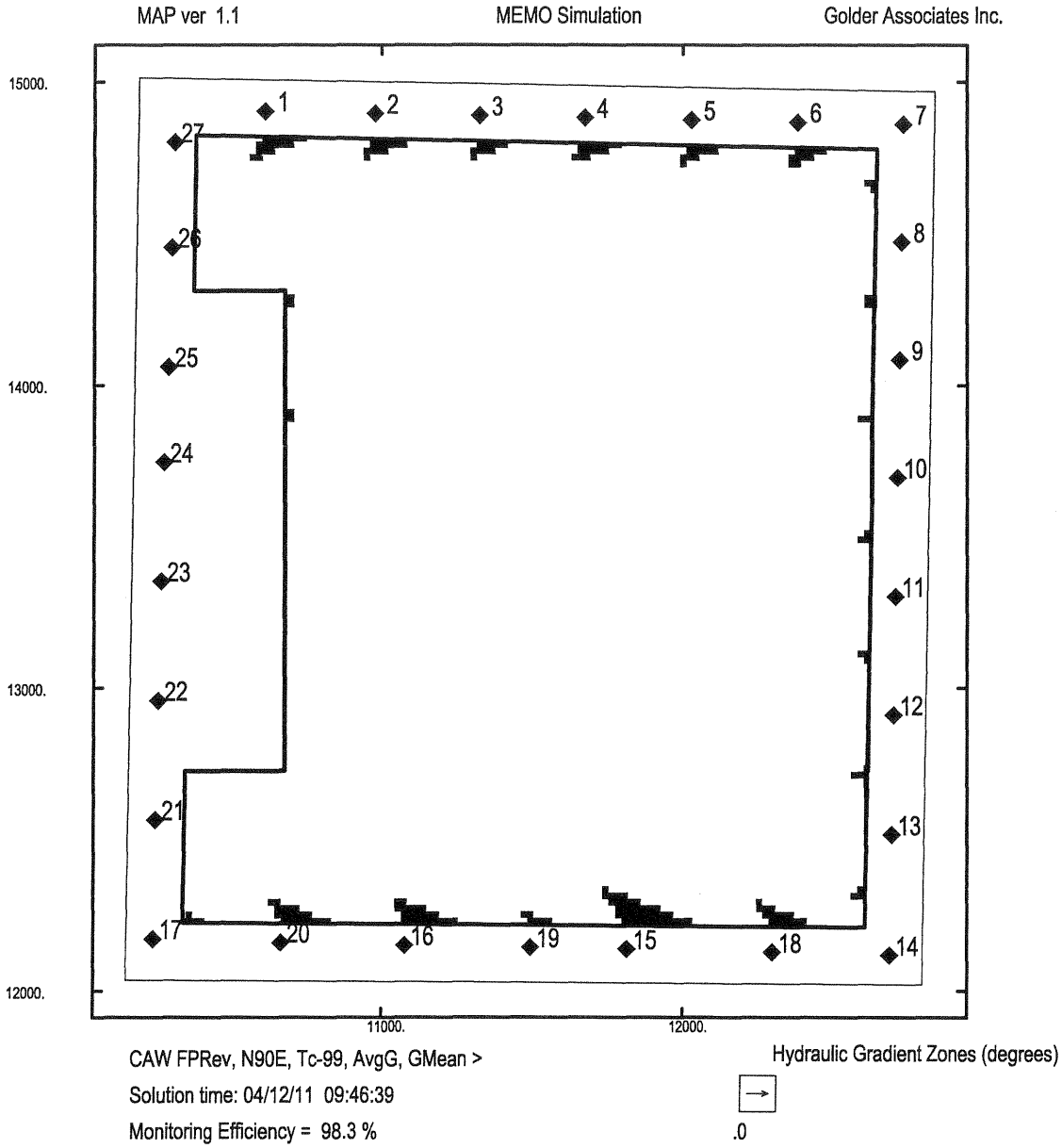
Monitoring Efficiency = 90.2 %

Hydraulic Gradient Zones (degrees)

→

.0

# CAWTc99i.PLT



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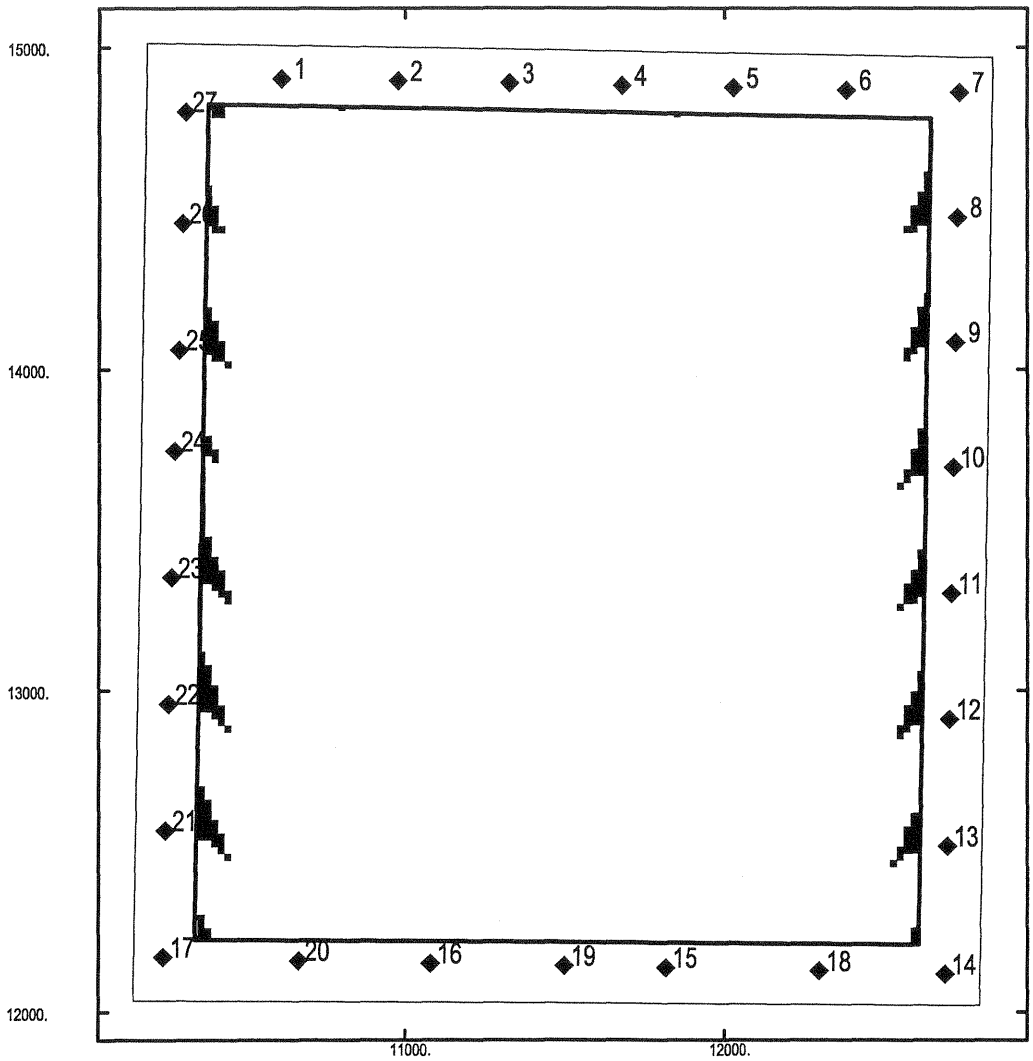


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Solution time: 03/09/11 18:07:56

Monitoring Efficiency = 98.4 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWTc99k.PLT

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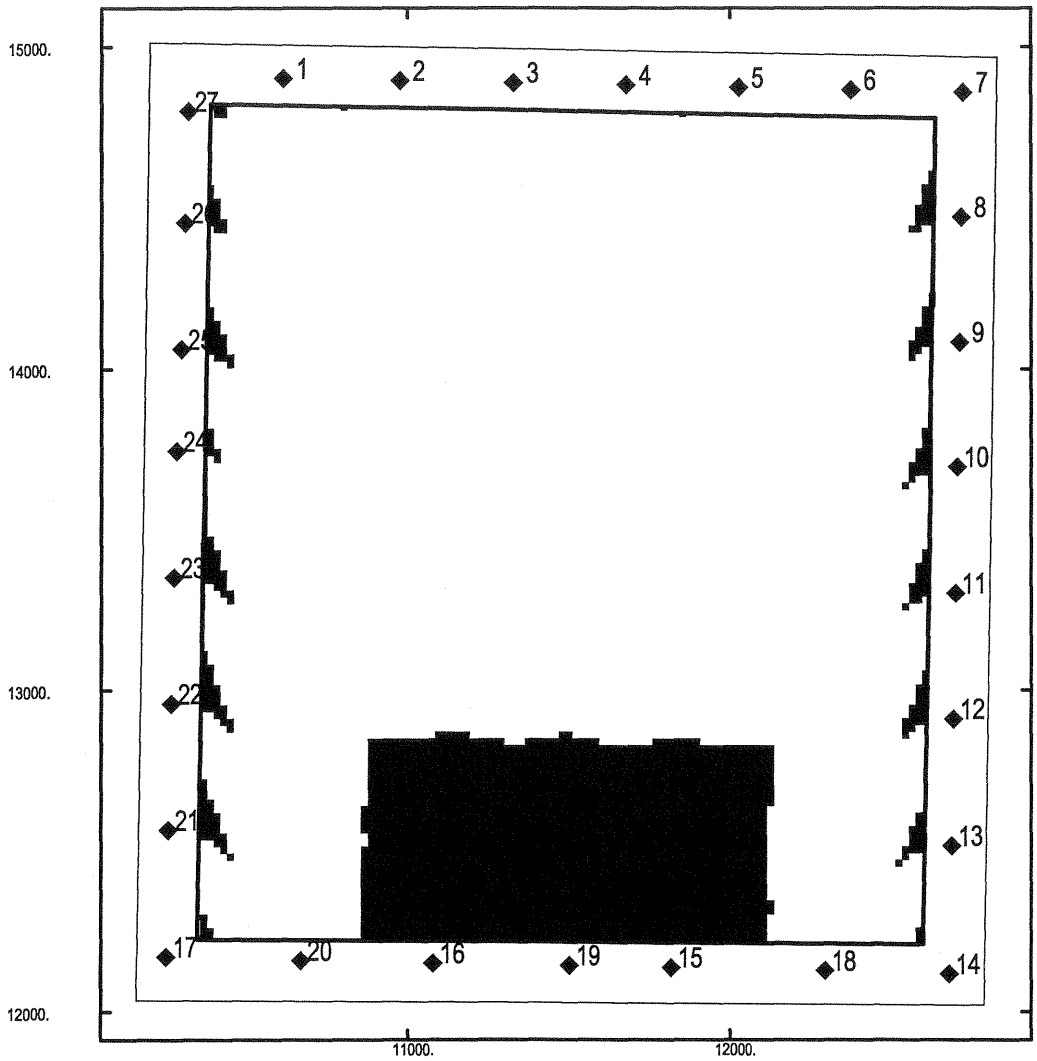


CAW FPRev, N0E, Tc-99, AvgG, GeoMeanHC >

Solution time: 03/10/11 14:06:48

Monitoring Efficiency = 84.8 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWTc99L.PLT

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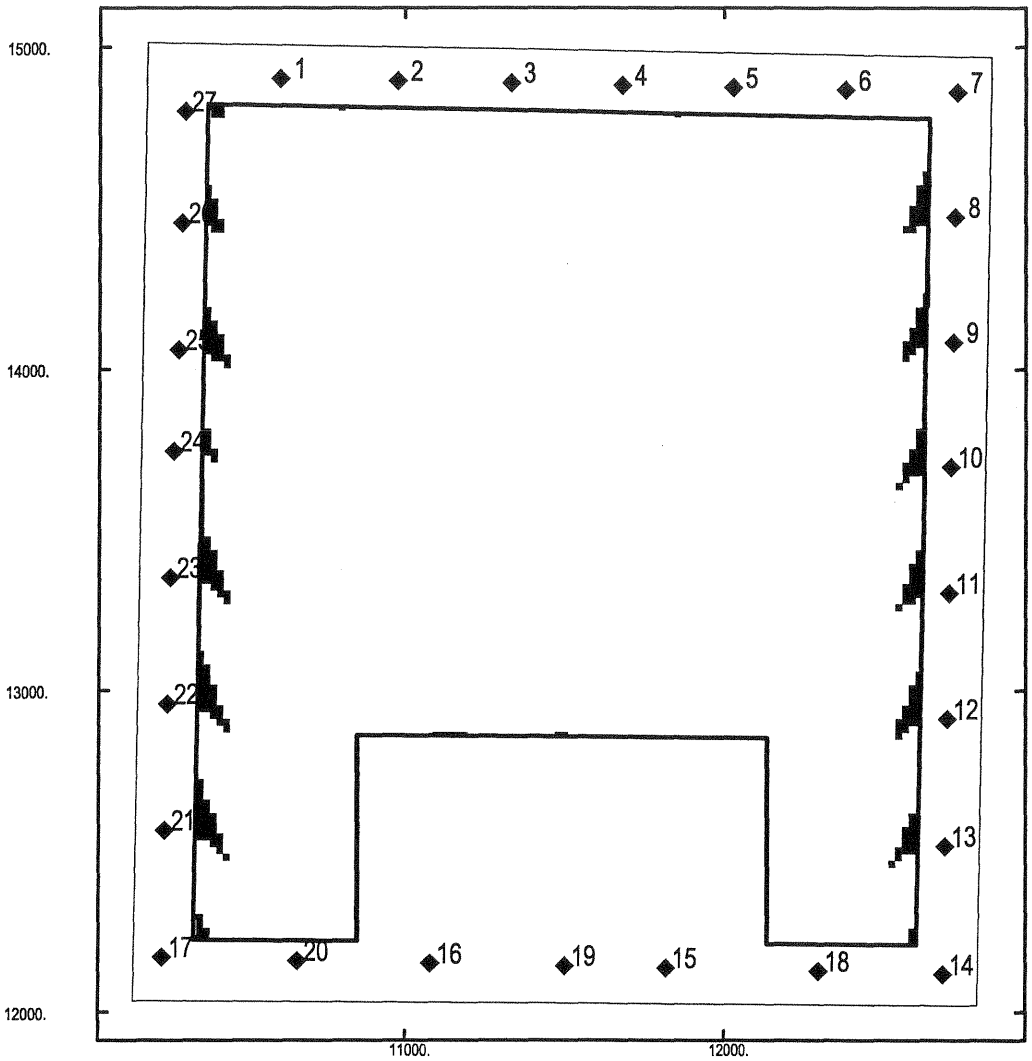


CAW FPRev, N0E, Tc-99, AvgG, GeoMeanHC >

Solution time: 04/11/11 17:42:29

Monitoring Efficiency = 97.9 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWTc99m.PLT

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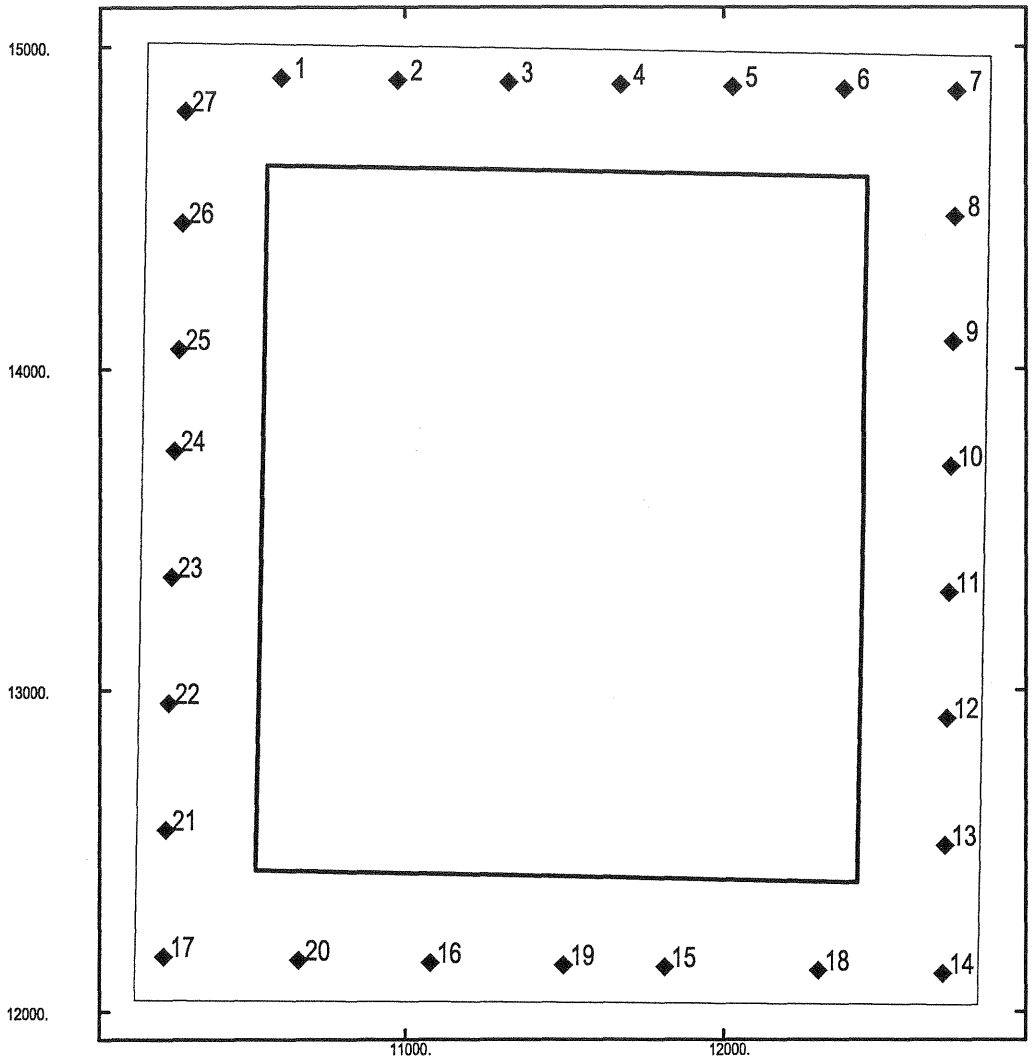


CAW TSRev, N90E, Tc-99, MaxG, AMean+90%C

Solution time: 04/11/11 15:43:55

Monitoring Efficiency = 100.0 %

Hydraulic Gradient Zones (degrees)

→

.0

# CAWTc99n.PLT

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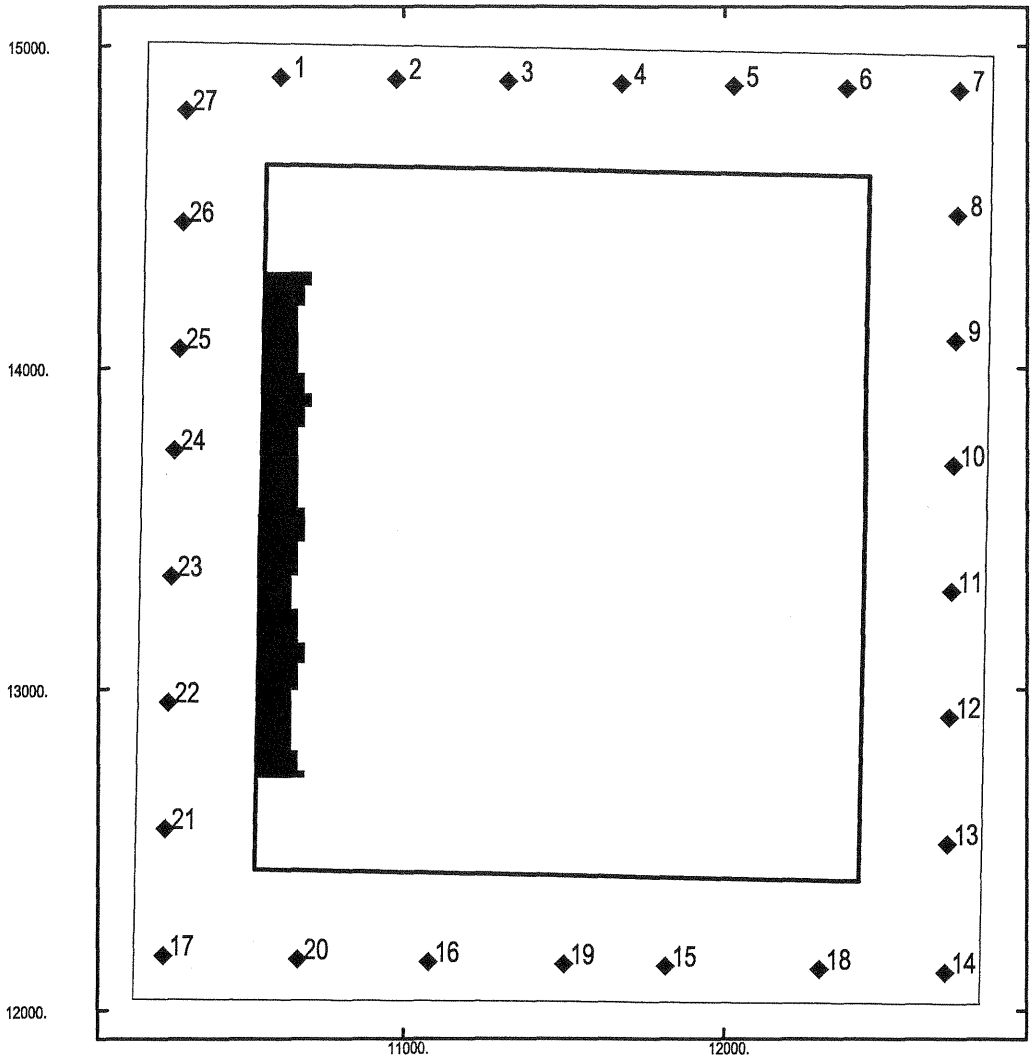


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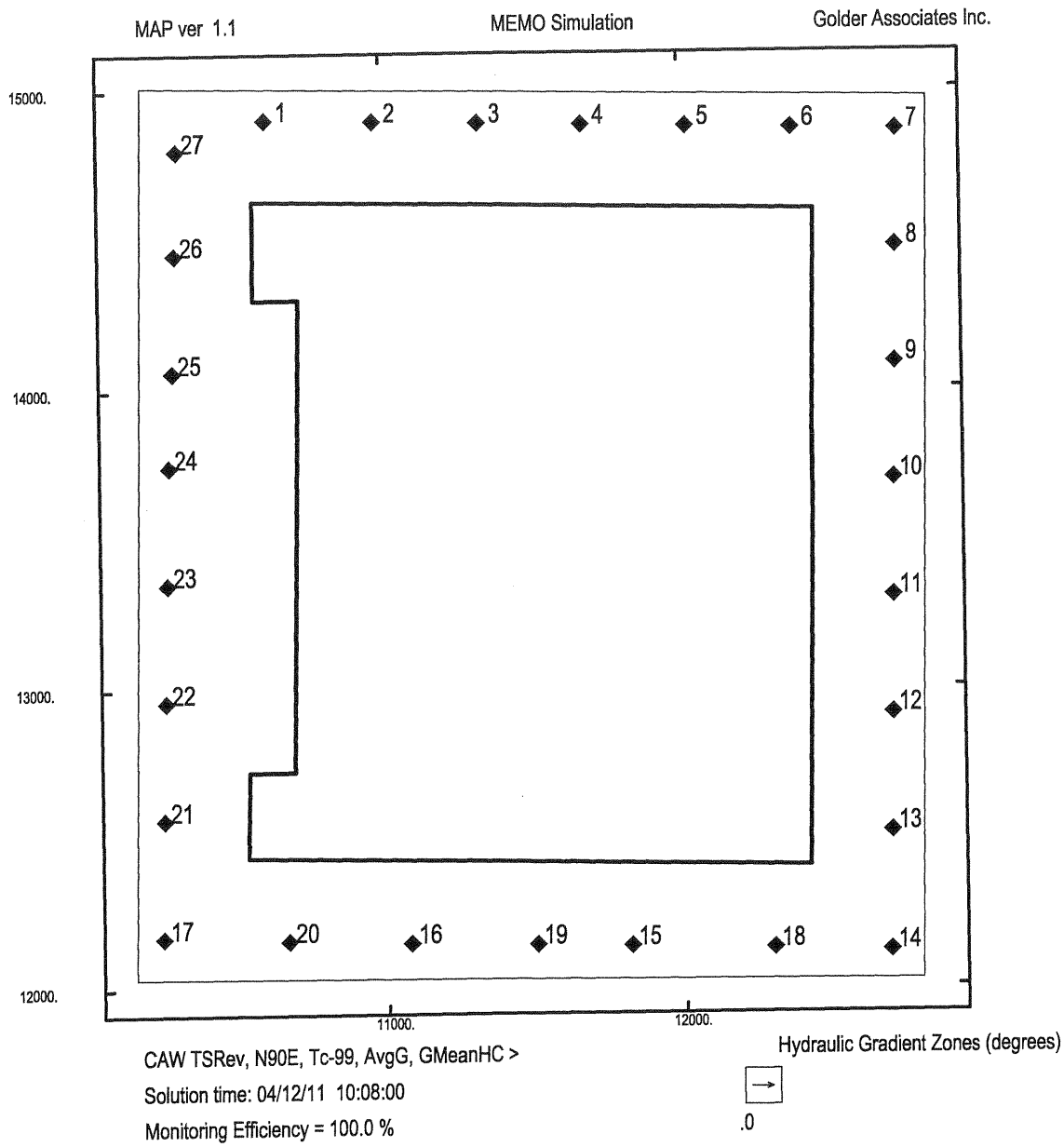
Solution time: 04/11/11 16:23:21

Monitoring Efficiency = 95.4 %

Hydraulic Gradient Zones (degrees)

.0

# CAWTc99o.PLT



# CAWTc99p.PLT

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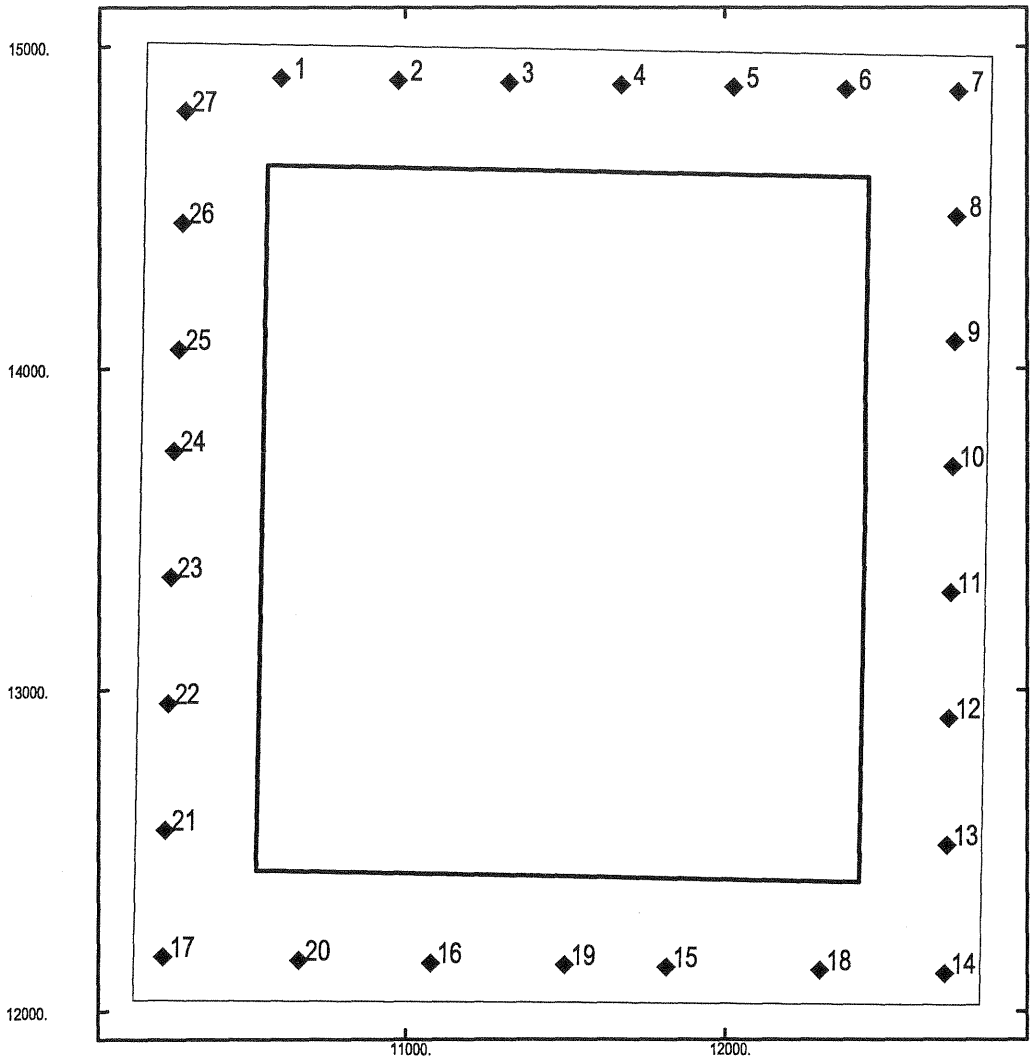



CAW TSRev, N0E, Tc-99, MaxG, AMean+90%C>

Solution time: 04/11/11 17:08:41

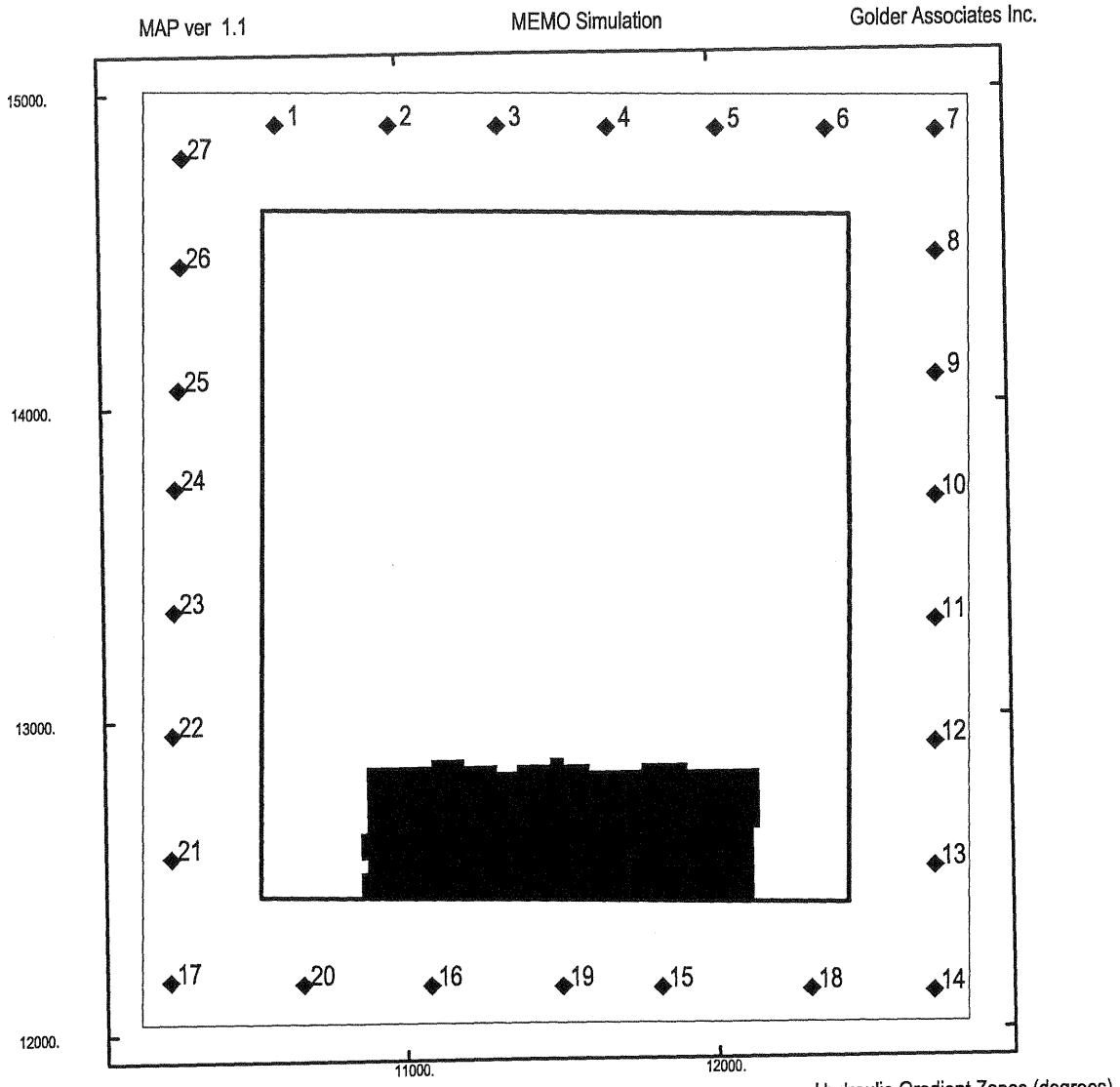
Monitoring Efficiency = 100.0 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWTc99q.PLT




CAW TSRev, N0E, Tc-99, AvgG, GMeanHC > >

Solution time: 04/11/11 17:13:13

Monitoring Efficiency = 87.1 %

Hydraulic Gradient Zones (degrees)

↑

90.0

# CAWTc99r.PLT

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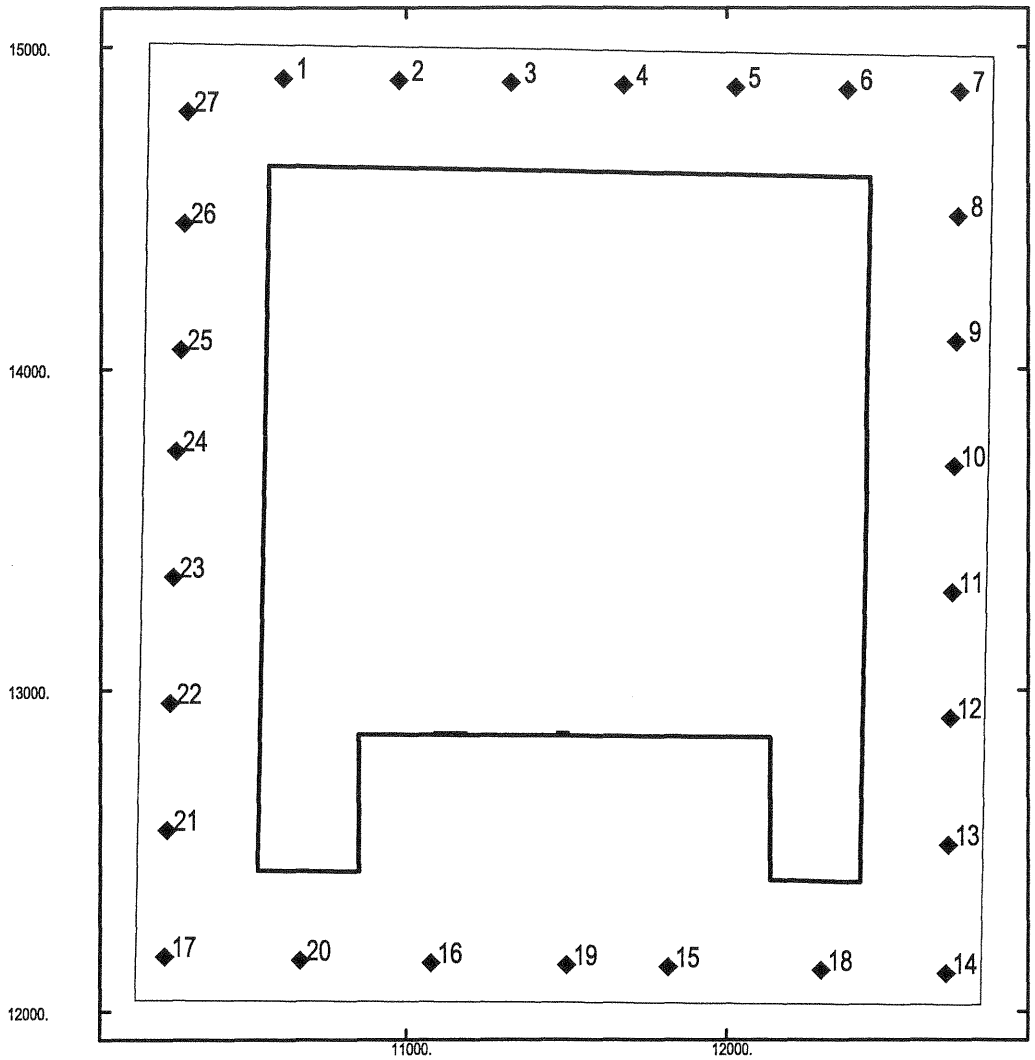


CAW TSRev, N0E, Tc-99, AvgG, GMeanHC > >

Solution time: 04/11/11 17:20:53

Monitoring Efficiency = 99.9 %

Hydraulic Gradient Zones (degrees)

↑

90.0

Attachment 7

ALARA Report

# Class A West ALARA Evaluation

I. Worker Radiation Safety

a. External Dose

1. R313-15-201. Occupational Dose Limits for Adults

The chemical, physical and radiological composition of radioactive waste proposed for disposal at Class A West are consistent with current waste composition at Class A and Class A North embankments. Clive radiation workers are consistently below all legal dose limits (total effective dose equivalent) and effectively controlled within the Clive Radiation Safety Committees' (RSC) goals. Therefore, the Clive Radiation Protection Program will need no revisions for this Class A West disposal embankment.

b. Internal Dose

1. R313-15-204. Determination of Internal Exposure

Clive radiation workers are consistently below all legal dose limits (total effective dose equivalent) and effectively controlled within the Clive RSC goals. Therefore, the Clive Radiation Protection Program will need no revisions for this Class A West disposal embankment.

II. Environmental

a. R313-15-301. Dose Limits for Individual Members of the Public

Air pathway dose evaluations were re-evaluated at the Clive site in March and April, 2005 using the computer code PATHRAE. PATHRAE is used to conduct dose evaluations by evaluating atmospheric transport of particulates that are resuspended from exposed waste piles and during off loading and placement operations. Based on the results of this evaluation, compliance with the 100 mrem/year and 2 mrem in one hour to a member of the public is within the capabilities of the current Environmental Monitoring Plan and the Clive Radiation Protection Program. The uncovered radioactive waste limit specified in license condition 11 will remain the same under this amendment request.

b. Effluent Constraint Limits

As described in II.d. below, compliance with the 10 mrem/year constraint limit to the general population is within the capabilities of the current Environmental Monitoring Plan and the Clive Radiation Protection Program.

c. R313-25-19. Protection of the General Population from Releases of Radioactivity

As described in II.d. below, compliance with 25/75/25 mrem/year dose to a member of the public is within the capabilities of the current Environmental Monitoring Plan and the Clive Radiation Protection Program.

d. Air, Groundwater and Soil Environmental Stations

The chemical, physical and radiological composition of radioactive waste proposed for disposal at Class A West are consistent with current waste composition at Class A and Class A North embankments. Quarterly environmental reports document that radiological data, both radiation and effluents, are consistently below regulatory requirements and ALARA constraints.

Existing groundwater wells GW-81 to 86, GW109 to 112, and GW-137 to 141 are located within the embankment footprint and will be abandoned prior to liner construction. Collection lysimeters CL-W3, CL-W4, and CL-N5 will also need to be abandoned prior to liner construction.

e. Haul Route

The haul route used to transport waste from Rotary Dump, Truck Unloading dock and Intermodal Unloading facility will be similar to current haul routes with no expected adverse changes to radiation dose and effluents from the RA.

III. ALARA Program

a. The current Occupancy Factor (OF) for the Clive RA, as approved by the RSC, is 25%. There are no changes necessary to this OF for the Class A west amendment.

b. The objective of the current Clive Radiation Protection Program and the ALARA program procedure is to ensure that all reasonable actions are taken to reduce radiation exposures and effluent concentrations to levels that are considered ALARA. The waste type and classification that will be disposed of in the Class A West embankment will be no different than waste currently being disposed of in the Class A and Class A North embankments. Therefore, the ALARA Program will not require revision for the Class A West embankment.

Clive Radiation Safety Committee Concurrence: Allan Gunthsen 4/8/2011

Attachment 8

LLRW CQA/QC Manual, Rev 26b

# LLRW and 11e.(2) Construction Quality Assurance/Quality Control (CQA/QC) Manual

## TABLE 1 – CQA/QC ACTIVITIES

**Work Elements:**


Document Control ..... Page 4
General Requirements ..... Page 5
Foundation Preparation ..... Page 10
Clay Liner Borrow Material ..... Page 12
Clay Liner Test Pad ..... Page 13
Clay Liner Placement ..... Page 16
Waste Placement with Compactor ..... Page 23
Waste Placement ..... Page 29
- Debris Placement ..... Page 33
- CLSM Pours ..... Page 36
- In-Cell Bulk Disposal ..... Page 43
- Cold Weather Placement ..... Page 44

Containerized Waste Facility Waste Placement Test Pad ..... Page 49
Containerized Waste Facility Waste Placement ..... Page 52
Interim Rad Cover Placement and Monitoring ..... Page 62
Temporary Cover Placement and Monitoring ..... Page 64
Radon Barrier Borrow Material ..... Page 70
Radon Barrier Test Pad ..... Page 72
Radon Barrier Placement ..... Page 75
Filter Zone ..... Page 84
Sacrificial Soil Placement ..... Page 87
Rock Erosion Barrier ..... Page 88
Drainage Ditch Imported Borrow ..... Page 91
Drainage Ditches ..... Page 92
Inspection Road ..... Page 94
Permanent Chain Link Fences ..... Page 96
Settlement Monitoring ..... Page 99
Annual As-Built Report ..... Page 102


## TABLE 2 – MATERIAL PROPERTIES FOR PORTLAND CEMENT CLSM

## TABLE 3 – MATERIAL PROPERTIES FOR FLY ASH CLSM


**FIGURE 1 –** LARW Settlement Monuments, May 1, 2006
**FIGURE 2 –** Class A West Settlement Monuments, rev. ~~2~~3, ~~July 30, 2008~~September 20, 2011
**FIGURE 3 –** Mixed Waste Settlement Monuments, rev. 2, October 10, 2008
**FIGURE 4 –** 11e.(2) Settlement Monuments, rev. 2, October 10, 2008
**FIGURE 5 –** Cross Section of 11e.(2) Settlement Plate Monument Installation, rev. 0, 2/16/07

**FIGURE 6 –** ~~Class A North Settlement Monuments, rev. 1, July 30, 2008~~Reserved (rev. 26a, September 15, 2011)
**FIGURE 7 –** CWF Cell Construction Requirements, sheet 1 of 2, rev. 1, 10/07
**FIGURE 8 –** CWF Cell Construction Requirements, sheet 2 of 2, rev. 0, 10/07

**Appendix A –** CQA/QC Documentation Forms, rev. ~~16, February 4, 2010~~17, September 15, 2011
**Appendix B –** Testing Methods, rev. 6, October 11, 2010
**Appendix C –** Rock Quality Scoring, rev. 14, October 19, 2007

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| **SCOPE:** This work element applies to all construction activities in the ~~Class A, Class A North,~~ Class A West and 11e.(2) embankments. | | |
| **QC DOCUMENTATION APPROVAL:** QC documentation shall be approved/rejected by the QC Officer and submitted to the Construction QA Officer. The Construction QA Officer shall approve/reject the documentation. | Sign the reports indicating documentation is adequate, correct, and has been accepted by QC. Provide QA with copies of the documentation and obtain their signature on the documentation indicating QA acceptance. Ensure that corrective actions required by QA personnel are accomplished. | Review the documentation generated by QC. Report deficiencies to the QC officer and the Construction QA Officer. Verify that corrective action has been taken (where required) and recorded on the QC documentation. Countersign reports indicating documentation is adequate, correct, and has been accepted by QA. Record findings on the "Daily Quality Assurance Report". |
| **QC DOCUMENTATION FILES:** Original QC documents shall be maintained at the site. A copy shall be saved into the electronic database. | After the QC documentation has been accepted by QA, a copy of the original shall be saved into the electronic database. Originals of all QC documentation shall be maintained in the site engineering file. | Periodically review the site engineering files to ensure the correct documentation is being retained by QC personnel. |
| **QA DOCUMENTATION FILES:** Original QA documents shall be maintained at the site. A copy shall be saved into the electronic database. | None | A copy of the original shall be saved into the electronic database and originals maintained in the site QA file. |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **RUNON CONTROL DURING PROJECT:** The perimeter berms shall be constructed to a minimum of 3 feet above the ground elevations (GL) shown in the engineering drawings. The first lift of material shall have an uncompacted thickness of no greater than 12 inches. Elevations for the berms between the specified ground elevations shall be linearly interpreted between the shown elevations. The berms shall be a minimum of 10 feet at the top and shall be compacted to 90 percent of a standard Proctor. | Verify that the required berms have been constructed to the specified dimension. Record any findings on the "Daily Construction Report". Spot check the density of the first lift and subsequent lifts of the berm to ensure that it meets specifications. Record density tests on the "Field Density Test" form. | Verify that berms have been inspected by QC personnel. |
| **RUNOFF CONTROL DURING PROJECT:** Berms shall be constructed around the outside edge of the clay liner to a height of 3 feet. This height is measured as the elevation above the design elevation of the clay liner; or as the elevation above the design elevation of the liner protective cover, whichever is higher. Berms shall be a minimum of 3 feet wide at the top. The first lift of material shall have an uncompacted thickness of no greater than 12 inches. The berm will be constructed on top of the clay liner such that the berm is not in contact with native ground. A distance of 10 feet shall be maintained between the toe of the berm and the toe of the waste. The berms shall be compacted to 90 percent of a standard Proctor. | Verify that the required berms have been constructed to the specified dimension. Record any findings on the "Daily Construction Report". Spot check the density of the first lift and subsequent lifts of the berm to ensure that it meets specifications. Record density tests on the "Field Density Test" form. | Verify that the berms have been inspected by QC personnel. |
| Contact water shall be controlled inside the runoff control berm system. Contact water is defined as any storm water that falls within the runoff berm system in the active, unfinished portions of the embankment. Access ramps that cross runoff berms shall be constructed to prevent such runoff from leaving the lined portion of the embankment. | Inspect the access ramps that cross runoff berms on a weekly basis for the presence of runoff control channels and document the inspection on the “Daily Construction Report”. | Verify that the weekly access ramp inspections have been performed and documented. |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| Fences or other barriers will be installed at the active cell boundary, (the run-off berm and near the radon barrier/waste interface) The barriers will be "chicken-wire", snow-fence, chain-link fence, or herculite (or other materials similar to herculite) secured to "T" posts. | Verify fences are installed around the active cell boundary and near the radon barrier/waste interface and document the inspection on the "Daily Construction Report". | Verify that fences are in place and have been inspected by QC personnel. |
| Storm runoff for up to a 10-year, 24-hour event that runs off from those portions of the embankment that have been completed to final cover design shall be managed and controlled to prevent such runoff from contacting contaminated waste material in the active unfinished portions of the embankment. | | |
| After the first lift of radon barrier material for an entire side slope area (i.e., from the toe of waste to the side slope breakover) has been constructed, verified, and approved, the adjacent runoff berm for that side slope area may be removed. During placement of this first lift of radon barrier, there is no minimum offset to the runoff berm. | | |
| **MONTHLY BERM INSPECTION:** The berms and fences are to be inspected monthly. Inspect for obvious damage to berms and fences. Ensure berm height where roads cross berms. | Inspect the berm on a monthly basis and document the inspection and any corrective actions taken (if required) on the "Daily Construction Report". Marker posts indicating the required berm height should be placed at both side of a road at the point where the road crosses the berm. This is to aid in identifying damage to the berm due to road traffic. Repair any noted damage of berm or wind dispersal fences and fill low spots to meet the design height. | Verify that the monthly berm inspections have been performed and properly documented. Verify proper installation of marker posts and wind dispersal fences or other barriers. |
| **BERM MAINTENANCE:** The runon and runoff berms shall be surveyed and improved, as required, by July 1 of each year. | Survey the berms at 100 foot intervals and key points. Repair any noted damage and fill low spots to meet the design height. | Verify that the berms are surveyed and improved, as required. |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| **MOVING OR BREACHING A BERM:** When moving or breaching a berm, the work must be authorized by the QC officer prior to commencing work. A temporary breach of a berm may be accomplished without a temporary berm, provided the work may be completed and the berm replaced the same day. A temporary berm will have the same specifications as a permanent berm. | Review the work to be performed. Document the approval to move or breach a berm on the "Breach of Berm" Form. | Verify that the approval to move or breach a berm has been properly documented. |
| **NUCLEAR DENSITY/MOISTURE GAUGE CALIBRATION:** To ensure proper calibration, a sand-cone density test shall be performed jointly with five percent of the nuclear density test. The frequency of sand-cone tests shall be reduced to two percent of the nuclear density tests for the clay liner or radon barrier to minimize the damage to these low permeability layers from the sand-cone test. Holes in the clay liner and radon barrier created by the nuclear density gauge shall be filled with dry bentonite.<br>To ensure proper calibration, an oven-drying test shall be performed jointly with five percent of the nuclear moisture tests. | Perform sand-cone density tests and oven-drying tests to calibrate the nuclear moisture/density gauge. Review the results with the Construction QA Officer.<br><br>When performing the sand-cone density test or the oven-drying test to calibrate the nuclear moisture/density gauge, the data obtained from the sand-cone density test or the oven-drying test takes precedence over the data obtained from the nuclear moisture/density gauge. | Review the results with the QC officer. Verify that the data obtained from the sand-cone density tests and oven-drying tests (when performed) are used in the calculations for ultimate acceptance of the tested media. |
| **SAMPLING LOCATIONS FOR LOTS:** For sample location chosen by random numbers, two random numbers shall be employed. The first number (X) shall be between 0 and the largest east-west distance of the lot. The second number (Y) shall be between 0 and the largest north-south distance of the lot. The test location will be located at X feet east and Y feet south of the north-west corner of the lot. For a linear lot (e.g. the intersection of lifts), a single random number shall be generated.<br><br>For borrow sources which consist of multiple lots which will be sampled by a single test pit, the test pit shall be located by two random numbers as outlined | Generate random numbers for each lot by using a calculator or computer with a random number generator. Locate the test location within five feet of the location specified by the random numbers. If the sample location is outside the lot, generate two new random numbers. | Verify that the test methods are being chosen by random number. |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| above and will be the same for all lots. | | |
| **TEST METHODS:** All tests shall be performed in accordance with the test methods specified in Appendix B. | Use the test methods in Appendix B to perform the require testing. | Verify that the test methods being use to conduct the tests are the methods specified in Appendix B. |
| **QA AUDITING:** Energy*Solutions* shall contract with an independent firm to perform an annual audit of the CQA/QC. The auditor shall: a) audit at least 15% of the CQA\QC documentation; and b) observe QC procedures for field density/moisture tests, classification tests, Proctors, permeability tests, and surveying. A copy of the auditors report shall be submitted to the DRC. | Schedule times with the QA auditor to observe the specified testing. Cooperate with QA auditor in the review of QC documentation. | Cooperate with QA auditor in the review of QC documentation. |
| **WEEKLY CONSTRUCTION SCHEDULE:** During clay liner and embankment cover construction projects, including test pads, a weekly construction schedule will be provided to DRC. This specification also applies to permitted facilities under construction within Section 32. The schedule does not constitute a binding commitment; but is a reasonable estimate of when listed construction activities will occur. No submittal is required if there are no clay liner, cover, or other permitted facilities under construction. | Support the Director of Engineering in preparing the schedule for submittal. | |
| **TEST FAILURE PROTOCAL:** Unless otherwise specified in this Manual, any failing test shall be addressed as follows:<br>1. Document the failing test result in applicable QC records.<br>2. Notify construction personnel of the failing test result and re-work as needed.<br>3. After re-work is complete, re-test and document results.<br>4. If the re-test results pass, approve the work.<br>5. If the re-test results fail, direct further re-work | | |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| until passing results are achieved.<br>6. Any circumstance where re-work is not desired or possible shall be documented on a Condition Report. The Director of Engineering or designee shall be responsible for determining and originating a Condition Report. Any circumstance addressed via Condition Report requires DRC notification and written approval prior to proceeding. | | |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **CLEARING AND GRUBBING:** Remove vegetation, debris, organic, or deleterious material from areas to be excavated for construction of cells. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary. | Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report". | Verify that the clearing and grubbing has been inspected by QC. |
| **EXCAVATION:** Excavation shall be made to the lines, grades, and dimensions prescribed in the approved plans. Any over excavation shall be backfilled with select materials and compacted to 95 percent of Standard Proctor. The uncompacted lift thickness shall not exceed 9 inches. | Observe the cell excavation. Record observations and corrective actions taken (where required) on the "Daily Construction Report".<br><br>In areas of over excavation, conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a lift of a specified type of material. Test locations shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified compaction.<br>b. Rework and retest lots not meeting the specified compaction.<br><br>Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log". | Observe, at a minimum, five percent of the tests performed by QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |
| **SCARIFICATION AND COMPACTION:** The foundation shall consist of either: a. scarifying the in-situ clays to at least six inches and compacting it to at least 95 percent of a standard proctor or; b. inspecting the in-situ sands and if cracking of the surface is | Observe the foundation. Record observations and corrective actions on the "Daily QC Report".<br><br>Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being |

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| observed, then scarify the in-situ sands to at least six inches and compact it to at least 95 percent of a standard proctor, or, if no cracking is observed, then compact the in-situ sands to at least 95 percent of a standard proctor without prior scarification. | form. A lot is defined as a maximum of 10,000 square feet of a 6 inch lift of a specified type of material. Test locations shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified compaction.<br>b. Rework and retest lots not meeting the specified compaction.<br><br>Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log". | completed. |
| **FINAL GRADING:** The foundation for the clay liner shall be fairly smooth and free from clods, rocks, soft spots, wet areas, etc. Foundation elevations shall be at grade or below grade. | Survey the foundation on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer.<br>a. Indicate where the foundation meets design line and grade.<br>b. Rework and resurvey areas not meeting the specified grade. | Review the final survey data. Verify the frequency of the survey points. |
| **UNSUITABLE MATERIAL:** Remove unsuitable material as required. Unsuitable material is non-soil material or soil which cannot be reworked to meet the compaction criteria. | Define areas of unsuitable material and advise the project manager that such areas must be removed. Observe the areas once the unsuitable material has been removed. Report corrective actions (where required) on the "Daily Construction Report". | Verify that the removal of unsuitable material has been properly documented. |
| **FOUNDATION APPROVAL:** Foundation to be approved by Construction QA Officer. | Obtain the "Notice of Acceptance" from the Construction QA Officer before construction of the clay liner begins. | Provide a "Notice of Acceptance" to the QC officer indicating that the foundation meet the required specifications. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **CLEARING AND GRUBBING:** Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary. | Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report". | Verify that the clearing and grubbing has been inspected by QC. |
| **MATERIAL:** Satisfactory material shall be defined as CL and ML soils based on the Unified Soil Classification with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than or equal to 1 inch. | Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the clay liner. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".<br>a. Approve lots (which meet the specified classification) for use in the clay liner.<br>b. Lots not meeting the specified classification can not be used. | Verify the frequency of laboratory tests and compliance of test results. |
| **PROTECTION:** The clay borrow material shall be handled in such a manner as to prevent contamination with radioactive waste material or other deleterious material. The in-place clay may contain up to 5 percent additional rocks and sand above the content found in the classification test. | Visually check clay liner materials for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements. Document corrective actions (where required) on the "Daily Construction Report". | Verify that the clay liner is being inspected for contaminates and that corrective actions (if required) are properly documented. |
| **PROCESSING:** These procedures may be used to provide suitable material for construction of the clay liner.<br>1. Apply deflocculant at a rate determined by the production engineer<br>2. Mix the deflocculant thoroughly into the soils by tilling or similar action. | Measure the mixing areas and verify that the application rate of the deflocculant is equal to or greater than the rate determined by the production engineer. Record the size of the mixing areas and the amount of deflocculant applied on the "Embankment Construction Lift Approval Form".<br>Observe the mixed clay and advise the project manager of areas which are adequately mixed. | Verify that the size of the mixing areas and the amount of deflocculant applied have been properly documented.<br>Verify that the clay is being inspected by QC. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **NOTICE OF TEST PAD CONSTRUCTION:** The test pad plan shall be approved by the DRC prior to the test pad construction. The DRC shall be notified 48 hours in advance of the start-up of test pad construction. | Obtain documentation confirming that the test pad plan has been approved by the DRC. Verify that the DRC has been notified, as required. | Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required. |
| **TEST PAD:** An approximately 60 feet by 75 feet large test pad will be constructed using the procedure proposed for construction of the clay liner.<br><br>A small test pad with minimum dimensions of 5 feet by 5 feet will be constructed. The purpose of this small test pad is to establish equipment and procedures for construction of clay liner in locations where large equipment is not practical (e.g. repairs).<br><br>A new test pad shall be constructed each time there is a change in specifications, construction procedures, types of equipment, unified soil classification, or QC testing equipment or procedure.<br><br>Test pads are to be constructed and tested in accordance with the following specifications: | Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Embankment Construction Lift Approval Form".<br><br>The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lot). Each lift of the small test pad shall equal a lot. | Observe the construction of the test pads. Verify that the test pad has been measured and is properly documented. |
| 1. Place the clay in at least three lifts with the first lift uncompacted thickness not exceeding twelve inches. Remaining lifts shall have a loose material thickness not exceeding nine inches for each lift. The clay material will be inspected for dry clod size during placement of each lift of clay liner. | Measure the lift thickness at a rate of 1 test per lot. Record thicknesses on the "Embankment Construction Lift Approval Form".<br><br>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the "Embankment Construction Lift Approval | Verify that the number of lifts and lift thicknesses have been documented. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness. |

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| | Form". | |
| 2. The clay is to be placed and compacted by equipment proposed for use during construction of the clay liner. | Verify with the project manager that the same or similar type equipment and compaction efforts will be used in the cell for construction of the clay liner. Record type of equipment used, and number of passes on the "Embankment Construction Lift Approval Form". | Verify equipment used and the number of passes made in preparing the test pad are those to be used during the construction of the clay liner. |
| 3. The lifts of clay shall be bonded by:<br>a) providing a rough upper surface on the underlying layer of clay liner. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot;<br>**- OR -**<br>b) by compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness. | Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge.<br>**- OR -**<br>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness. | Verify the frequency of measurements and compliance of test results. |
| 4. The clay is to be compacted to at least 95 percent of a standard Proctor with a moisture content of optimum to 5 percent over optimum. Compaction of the large test pad is to be accomplished by at least four passes of suitable compaction equipment. | Conduct in-place moisture-density tests at a rate of one test per lot. The test location shall be chosen on the basis of random numbers. Record the test result on the "Field Density Test" form.<br>a. Approve lots which meet the specified moisture and compaction.<br>b. Rework and retest lots not meeting the specified moisture or compaction.<br>c. Any additional work under b. shall be included in the test pad construction method. | Verify the frequency of tests and compliance of test results. |
| 5. The clay is to be constructed to provide a permeability less than or equal to 1 x $10^{-6}$ cm/sec. Permeability testing on the bottom lift will be performed at the surface. Permeability on the second lift will be performed ≥ 2" below the surface. Permeability on the third lift will be performed ≥ 4" below the surface. | Conduct in-place permeability tests at a rate of one test per lot per lift. The permeability test shall be run in close proximity to the moisture-density test. Record the test result on the "Field Permeability Test" form.<br>a. Approve lots which meet the specified permeability.<br>b. Rework and retest lots not meeting the specified permeability<br>c. Any additional work under b. shall be included in | Verify the frequency of tests and compliance of test results. |

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| | the test pad construction method. | |
| 6. At least one PI, LL, and gradation test shall be conducted for each test pad. | Conduct PI, LL, and gradation tests at a rate of one of each type of test per test pad. | Verify that the PI, LL, and gradation tests have been conducted and documented. |
| 7. The procedures used to construct the test pad shall be reviewed and approved by the certifying engineer. The test must be approved by a Professional Engineer. | Provide the certifying engineer with copies of the documentation for the test pad for review and approval. | Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during clay liner construction. |
| 8. The procedures used to construct the test pad shall be reviewed and approved by the DRC prior to using the new test pad construction method. | Obtain documentation confirming the DRC approval of the test pad. | Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during clay liner construction. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **LIFT IDENTIFICATION:** Each lift shall be given a discrete designation for testing and surveying purposes. | Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift. | Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift. |
| **PLACEMENT:** The clay liner will be prepared, placed, and compacted using the same type of equipment and mixing and compacting procedures that were approved in the test pad. | Observe the clay liner placement. Record the equipment used to place the clay liner and any corrective actions (where required) on the "Embankment Construction Lift Approval Form". | Verify the equipment used to construct the clay liner has been documented and that it is the same type of equipment used to construct the test pad. |
| **LIFT BONDING:** The lifts of clay shall be bonded by:<br>1) providing a rough upper surface on the underlying layer of clay liner. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot;<br>**- OR -**<br>2) by compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness. | Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge.<br>**- OR -**<br>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness. | Verify the frequency of measurements and compliance of test results. |
| **LIFT THICKNESS:** The first lift of material shall have an uncompacted thickness of no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the lift thickness used to construct the test pad or nine inches. Thickness for the lift will be established by installing grade poles on at least a 70-foot grid and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed. The clay material will be inspected for dry clod size during placement of each lift of clay liner. | Verify that the required grading tolerance is achieved as follows:<br>a. Ensure that the required frequency for placement of grade poles has been met.<br>b. Compare soil level with the marked level on the grade poles.<br>c. Use a string line where necessary between poles to check for high or low spots.<br>d. Define high out of specification areas and advise the project manager to rework those areas.<br>e. Review areas reworked and approve areas meeting criteria.<br>f. Continue "b" through "d" above until all areas meet criteria. | Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness. |

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| | g. Indicate areas meeting criteria on the "Embankment Construction Lift Approval Form".<br>**- OR -**<br>Dig a hole and measure the loose lift thickness at a rate of one per lot. A lot is defined as 10,000 square feet of a single lift and record on the "Lift Approval Form". The location of the measurement shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified lift thickness.<br>b. If the thickness is greater than the specified thickness, measure the thickness at four points (north, east, south, and west) within ten feet of the first measurement. Average the five measurements together.<br>c. Approve lifts with an average less than or equal to the specified lift thickness.<br>d. Rework and retest lots with an average lift thickness greater than the specified lift thickness.<br><br>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the "Embankment Construction Lift Approval Form". | |
| **KEYING-IN:** Segments of cell clay liner constructed at times more than 30 days apart from each other shall be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high. | Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Embankment Construction Lift Approval Form". | Verify that the keying-in of the liner has been documented. |
| **COMPACTION:** Clay liner material will be compacted to at least 95 percent of standard Proctor with a moisture content between optimum and 5 percent over optimum. | Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified moisture and | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |

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| | compaction.<br>b. Rework and retest lots not meeting the specified moisture or compaction.<br><br>Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log". | |
| **PERMEABILITY:** Clay liner will have an in-place permeability less than or equal to 1 x $10^{-6}$ cm/sec. | Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 2,000 cubic yards (compacted) of clay liner. The permeability test shall be run in close proximity to a moisture density test location.<br>a. Approve lots which meet the specified permeability.<br>b. Rework and retest lots not meeting the specified permeability.<br>c. Restore all test areas to assure no leaks. | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |
| **LINER DRYING PREVENTION:** To prevent the clay liner from drying, water will be applied to the clay surface on an as needed basis or the liner will be covered with six inches of loose clay or 12 inches of loose waste. Newly constructed liner will be covered with six inches of loose clay or 12 inches of loose waste within 15 days of liner completion. Desiccation cracks larger than one-fourth inch wide and one-inch deep in the clay liner will be reported to the DRC and will be documented as a non-conformance item when discovered. | Observe the liner surface for drying. Advise the project manager of any deficiencies. Record corrective actions taken (where required) on the "Daily Construction Report". | Verify that the liner is being inspected. |
| **SNOW REMOVAL:** When clay liner material is to be placed and the work area is covered with snow, the snow must be removed. | Observe that snow is removed. Advise the project manager of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Record these corrective actions (where required) | Verify that snow removal is being documented. |

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| | in the "Daily Construction Report". | |
| **COLD WEATHER PLACEMENT OF CLAY LINER:** For purposes of this CQA/QC Manual, "frozen" is defined as a soil temperature of less than or equal to 27ºF. Clay liner shall not be placed above frozen material. In addition, no frozen material shall be processed or placed.<br><br>If the air temperature has dropped below 32ºF since the last lift of clay liner was approved, one of the following three scenarios apply:<br>(1) If less than 30 days have passed since the date of lift approval and the last lift of clay liner has been covered since the approval date with at least 9 inches of loose clay or 6 inches of compacted clay, then the cover clay may be worked with no additional testing of the lower approved lift.<br>(2) If less than 30 days have passed since the date of lift approval and the last lift of clay liner has not been covered with at least 9 inches of loose clay or 6 inches of compacted clay, then:<br>(a) Perform spring start-up testing as discussed below; or<br>(b) Monitor the liner/foundation temperature approximately 1 inch beneath the surface. If the temperature 1 inch beneath the surface is greater than 27ºF, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with liner construction. If the temperature 1 inch beneath the surface is less than or equal to 27ºF, re-work and re-test density and permeability of the affected area after the clay temperature has risen above 27ºF.<br>(3) If more than 30 days have passed since the date of lift approval, perform spring start-up testing. | As needed, observe the area where clay liner is to be placed. If frozen material is observed, cease placement of clay liner. If frozen material is suspected, measure soil temperature. Record the stopping of placement in the "Daily Construction Report."<br><br>Review ambient air temperature records as measured at the site meteorological station. Document status of clay liner cover placement on the "Daily Construction Report." Monitor liner/foundation temperature when triggered under 2.(b). Clay temperature shall be measured between 6:00 am and 8:00 am on the day that clay liner will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is a portion of the liner that is shaded or at a low point. Temperature monitoring frequency shall be at least one point per 100,000 square feet or one point per contiguous project area, whichever is smaller.<br><br>If the initial clay temperature measurement is less than or equal to 27ºF, the affected area may be resampled before 8:30 am the same day as follows:<br>a. Measure the liner/foundation temperature at a frequency of one measurement per lot (defined as no more than 10,000 square feet).<br>b. Lots where the temperature is greater than 27ºF do not require rework; except that the lot where the initial temperature less than or equal to 27ºF was measured shall be reworked regardless of resampling results. | Verify that clay liner is tested during cold weather conditions. |

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| **SPRING START-UP:** See "Cold Weather Placement of Clay Liner" above for situations that trigger this specification.<br><br>For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of clay liner at one time or not. Excavate 9 inches below the clay surface and re-test for density and permeability. Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by 'potholing' only at the testing locations. Areas that have been 'potholed' for permeability testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for liner construction.<br><br>Spring start-up testing shall be conducted on 11e.(2) embankment lift areas S-11, R-12, L-12, H-12, and D-12 prior to and in the same construction season as initial waste placement for each area. | Perform density and permeability testing at the frequencies outlined for liner construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up.<br>a. Approve lots that meet specification. The protective cover lift may then be worked in place and tested to become the next lift of clay liner.<br>b. For lots that do not meet specification, test the surface at successively deeper 9 inch increments until a passing lift is found; remove all failing lifts; re-work all failing areas; and re-test.<br><br>Document that repairs are completed to the same level of effort as required by the approved test pad for clay liner construction. | |
| **CONTAMINATION OF CLAY LINER:** The clay liner material shall not become contaminated with radioactive soils or debris during construction. The in-place clay may contain up to 5 percent additional rocks and sand above the content found in the classification test. | Visually check clay liner for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements. | Verify that removal of contaminated material has been properly documented. |
| **FINAL GRADING:** Final grading shall be from grade to above grade. Survey on a 50 ft grid and key points to verify the minimum design liner thickness requirement is met. | Survey the foundation on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer.<br>a. Indicate where the clay liner meets design line and grade.<br>b. Rework and resurvey areas not meeting the | Review the final survey data. Verify the frequency of the survey points. |

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| | specified grade. | |
| **HEAVY EQUIPMENT ON CLAY LINER:** Heavy equipment travel will be minimized on top of the finished clay liner. Heavy equipment will not be operated on saturated clay liner. | Observe work on clay liner. Advise the project manager of problems with equipment on the clay liner. Record corrective actions taken (where required) on the "Daily Construction Report". | Verify that the work is being inspected. |
| **DRC APPROVAL:** The DRC shall approve documentation associated with completed clay liner. Documentation shall include all QC and QA records associated with clay liner construction, as well as photographs of the completed liner surface. In addition, 48 hour notification shall be provided to the DRC prior to placement of soil material over the clay liner (waste or soil protective cover). However, DRC approval of clay liner documentation is not required prior to placement of waste material over the clay liner. | Notify the Construction QA Officer that the clay liner is prepared and ready for inspection by the DRC. Obtain written authorization on the "Liner Inspection Form" from the Construction QA Officer that the clay liner has been inspected. Obtain documentation confirming the DRC approval of the clay liner documentation. | Provide written approval of the clay liner prior to the placement of material over clay liner (waste or soil protective cover). Notify the DRC that the clay liner is prepared and ready for inspection at least 48 hours prior to covering with soil material. |
| **LINER PROTECTIVE COVER:** At least 1 ft of compacted native soils, free of debris, shall be constructed on top of the clay liner. This layer is termed Liner Protective Cover. Liner Protective Cover shall be placed in accordance with the lift thickness and compaction requirements specified under Work Element – Waste Placement or in accordance with the lift thickness and compaction requirements specified under Work Element – Clay Liner Placement. Contaminated equipment may be used to place Liner Protective Cover. | Verify and test Liner Protective Cover in accordance with the specifications for the relevant Work Element (Clay Liner Placement or Waste Placement). | |
| **QUALITY ASSURANCE SAMPLING:** Assurance samples for clay liner materials tests are to be obtained at the following minimum frequency:<br><br>1. In-place moisture-density tests (ASTM D6938): 1 per 50,000 cubic yards (compacted). | Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log" and moisture-density test on the "Density Testing Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made. | Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the |

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| 2. Moisture/density relationship testing (ASTM D698): 1 per 50,000 cubic yards (compacted).<br><br>3. Classification tests (ASTM D2487, D1140, and D4318): 1 per 50,000 cubic yards (compacted).<br><br>A minimum of one of each of the above tests is required for each year that clay liner is placed. | | rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report". |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **APPLICABILITY:** This work element is applicable to waste placed with the CAT 826 compactor. With prior DRC approval, this work element may be implemented by equipment demonstrated to perform equivalent to the CAT 826 compactor. | Document equipment used for compaction on the Lift Approval Form. | |
| **DEFINITIONS:**<br>Machine Pass is defined as movement of the compactor across an area of the lift in any direction, which also meets compaction criteria calculated by an algorithm in the compactor's system. For example, movement of the compactor from south to north across the lift, which also meets compaction criteria calculated by an algorithm in the compactor's system, constitutes one machine pass; the return trip from north to south, which also meets compaction criteria calculated by an algorithm in the compactor's system, constitutes a second pass.<br><br>Wheel Pass is defined as movement of any of the compactor's drums across an area of the lift, which also meets compaction criteria calculated by an algorithm in the compactor's system. Since there are forward and rear drums on the CAT 826 compactor, each machine pass constitutes two wheel passes. The CAES compaction tracking system reports wheel passes. | | |
| **LINER PROTECTION:** The compactor shall not be operated on the surface of finished clay liner or on the surface of the Liner Protective Cover directly over the clay liner. The compactor may not be used to compact the first lift of waste above the Liner Protective Cover. | When disposal and compaction is being performed on or adjacent to the first lift above the Liner Protective Cover, observe compactor operation for protection of the liner and Liner Protective Cover. Document observations on the Daily Construction Report. | |

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| When operating on a slope that terminates on the surface of the first lift of waste above the Liner Protective Cover, the compactor shall be operated in a manner to prevent impact to the Liner Protective Cover. | | |
| **LIFT IDENTIFICATION:** Each lift shall be given a discrete designation. | Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift. Summarize all lifts on the lift summary form or master sheet. | Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift. |
| **LIFT ACCEPTANCE:** At the time of acceptance, the date and time of lift approval shall be recorded. | Record the date and time of lift approval on the lift approval form. | Verify that the date and time of lift approval is recorded on the lift approval form. |
| No waste material will be disposed on a lift until the prior lift is approved, except for management of in-cell bulk disposal | Verify that the previous waste lift has been approved prior to waste disposal. | |
| **LIFT THICKNESS:** The waste material will be placed in lifts with a compacted average thickness not exceeding 24 inches. | Survey the mean elevation of the top of each lift by surveying at least five points and taking the average. Where practical, survey the corners and at least one spot in the middle. Survey measurements will be documented and forwarded to the Construction QA Officer. Lift thickness may also be verified via GPS.<br>a. Approve lifts with an average less than or equal to the specified lift thickness.<br>b. Remove excess material from the thicker areas of the lift if the average lift thickness is greater than 24 inches, and re-compact lift in the areas where wastes are removed.<br><br>OR<br><br>Download the CAES system report of beginning and ending lift elevations. For lifts that are not sloped, survey data may be used for beginning lift elevation. Lift thickness shall be reported using CAES in accordance with operating procedure CL-QC-PR-038. | Perform a monthly assessment of the survey documentation performed by the QC personnel to ensure that the measurements and observations are being performed correctly. Verify that the surveys are being performed at the correct frequency and that the documentation is being completed.<br><br>Verify that the survey data has been received from the QC personnel. |

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| | When calculating the average lift thickness on a side slope, no point shall be more than 2.1'. If CAES is used to document lift thickness on the side slope, there shall be no white pixels shown in the lift. | |
| **LIFT AREA:** Identify the dimensions and the location of the northwest corner of the lift. There is no minimum lift area for this work element. | Locate the northwest corner of each lift, and document the location and lift dimensions. | |
| **CLASSIFICATIONS:** Soil classification testing is not required for waste placed using this work element. | | |
| **TERRACING OF LIFTS:** As new lifts are placed next to old lifts, at least one foot, measured horizontally, shall be removed from the outer edge of the old lift (except for CLSM lifts). | Inspect the intersections of old and new lifts. Verify that the outer one foot of the old lifts are being removed (except for CLSM lifts). Record any problems on the "Daily Construction Report". | Verify that the required inspections are being performed. |
| **COMPACTION WITH CAES:** When using the CAES system, each lift and lift interface shall be compacted by at least 4 machine passes with the CAT 826 compactor. The lift surface shall be firm and unyielding to the compactor's weight. A minimum of 90% of the grid points reported for the lift by CAES shall exhibit adequate compaction and machine passes. Adequate compaction as well as meeting the minimum number of wheel passes is reported by CAES when the pixel turns green. Furthermore, a maximum of 5 non-green pixels shall be adjacent to each other within the lift area limits. "Adjacent" means that two pixels share a common side; pixels that share only a common corner are not adjacent to each other.<br><br>**a.** Additional compaction may be required if, after the minimum number of passes is complete, the minimum percentage of grid points do not exhibit adequate compaction, as reported by the CAES system. | Document the CAES system report of compaction for each lift area. Compactive effort is reported by CAES on a roughly 3.3' x 3.3' grid; with each on-screen pixel representing one square meter. Ensure that the CAES reports a minimum of 4 machine passes (i.e., 8 wheel passes) for at least 90% of the grid points in the lift, as detailed in operating procedure CL-QC-PR-038. Record this information on the Lift Approval Form. Perform a QC inspection of the compacted lift by observing the CAES control screen for evidence of uniform and adequate compaction. This condition is indicated by having a majority of the screen light green, with only isolated pixels in other colors. Evaluate all pixels that are not green to ensure the maximum number of adjacent pixels is not exceeded. Print the screen as a color image and include with the lift approval form. Record QC inspection results on the Lift Approval Form. | Perform a monthly assessment of the compaction documents generated by the QC technician. |

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| **b.** Evaluate the lift interface when compacting adjacent to previously poured CSLM. Visually inspect for obstructions (e.g., CLSM surface, irregularities in CLSM side slope, etc.) that may affect compaction data. More than 5 non-green adjacent pixels are permitted in this situation if QC visually observes and documents a minimum of 6 machine passes to within 12 inches of the obstruction. | Perform a visual inspection of the CLSM/Soil interface. Identify areas of the CLSM pour that present an obstacle for the 826 compactor. Visually observe the compactor operator make a minimum of 6 machine passes to within 12 inches of the obstruction. Document the observations on the Lift Approval form. | |
| **COMPACTION WITHOUT CAES:** If the CAES system is not available to be used for compaction under this work element, the following requirements apply.<br><br>1. Verbal notice shall be provided to DRC within 24 hours of beginning to approve lifts without CAES. This notice may be provided via email.<br>2. Written notice shall be provided to DRC no later than 3 calendar days (72 hours) after beginning to approve lifts without CAES. The written notice shall explain why CAES is down; an estimate of when CAES will be back online; a map of the areas being compacted without CAES; and a map of pre-final cover settlement monitoring points over the area being compacted without CAES.<br>3. Compaction without CAES is limited to 10 calendar days per occurrence.<br><br>Each lift and lift interface shall be compacted by at least 6 machine passes with the CAT 826 compactor. The lift surface shall be firm and unyielding to the compactor's weight. Additional compaction may be required if, after the minimum number of passes is complete, any of the following are observed:<br>a. The lift surface exhibits ruts or compression (excluding depressions caused by the tines of the | Document that the minimum number of passes is completed for each lift area. Passes shall be counted by the QC technician or by using a GPS unit communicating with the GPS unit on the compactor.<br><br>Perform a visual inspection of the compacted lift surface. If rutting or other indications of inadequate compaction are present, direct the equipment operator to complete additional passes until the situation is corrected. If additional passes are unable to correct the situation, moisture adjustment or other corrective actions may be needed and the lift shall not be approved until these actions are completed.<br><br>Survey lift elevation and thickness in accordance with the specification "Lift Thickness" above, with the further requirement that the greater of the following number of points shall be surveyed per lift:<br>a. At least 5 points; or<br>b. One point per 2,000 square feet of lift area.<br><br>Record number of passes and visual inspection results on the Lift Approval Form. | Perform a monthly assessment of the compaction documents generated by the QC technician. |

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| compactor wheel) in excess of four inches;<br>b. The waste material exhibits pumping behavior, or has other indications of excess moisture content; or<br>c. The lift does not appear to be uniformly compacted. | | |
| **DEBRIS PLACEMENT WITH THE COMPACTOR:** For purposes of this work element, debris shall be defined as provided in the work element "Waste Placement", below. | Determine the volume of debris. Volume determination shall be established by either: a) inspecting the debris on the lift and calculating the quantity of debris, or b) using the manifested waste volume for shipments placed on the lift. | |
| Debris placed in accordance with this work element shall be limited to no more than 50% by volume of the compacted volume of the lift. The debris shall be uniformly distributed across the lift. | Inspect debris once it is spread out on the lift and prior to placement of fill material. Ensure that debris is spread out uniformly across the lift and in a manner to minimize void spaces and does not exceed volume requirements. Document the debris inspection on the Lift Approval Form. Record the debris fill calculations and estimates on the Lift Approval Form. | Observe in the field that the debris calculations and estimates are being performed and properly documented. Review documentation to verify that the visual observations of debris shipments are being properly performed by QC personnel or that the manifested volume of waste is used to calculate the volume of fill material required. |
| Lifts containing materials susceptible to wind dispersal shall be covered with soil-like waste, fill material, or a commercial fixative so that these materials are secured by the end of the shift the materials were placed into the lift. "Secure" means a visual inspection to confirm that cover material has been applied to all materials susceptible to wind dispersal so that no material is obviously blowing around. Plastic, etc., may be visible at the surface. | Document cover material used, location, and result of visual inspection to ensure materials are secure on the "Daily Construction Report". | |
| **DEBRIS SIZE:** All debris placed in accordance with this work element shall be less than 10 inches in at least one dimension and no longer than 12 feet in any dimension. Note: bags of asbestos-containing debris may be larger than 10 inches in all dimensions before compaction. | Inspect debris placed in soil lifts to ensure that it meets the debris size requirements. | |

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| **SNOW REMOVAL:** When waste material is to be placed and the work area is covered with snow and/or ice, the snow and/or ice must be removed so that no more than ¼ inch remains on the surface. Isolated individual clumps of snow and/or ice may be present, but shall be no larger than 2 inches in diameter. | Observe that snow is removed. Advise the project manager of deficiencies. Construction may not continue without corrective action. Record corrective action (where required) in the "Daily Construction Report". | Verify that snow removal is being performed and documented. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **LIFT IDENTIFICATION:** Each lift shall be given a discrete designation for testing and surveying purposes. | Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift. | Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift. |
| **LIFT ACCEPTANCE:** At the time of acceptance, the date and time of lift approval shall be recorded. | The QC technician shall record the date and time of lift approval on the lift approval form. | Verify that the date and time of lift approval is recorded on the lift approval form. |
| No waste material will be disposed on a lift until the prior lift is approved, except for management of in-cell bulk disposal | Verify that the previous waste lift has been approved prior to waste disposal. | |
| **LIFT THICKNESS:** The radioactive disposal material will be placed in lifts with a compacted average thickness not exceeding 12 inches (except CLSM lifts). | Survey the mean elevation of the top of each lift by surveying at least five points and taking the average. Where practical, survey the corners and at least one spot in the middle. Survey measurements will be documented and forwarded to the Construction QA Officer.<br>a. Approve lifts with an average less than or equal to the specified lift thickness.<br>b. Remove excess material and retest lots with an average lift thickness greater than the specified lift thickness. | Observe, at a minimum, five percent of the surveys performed by the QC personnel to ensure that the measurements and observations are being performed correctly. Verify that the surveys are being performed at the correct frequency and that the documentation is being completed.<br><br>Verify that the survey data has been received from the QC personnel. |
| **LIFT AREA:** The lift area shall be at least 10,000 square feet except CLSM, Containerized Waste Facility, and Mixed Waste lifts. Identify the dimensions and the location of the northwest corner of the lift. | Locate the northwest corner of each active lift, and determine the dimension.<br>a. Allow placement to continue on any lift that meets the lift area requirement.<br>b. Stop placement on any lift which does not meet the lift area requirements.<br>c. The Construction QA Officer may grant a waiver, for up to five percent of the lifts, if it is deemed impracticable to place at the specified lift area (e.g. a narrow lift on the outside edge of the cell). Insufficient material from a specific generator does | Verify that the lift area meets the lift area requirements. |

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| | not constitute grounds for a waiver. | |
| **COMPACTION:** Each lift shall be compacted to 90 percent of a standard Proctor, except lifts with greater than ten (10%) compressible debris, which shall be compacted to a minimum of 95 percent of a standard Proctor. The moisture content of all lifts shall be equal to at least 2 percent and no greater than up to 3 percentage points above the optimum moisture (except for CLSM lifts). | Except for CLSM lifts, conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 1,000 cubic yards (compacted) of a single lift. At least one test will be performed per lift. At least one test will be performed per soil type in the lift. The test location shall be chosen on the basis of random numbers. Approve lots when:<br>a. Material is observed to be properly compacted throughout the lot;<br>b. Moisture/density tests performed meet moisture and compaction specifications. | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that field moisture/density tests are being performed at the correct frequency and that the documentation is being completed. |
| | Outliers shall be resolved according to the following:<br>a. For lot sections where the material is observed to not be properly compacted throughout the entire lot:<br>1) Identify the section requiring further compaction and rework the material until it is observed to be adequately compacted;<br>2) Perform moisture/density testing as outlined above.<br>b. For lots where the dry density reading from a nuclear gauge moisture/density test is less than or equal to the required percentage of the standard Proctor:<br>1) Identify the section(s) of the lot (including dimensions) requiring further compaction, and re-work the material. Re-test at the location previously tested. Test one more location in the re-worked lot section. Identify the test location using the lot section dimensions and random numbers.<br>- If the test results from both tests meet moisture/density requirements, approve the lot;<br>- If either test fails, repeat the above process | Ensure that resolution of any outliers is properly accomplished and documented. |

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| | until all tests at both locations meet moisture and compaction requirements.<br>**- OR -**<br>2) If the lot is observed by the QC Technician to be adequately compacted, investigate the reason for the low density reading. If it is determined that the test results were <u>improperly influenced</u> (e.g. debris directly beneath the gauge), take two more density tests within 5 feet of the original test. **NOTE: <u>All tests are to be recorded.</u>**<br>- If the results from both tests are above the required compaction requirements, record both tests and approve the lot.<br>If either test fails to meet moisture/density specifications – and the test results were not improperly influenced as described above - follow instructions for a.1 above. | |
| | Proctors shall be performed at a rate of one test per 15,000 cubic yards (compacted) or less of a specific material type. | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that proctor tests are being performed at the correct frequency for each specific material type and that the documentation is being completed properly. |
| **CLASSIFICATIONS:** One soil classification test shall be performed at six month intervals for each large soil waste generator. | Perform a soil classification test (ASTM D2487) every six months for each large soil waste generator. A large soil waste generator is defined as a generator disposing of at least 30,000 cubic yards (compacted) of compactable soil in a given calendar year. Record the location of the classification sample on the "Sampling Log". | Verify the frequency of laboratory tests. |
| **TERRACING OF LIFTS:** As new lifts are placed next to old lifts, at least three feet, measured horizontally, shall be removed from the outer edge of | Inspect the intersections of old and new lifts. Verify that the outer three feet of the old lifts are being removed (except for CLSM lifts). Record any problems | Verify that the required inspections are being performed. |

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| the old lift (except for CLSM lifts). | on the "Daily Construction Report". | |
| **INTERSECTION OF LIFTS:** In addition to the density testing of the lift, an average of one density test per three lifts shall be performed at the old/new-lift interfaces. For lifts intersecting with CLSM lifts, the interface density testing is performed on the non-CLSM lift within 2 feet of the CLSM interface. | Conduct in-place moisture-density tests at an average rate of one test per three lifts and record the results on the "Field Density Test" form. For each lift random numbers between 0 and 1 shall be generated. If the random number is 0.65 or greater, then a moisture-density test is required on the lift interface between the new lift and old lift. On lifts requiring an interface test, the test location shall be chosen on the basis of a random number. For intersections with CLSM, perform a density test on the non-CLSM portions of the intersection within 2 feet of the CLSM interface.<br>a. Approve lots which meet the specified compaction.<br>b. Rework and retest lots not meeting the specified compaction. | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests are being performed correctly. Verify that tests are performed at the correct frequency and the documentation has been completed. |

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| **DEBRIS PLACEMENT** | | |
| **DEBRIS DEFINITION:** For the purposes of this CQA/QC project plan, debris is defined as any radioactive waste for disposal other than compactable soils. Compactable soil is defined as: (a) having a graded material that will pass through a four inch grizzly; (b) as having a bulk density greater than seventy pounds per cubic foot dry weight in accordance with ASTM D-698; and (c) having soil-like properties (i.e., standard tests in accordance with waste placement procedures can be performed. Additionally, debris shall be classified as either incompressible debris (i.e. concrete, stone, or solid metal) or compressible debris (all other debris types). A large object is defined as any debris that does not have at least one dimension less than 10-inches or that has any dimension in excess of 12-feet. A large component is defined as a large object that weighs more than 100,000 pounds. | No action required. | No action required. |
| **DEBRIS PLACEMENT METHODS:** Debris may be placed in the embankment using two different methods: 1) placement of the debris in a lift with compactable soil at a limited ratio of debris to soil, or 2) placement of the debris in a lift and in-filling the debris with Controlled Low Strength Material (CLSM). | | |
| For placement of large components, the maximum allowable load on the clay liner surface must be less than 3000 psf.<br><br>When CLSM is required as structural fill in the Large Component Engineering Review in order to meet the load specification, the first 4 feet of CLSM shall be placed around the large component within 30 calendar days of large component disposal. | Perform a Large Component Engineering Review. Ensure that the bearing pressure at the clay liner surface meets specification for the load associated with placement of any large component.<br><br>Document the following on the Lift Approval Form:<br><br>1. Date of large component disposal and date of CLSM pour. | |

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| **DEBRIS QUANTITY IN SOIL WASTE LIFTS:** Debris that is placed in the embankment with compactable soil shall be limited to a portion of the total volume of the waste lot. Furthermore, the debris shall be uniformly distributed across the lot.<br><br>Lifts containing materials susceptible to wind dispersal shall be covered with soil-like waste, fill material, or a commercial fixative so that materials susceptible to wind dispersal are secured by the end of each working day.<br><br>A lot is defined as an area for the placement of waste from a single generator. The volume of a lot is limited to one thousand (1000) cubic yards for testing purposes. A lift is defined as one or more lots which are compacted and tested together to meet lift placement requirements. The minimum fill required will be controlled by the volume of uncompacted debris placed in the lift.<br><br>For compressible debris, the volume of the debris in a lot shall be limited to less than or equal to thirty percent (30%) by volume of the calculated compacted volume of the lot.<br><br>Incompressible debris (concrete, stone, or solid metal) may be placed in a lot up to twenty-five percent by volume of the calculated compacted volume of the lot. When combining the two types of debris in one lot, the above volume limit applies and the maximum volume of all debris shall be less than or equal to 25 percent. At least one moisture/density test shall be performed per soil type in the lift. | For shipments containing debris material, determine the volume of debris for the shipments. Volume determination shall be established by either a) inspecting the debris in the shipment and calculating the quantity of debris, or b) using the manifested waste volume.<br><br>Visually inspect lifts containing materials susceptible to wind dispersal are covered with soil-like waste or fill material by the end of each working day.<br><br>Inspect debris once it is spread out on the lot and prior to placement of fill material. Ensure that debris is spread out uniformly across the lot and in a manner to minimize void spaces and does not exceed volume requirements. Document the debris inspection on the “Lift Approval Form.” Record the debris fill calculations and estimates on the "Lift Approval Form". | Observe in the field that the debris calculations and estimates are being performed and properly documented.<br><br>Review documentation to verify that the visual observations of debris shipments are being properly performed by QC personnel or that the manifested volume of waste is used to calculate the volume of fill material required. |

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| **DEBRIS SIZE:** All debris placed in soil waste lifts shall be less than ten (10) inches in at least one dimension, and no longer than twelve (12) feet in any dimension. Note: bags of asbestos-containing debris may be larger than 10 inches in all dimensions before compaction. | Inspect debris placed in soil lifts to ensure that it meets the debris size requirements. | Review documentation associated with debris lifts to verify that debris inspections are being performed. |
| **RESIN LIFTS:** Unless disposed in the Containerized Waste Facility, resins shall be disposed as follows or in accordance with the specification "CLSM Pours with Resin-Filled Containers" below. For resin lifts, resins will be less than one inch thick, at any location on the surface of the lift, prior to tilling.<br><br>Ion Exchange Resin (IER) must be blended with native clay that meets the CL classification in a minimum ratio of 1:9 (one part IER to nine parts CL clay) on a volumetric basis. This native clay shall be tested by ASTM method D-2487 at a rate of one test every 250 cubic yards.<br><br>Blending of IER must take place where native soil has been placed and approved by the Construction Quality Control Officer (CQCO) as a marker layer over the previous lift. The CQCO may approve the 6-inch fill cover for the 10% debris lifts as the bottom marker layer provided verification of the following:<br>10% debris is placed in previous lifts; and cover fill is native soil that is distinguishable from the previous lift and resin clay.<br><br>Exposed blended resins shall be compacted, tested and approved after placement of at least 2-inches of native soil cover. A minimum of 2-inches of native soil cover must be placed by the end of each workday. The minimum 2-inch native soil cover may be used to blend the resin in the next lift. | For resin lifts, inspect the spread resin prior to tilling to ensure:<br>a) resin is less than one inch thick at any location on the surface of the lift;<br>b) resin is spread throughout the resin lift area;<br>c) there are no areas larger than 25 $ft^2$ without resin;<br>d) there are no depressions or wheel ruts deeper than one inch.<br>e) verify native clay meets CL classification and is blended at a 9 to 1 ratio.<br>f) Verify a minimum of 2-inches of native soil cover must be placed by the end of each workday.<br><br>Require additional spreading for any resin lift not meeting these specifications. Record the debris inspection on the Lift Approval Form.<br><br>Notify DRC during normal working hours of placement of blended materials at least 24 hours prior to covering beyond this 2" clay layer in order to allow inspection and sampling of placed blended materials. | Review documentation associated with resin lifts to verify blending and disposal requirements are being performed. |

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| **CLSM POURS:** | | |
| **CLSM PYRAMID**: 1) CLSM lifts shall form a pyramid with a maximum 3H:1V outside edge slope. Thus, with a six foot CLSM lift and six inch (6") cap, the next CLSM lift must be constructed to minimum of 19.5 feet inside the edge of the lift immediately below it. 2) The pyramid base dimensions and maximum 3H:1V side slope requirements will control the location of all subsequent CLSM lifts throughout the full height of the embankment. 3) Adjacent pyramids shall not be placed above any portion of previous CLSM pyramids. | Determine the location of the northwest corner and the dimensions of each lift and document on the ES-1904 form. Use the lift location and dimensions to ensure compliance with the CLSM pyramid specification. Document the dimensions of the previous CLSM lift on the ES-1904 form diagram. In locating a new pyramid, document on the ES-1904 form:<br>a) The pyramid base is placed on the Liner Protective Cover; or,<br>b) The pyramid base has not been placed above a previously placed pyramid | Verify compliance with the CLSM pyramid specification and proper documentation of the QC requirements. |
| CLSM Lift Preparation: The average height of each pour shall be limited to six feet. Large objects taller than six feet shall be poured with the subsequent CLSM pours (in layers) until completion.<br><br>Debris disposed with CLSM will be placed to minimize the entrapment of air in the CLSM pour. | Perform an inspection of the preparation of debris for placement with CLSM. Ensure that the average formed height of the CLSM lift is less than six feet and that any large objects are localized into specific areas. Also, ensure that debris is placed in a manner to minimize the possible entrapment of air during the CLSM pour and to allow maximum in-filling of the debris. Document the inspection on the CLSM Inspection Form. | Review inspection documentation to ensure that inspections are performed and properly documented. |
| **DRC NOTIFICATION FOR CLSM POURS**: The DRC shall be notified at least 48 hours in advance of any CLSM pour. A CLSM pour will be defined as a formed area approved and documented by Engineering for CLSM designated on a waste lift. | Verify that the DRC has been notified at least 48 hours in advance of any CLSM pour. Document DRC notification on the "Daily Construction Report". | Verify that the DRC has been notified at least 48 hours in advance of any CLSM pour. |
| **PORTLAND CEMENT OR FLY ASH CLSM DESIGN SPECIFICATIONS:**<br><br>Notwithstanding the following specifications, Macro Vaults as approved by the Division of Solid and | | |

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| Hazardous Waste in the Mixed Waste Landfill Cell are considered large objects that do not require CLSM. Macro Vaults shall not be proof rolled. | | |
| CLSM shall have the following characteristics:<br>a) The design mix is approved by the production engineer prior to use in the cell area and meets the material specifications provided in Table 2 or Table 3 of this Attachment II-A.<br><br>b) The CLSM passes a Slump Test (procedure provided in Appendix B of this manual), Flow Consistency Test (ASTM D6103) or Efflux test (procedure provided in Appendix B of this manual), as applicable. Passing criteria for each test is specified in Table 2 "Material Specifications for Portland Cement CLSM" or Table 3 "Material Specifications for Fly Ash CLSM" of this Attachment II-A.<br><br>c) The CLSM shall have a wet unit weight in all cases of at least 100 lbs/ft$^3$ as determined by ASTM D6023 (Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of CLSM). | Two types of tests will be performed to ensure that the CLSM meets the design specifications: initial screening tests and lot acceptance tests. The results of these tests and corrective actions, if any, shall be documented on the CLSM Testing Form.<br>a. Initial screening tests shall be performed on the first load of CLSM for each day that CLSM is poured. This screening test shall be performed from the "front end" of the load. The initial screening test includes either a Flow Consistency Test (ASTM D6103) or Efflux test (procedure given in Appendix A), as well as a unit weight test (ASTM D6023). The results from this initial screening test shall indicate whether or not any adjustments need to be made at the batch plant to ensure loads meet design specifications.<br>b. If adjustments are made to the load to produce a product that passes the testing requirements, perform initial screening testing on the subsequent two loads to verify that the batch plant adjustments are sufficient<br>c. CLSM pouring shall only be authorized to proceed upon verification that the initial load (and subsequent two loads if the initial load failed) meets mix specifications.<br>d. Acceptance tests shall be performed at a rate of one test per lot, with a minimum of one acceptance test performed for each CLSM pour. A lot is defined as 100 cubic yards of CLSM. Sampling for acceptance tests shall be performed in accordance with ASTM D5971 | Observe, at a minimum, five percent of the tests performed by QC personnel on the CLSM to ensure that the tests and observations are being performed correctly. Verify that the required testing has been performed and properly documented. |

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| | (Sampling Freshly Mixed CLSM). These acceptance tests shall be performed from a composite of two samples from near the middle of the load.<br>a. Accept loads that meet specification.<br>b. For loads with unsatisfactory results, accept the first part of the load and reject the remainder, or modify the load and/or pour techniques and retest. | |
| d) The CLSM shall have a minimum 28-day strength of 150 pounds per square inch (psi) as determined by ASTM D4832. A minimum of 3 cylinders shall be cast for compressive strength testing. | Cast a minimum of 3 cylinders per 2000 cubic yards of CLSM placed, with at least one set per lift for lifts smaller than 2000 cubic yards. Perform compressive strength testing in accordance with ASTM D4832 at 28 days to ensure the minimum strength requirements are met. If the CLSM cap does not meet specification, evaluate why it failed and implement corrective actions to prevent recurrence. | Ensure compressive strength testing is being performed at the correct frequency. |
| e) A load ticket shall be furnished for each truck of CLSM to be poured. | Obtain the load ticket for each truck load of CLSM and ensure the load meets the mix specifications provided in Table 2 "Material Specifications for Portland Cement CLSM" or Table 3 "Material Specifications for Fly Ash CLSM" of this Attachment II-A. Reject any loads not meeting the mix specifications. Include the load ticket with the Lift Approval Form for the CLSM lift. During each CLSM pour, a QC Technician shall be present at or near the pour at all times and shall visually observe pour activities. | Verify that the load tickets have been obtained by QC personnel for each truck load of CLSM and that the load ticket has been checked against Table 2 "Material Specifications for Portland Cement CLSM" or Table 3 "Material Specifications for Fly Ash CLSM". |
| **CLSM PLACEMENT OF UNCONTAINERIZED DEBRIS:** Debris shall be placed to minimize the entrapment of air in the CLSM pour. To accomplish this, any plastic caps, wrappings, or other obstructions placed on pipes, valves, and other debris objects shall be cut or removed prior to pouring CLSM. The uncontainerized debris shall be spread horizontally across the lift. Any compressible debris in the lift shall | Visually inspect the debris pour to ensure that the CLSM can flow throughout all uncontainerized debris in the waste matrix. Inspect pipes, valves, and other debris object and ensure that sufficient access exists for CLSM to enter the debris interior and fill voids. Verify that all compressible debris is properly secured. Ensure that wood materials are spread throughout the lift and not stacked or nested together. | Verify the large debris inspections have been performed and documented on the CLSM Inspection and Testing Form. |

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| be secured to ensure proper disposal and cover with CLSM. Any wood materials shall be spread throughout the lift to prevent localized stacking or concentration of wood materials. | | |
| **CLSM POURS WITH DEBRIS-FILLED CONTAINERS:** In-filling of debris inside containers with CLSM shall be maximized. A minimum of two holes shall be punched into the bottom of one of the walls of each box container to allow for flow throughout the container. Containers filled with primarily wood materials shall not be disposed with CLSM, and must be emptied and spread out prior to placement. | | |
| Lids shall be removed from all box containers prior to pouring CLSM (unless a specific waste stream or shipments are exempted by UDRC for safety or ALARA considerations). Drum containers do not require removal of the lid. However, a drum container lid shall be pierced with a hole size of at least 2” X 4” to allow flow of CLSM into the container. If any container includes compressible debris, the material shall be secured to remain inside the container. Drum containers that contain compressible debris shall have the lid removed or a six-inch CLSM cap shall be placed over the filled container. | Visually inspect compressible debris inside containers to ensure the debris is secured. Ensure lids are removed from all box containers. If the lid shall remain on the drum container (or other waste container specifically exempted by UDRC), ensure that the lid has been pierced with the proper size and number of holes. Record results on the CLSM Inspection Form.<br><br>If the lid remains on the drum container, ensure that the required number and size of holes exist in the lid. A flowability test is not required on containers filled with soil or fine-grained materials. | Review inspection results to ensure that compressible debris is being properly secured and that adequate holes exist for containers where lids remain on the container. |
| Hot particles are very small, often microscopic discrete radioactive fragments with high specific activity. Their presence or potential presence in a waste stream is documented on the waste profile record. To protect worker health and safety, waste containers up to 115 cubic feet containing asbestos, beryllium or hot particles do not require in-filling of debris inside the containers to be maximized. Box lids and at least one wall shall be punctured with a minimum of two holes | Ensure that containers with asbestos, beryllium or hot particle waste are marked. Document the location of each such container within the pour. Ensure that the lift is not approved without placement of a six-inch CLSM cap. | |

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| at least 2" x 4". Containers placed in this manner shall be marked as "asbestos", "beryllium" or "hot particle" waste and shall have a six-inch CLSM cap placed over them. | | |
| **CLSM POURS WITH SOIL-FILLED CONTAINERS:** Containers that are filled with soil-like materials may be placed with CLSM. The lid may remain on the container. However, holes must be placed in the lid as required for compressible debris-filled containers above. | Verify that ion-exchange resin containers are constructed of steel or poly. Document this inspection on the CLSM Inspection Form. | |
| **CLSM POURS WITH RESIN-FILLED CONTAINERS:** Containers that include or are filled with ion-exchange resin materials may be placed with CLSM. Only watertight steel or poly containers are permitted for resin disposal in CLSM. Cardboard, wood, and soft plastic "supersack" containers are expressly prohibited from use as the sole container for resin disposal in CLSM. | | |
| Each container shall be inspected for headspace void and have any headspace void filled with an inert material. Provide a minimum of 24 hours notice to DRC prior to filling headspace void and sealing containers. CLSM and other concrete products are expressly prohibited for use filling this headspace void. After filling the headspace void, the lid shall be replaced on the container and latched, banded, or otherwise secured. The container shall be watertight to minimized potential CLSM contact with ion-exchange resins. Paint or mark the word "RESIN" on all 4 sides and the lid of each container when void filling and sealing operations are complete. | Verify that DRC has been notified at least 24 hours prior to the following activities. Inspect each container of ion-exchange resins for headspace void. Document the material used to fill any headspace voids. Document that the lid has been replaced and secured on the container. Document that the container is inherently watertight (i.e., a drum with the ring secured around the lid) or has been rendered watertight (i.e., a steel box with a flexible gasket in place before the lid is secured or that has been otherwise sealed). Document that the container has been painted or marked as required. | |
| The total waste resin volume shall be limited to no more than 25 percent of the total volume of the CLSM | Prior to the CLSM pour, calculate the ratio of resins to other material in the pour as follows: (1) Document the container type and volume for each container of resins in the pour; (2) Document the total pour volume based on the formed area x height; (3) Resin volume divided by total volume x 100 = resin percentage. Container | |

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| pour. Other wastes meeting the criteria for CLSM disposal as outlined in this CQA/QC Plan may be used to make up the remainder of the volume of the pour. | volume may be calculated from the nominal capacity or from manifested volume of resins in the container. | |
| Containers of ion-exchange resins shall not be placed directly adjacent to each other within the CLSM pour. Containers of ion-exchange resins shall not be placed directly above containers of ion-exchange resins in previous lifts within the CLSM pyramid. | Survey and document the location of each resin-filled container on the CLSM Inspection Form. Verify that each resin-filled container is not placed directly above resin-filled containers in previous lifts within the CLSM pyramid. | Review the documentation to ensure proof-roll testing is being performed and properly documented. |
| CLSM pours with resin-filled containers are subject to all CLSM pyramid controls under the specification "CLSM Pyramid" above. | Visually inspect the final CLSM pour surface to ensure the area is acceptable for proof rolling. | Review the documentation to ensure rework, if required, has been performed and documented |
| **FINAL CLSM POUR SURFACE:** The final CLSM surface will be a horizontal plane with no exposed debris that impedes contact with the surface area during proof rolling. (with the exception of large objects that require multiple pours to completely dispose with CLSM). | | |
| **PROOF-ROLL TESTING:** A proof roll test shall be performed on all CLSM lifts a minimum of 3 calendar days following completion of the CLSM pour and prior to placement of any additional waste lifts on top of the completed pour. The test shall consist of a loaded truck (rock truck, cement truck, or other vehicle of equal or greater surface load) driving across the entire footprint of the completed CLSM pour. | Inspect the entire cured CLSM pour surface. Following inspection, direct the truck (rock truck, cement truck, or other vehicle of equal or greater surface load) across the entire CLSM pour surface. Inspect the surface during rolling for any cracking or depressions resulting from the proof-rolling. Identify any surface cracks or depressions with a vertical displacement of ½-inch or greater, or cracks greater than ½-inch in depth. Mark these areas for repair or re-work. Document observations on the Lift Approval Form. Approve all lift areas not marked for repair or rework. For any areas with surface cracking or depressions with a vertical displacement of ½-inch or greater, or cracks greater than ½-inch in depth, one of the following methods shall be followed to remedy the failed area(s):<br>a. The area may be compacted and then | |

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| | re-poured. Following three days from the re-pour, perform another proof-roll test to evaluate if the repair was adequate; or<br>b. Remove the CLSM and debris from the marked area and replace it with debris and CLSM. Following three days from the re-pour, perform another proof-roll test of the area to evaluate if the repair was adequate. Repeat this process until satisfactory results are achieved; or<br>c. Place a six-inch CLSM cap over the pour lift area after the area in question has been compacted. The six-inch cap shall extend a minimum of three feet (3') past the damaged areas created during proof rolling in each direction. Following a minimum of three calendar days, perform a proof roll test of the six-inch cap area to evaluate if the cap was adequate. This process may also be repeated (i.e., placement of additional cap to a 12-inch cap) until satisfactory results are achieved. | Review the documentation associated with the CLSM cap. |
| **SIX-INCH CAP:** All containers filled with compressible debris that do not have the lids removed shall have a six inch CLSM cap poured over the top of the containers prior to proof rolling. In addition, any CLSM pours that have areas which did not pass the proof-rolling test may have a CLSM cap placed over | Visually inspect the CLSM pour area and identify the highest elevations of debris that requires a six-inch cap. Survey and document these designated elevations on the CLSM Inspection Form. Following completion of the six-inch cap, perform a final survey of the entire lift as required for determining lift thicknesses above. Ensure that the thickness of the cap is six inches above all debris requiring a CLSM cap and that the cap extends three feet in each direction past the edge of the area that requires the cap. Document the inspection | Verify that compressive strength testing is performed at a rate of 1 per CLSM lift. Ensure that the compressive strength of the cap is greater than or equal to 500 psi. |

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| those areas. Areas poured with a CLSM cap shall still require a proof-rolling test (as described above) to verify adequacy of the cap. The six inch cap shall extend a minimum of three feet in each direction past the edge of the container area that requires a cap. | and completion of the CLSM cap on the Lift Approval Form. | |
| The minimum compressive strength of the CLSM cap shall be 500 psi. Table 2 and Table 3 specifications do not apply to the CLSM cap. | Perform compressive strength testing of the CLSM used for caps at the rate of 1 test per CLSM lift. Test specimens/samples shall be collected in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM). The samples shall then be tested in accordance with ASTM D4832 (Preparation and Testing of CLSM Test Cylinders). If the CLSM cap does not meet specification, evaluate why it failed and implement corrective actions to prevent recurrence. | |
| **IN-CELL BULK DISPOSAL:** For both LLRW and 11e.(2) waste: Any waste material taken to the disposal cell but not spread out (for lifts placed with compactable soil) or set into a CLSM lift area for forming (for debris to be placed using CLSM) shall be considered in-cell bulk disposal. In-cell bulk disposal may be temporarily managed in piles up to twenty-five feet high on the embankment. For 11e.(2) waste: In-cell bulk disposal cannot be placed on slopes steeper than approximately 5H:1V. The volume of in-cell bulk disposal shall not exceed the limits found in RML #UT 2300478, condition 10.8.e. All 11e.(2) in-cell bulk placement material shall be placed to final specifications by August 1 of each year. | On a monthly basis, calculate and document the volume of in-cell bulk disposal and waste stored on the LLRW storage pads. Stop waste unloading before the volume of waste stored exceeds the volume specified in the trust agreement. | Review documentation of in-cell bulk disposal and ensure that volumes do not exceed the trust agreement. |
| Open-air storage of PCB/Radioactive waste and Dry Active Waste (DAW) is prohibited. DAW is defined in condition I.E.10.(d) of the Ground Water Quality Discharge Permit. In-cell bulk disposal of PCB and DAW shall be managed to prevent open-air storage as follows:<br>1. Maintained in a water-tight container; or | Obtain reports from waste disposal personnel as to the location and status of PCB and DAW in-cell bulk disposal at the beginning of each shift. When material requiring cover has been placed into in-cell bulk disposal during the preceding shift, track placement of the specified cover material. Document completion of cover within the required timeframe on the Daily Construction Report. | |

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| 2. Covered within 24 hours of the end of the shift that the waste was unloaded with a nominal 6" of soil or soil-like waste material that is free of PCB and DAW; or<br>3. Covered within 24 hours of the end of the shift that the waste was unloaded with a commercial fixative to prevent wind dispersal and leachate generation, applied in accordance with the manufacturer's instructions; or<br>4. The following PCB wastes do not require cover to prevent wind dispersal:<br>a. Drained equipment;<br>b. Large objects with inaccessible PCB contamination; or<br>c. PCB bulk product waste (as defined in 40 CFR 761.62(b)(1)(i)) with a bulk density greater than 70 pounds per cubic foot.<br>When cover is required, maintain documentation of the date and shift that PCB and DAW were placed in in-cell bulk disposal and of the date and shift that cover was applied. | | |
| The volume of in-cell bulk disposal plus the volume of waste stored at the LLRW container storage pads (e.g. LLRW bulk storage pad, LLRW container storage pad, etc.) shall not exceed the volume allowed in the trust agreement. | | |
| | | Verify that inspections for frozen material are being conducted during cold weather and that any corrective actions (if required) are properly documented. |
| **COLD WEATHER PLACEMENT**<br><br>**FROZEN MATERIAL:** No frozen material shall be disposed directly on or within 24 inches of the clay liner. Frozen material is defined as material which cannot meet the compaction requirements because of frozen water mixed within the material. | During cold weather, inspect material to be disposed directly on the clay liner. Do not allow frozen material to be disposed on the clay liner. Record corrections on the "Daily Construction Report". | |
| **PLACEMENT OF WASTE DURING COLD** | 1. For soil lifts: | 1. For soil lifts: |

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| **WEATHER:** Waste material shall only be placed when the required moisture and compaction can be met. | a) On November 1, decrease density and moisture lot size to 750 cubic yards (compacted).<br>b) On December 1, and continuing to March 1, decrease density and moisture lot size to 500 cubic yards (compacted).<br>c) Stop placement of waste on a lift when two consecutive tests fail compaction requirements due to frozen material. The first "unapproved" lift is classified as in-cell bulk disposal.<br>d) When temperatures are high enough to place the in-cell bulk disposal material, place the material in accordance with lift thickness and compaction requirements specified for waste lifts above.<br><br>a) If more than 2 feet of waste was stored as in-cell bulk disposal, excavate to a maximum of 12 inches above the last approved waste lift. Test and approve this in accordance with lift thickness and compaction requirements given above.<br>b) If less than 2 feet of in-cell bulk waste was disposed over the last approved lift, excavate to the top of the last approved lift and re-test this lift in accordance with lift thickness and compaction requirements specified above. | Verify that the testing frequency is increased at the beginning of November, and December. Verify that work stops on a lift after the failure of two consecutive compaction test and that the lift is surveyed before the placement of in-cell bulk disposal. |
| For CLSM pours:<br><br>a) Do not pour CLSM on a frozen soil base. | 2. For CLSM pours:<br><br>a) If the CLSM is to be poured on a soil base, perform a soil density test on adjacent material prior to the pour to determine if the underlying soil is frozen. If the soil is found to be frozen do not allow placement of material. | 2. For CLSM pours:<br><br>a) Review documentation of soil base testing verify that CLSM is not to be poured on a frozen soil base. During freezing conditions, verify that QC personnel have performed initial sampling and testing of the CLSM to ensure flowability ensured that the CLSM |

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| | | has been covered with concrete blankets or tented and heated, where required. Verify that QC personnel have periodically checked the temperature of the CLSM and recorded the results on the "CLSM Inspection and Testing Form". |
| b) If the ambient air temperature is forecast to drop below 5°F anytime during the CLSM pour, CLSM shall not be poured. When the ambient or expected air temperature will fall below 35°F anytime during the CLSM pour, the CLSM shall be sampled and an initial screening test performed as outlined under CLSM Design Specifications above. This initial sample may be used to prompt an adjustment of the load water content or temperature, modify the pour techniques, motivate rescheduling of the pour event, etc., but should not be considered acceptance sampling and testing. Acceptance sampling and testing should be obtained in accordance with ASTM D5971 (Sampling Freshly Mixed CLSM). | b) When the ambient or expected air temperature will fall below 35°F anytime during the CLSM pour, perform an initial screening test of the CLSM immediately before pouring to ensure that it meets the flowability criteria. This screening test includes either a Flow Consistency Test (ASTM D6103) or Efflux test (procedure given in Appendix A), as well as a unit weight test (ASTM D6023). The result from this initial screening test shall indicate whether or not any adjustments need to be made at the batch plant to ensure loads meet design specifications.<br>1) If adjustments are made to the load to produce a product that passes the testing requirements, perform initial screening testing on the subsequent two loads to verify that batch plant adjustments are sufficient.<br>2) CLSM pouring shall only be authorized to proceed upon verification that the initial load (and subsequent two loads if the initial load failed) meets mix specifications.<br>Perform acceptance sampling and testing from near the center of the load.<br>a. Accept loads which meet specification.<br>b. For loads with unsatisfactory results, accept the first part of the load and reject the remainder, or modify the load and/or pour techniques and retest. Record the results on the "CLSM Inspection and Testing" forms. | b) Review documentation of screening tests to ensure that CLSM met flowability specifications during cold weather. |
| c. Unless the ambient air temperature is at least 35°F | c) When the ambient air temperature decreases to | c) Review documentation of CLSM temperature |

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| and rising, measures must be taken to ensure the CLSM temperature does not fall below 40°F. To ensure this occurs and therefore the CLSM can adequately cure prior to exposure to freezing temperatures, the following should occur: Limit the pour to a surface area of no more than 4,800 $ft^2$. Heat the CLSM prior to pouring (as possible). Cover, or tent and heat, the CLSM directly following pouring (i.e. - pour one truck load, cover or tent the in-place material, then pour the next truck load). Following completion of the pour, cover the CLSM with concrete blankets, or tent and heat the CLSM. Likewise, if following placement, the ambient air temperature decreases below 35°F, or is anticipated to decrease below 35°F anytime in the 24 hours following placement, the CLSM must be covered with concrete blankets, or tented and heated. | below 35°F, ensure the CLSM temperature does not fall below 40°F. Measure and record the temperature of each CLSM load prior to introduction to the cell. Ensure the freshly poured CLSM is covered or tented and heated in a timely manner. Measure and record the temperature of the in-place CLSM every two hours during pouring, at the end of the work shift and at the beginning of the next work shift. Temperature results of pour temperatures shall be recorded on the "CLSM Inspection and Testing" forms. If, following placement, the ambient air temperature decreases below 35°F, or is anticipated to decrease below 35°F anytime in the 24 hours following placement of the CLSM, verify that concrete blankets or tenting and heating has been employed to ensure the CLSM is maintained greater than 40°F. Record the results of the inspection on the "CLSM Inspection and Testing" forms. | measurements and actions taken for cold weather pouring to verify that CLSM temperatures meet specifications. |
| **SNOW REMOVAL:** When waste material is to be placed and the work area is covered with snow and/or ice, the snow and/or ice must be removed so that no more than ¼ inch remains on the surface. Isolated individual clumps of snow and/or ice may be present, but shall be no larger than 2 inches in diameter. | Observe that snow is removed. Advise the project manager of deficiencies. Construction may not continue without corrective action. Record corrective action (where required) in the "Daily Construction Report". | Verify that snow removal is being performed and documented. |
| **FINAL GRADING BEFORE TEMPORARY COVER PLACEMENT:** Top of waste elevations shall be at grade or below grade. Also, special attention shall be taken to emphasize complete and thorough void filling around and within any debris in the final waste lift.<br><br>If the last lift of waste was built to work element – Waste Placement (as opposed to work element – Waste Placement with Compactor), then a proof roll of the top of waste surface shall be performed. | Survey the top lift of waste on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC and Construction QA Officers.<br>a. Indicate where the waste meets design line and grade.<br>b. Rework and resurvey areas not meeting the specified grade.<br><br>Observe the proof roll and document on the "Daily Construction Report". Advise the project manager of any "soft spots" or other areas of concern. | Review the final survey data. Verify the frequency of the survey points. |

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| A visual inspection shall be performed of the top of waste surface. Any incompressible debris protruding greater than 0.1 foot above the surface shall be compacted into the lift or removed. | Perform the visual inspection. Advise the project manager of any deficiencies. Document inspection results on the "Daily Construction Report". | |
| **DRC APPROVAL:** The DRC shall approve the final grade before temporary cover placement. 48 hour notification shall be provided to the DRC prior to placement of temporary cover material over the finished final grade surface. Energy*Solutions* may proceed with temporary cover placement 48 hours after DRC notification if the DRC has not inspected and has not notified the Director of Engineering of its intent to inspect the final grade surface. | Notify the Construction QA Officer that the final grade surface is ready for DRC inspection. Obtain written authorization from the Construction QA Officer that the final grade surface has been inspected. Obtain documentation confirming the DRC inspection and approval. | Provide written approval of the final grade surface. Notify DRC that the final grade surface is ready for inspection. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A and Class A North~~ embankment~~s~~. | | |
| **NOTICE OF TEST PAD CONSTRUCTION:** The test pad plan shall be approved by the DRC prior to the test pad construction. The DRC shall be notified 48 hours in advance of the start-up of test pad construction. | Obtain documentation confirming that the test pad plan has been approved by the DRC. Notify the DRC 48-hours in advance of test pad construction. | Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required. |
| **CONTAINERIZED WASTE PLACEMENT TEST PAD:** A test pad with a minimum area of 400 $ft^2$ will be constructed using the procedure (container or large component type, container configuration, backfill material properties, placement and compaction methods) proposed for construction of the waste lifts. The test pad shall be representative of anticipated field placement conditions and of dimensions suitable to the equipment to be used for production. The minimum area of the test pad may be reduced with DRC concurrence with the test pad plan. | Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Daily Construction Report". | Daily, observe the construction of the test pads. The Quality Assurance review for test pad specifications shall cover each specification in this work element. Review 100% of the QC documentation to verify that the tests were performed and documented correctly. |
| Prior to implementation, within the Containerized Waste Facility, of a containerized waste configuration that has not been previously approved, a waste placement test pad shall be constructed utilizing the proposed containerized waste configuration. | | |
| Test pads are to be constructed and tested in accordance with the following specifications: | | |
| 1. Construct the proposed configuration of containerized waste in the test pad area. | Document the constructed configuration of containers in the test pad on the “Daily Construction Report.” | Perform a minimum of one (1) QA visual inspection of the resulting waste form per test pad. |
| 2. At least one Proctor (or relative density) and classification test shall be conducted on the backfill material for each test pad. | Conduct the required proctor (or relative density) and classification (PL, LL, and gradation) tests. | |

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| 3. Backfill shall be placed over and between the waste packages in a manner that encourages flow into void spaces. The backfill is to be placed and compacted by equipment and methods proposed for use during construction of the waste lifts. Other equivalent equipment may be used for placement or compaction of backfill with approval from the Director of Engineering and DRC. | Record type of equipment used, and number of passes on the "Daily Construction Report". Verify DRC approval has been received for equivalent equipment when used. | |
| 4. The backfill surrounding the containers shall achieve an average density of at least 85% standard proctor or 55-percent relative density for drum configurations, or an average density of at least 80-percent standard proctor or 50-percent relative density around B-12 or B-25 boxes, HICs, cask liners, large components, or container overpack configurations. The completed test pad shall have no greater than 1% external void space by volume of the entire test pad. | Conduct direct or indirect in-place moisture-density tests at a rate of at least four tests per test pad. The test location shall be chosen to verify backfill compaction throughout the test pad. Record the test result on the "Field Density Test" form. Inspect the constructed test pad for void spaces surrounding the containers. Observe destructive testing of the test pad and measure external void spaces found in the backfill in accordance with the "Containerized Waste Facility Waste Placement Test Pad Destructive Testing" method in Appendix B.<br>a. Approve test pads which meet the specified compaction, and minimize void space conditions.<br>b. Rework and retest test pads not meeting the specified moisture or compaction or minimize void space conditions. Document all rework that was performed.<br>c. Where rework and retesting is impractical, reject the test pad procedure. | |
| 5. The procedures used to construct the test pad (container type, container configuration/orientation, backfill material properties, placement and compaction methods) shall be reviewed and approved by the Director of Engineering. The test must be approved by a Professional Engineer. | Provide the Director of Engineering with copies of the documentation for the test pad for review and approval. | |
| 6. The procedures used to construct the test pad shall | Obtain documentation confirming DRC approval of the | Verify that proper approval has been obtained for the |

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| be reviewed and approved by the DRC prior to using the new test pad construction method. | test pad. | test pad and that the necessary construction procedure documents are in place for use during backfill construction. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A and Class A North~~ embankment~~s~~. | | |
| **LIFT IDENTIFICATION:** Each lift shall be given a discrete designation for testing and surveying purposes. | Assign a lift identification number to each lift. Use the lift identification number to identify all paperwork for that lift. Summarize all lifts on the lift summary form. | The Quality Assurance review for waste placement specifications shall cover each specification in this work element. Review a minimum of 50.0% of the QC documentation to verify that the tests were performed and documented correctly. |
| **LIFT ACCEPTANCE:** At the time of acceptance, the date and time of lift approval shall be recorded. | The QC technician shall record the date and time of lift approval on the CWF Lift Approval Form | |
| **DEFINITIONS:** For the purpose of this CQA/QC project plan, the following terms are defined: | No action required. | No action required. |
| Backfill is defined as poorly graded type SP or well graded type SW sand with a minimum of 95% passing the #4 sieve, a minimum of 35% passing the #30 sieve, and less than 5% passing the #200 sieve. The maximum moisture content for backfill shall be less than or equal to 4.1% at the time of backfill placement. This specification may be modified following successful completion and DRC approval of a test pad. | | |
| Backfill cover is defined as a minimum of one foot of soil placed over containerized waste packages after backfilling is complete. In the case of standard liners and large liners, the placement sequence is: (1) backfill between the waste forms; (2) intermediate sand; (3) backfill cover. | | |
| Containerized waste is defined as any containers of Certified Containerized Waste in accordance with applicable requirements of the Waste Characterization Plan. Certified Containerized Waste is defined as monolithic units in the form of the following filled containers. | | |

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| 1. Any DOT "Strong, Tight" Containers up to 5 feet tall<br>2. Standard Liners are High Integrity Containers (HICs) or other cylindrical packages up to 6.65 feet tall (up to 215 cubic feet external volume)<br>3. Large Liners are HICs or other packages between 6.65 and 9 feet tall (between 215 and 331 cubic feet external volume)<br>4. Other Large Components and oversized DOT containers (larger than 331 cubic feet)<br><br>Containerized Waste Facility (CWF) pyramid is limited to a maximum of two lifts of containerized waste. Containers up to 5 feet tall are limited to a single lift at the pyramid base. Containers greater than 5 feet tall are limited to two lifts. The volume of the embankment above and surrounding the pyramid shall be filled with bulk waste lifts placed in accordance with the Bulk Waste Placement Work Element of this plan.<br><br>Intermediate sand is defined as a minimum of 2 feet of sand meeting gradation specifications for backfill, placed above the top of caissons used for placement of cylindrical containers greater than 5 feet tall. In the case of containers placed using removable steel forms, intermediate sand shall be placed to an elevation at least 9 feet above the base of the container for standard liners and 11.5 feet above the base of the container for large liners.<br><br>Lift is defined as containerized waste packages, backfill between packages, intermediate sand (when applicable), and the backfill cover layer. A containerized waste placement lift may contain one layer of containers or more than one stacked layer of containers, depending on the container type and height.<br><br>Removable Steel Form is a circular steel form used to | | |

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| ensure the spacing of standard or large liners. Removable steel forms are placed in an approved disposal configuration (hexagonal for example) prior to placement of liners. Removable steel forms can be used in either the first lift or second lift in place of caissons. All removable steel forms shall be pulled after liner placement and before backfill. | | |
| **CONTAINERIZED WASTE PLACEMENT:** 1) All containers shall be placed in accordance with an approved container placement method. Containers shall be placed in a configuration that has been approved through the successful completion of a waste placement test pad. Figures 7 and 8 illustrate approved waste placement configurations. A minimum 6-inch layer of loose sand shall be placed prior to placement of containers. Containers shall be worked into this loose sand to minimize any voids underneath the containers. Containers shall be placed with a minimum distance as specified by individual container type below. Backfill shall be placed over and between the containers in accordance with the approved container placement method for the type of container being placed. The containerized waste placement backfill soil properties shall be tested once per 2,500 square feet of placement area or once per lift. | 1) Verify through observation and document that the appropriate container placement method and spacing is followed for the type of container stacking in each lift.<br><br>Perform at least one moisture content and classification (PL, LL, and gradation) test per 2,500 square feet of placement area, or change in backfill material type, or change in borrow source.<br><br>Conduct an inspection of the container placement configuration prior to commencement of backfill placement. This inspection shall document that an approved configuration has been utilized for the container types present.<br><br>Observe placement and compaction of the backfill to ensure that type of equipment, equipment load (if applicable), and number of passes meet the specifications approved by the containerized waste placement test pad. Record type of equipment used, equipment load (if applicable), and number of passes on the CWF Lift Approval Form. | 1) Review the QC documentation to confirm that the appropriate container placement and backfilling method has been used and properly documented. |
| 2) Standard Liners shall be placed as follows. Spacing and backfill of standard liners may be facilitated by the use of concrete caissons or removable steel forms; use of caissons or removable steel forms is not required. Caissons or other forms shall not exceed 7 feet tall. When used, removable steel forms shall be removed prior to backfill. Caissons shall not be removed without prior | 2) Verify through observation and document on the CWF Lift Approval Form that standard liners are placed with the appropriate container placement method and spacing.<br><br>Conduct in-place density tests at the surface of the intermediate sand layer at a rate of one test per lot and | |

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| DRC notification. Backfill shall be placed to a minimum height of 7 feet above the container base elevation by dropping from the bucket of a front-end loader or equivalent around and above the container (whether in a caisson or not). Backfill shall achieve a minimum density of at least 80% of a standard Proctor, as demonstrated by the approved test pad(s). The backfill layer shall be covered by an intermediate sand layer to a minimum depth of 2 feet above the top of the caisson (9 feet above the container base elevation). Intermediate sand shall achieve a minimum density of 85% of a standard Proctor. The backfill cover layer is then placed above the intermediate sand layer. Caissons shall be placed in a hexagonal or other approved (through a test pad) configuration, such as rectangular, that meets the following criteria. Caissons with an outer diameter of 100 inches shall be placed a minimum of 4 inches apart. If no caisson is used, or if a caisson or other form of smaller outer diameter is used, the container shall be placed as if the 100-inch diameter caisson were there for spacing purposes; i.e., within a minimum area of 108-inch diameter centered around the container, no other caisson or container shall intrude. | record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers. Approve lots when:<br>a. Material is observed to be properly compacted throughout the lot;<br>b. Density tests performed meet compaction specifications.<br><br>Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Site Engineer. For each lift larger than 50’ x 50’, survey the corners and at least one spot in the middle. For lifts less than 50’ x 50’, a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50’ x 50’ may be segmented to areas 50’ x 50’ or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand. Thickness measurements of the compacted intermediate sand will be documented and forwarded to the Construction QC Officer.<br>a. Approve lifts with an average compacted intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness.<br>b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness. | |
| 3) Unusually shaped containers shall be placed and backfilled in a manner that allows void spaces to be filled. In no case shall unusually shaped containers be placed such that a significant amount of external void space cannot be filled. A significant amount of external void space for unusually shaped containers is 5 percent of | 3) Verify through observation and document that the unusual containers are placed such that all significant voids can be filled. | |

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| the volume of the unusually shaped containers in the lift, unless otherwise approved by the Division. | | |
| 4) Large components and oversized DOT containers shall be placed and backfilled such that void spaces are filled and the bearing capacity of the embankment is not exceeded. | 4) Verify through observation and document that the large components and oversized DOT containers are placed in accordance with an approved large component placement method. | |
| 5) Large Liners shall be placed as follows. Spacing and backfill of large liners may be facilitated by the use of concrete caissons or removable steel forms; use of caissons or removable steel forms is not required. Caissons or other forms shall not exceed 9.5 feet tall. When used, removable steel forms shall be removed prior to backfill. Caissons shall not be removed without prior DRC notification. Backfill shall be placed to a minimum height of 9.5 feet above the container base elevation by dropping from the bucket of a front-end loader or equivalent around and above the container (whether in a caisson or not). Backfill shall achieve a minimum density of at least 80% of a standard Proctor, as demonstrated by the approved test pad(s). The backfill layer shall be covered by an intermediate sand layer to a minimum depth of 2 feet above the top of the caisson (11.5 feet above the container base elevation). Intermediate sand shall achieve a minimum density of at least 85% of a standard Proctor. The backfill cover layer is then placed above the intermediate sand layer. Caissons shall be placed in a hexagonal or other approved (through a test pad) configuration, such as rectangular, that meets the following criteria. Caissons with an outer diameter of 114 inches shall be placed a minimum of 5 inches apart and no more than 11 inches apart (at the nearest point between two adjacent caissons). If no caisson is used, or if a caisson or other form of smaller outer diameter is used, the container shall be placed as if the 114-inch diameter caisson were there for spacing purposes; i.e., | 5) Verify through observation and document that large liners are placed with an approved container placement method and spacing.<br><br>Conduct in-place density tests at the surface of the intermediate sand layer at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers. Approve lots when:<br>a. Material is observed to be properly compacted throughout the lot;<br>b. Density tests performed meet compaction specifications.<br><br>Verify the mean elevation of the top of each intermediate sand lift by installing grade poles, or other methods approved by the Site Engineer. For each lift larger than 50’ x 50’, survey the corners and at least one spot located near the center. For lifts less than 50’ x 50’, a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50’ x 50’ may be segmented to areas 50’ x 50’ or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness of the intermediate sand material shall be verified as part of the test pad for intermediate sand. Thickness measurements of the compacted intermediate sand will be documented and forwarded to the | |

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| within a minimum area of 124-inch diameter centered around the container, no other caisson or container shall intrude and adjacent caissons shall be within a maximum area of 136-inch diameter. | Construction QC Officer.<br>a. Approve lifts with an average compacted intermediate sand thickness greater than or equal to the specified compacted intermediate sand thickness.<br>b. Add intermediate sand and retest lots with an average compacted intermediate sand lift thickness less than the specified compacted intermediate sand lift thickness. | |
| 6) Large Liners shall meet the following void space criteria: void spaces within the waste and between the waste and its packaging shall be reduced to the extent practicable, but in no case shall less than 90 percent of the capacity of the container be filled. | 6) For large liners, document that the void space criteria is met. | |
| 7) Drums shall be placed horizontally at least 1 inch apart in a single layer. There shall be no continuous contact between drums. Forklifts may be used for drum placement provided that protective measures are taken to prevent damage to the drums. The forklift tines shall not come into direct contact with the drums. Sand shall be compacted to an average standard proctor density of 85% with a minimum of a single pass of a hoe mounted vibratory compactor or its equivalent, prior to placement of the next layer of drums. For purposes of this specification, the “Standard I-13 Liner” and “NUHIC-55 liners” may be placed as a drum. | 7) Document that drums have been placed as required. Document equipment used and number of passes. | |
| 8) When backfilling between standard or large caissons placed in a hexagonal pattern, the following controls apply as demonstrated in the “Test Pad Report for the Containerized Waste Facility Tri-Arc Test Pad Plan, Revised Plan” dated September 18, 2007. The loader or other equipment shall have a bucket of at least 25 cubic foot capacity and the bucket shall be totally filled. Dump the backfill sand from a height of approximately 2 feet above the top of the caisson (measured from the lower lip of the bucket to the top of the caisson). | | |

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| 9) If placing ion-exchange resins in containers other than standard liners or large liners, ensure that each 50' x 50' lift area contains no more than 25% resins by volume. Increase spacing of resin containers as needed to maintain this criteria. | 8) Document that the bucket used to place backfill sand meets or exceeds the minimum capacity. Observe sand dumping operations for compliance with the specification. Document on the Daily Construction Report. | |
| | 9) Calculate the ratio of resins to other material (soil, non-resin wastes) in the lift based on manifested resin volume and actual lift dimensions. Nominal container capacity may be used instead of manifested volume. Resin volume divided by total volume x 100 = resin percentage. Document on the CWF Lift Approval Form. | |
| **PYRAMID CONTROLS:** Refer also to Figure 7. Containerized Waste Facility (CWF) Pyramid: 1) Containerized waste lifts shall form a pyramid with a maximum 3H:1V outside edge slope. The slope shall be measured to the top of the backfill cover above containers in the lift. 2) Drums and boxes less than 5 feet tall are limited to a single lift on the lower layer of the CWF pyramid. Standard and large liners are limited to two lifts. 3) The pyramid base dimensions and maximum 3H:1V side slope requirements will control the location of the second lift of containers. 4) Adjacent pyramids shall not be placed above a previous CWF pyramid. 5) CLSM pyramids for bulk waste shall not be placed above a previous CWF pyramid. 6) CLSM may be used for fill within the initial lift of the container pyramid. 7) The first liner placed in a second lift using this method shall be | Determine the location of the northwest corner and the dimensions of each lift and document on the CWF Lift Approval Form. Use the lift location and dimensions to ensure compliance with the containerized waste facility pyramid specification. As each lift of backfill cover is placed, survey and document that the corners of the lift meet the 3H:1V slope. If applicable, document the dimensions of the previous containerized waste facility lift on the CWF Lift Approval Form. In locating a new pyramid, document on the CWF Lift Approval Form:<br>a) The pyramid base is placed on the liner protective cover; or<br>b) The pyramid base does not encroach the vertical limits of a previous pyramid.<br><br>Prior to positioning the first liner in a second lift, | Verify compliance with the containerized waste facility pyramid specification and proper documentation of the QC requirements. |

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| offset from liners in the lower lift. 8) Large Liners placed in the upper lift of the Containerized Waste Facility shall be placed at least 75 feet from the outer perimeter of the lower lift. | document the location of containers in the first lift. Ensure that the first liner placed in the second lift is offset so that it is not directly above any single liner in the lower lift. Document that large liners placed in the upper lift meet the setback criteria. | |
| **CLSM USE AS FILL:** CLSM use as fill within the initial lift of the container pyramid shall comply with specifications "DRC Notification for CLSM Pours" and "Portland Cement or Fly Ash CLSM Design Specifications" under Work Element – Waste Placement above. However, CLSM used as fill at the Containerized Waste Facility is not required to meet the compressive strength requirements referenced above.<br><br>CLSM may be used for fill with up to two, 5-drum pallets stacked inside a standard or large caisson. CLSM may also be used for fill with other waste containers that fit inside a standard or large caisson. The entire caisson height may be filled in a single CLSM pour.<br><br>CLSM may also be used for fill around drums and boxes less than 5 feet tall around the perimeter of the CWF pyramid, so long as the 3H:1V pyramid slope is maintained. Drums placed in this manner may be oriented vertically. | Document DRC notification and CLSM mix inspections and approval in accordance with the referenced specifications. | |
| **BACKFILL COVER:** After backfilling of voids between containers is complete and intermediate sand is placed (as needed), each lift of containerized waste shall be covered by at least one foot of compacted backfill cover material. | 1. For containerized waste lifts:<br><br>Verify the mean elevation of the top of each backfill cover lift by installing grade poles, or other methods approved by the Site Engineer. For each lift larger than 50' x 50', survey the corners and at least one spot in the middle. For lifts less than 50' x 50', a minimum of four grade poles, one in each direction, shall be used. Lifts larger than 50' x 50' may be segmented to areas 50' x 50' or less and elevation verified with the use of grade poles. The use of grade poles to verify the compacted thickness | Review the QC documentation. |

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| | of the backfill cover material shall be verified as part of the test pad for backfill cover. Thickness measurements of the compacted backfill cover will be documented and forwarded to the Construction QC Officer.<br>a. Approve lifts with an average compacted backfill cover thickness greater than or equal to the specified compacted backfill cover thickness.<br>b. Add backfill and retest lots with an average compacted backfill cover lift thickness less than the specified compacted backfill cover lift thickness. | |
| Backfill cover for each lift shall achieve a density of at least 95 percent of a standard Proctor. | Conduct in-place density tests at the surface of the backfill cover at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 10,000 square feet of a single lift. At least two tests will be performed per lift. The test location shall be chosen on the basis of random numbers. Approve lots when:<br>a. Material is observed to be properly compacted throughout the lot;<br>b. Density tests performed meet compaction specifications.<br>Perform a laboratory classification test on the backfill cover material at a rate of one test per 3,000 cubic yards (compacted), or change in backfill cover material type, or change in borrow source. The sample for this test will be taken from the backfill cover stockpile. | |
| **SET BACK OF WASTE:** Maintain a distance of at least 10 feet between the inside toe of the runoff berm and the outside toe of the waste containers. | Initial waste set back approval shall measure the set back distance around the edge of the runoff berm at 100 foot intervals. Record the inspection of the setback on the "Daily Construction Report".<br><br>Inspect the waste setback on a monthly basis. Record findings on the “Daily Construction Report”.<br><br>Require removal of any waste necessary to maintain the | Review the QC documentation to confirm that the monthly inspections have been performed and properly documented. |

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| | required set back. | |
| **SNOW REMOVAL:** When waste material is to be placed and the work area is covered with snow, the snow must be removed. | Observe that snow is removed. Advise the project manager of deficiencies. Construction may not continue without corrective action. Record corrective action (where required) in the "Daily Construction Report". | Review the QC documentation to verify that snow removal is being performed and documented. |
| **Cold Weather Placement of Backfill:** The following requirements apply to placement of flowable sand backfill when the ambient air temperature is below 32 degrees Fahrenheit:<br>a. Backfill with frozen clods shall not be accepted for placement.<br>b. The backfill stockpile shall be worked using heavy equipment prior to use.<br>c. The minimum average spread diameter for the flowability tests shall be 8.75”.<br>d. If backfill is observed to have frozen clods or does not meet the flowability specification, the backfill stockpile may be re-worked. Each inspection and test shall be repeated for re-worked material. | When the ambient air temperature falls below 32 degrees Fahrenheit:<br>a. Inspect the backfill stockpile to be used that day for any visible frozen clods.<br>b. Observe working of the backfill stockpile.<br>c. Perform a flowability test (ASTM D6103) on material from the backfill stockpile:<br>1) Collect a minimum of three representative samples from the backfill stockpile.<br>2) Test each sample using ASTM D6103.<br>d. Record these actions and test results on the “Daily Construction Report.” | Verify that the backfill stockpile is inspected, worked, and tested during cold weather conditions. |
| **FINAL GRADING:** Top of waste elevations shall be at grade or below grade. | Survey the top lift of waste on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the Director of Engineering and Construction QA Officer.<br>a. Indicate where the waste meets design line and grade.<br>b. Rework and resurvey areas not meeting the specified grade. | Review the final survey data. Verify the frequency of the survey points. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A and Class A North~~ embankment~~s~~. | | |
| **DEFINITION:** Interim rad cover is non-waste soil used to comply with the "uncovered radioactive waste" limit at Radioactive Material License UT 2300249, Condition 11. This material was formerly referred to as "temporary cover" or "interim temporary cover". Waste in closed containers may be stored on interim rad cover. If bulk waste is placed or stockpiled on interim rad cover, the affected area shall no longer be considered to have interim rad cover on it.<br><br>The following areas do not count against the "uncovered radioactive waste" limit at RML Condition 11 and do not require interim rad cover to be placed over them:<br>1. Containerized Waste Facility<br>2. Large Component disposal areas<br>3. CLSM pour areas that have been poured and covered. *Note: Areas where debris has been staged or formed for CLSM, but have not yet been poured and covered, shall be counted against the "uncovered radioactive waste" limit.* | | |
| **INTERIM RAD COVER MATERIAL:** Interim rad cover shall be native soil that is free of debris material. ~~This work element shall have an effective date one year following DRC approval of its inclusion in the LLRW and 11e.(2) CQA/QC Manual.~~ | Visually inspect interim rad cover soil and document on the Daily Construction Report. | |
| **INTERIM RAD COVER PLACEMENT:** Interim rad cover shall be a minimum of 6 inches thick in order for an area to be removed from the "uncovered radioactive waste" inventory. Thickness shall be evaluated through use of grade poles or survey. Contaminated equipment may be used to place interim rad cover. | Survey at least the perimeter of the area covered and document. Document thickness of cover on the Daily Construction Report. | Periodically observe lift approval documentation. |

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| A commercial fixative product (i.e., polymer), magnesium chloride, or non-contact water may be applied, in accordance with the manufacturer's instructions, to the surface of the interim rad cover to aid in dust control and erosion prevention. Erosion control blankets, mats, or fiber mulch may also be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. | | |
| **OPERATIONAL CONTROLS:** Interim rad cover shall be fenced, roped, or otherwise marked to identify as distinct from active waste placement areas. Traffic across interim rad cover shall be minimized. Haul roads are prohibited on interim rad cover. | | |
| **INSPECTIONS:** Monthly, inspect interim rad cover for the presence of erosion gullies. If the inspection indicates that waste material is exposed due to erosion, the interim rad cover shall be repaired in that area within 7 calendar days. | Perform monthly inspections and document on the Daily Construction Report. | |
| **SURVEYS:** Quarterly, perform an elevation survey on interim rad cover that is within 2 feet of the design top of debris waste elevation. Surveys shall be performed at the temporary and final settlement monument locations provided in Figure~~s~~ 2~~ and 6~~, within an 18-inch radius of the design monument location. | Perform quarterly surveys and document. | |
| **REMOVAL:** Interim rad cover may be removed. Soils used as interim rad cover may be used as fill for debris wastes. If used, erosion control blankets, mats, or fiber mulch may be left in place or removed, but either way must be placed and compacted as waste. | | |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. Because there is no open cell time limit for the 11e.(2) embankment, time limits within this specification do not apply there. | | |
| **TEMPORARY COVER MATERIAL:** Temporary cover shall be native CL or ML soils that are free of debris material. This material provides an adequate thickness of material free of debris to protect the overlying radon barrier. | Perform laboratory classification tests at a rate of 1 test per lot prior to use of material. A lot is defined as a maximum of 6000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".<br>a. Approve lots which meet the specified classification for use.<br>b. Lots not meeting the specified classification can not be used. | |
| **TEMPORARY COVER PLACEMENT:** Temporary cover shall be placed within 15 years of the date of initial waste placement on each lift area, and within 90 days of any survey that determines top of waste elevations and grades for each lot. Top of waste elevations and grades are defined as those found on the approved engineering design drawings authorized under the license. DRC shall be notified in writing at least 48 hours in advance of the start-up of temporary cover placement.<br><br>A side slope exemption is limited to the 90 calendar day requirement for temporary cover placement, which does not apply to side slope areas immediately adjacent to top slope lifts that have not reached the top of waste elevations. Once the adjacent top slope area has reached the top of waste elevation all top slope and adjacent side slope areas shall have temporary cover placed within 90 calendar days. | Visually inspect temporary cover soil and verify that it is free of debris. Record results on the Lift Approval Form. Provide DRC notification. Document lift area, location, thickness, and compaction on the Lift Approval Form. | Periodically observe lift approval documentation. |

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| Temporary cover shall be a minimum of 1 foot thick. Temporary cover may be over-built in order to achieve this thickness. Temporary cover shall be placed in accordance with the lift thickness and compaction requirements specified under Work Element – Waste Placement, above. Contaminated equipment may be used to place temporary cover. | | |
| The edge of the temporary cover shall be marked with fencing, rope, snow fence, or equivalent marking to prevent heavy equipment travel on the temporary cover surface. Haul routes may traverse temporary cover, provided that the haul route does not travel over any pre-final cover settlement monuments and that the haul route is marked with fencing, rope, snow fence, or equivalent markings. Temporary cover may encroach up to 5 feet into the offset for the run-off berm. | | |
| A commercial fixative product, magnesium chloride, or clean water may be applied to the surface of the temporary cover to aid in dust control and erosion prevention. Contaminated water shall not be used for dust suppression on temporary cover. Erosion control blankets, mats, or fiber mulch may also be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to radon barrier construction. | Provide DRC notification. Document application and removal of erosion control materials on the Daily Construction Report. | |

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| **PRE-FINAL COVER SETTLEMENT MONUMENTS:** Pre-final cover settlement monuments shall consist of approximately 18-inch long #5 or greater rebar that is welded to a metal plate. The metal plate shall be approximately 18 inches square with a thickness of 3/16 inch to 1/4 inch. The metal plate shall be placed on the top of waste surface and then secured by the temporary cover as it is placed. Each monument shall be labeled, flagged, and documented on a reference drawing. | Inspect pre-final cover settlement monuments for compliance with the specification prior to installation. | Perform a surveillance of monument installation activities. |
| **PRE-FINAL COVER SETTLEMENT MONUMENT PLACEMENT:** Pre-final cover settlement monuments shall be placed as close as practical to the locations of final cover settlement monuments identified in Figures 2~~,~~ and 4~~, and 6~~. In addition, pre-final cover settlement monuments shall be placed at the locations identified as "additional final temporary cover monuments" on Figures 2 and~~,~~ 4~~, and 6~~. | Perform and document a post-construction survey of the pre-final cover settlement monuments. | Verify that surveys have been performed. |
| **SURVEY REQUIREMENTS:** Surveys shall be performed with GPS or approved equivalent equipment. Tolerance shall be no more than ± 0.1 foot. | Calibrate and operate survey equipment in accordance with the manufacturer's recommendations. | |
| **SURVEY INTERVAL:** The pre-final cover settlement monuments shall be surveyed within 30 days of temporary cover installation. New monuments shall be surveyed again during the months of January, March, May, July, September, and November. After at least one year of data has been obtained for a monument, it shall be surveyed semi-annually during the months of May and November until final cover construction begins. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report. | Perform and document the required surveys. Provide survey data to the Director of Engineering. | Verify that monument surveys are completed as required. |

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| **INSPECTIONS:** Monthly, inspect temporary cover for the presence of erosion gullies. If the inspection indicates that waste material is exposed due to erosion, the temporary cover shall be repaired in that area within 7 calendar days. | Perform and document monthly inspections. | |
| Semi-annually, maintain the temporary cover surface. Maintenance shall consist of filling in any erosion gullies and, if necessary, re-grading to prevent ponding on the temporary cover. | Document semi-annual maintenance activities. Document any areas requiring filling or re-grading. | |
| **REPORTING:** Survey data for pre-final cover settlement monuments shall be compiled and analyzed to evaluate total and differential settlement. This data and analysis shall be submitted to DRC with the annual as-built report.<br><br>Review and analysis of settlement monitoring data will include the following:<br>• A drawing identifying the location of each point.<br>• Graphical or tabular presentation of the incremental settlement for each point (how much each point has moved since the last set of readings),<br>• Graphical or tabular presentation of the total settlement for each point,<br>• Graphical or tabular presentation of the time rate of settlement for each point (to include both the overall rate from the first data for the point, and the incremental rates for each period),<br>• Graphical or tabular presentation of the differential settlement for each point with respect to the nearest adjacent points, and<br>• A discussion about the general nature of the observed settlement, and any areas of the landfill that are behaving in an anomalous manner. | | |
| **TRANSITION TO FINAL COVER:** If distortion is less | The Director of Engineering shall evaluate pre-final cover | |

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| than 0.007 foot/foot for all of the grid points in a given area, and each grid point has at least one year's monitoring data; then final cover construction may proceed. Once an area is approved, final cover construction shall be completed within 3 years of this determination. | settlement data for each area of cover construction to determine distortion between all adjacent points in that area. If the criteria are met, a written report shall be prepared and forwarded to DRC at least 7 calendar days prior to removing the pre-final cover settlement monuments. | |
| The Director of Engineering shall perform the analysis of projected future distortions. The analysis shall be submitted no later than the end of the 16th year since waste placement began in the oldest lift area subject to analysis. | Inspect and document that all pre-final cover settlement monuments have been removed prior to final cover construction. | |
| If an area is not approved for final cover construction by the end of the 16th year of the 18-year open cell period, an analysis of projected future distortions shall be performed and submitted to DRC. The analysis shall evaluate settlement through the end of year 17 of the open-cell period, at a minimum. If the analysis indicates that the future distortions between any two adjacent points will be more than 0.007~~1~~ foot/foot, then surcharging over the area(s) in question will be required to stabilize settlement prior to final cover construction. If surcharging is required, a plan and schedule shall be provided to DRC by the end of the 16th year of the open-cell period. The surcharging schedule shall show that surcharging will be complete by the end of the 17th year of the open-cell period. Settlement monitoring frequency during surcharging shall be at least equivalent to that required in Year 16. | Survey and document the temporary cover surface to confirm that the top of waste design grades and elevations are achieved. Document lift thickness and compaction for any debris-free soil material placed to bring the temporary cover surface to the design top of waste grades and elevations. | Verify that pre-final cover settlement monuments have been removed and that the temporary cover surface meets design top of waste grades and elevations. |
| Immediately prior to placement of the first lift of radon barrier, the pre-final cover settlement monuments shall be removed and the temporary cover surface restored. | Provide DRC notification of pending temporary cover removal. Document lift area and location on a Daily Construction Report. | |
| Additional clean debris-free soil material shall be placed; or excess temporary cover material shall be cut, as needed | | Periodically observe paperwork for temporary cover removal. |

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| to return the area for final cover construction to the original top of waste design grades and elevations. When placing clean debris-free soil material for this purpose, the soil shall be placed in lifts with a compacted average thickness not exceeding 12" and compacted to 90% of a standard Proctor. If an area has settled more than 12", bulk waste may be placed in accordance with the applicable work elements and specifications of this manual, so long as at least 1 ft of temporary cover is in place prior to radon barrier construction.<br><br>DRC shall be notified at least 48 hours in advance of the start-up of temporary cover removal in previously placed areas. | | |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **CLEARING AND GRUBBING:** Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary. | Inspect the area once clearing and grubbing has been completed. Record observations and corrective action (where required) on the "Daily Construction Report". | Verify that the clearing and grubbing has been inspected by QC. |
| **MATERIAL--NATURAL CLAY MIXTURE:** Satisfactory material shall be defined as CL and ML soils based on the Unified Soil Classification with at least 85 percent passing the No. 200 sieve (silt and clay), a plasticity index (PI) between 10 and 25, and a liquid limit (LL) between 30 and 50. The clay shall also have a dry clod size less than or equal to 1 inch. | Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the radon barrier. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".<br>a. Approve lots (which meet the specified classification) for use in the radon barrier.<br>b. Lots not meeting the specified classification can not be used. | Verify the frequency of laboratory tests and compliance of test results. |
| **PROTECTION:** The borrow material will be handled in such manner as to prevent contamination with radioactive waste material or other deleterious material. The in-place material may contain up to 5 percent additional rocks and sand above the content found in the classification test. | Visually check radon barrier materials for contamination by foreign materials. Remove clays that have been contaminated above the specified requirements. Document corrective actions (where required) on the "Daily Construction Report". | Verify that the radon barrier is being inspected for contaminates and that corrective actions (if required) are properly documented. |
| **PROCESSING:** These procedures may be used to provide suitable material for construction of the radon barrier. | | |
| 1. Apply deflocculant at a rate determined by the production engineer. | Measure the mixing areas and verify that the application rate of the deflocculant is equal to or greater than the rate determined by the production engineer. Record the size of the mixing areas and the amount of deflocculant applied on the "Embankment | Verify that the size of the mixing areas and the amount of deflocculant applied have been properly documented. |

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| | Construction Lift Approval Form". | |
| 2. Mix the deflocculant thoroughly into the soils by tilling, or similar action. | Observe the mixed clay and advise the project manager of areas which are adequately mixed. | Verify that the clay is being inspected by QC. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **NOTICE OF TEST PAD CONSTRUCTION:** The test pad plan shall be approved by the DRC prior to test pad construction. The DRC shall be notified 48 hours in advance of the start-up of test pad construction. | Obtain documentation confirming that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required. | Verify that the test pad plan has been approved by the DRC. Verify that the DRC has been notified as required. |
| **TEST PAD:** An approximately 60 feet by 75 feet large test pad will be constructed using the procedure proposed for construction of the radon barrier when using heavy equipment for compaction. An approximately 5 feet by 5 feet small test pad will be constructed using the procedure proposed for construction of the radon barrier when using hand compaction equipment.<br><br>A new test pad shall be constructed each time there is a significant change in specifications, construction procedures, types of equipment, unified soil classification, QC testing equipment or procedure. A new test pad must be constructed each time there is a change in the grade or source of bentonite. | Observe the construction of test pads. Measure test pads to ensure that they are constructed to the size indicated. Record the test pad size on the "Embankment Construction Lift Approval Form".<br><br>The large test pad shall be divided into three lots per lift (approximately 1,500 square feet per lift). Each lift of the small test pad shall equal a lot. | Observe the construction of the test pads. Verify that the test pad has been measured and is properly documented. |
| Test pads are to be constructed and tested in accordance with the following specifications: | | |
| 1. Place the clay in at least three lifts with the first lift uncompacted thickness not exceeding twelve inches. Remaining lifts shall have a loose material thickness not exceeding nine inches for each lift. The clay material will be inspected for dry clod size during placement of each lift of radon barrier. | Measure the lift thickness at a rate of 1 test per lot. Record thickness on the "Embankment Construction Lift Approval Form".<br><br>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the dry clod size on the "Embankment Construction Lift | Verify that the number of lifts and lift thicknesses have been documented. Verify that the clod size inspection has been performed and documented for each uncompacted lift thickness. |

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| | Approval Form". | |
| 2. The clay is to be placed and compacted by equipment proposed for use during construction of the radon barrier. | Verify with the project manager that the same or similar type equipment and compaction efforts will be used in the cell for construction of the radon barrier. Record type of equipment used, and number of passes on the "Embankment Construction Lift Approval Form". | Verify equipment used and the number of passes made in preparing the test pad are those to be used during the construction of the radon barrier. |
| 3. The lifts of clay shall be bonded by:<br>a) Providing a rough upper surface on the underlying layer of radon barrier. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot;<br>**- OR –**<br>b) By compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness. | Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge.<br>**- OR -**<br>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness. | Verify the frequency of measurements and compliance of test results. |
| 4. The clay is to be compacted to at least 95 percent of a standard Proctor with a moisture content of optimum to 5 percent over optimum. Compaction of the large test pad is to be accomplished by at least four passes of suitable compaction equipment. | Conduct in-place moisture-density tests at a rate of one test per lot per lift. The test location shall be chosen on the basis of random numbers. Record the test result on the "Field Density Test" form.<br>a. Approve lots which meet the specified moisture and compaction.<br>b. Rework and retest lots not meeting the specified moisture or compaction.<br>c. Any additional work under b. shall be included in the test pad construction method | Verify the frequency of tests and compliance of test results. |
| 5. The clay is to be constructed to provide a permeability of less than or equal to the specified permeability as shown on the approved engineering drawings. Permeability testing on the bottom lift will be performed at the surface. Permeability on the second lift will be performed ≥ 2" below the surface. Permeability on the third lift will be performed ≥ 4" below the surface. | Conduct in-place permeability tests at a rate of one test per lot per lift. The permeability test shall be run in close proximity to the moisture-density test. Record the test result on the "Field Permeability Test" form.<br>a. Approve lots that meet the specified permeability. b. Rework and retest lots not meeting the specified permeability<br>c. Any additional work under b. shall be included in | Verify the frequency of tests and compliance of test results. |

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| | the test pad construction method | |
| 6. At least one PI, LL, and gradation tests shall be conducted for each test pad. | Conduct PI, LL, and gradation tests at a rate of one of each type of test per test pad. | Verify that the PI, LL, and gradation tests have been conducted and documented. |
| 7. The procedures used to construct the test pad shall be reviewed and approved by the certifying engineer. The test must be approved by a Professional Engineer. | Provide the certifying engineer with copies of the documentation for the test pad for review and approval. | Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during radon barrier construction. |
| 8. The procedures used to construct the test pad shall be reviewed and approved by the DRC prior to using the new test pad construction method. | Obtain documentation confirming the DRC approval of the test pad. | Verify that proper approval has been obtained for the test pad and that the necessary construction procedure documents are in place for use during radon barrier construction. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **NOTICE OF COVER CONSTRUCTION:** The DRC shall be notified of the cessation of waste placement and the start-up of cover construction for each phase of the "cut and cover" operation. | Verify that the DRC has been notified of the anticipated cessation of waste placement and the start-up of cover construction, prior to the placement of radon barrier. | Verify that the DRC has been notified of the anticipated cessation of waste placement and the start-up of cover construction, prior to the placement of radon barrier. |
| **PROJECT AREA:** Radon barrier projects shall have a minimum total area of 300,000 square feet, unless otherwise approved in advance, in writing by DRC. Radon barrier projects may continue over more than one construction season, so long as the specifications for cold weather placement and spring start-up are met. A radon barrier project may consist of any number of lift areas. | Document the radon barrier project area dimensions. | |
| **LIFT IDENTIFICATION:** Each lift shall be given a discrete designation for testing and surveying purposes. | Assign a lift identification number to each lift. Use the lift identification number to identify all paper work for that lift. | Verify that a lift identification number has been assigned to each lift. Verify that the lift identification number is used on all paper work for that lift. |
| **PLACEMENT:** The radon barrier will be prepared, placed and compacted using the same type of equipment and mixing and compacting procedures that were approved in the test pad. | Observe the radon barrier placement. Record the equipment used to place the radon barrier, along with any corrective actions (where required) on the "Daily Construction Report". | Verify the equipment used to construct the radon barrier has been documented and that it is the same type of equipment used to construct the test pad. |
| **LIFT BONDING:** The lifts of clay shall be bonded by:<br>1) Providing a rough upper surface on the underlying layer of radon barrier. The surface should have changes in grade of approximately one inch or more at a rate of two per linear foot;<br>**- OR -**<br>2) By compacting with a sheepsfoot with feet approximately two inches longer than the lift thickness. | Verify that there are adequate changes in grade by placing a straight edge at least two feet long on the surface. Count the number of points approximately one inch or more below the straight edge.<br>**- OR -**<br>Verify that the feet on the sheepsfoot compactor are approximately two inches longer than the lift thickness. | Verify the frequency of measurements and compliance of test results. |

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| **LIFT THICKNESS:** The first lift of material shall have an uncompacted thickness of no greater than 12 inches. For the remaining lifts, the loose lift thickness shall not exceed the lesser of the lift thickness used to construct the test pad or nine inches. Thickness for the lift will be established by installing grade poles on at least a 70-foot grid and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade for the lift has been checked and approved by QC personnel, the grade poles shall be removed. The clay material will be inspected for dry clod size during placement of each lift of radon barrier. | Verify that the required grading tolerance is achieved as follows:<br>a. Ensure that the required frequency for placement of grade poles has been met.<br>b. Compare soil level with the marked level on the grade poles.<br>c. Use a string line where necessary between poles to check for high or low spots.<br>d. Define out of specification areas and advise the project manager to rework those areas.<br>e. Review areas reworked and approve areas meeting criteria.<br>f. Continue "b" through "d" above until all areas meet criteria.<br>g. Indicate areas meeting criteria in the “Embankment Construction Lift Approval Form”.<br>**- OR -**<br>Dig a hole and measure the loose lift thickness at a rate of one per lot. A lot is defined as 10,000 square feet of a single lift and record on the "Lift Approval Form". The location of the measurement shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified lift thickness.<br>b. If the thickness is greater than the specified thickness, measure the thickness at four points (north, east, south, and west) within ten feet of the first measurement. Average the five measurements together.<br>c. Approve lifts with an average less than or equal to the specified lift thickness.<br>d. Rework and retest lots with an average lift thickness greater than the specified lift thickness.<br><br>Inspect the loose clay material during the unloading and spreading process for each uncompacted lift to ensure any dry clods that are present are less than or equal to one (1) inch. Record inspection of the clod size on the “Embankment Construction Lift Approval | Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. Verify that the clod size inspection has been performed and documented for each uncompacted lift. |

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| | Form". | |
| **KEYING-IN:** Segments of cell radon barrier constructed at times more than 30 days apart than each other shall be keyed-in to each other at vertical steps no greater than nine inches and at least twice as wide as they are high. | Verify that the new liner has been properly keyed-in to the existing liner. Record deficiencies on the "Embankment Construction Lift Approval Form". | Verify that the keying-in of the liner has been documented. |
| **COMPACTION:** Radon barrier material will be compacted to at least 95 percent of standard Proctor with a moisture content between optimum and 5 percent over optimum. | Conduct in-place moisture-density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of a single lift. The test location shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified moisture and compaction.<br>b. Rework and retest lots not meeting the specified moisture or compaction.<br><br>Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log". | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |
| **PERMEABILITY:** The radon barrier shall have an in-place permeability of less than or equal to $1 \times 10^{-6}$ cm/sec for the bottom layer. The radon barrier shall have an in-place permeability of less than or equal to $5 \times 10^{-8}$ cm/sec for the final top foot. | Conduct in-place permeability tests at a rate of one test per lot and record the results on the "Field Permeability Test" form. A lot is defined as 2,000 cubic yards (compacted) of $1 \times 10^{-6}$ cm/sec or 200 cubic yards (compacted) of $5 \times 10^{-8}$ cm/sec radon barrier. The permeability test shall be run in close proximity to a moisture-density test location.<br><br>a. Approve lots that meet the specified permeability.<br>b. Rework and retest lots not meeting the specified permeability.<br>c. Restore all test areas with the approved construction method. | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |

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| **LAYER THICKNESS:** For the LLRW embankment, the bottom (1 x $10^{-6}$ cm/sec permeability) layer shall be at least 1.0 feet thick. For the 11e.(2) embankment top slopes, the bottom (1 x $10^{-6}$ cm/sec permeability) layer shall be at least 3.0 feet thick. For the 11e.(2) embankment side slopes, the bottom (1 x $10^{-6}$ cm/sec permeability) layer shall be at least 2.5 feet thick. For the LLRW and 11e.(2) embankments, the top (5 x $10^{-8}$ cm/sec permeability) layer shall be at least 1.0 feet thick. | | |
| **LINER TRANSITIONS BETWEEN RADON BARRIER WITH DIFFERENT SPECIFIED PERMEABILITIES:** The radon barrier with the higher permeability (i.e. the bottom radon barrier) shall be final graded from grade to 0.4 feet below grade design grade. Survey on a 50 ft grid and key points. | Survey the radon barrier surface on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC Officer and Construction QA Officer.<br>a. Indicate where the radon barrier meets design line and grade.<br>b. Rework and resurvey areas not meeting the specified grade. | Review the final survey data. Verify the frequency of the survey points. |
| **RADON BARRIER DRYING PREVENTION:** To prevent the radon barrier from drying, water will be applied to the clay surface on an as needed basis or the radon barrier will be covered with 6 inches of loose clay. Finished radon barrier shall be covered with 12 inches of filter zone, sacrificial soil layer, or 6 inches of loose clay within 30 days of completion. Unfinished radon barrier shall be covered with 6 inches of loose clay within 30 days of the last activity for the lift. Desiccation cracks larger than one-fourth inch wide and one-inch deep in the radon barrier will be reported to the DRC and will be documented as a non-conformance item when discovered. | Observe the liner surface for drying. Advise project manager of any deficiencies. Record corrective actions taken (where required) on the "Daily Construction Report". | Verify that the liner is being inspected. |
| **SNOW REMOVAL:** When radon barrier material is to be placed and the work area is covered with snow, | Observe that snow is removed. Advise the project manager of deficiencies. Construction may not | Verify that snow removal is being documented. |

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| the snow must be removed. | continue without taking corrective actions to remove the snow. Record corrective actions (where required) in the "Daily Construction Report". | |
| **COLD WEATHER PLACEMENT OF RADON BARRIER:** For purposes of this CQA/QC Manual, "frozen" is defined as a soil temperature of less than or equal to 27ºF. Radon barrier shall not be placed above frozen material. In addition, no frozen material shall be processed or placed. | As needed, observe the area where radon barrier is to be placed. If frozen material is observed, cease placement of radon barrier. If frozen material is suspected, measure soil temperature. Record the stopping of placement in the "Daily Construction Report." | Verify that radon barrier is tested during cold weather conditions. |
| If the air temperature has dropped below 32ºF since the last lift of radon barrier was approved, one of the following three scenarios apply:<br>(1) If less than 30 days have passed since the date of lift approval and the last lift of radon barrier has been covered since the approval date with at least 9 inches of loose clay or 6 inches of compacted clay, then the cover clay may be worked with no additional testing of the lower approved lift.<br>(2) If less than 30 days have passed since the date of lift approval and the last lift of radon barrier has not been covered with at least 9 inches of loose clay or 6 inches of compacted clay, then:<br>(a) Perform spring start-up testing as discussed below; or<br>(b) Monitor the radon barrier temperature approximately 1 inch beneath the surface. If the temperature 1 inch beneath the surface is greater than 27ºF, re-roll the surface with one pass of the same type of construction equipment (i.e., a compactor for intermediate lifts or a smooth drum roller for the final surface) and continue with radon barrier construction. If the temperature 1 inch beneath the surface is less than or equal to 27ºF, re-work and re-test density and permeability of the affected area after the clay temperature has risen above 27ºF. | Review ambient air temperature records as measured at the site meteorological station. Document status of radon barrier cover placement on the "Daily Construction Report." Monitor radon barrier temperature when triggered under 2.(b). Clay temperature shall be measured between 6:00 am and 8:00 am on the day that radon barrier will be placed. Temperature measurements shall include a location that is most likely to be coldest; i.e., if there is a portion of the radon barrier that is shaded or at a low point. Temperature monitoring frequency shall be at least one point per 100,000 square feet or one point per contiguous project area, whichever is smaller.<br><br>If the initial radon barrier temperature measurement is less than or equal to 27ºF, the affected area may be resampled before 8:30 am the same day as follows:<br>a. Measure the radon barrier temperature at a frequency of one measurement per lot (defined as no more than 10,000 square feet).<br>b. Lots where the temperature is greater than 27ºF do not require rework; except that the lot where the initial temperature less than or equal to 27ºF was measured shall be reworked regardless of resampling results. | |

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| (3) If more than 30 days have passed since the date of lift approval, perform spring start-up testing. | | |
| In addition, the final lift of 5 X $10^{-8}$ cm/sec radon barrier requires that the Type B filter zone and sacrificial soil be placed over the radon barrier prior to the end of the work day when ambient temperatures will drop below 32 degrees Fahrenheit. If this protective cover is not applied prior to freezing conditions, an additional density test and permeability test shall be performed directly prior to covering the radon barrier final surface with filter zone and sacrificial soil. This process must be repeated whenever any final surface material is not covered with the filter zone and sacrificial soil prior to overnight freezing conditions. | Perform an additional density test and permeability test on 5 x $10^{-8}$ cm/sec final surface that has been exposed to overnight freezing conditions prior to placement of the Type B filter zone and sacrificial soil material. If passing test results are achieved, but it is not possible to cover all of the exposed radon barrier material with filter zone and sacrificial soil prior to the end of the workday, testing must be repeated for the exposed materials. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). | |
| **SPRING START-UP:** See "Cold Weather Placement of Radon Barrier" above for situations that trigger this specification. | Perform density and permeability testing at the frequencies outlined for radon barrier construction above. This testing may be performed outside of the approved lift area so long as the area tested is representative of the clay in the approved lift area (i.e., was constructed at the same time and with the same method). Moisture testing is not required for spring start-up. | |
| For spring start-up testing, the surface lift is treated as protective cover, regardless of whether it was an approved lift of radon barrier at one time or not. Excavate 9 inches below the clay surface and re-test for density and permeability. Excavation for testing purposes may consist of removing the protective cover lift; or may be performed by 'potholing' only at the testing locations. Areas that have been 'potholed' for permeability testing shall be repaired by applying the same level of effort as prescribed by the approved test pad for radon barrier construction. | a. Approve lots that meet specification. The protective cover lift may be worked in place and tested to become the next lift of radon barrier.<br>b. For lots that do not meet specification, test the surface at successively deeper 9 inch increments until a passing lift is found; remove all failing lifts; re-work all failing areas; and re-test.<br><br>Document that repairs are completed to the same level of effort as required by the approved test pad for radon barrier construction. | |

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| **CONTAMINATION OF RADON BARRIER:** The radon barrier material shall not become contaminated with radioactive soils or debris during construction. The in-place clay may contain up to 5 percent additional rocks and sand above the content found in the classification test. | Visually check radon barrier for contamination by foreign materials. Remove clays which have been contaminated above the specified requirements. | Verify that removal of contaminated material has been properly documented. |
| **FINAL GRADING:** Final grading shall be from grade to 0.2 feet above grade. Survey on a 50 ft grid and key points. Upon completion, the surface shall be rolled with a smooth drum roller. | Survey the foundation on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer.<br>a. Indicate where the radon barrier meets design line and grade.<br>b. Rework and resurvey areas not meeting the specified grade. | Review the final survey data. Verify the frequency of the survey points. |
| **EROSION CONTROL FOR EXPOSED SOIL:** If DRC-approved final grade 5 x 10-8 cm/sec radon barrier soil surfaces are not covered by filter zone within 30 days of lift approval, the following erosion control repair measures shall apply.<br><br>Semi-annually, inspect exposed radon barrier soil surfaces for evidence of erosion. Rivulet or gullied areas wider than 6 inches or deeper than 6 inches require maintenance to fill the rivulet or gully and restore the area to design grade. Soils imported as fill shall meet the requirements of "Radon Barrier Borrow Material", above. Maintenance shall be performed within 30 calendar days when needed.<br><br>Erosion control blankets, mats, or fiber mulch may be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of | Perform monthly inspections. Document the inspection as well as associated maintenance activities on the Daily Construction Report. | |

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| erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to filter zone construction. | | |
| **RADIOLOGICAL SAMPLING FOR EXPOSED SOIL:** If DRC-approved final grade 5 x 10-8 cm/sec radon barrier soil surfaces are not covered by filter zone within 30 days of final approval, the area shall be either: (a) sampled and radiologically released in accordance with the Environmental Monitoring Plan; or (b) have a minimum of 6 inches of clay removed and replaced prior to filter zone placement. Under option (b), no environmental sampling is required. | Coordinate sampling and analysis with environmental personnel. Attach a copy of the release report to the lift approval documentation. | |
| **HEAVY EQUIPMENT ON RADON BARRIER:** Heavy equipment travel will be minimized on top of the finished radon barrier. Heavy equipment will not be operated on saturated radon barrier. | Observe work on radon barrier. Advise the project manager of problems with equipment on the radon barrier. Record corrective actions taken (where required) on the "Daily Construction Report". | Verify that the work is being inspected. |
| **QUALITY ASSURANCE SAMPLING:** Assurance samples for radon barrier materials tests are to be obtained at the following minimum frequency:<br><br>1. In-place moisture-density tests (ASTM D6938): 1 per 50,000 cubic yards.<br><br>2. Moisture/density relationship testing (ASTM D698): 1 per 50,000 cubic yards.<br><br>3. Classification tests (ASTM D2487, D1140, and D4318): 1 per 50,000 cubic yards.<br><br>A minimum of one of each of the above tests is required for each year that radon barrier is placed. | Coordinate with QA personnel in obtaining the quality assurance samples. Record the samples on the "Sample Log" and moisture-density test on the "Density Testing Log". Promptly report result of QC testing to Construction QA Officer so that a comparison of QA and QC testing results can be made. | Conduct or coordinate quality assurance sampling and testing in accordance with the designated frequencies. Obtain test results of QC samples so that a comparison of QA and QC test results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of quality assurance sampling in the “Daily QA Report”. |
| **DRC APPROVAL:** The DRC shall approve documentation associated with completed radon | Notify the Construction QA Officer that the radon barrier is ready for inspection by the DRC. Obtain | Provide written approval of the radon barrier. Notify DRC that the radon barrier is ready for inspection. |

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| barrier. Documentation shall include all QC and QA records associated with construction, as well as photographs of the completed surface. In addition, 48 hour notification shall be provided to the DRC prior to placement of filter zone material over the finished radon barrier. Energy*Solutions* may proceed with filter zone placement 48 hours after DRC notification if the DRC has not inspected and has not notified the Director of Engineering of its intent to inspect the radon barrier surface. | written authorization on the "Liner Inspection Form" from the Construction QA Officer that the radon barrier has been inspected. Obtain documentation confirming the DRC approval of the radon barrier documentation. | |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **QUALITY OF ROCK:** The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C-128), Absorption (ASTM C-127), Sodium Soundness (ASTM C-88), and L.A. Abrasion (ASTM C-131 or ASTM C-535). The procedures for scoring "Rock Quality" are found in Appendix C. | As described in NUREG-1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C-295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring.<br><br>Perform Na soundness, LA abrasion, absorption, and specific gravity testing at a rate of one set of tests per 10,000 cubic yards of rock. Record the location of all collected samples in the "Sampling Log".<br>a. Approve rock for use in the filter zone which meet the specifications for rock quality.<br>b. Rock not meeting the specifications for rock quality can not be used. | Verify the frequency of laboratory quality control tests and compliance of test results.<br><br>Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report". |
| **TYPE B FILTER ZONE PERMEABILITY:** The type B filter zone rock on the Class A and Class A North embankments will have a minimum permeability of 3.5 cm per second.<br><br>The filter zone rock on the 11e.(2) embankment will have a minimum hydraulic conductivity of 42 cm/sec. | Perform permeability testing at a rate of one test per 10,000 cubic yards placed. Record the location of all samples in the "Sampling Log".<br>a. Approve rock for use in the filter zone which meet the specified gradation.<br>b. Rock not meeting the specified gradation can not be used. | Verify the frequency of laboratory tests and compliance of test results. |
| **GRADATION:** LLRW embankment rock gradation shall be as specified on the currently approved engineering drawings ~~9821 and 0408~~10014. 11e.(2) | For Type B filter zone rock, if material is to be stockpiled, perform gradation testing at a rate of one test per 2,500 cubic yard stockpile. If Type B filter | Verify the frequency of laboratory quality control tests and compliance of test results. |

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| embankment rock gradation shall be as specified on the currently approved engineering drawing 9420-4. | zone rock material is transferred directly to the cell from the production plant, perform at least one test per source per day material is placed, or at least one test per 2,500 cubic yards. For Type A filter zone rock, perform gradation testing at a rate of one test per 10,000 cubic yards. In addition, perform a minimum of one test per change in soil type by ASTM D 2488. Record the location of all samples in the "Sampling Log".<br>a. Approve rock for use in the filter zone which meet the specified gradation.<br>b. Rock not meeting the specified gradation can not be used. | Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the "Sampling Log". Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report". |
| **PLACEMENT:** Filter zone material will be placed over the radon barrier. The thickness of the filter zone layer for the LLRW embankments shall be as specified on the currently approved engineering drawings ~~9821 and 0408~~10014. The thickness of the filter zone layer for the 11e.(2) embankment shall be as specified on the currently approved engineering drawings 9420-4, 9420-5, and 9420-6. Filter zone material shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials. | Observe the placement of the filter zone material. Ensure that soil fines are not concentrated in localized areas. If soil fines are concentrated in localized areas, the project manager shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report". | Verify that QC personnel observe the placement of the filter zone material such that soil fines are not concentrated in localized areas. |
| **SNOW REMOVAL:** When filter zone material is to be placed and the work area is covered with snow, the snow must be removed. | Observe that snow is removed. Advise the project manager of any deficiencies. Construction may not continue without taking corrective actions to remove the snow. Record corrective actions (where required) in the "Daily Construction Report". | Verify that snow removal is being documented. |
| **FINAL GRADING:** Thickness for the lift will be | Verify that the grade poles are marked at the | Review documentation for final grading. |

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| established by installing grade poles on at least a 50' grid and at all control points. The grade poles shall consist of PVC pipe (approximately ½-inch diameter) with surveyors ribbon (or other distinguishable markings) attached to the appropriate lift thickness. The poles shall be held in place by placing the filter rock adjacent to the base of the grade pole to secure it in a vertical position (long axis of the grade pole perpendicular to the radon barrier surface). With the grade pole marked at the appropriate thickness and secured at the appropriate locations, the filter rock may be placed throughout the project area. The base of the grade poles shall rest on the surface of the radon barrier and therefore will not damage the radon barrier surface. After the grade has been checked and approved by QC personnel, the grade poles shall be removed from the filter zone placed directly above the radon barrier. | appropriate depth to establish grade for the layer that will be placed. Observe the installation of some of the grade poles to ensure that the installation method has been followed and verify that the grade poles have not penetrated or damaged the surface of the radon barrier.<br><br>Verify the required grade is achieved at all control points throughout the placed filter rock in the project area. Rework and re-verify areas not meeting the specified grade. Ensure all grade poles have been removed following verification of grade. Document all inspections and corrective actions, where required, on the "Daily Construction Report". | |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, and Class A North~~ embankment~~s~~. | | |
| **PLACEMENT:** Sacrificial soil will be placed over the filter zone as specified on currently approved engineering drawings ~~9821 and 0408~~10014. Sacrificial soil shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials. | Observe the placement of the sacrificial soil. Ensure that fines are not concentrated in localized areas. If fines are concentrated in localized areas, the project manager shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report". | Verify that QC personnel observe the placement of the sacrificial soil such that fines are not concentrated in localized areas. |
| **GRADATION:** Gradation of the sacrificial soil shall be as specified on the currently approved engineering drawings ~~9821 and 0408~~10014. | If material is to be stockpiled, perform gradation testing at a rate of one test per 2,500 cubic yard stockpile. If material is transferred directly to the cell from the production plant, perform at least one test per source per day material is placed, or at least one test per 2,500 cubic yards. In addition, perform a minimum of one test per change in soil type by ASTM D 2488. Record the location of all samples in the "Sampling Log".<br>a. Approve material for use as sacrificial soil which meet the specified gradation.<br>b. Material not meeting the specified gradation can not be used. | Verify the frequency of laboratory tests and compliance of test results. |
| **SNOW REMOVAL:** When sacrificial soil is to be placed and the work area is covered with snow, the snow must be removed. | Observe that snow is removed. Advise the project manager of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Record corrective actions (where required) in the "Daily Construction Report". | Verify that snow removal is being documented as per DRC requirement. |
| **FINAL GRADING:** Thicknesses for the lift will be established by installing grade poles on at least a 50' grid and at all control points. The grade poles must be marked at the appropriate depth to establish grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed. | Verify the required grade is achieved at all control points. Rework and re-verify areas not meeting the specified grade. | Review the documentation for final grading. |

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| **SCOPE:** This work element applies to the C Class A West ~~lass A, Class A North,~~ and 11e.(2) embankments. | | |
| **QUALITY OF ROCK:** The rock shall have a "Rock Quality" score of at least 50 based on the following tests: Specific Gravity (ASTM C-128), Absorption (ASTM C-127), Sodium Soundness (ASTM C-88), and L.A. Abrasion (ASTM C-131 or ASTM C-535). The procedures for scoring "Rock Quality" are found in Appendix C. | As described in NUREG-1623, appendix F, perform at least one petrographic examination for each rock source in accordance with ASTM C-295. If a combination of limestone, sandstone, and igneous rock is found for a source, percentages of each type of material shall be determined for scoring.<br><br>Record the location of all collected samples in the "Sampling Log". Test rock at a rate of one set of test for every 10,000 cubic yards of rock.<br>a. Approve rock for use in the rock erosion barrier which meet the specifications for rock quality.<br>b. Rock not meeting the specifications for rock quality can not be used. | Verify the frequency of laboratory quality control tests and compliance of test results.<br><br>Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the “Sampling Log”. Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report". |
| **GRADATION:** Gradation of the rock for the LLRW embankments shall be as specified on the currently approved engineering drawings ~~9821 and 04080~~10014. Gradation of the rock for the 11e.(2) embankment shall be as specified on the currently approved engineering drawing 9420-4. | Perform gradation testing, in accordance with ASTM D-5519 or C-136, at a rate of one test per 10,000 cubic yards. Record the location of all samples in the "Sampling Log".<br>a. Approve rock for use in the rock erosion barrier which meet the specified gradation.<br>b. Rock not meeting the specified gradation can not be used. | Verify the frequency of laboratory quality control tests and compliance of test results.<br><br>Perform quality assurance testing at a minimum of one set of tests per 100,000 cubic yards of rock. A minimum of one set of tests is required each year that filter zone is placed. Record the samples on the “Sampling Log”. Promptly report results to the Construction QA Officer so that a comparison of QA and QC testing results can be made. The Construction QA Officer, in consultation with the QC officer, shall be responsible for determining the adequacy of |

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| | | correlation and documentation of the rationale used to determine adequacy. If the correlation is not adequate, new QC and QA samples shall be taken immediately. The Construction QA Officer, in consultation with the QC officer, shall then evaluate the accuracy of the QC sampling and testing and, if necessary, provide for improved sampling and testing procedures and closer inspection and control. Record findings of the quality assurance sampling in the "Daily QA Report". |
| **PLACEMENT:** Rock erosion material will be placed over the filter zone. Thickness of rock erosion barrier shall be 18 inches inside the centerline of the perimeter ditch and 12 inches outside the centerline of the perimeter ditch. Rock erosion material shall be handled in such a manner as to prevent contamination from waste material and segregation of finer materials. | Observe the placement of the filter zone material. Ensure that soil fines are not concentrated in localized areas. If soil fines are concentrated in localized areas, the project manager shall be directed to evenly distribute the fines or to remove them. Record corrective actions (where required) in the "Daily Construction Report". | Verify that QC personnel observe the placement of the filter zone material such that soil fines are not concentrated in localized areas. |
| **SNOW REMOVAL:** When rock erosion barrier material is to be placed and the work area is covered with snow, the snow must be removed. | Observe that snow is removed. Advise the project manager of any deficiencies. Construction may not continue without taking corrective action to remove the snow. Record corrective actions (where required) in the "Daily Construction Report". | Verify that snow removal is being documented as per DRC requirement. |
| **FINAL GRADING:** Thickness for the lift will be established by installing grade poles on at least a 50' grid and at all control points. The grade poles shall consist of PVC pipe (approximately ½-inch diameter) with surveyor ribbon (or other distinguishable markings). The grade poles must be marked at the appropriate depth to establish grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed. | Verify the required grade is achieved at all control points. Rework and re-verify areas not meeting the specified grade. Document all inspections and corrective actions, where required, on the "Daily Construction Report". | Review the documentation for final grading. |
| **NOTICE OF COVER CONSTRUCTION:** Provide written notice of the completion of cover construction to the DRC within 30 days of completion of each phase | Verify the DRC has been notified of completion of cover construction within 30 days of completion of each phase of cover construction. | Verify the DRC has been notified of completion of cover construction within 30 days of completion of each phase of cover construction. |

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| of cover construction in the "cut and cover" operation. | | |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **CLEARING AND GRUBBING:** Remove vegetation, debris, organic, or deleterious material from areas to be used for borrow. Grubbing depth will depend on the type of vegetation, debris, organic, or deleterious material on the site. If the area is free of these materials then no clearing and grubbing will be necessary. | Inspect the area once clearing and grubbing has been completed. Record observations and corrective actions (where required) on the "Daily Construction Report". | Verify that the clearing and grubbing has been inspected by QC. |
| **MATERIAL:** The imported borrow shall be classified as CL or ML soils by ASTM D-2487. | Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the road. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".<br>a. Approve lots (which meet the specified classification) for use in the road.<br>b. Lots not meeting the specified classification can not be used. | Verify the frequency of laboratory tests and compliance of test results. |
| **LIFT THICKNESS:** Drainage ditch borrow material shall be placed in lifts with an uncompacted thickness of less than or equal to 9 inches. Thickness for the lift will be established by installing grade poles on at least a 50-foot grid lengthwise and at all control points. The grade poles must not be installed deeper than 1 inch into the underlying clay liner. The grade poles must be marked at the appropriate depth to establish the grade. After the grade has been checked and approved by QC personnel, the grade poles shall be removed. | Verify that the required grading is achieved as follows:<br>a. Ensure that the required frequency for placement of grade poles has been met.<br>b. Compare soil level with the marked level on the grade poles.<br>c. Use a string line where necessary between poles to check for high or low spots.<br>d. Define those areas that are high out of specification and advise the project manager to re-work those areas.<br>e. Review areas re-worked and approve areas meeting criteria.<br>f. Continue b through d above until all areas meet criteria.<br>g. Indicate areas meeting criteria in the "Embankment Construction Lift Approval Form". | Observe, at a minimum, five percent of the measurements performed by QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **EXCAVATION:** Excavation shall be made to the lines, grades, and dimensions prescribed in the approved plans. Prior DRC approval in writing must be obtained before diverting ditches from the current approved design. The purpose and duration of diversion shall be specified in any request to do so.<br><br>Any over excavation shall be backfilled with select materials and compacted to 95 percent of standard Proctor. The uncompacted lift thickness shall not exceed 9 inches. | Provide daily observation of the cell excavation. Record observations and corrective actions (where required) on the "Daily Construction Report".<br><br>In areas of over excavation, conduct in-place density test at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as a maximum of 10,000 square feet of a lift of a specified type of material. Test locations shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified compaction.<br>b. Rework and retest lots not meeting the specified compaction.<br><br>Proctors shall be performed at a rate of one test per 100,000 square feet for each material type. At least one proctor shall be performed for each material type. Record the location of the sample on the "Sampling Log". | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |
| **FINAL GRADING:** Smooth roll the excavated surface to prepare for filter zone. Final grading of this surface shall be ±0.1 of a foot. | Inspect the surface for smoothness. Survey the surface on a 50 ft grid and at key points. Final survey measurements will be documented and provided to the QC officer and Construction QA Officer.<br>a. Indicate where the surface meets design line and grade.<br>b. Rework and resurvey areas not meeting the specified grade. | Review the final survey data. Verify the frequency of the survey points. |
| **FILTER ZONE AND ROCK EROSION BARRIER:** The filter zone and rock erosion barrier shall be constructed in accordance with the specifications outlined under work elements "Filter | See work elements "Filter Zone" and "Rock Erosion Barrier". | See work elements "Filter Zone" and "Rock Erosion Barrier". |

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| Zone" and "Rock Erosion Barrier". | | |
| **EROSION CONTROL FOR EXPOSED SOIL:** If reviewed and approved drainage ditch soil surfaces are not covered by filter zone within 30 days of lift approval, the following erosion control repair measures shall apply.<br><br>Semi-annually, inspect exposed drainage ditch soil surfaces for evidence of erosion. Rivulet or gullied areas wider than 6 inches or deeper than 6 inches require maintenance to fill the rivulet or gully and restore the area to design grade. Soils imported as fill shall meet the requirements of "Drainage Ditch Imported Borrow", above. Maintenance shall be performed within 30 calendar days when needed, unless additional time is approved by DRC.<br><br>Erosion control blankets, mats, or fiber mulch may be used, in accordance with the manufacturer's instructions, for erosion prevention. DRC shall be notified at least 48 hours prior to deployment of erosion control blankets, mats, or fiber mulch. If used, such erosion control materials shall be removed prior to filter zone construction. | Perform monthly inspections. Document the inspection as well as associated maintenance activities on the Daily Construction Report. | |
| **RADIOLOGICAL SAMPLING FOR EXPOSED SOIL:** If reviewed and approved drainage ditch soil surfaces are not covered by filter zone within 30 days of lift approval, the area shall either (a) be sampled and radiologically released in accordance with the Environmental Monitoring Plan; or (b) have a minimum of 6 inches of clay removed and replaced prior to filter zone placement. Under option (b), no environmental sampling is required. | Coordinate sampling and analysis with environmental personnel. Attach a copy of the release report to the lift approval documentation. | |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **MATERIAL:** The material used to construct the road shall conform to the following specification:<br><br>Sieve Size — % Passing<br>1-1/2" — 100<br>3/4" — 75-95<br>1/2" — 62-82<br># 4 — 38-58<br># 16 — 16-36<br># 200 — 0-18 | Perform laboratory classification tests at a rate of 1 test per lot prior to use of material in the road. A lot is defined as a maximum of 3,000 cubic yards (compacted) of specified material type. Record the location of the classification sample on the "Sampling Log".<br>a. Approve lots (which meet the specified classification) for use in the road.<br>b. Lots not meeting the specified classification can not be used. | Verify the frequency of laboratory tests and compliance of test results. |
| **SUBSURFACE PREPARATION:** The subsurface will be scarified and re-compacted to at least 95 percent of a standard proctor (ASTM D-698). | Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of material. The test location shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified compaction.<br>b. Rework and retest lots not meeting the specified compaction.<br><br>Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log". | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |
| **ROAD THICKNESS:** The compacted road shall be 12 inches thick plus or minus 0.2 feet. | Measure the thickness of the road at both edges of the road at no greater than 50 foot intervals.<br>Record the results on the "Lift Approval Form".<br>a. Approve section of the road which meet the specified thickness.<br>b. Rework and retest sections not meeting the required thickness. | Observe, at a minimum, five percent of the measurements performed by the QC personnel to ensure that the measurements are being performed correctly. Verify that the measurements are being performed at the correct frequency and that the documentation is being completed. |

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| **COMPACTION:** The road will be compacted to at least 95 percent of standard Proctor (ASTM D-698). | Conduct in-place density tests at a rate of one test per lot and record the results on the "Field Density Test" form. A lot is defined as 200 cubic yards (compacted) of material. The test location shall be chosen on the basis of random numbers.<br>a. Approve lots which meet the specified compaction.<br>b. Rework and retest lots not meeting the specified compaction.<br><br>Proctors shall be performed at a rate of one test per borrow lot. A borrow lot is defined as 3,000 cubic yards (compacted) or less of a specific material type. Record the location of the Proctor sample on the "Sampling Log". | Observe, at a minimum, five percent of the tests performed by the QC personnel to ensure that the tests and observations are being performed correctly. Verify that the tests are being performed at the correct frequency and that the documentation is being completed. |

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| **SCOPE:** This work element applies to the Class A West ~~Class A, Class A North,~~ and 11e.(2) embankments. | | |
| **MATERIALS:** All burial embankments and waste storage areas, including immediately adjacent drainage structures, shall be controlled areas, surrounded by six foot high, chain link fence. All permanent fence shall be chain link, six feet high, topped with three strand barbed wire, top tension wire and twisted selvedge.<br><br>Zinc coated chain link fence shall meet the requirements of ASTM A-392 with Class I coating. Aluminum Coated fence fabric shall meet the requirements of ASTM A-491.<br><br>Fence Fabric: Fence fabric shall be made of 0.148 inch or larger diameter wire. The fabric shall have twisted selvedge.<br><br>Wire and Ties: Tension wires shall be 0.177 inch or larger diameter spiral type. Ring ties for tying fabric to supporting members shall be made of 0.148 inch or larger diameter wire. Wire ties for tying fabric to support members shall be made of 0.12 inch or larger diameter wire. Ties to line posts shall be made of 0.192 inch or larger diameter wire. All wire shall have Class II coating as specified by ASTM A-116.<br><br>Barbed Wire: Barbed wire on zinc coated fence shall meet the requirements of ASTM A-121, including a Class I zinc coating. Barbed wire shall be made of 0.099 inch or larger diameter wire with 0.080 inch or larger diameter wire four point barbs on 5 inch centers. When aluminum or aluminum coated fence is used, aluminum coated barbed ware shall be used meeting the requirements of ASTM A-0491. The support arm | Obtain a copy of the manufacture's specification for the materials to be used in the construction of the fence. Verify that the materials meet the required specifications. Document materials acceptance on the "Daily Construction Report". | Verify that the materials to be used in the construction of the fence have been approved. |

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| on the fence for the barbed wire shall be capable of supporting a 200 pound vertical load at the end of the arm without permanent deflection.<br><br>Posts: Line posts may be "H" section or pipe. The minimum strength requirements are as follows:<br>1. Load at top: 600 lbs.<br>2. Maximum Moment: 1200 ft-lbs.<br>3. Maximum permanent set: 0.010 in.<br>"H" posts shall be coated in accordance with the requirements of ASTM A-123. Pipe posts shall conform to the requirements of ASTM A-120 (Schedule 40) for zinc coated pipe. All pipe posts shall be fitted with a weather resistant tip, designed to fit securely over the post, and carry an apron around the outside of the post.<br><br>Fittings: Fittings shall be malleable cast iron or pressed steel and be coated in accordance to ASTM A-123.<br><br>Gates: Gate posts and frames shall be constructed of the sizes shown on the approved plans for the various gate dimension. The corners of the gate frame shall be fastened together with pressed steel or malleable iron corner ells riveted or welded in accordance with the plans. Welded steel gate frames shall be galvanized after fabrication in accordance with the provision of ASTM A-123. Chain link fence fabric for covering the gate frames shall be the same as required for the fence. Each gate shall be furnished complete with necessary galvanized hinged, latch, and drop bar locking device for the type of gate used on the project. | | |
| **INSTALLATION:** The steel posts shall be set true to line and grade in concrete bases. The distances between posts shall be uniform and not exceeding 10 feet. Fence corners and ends shall be constructed in accordance | Verify that the fence is constructed in the location shown on the plans and in accordance with sheet L9. Document any problems in the "Daily Construction Report". | Verify that the fence has been inspected and problems have been properly documented. |

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| with Detail A on sheet L9 of the approved engineering drawings. Gates shall be constructed in accordance with Detail B on sheet L9 of the approved engineering drawings. | | |
| A minimum of 6 inches of concrete shall be provided below the bottom of each post. End posts, pull posts, corner posts, and gate posts shall have a concrete base at least 12 inches in diameter. Bases for line posts shall be at least 10 inches in diameter. | Spot check the depth and diameter of the post holes to verify that the holes meet the required specification. Document any problems in the "Daily Construction Report". | Verify that the fence has been inspected and problems have been properly documented. |
| Pull posts shall be provided at 500 feet maximum intervals. Changes in line of 30 degrees or more shall be considered as corners. | Inspect the fence for proper placement of pull and corner posts. Document any problems in the "Daily Construction Report". | Verify that the fence has been inspected and problems have been properly documented. |
| The fabric shall be stretched taut, and securely fastened to the posts. Fastening to end, gate, corner, and pull posts shall be with stretcher bars and metal bands, spaced at one foot intervals. The fabric shall be cut and each span fastened independently at all pull and corner posts. Fastening to line posts shall be with tie wire, metal bands, or other approved method at 14 inch intervals. The top edge of fabric shall be attached to the top rail or tension cable at approximately 24 inch intervals. The bottom tension wire is required and shall be attached to the fabric with tie wires at 24 inch intervals and shall be secured to the end or pull posts with brace bands. | Inspect the fencing fabric to verify that it has been installed in accordance with the specifications. Document any problems in the "Daily Construction Report". | Verify that the fence has been inspected and problems have been properly documented. |

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| **SCOPE:** This work element applies to the LARW, Class A West~~Class A, Class A North~~, 11e.(2), and Mixed Waste embankments. | | |
| **SETTLEMENT MONUMENTS:** Settlement monuments constructed before January 1, 2005 consist of #4 or greater rebar that is approximately 3 feet long, secured in place using a sand-cement grout. Grout shall consist of approximately 0.5 cubic foot of low slump fiber reinforced grout per monument. The top of the rebar shall be placed roughly even with the top of the riprap rock. Each monument shall be permanently labeled, flagged, and documented on a reference drawing. | | |
| Settlement monuments constructed after January 1, 2005 shall consist of approximately 4-foot long #5 or greater rebar that is welded to a metal plate. The metal plate shall be approximately 18 inches square with a thickness of 3/16 inch to 1/4 inch. The rebar shall be sized to extend no more than 6 inches above the rock erosion barrier surface. The settlement plate shall be placed on top of the final approved radon barrier (Class A and LARW cells) or on top of the final approved geosynthetics layer (Mixed Waste) and then secured by the rock cover layers as they are built. Each monument shall be permanently labeled, flagged, and documented on a reference drawing. | Inspect settlement monuments for compliance with the specification prior to installation. Observe installation to ensure that the radon barrier or geosynthetic layer is not damaged. | Perform a surveillance of monument installation activities. |
| **SETTLEMENT MONUMENT PLACEMENT:** Settlement monuments constructed prior to January 1, 2005 are set at 100- and 200-foot grids, as indicated on Figure 1. | | |
| Settlement monuments constructed after January 1, 2005 on the LARW, Class A, Mixed Waste, 11e.(2), and Class A North embankments shall be placed at the | Perform and document a post-construction survey of the placed settlement monument. | Verify that surveys have been performed. |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| locations identified on Figures 1, 2, 3, and 4, ~~and 6~~ respectively. | | |
| **SURVEY REQUIREMENTS:** Surveys shall be performed with GPS or approved equivalent equipment. Tolerance shall be no more than ± 0.1 feet. | Calibrate and operate survey equipment in accordance with the manufacturer's recommendations | |
| **SURVEY INTERVAL:** Settlement monuments constructed before January 1, 2005 shall be surveyed prior to grouting and again afterwards within 30 days of grouting for coordinate verification. Annual surveys of the existing monuments shall continue for a minimum of 5 years from the date of grouting. In cases where monuments are reset, measurements shall continue at the specified frequency continuing from the last reliable measurement. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report. | Perform and document the required surveys. Provide survey data to the Director of Engineering. | Verify that monument surveys are completed as required. |
| Settlement monuments constructed after January 1, 2005 shall be set and surveyed for initial location within 30 days of the completion of final cover construction. New monuments shall be surveyed again at 2, 4, and 12 months (± 10 calendar days) after the initial survey. Thereafter, monuments shall be surveyed once annually between October 1 and December 31 until a minimum of 5 years after initial placement. Weather conditions at the time of the survey and a discussion of the potential for frost to be present shall be documented in the survey report. | Perform and document the required surveys. Provide survey data to the Director of Engineering. | Verify that new monument surveys are completed as required. |
| During the annual survey, perform a visual inspection of the completed cover to evaluate potential areas of settlement that may not be captured by the settlement monument network. | Document observations made during the inspection, and denote areas where differential settlement may be occurring. Provide documentation to the Director of Engineering. | Perform a surveillance of visual inspection activities. |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| **REPORTING:** Settlement monitoring data shall be summarized and evaluated in the annual as-built report for each embankment.<br><br>Calculate total and differential settlement for each settlement monument against the most recent measurement and against the baseline monument location.<br><br>Total settlement of more than 1.5 feet at any settlement monument or differential settlement of more than 1.0 percent slope between adjacent monuments shall be reported to and evaluated by the Director of Engineering within 30 days of measurement and discussed in the annual as-built report.<br><br>Any failure in the settlement monuments shall be documented. A replacement monument shall be reset as close as possible to the previous location, surveyed, and documented. | Provide settlement monitoring data to the Director of Engineering. | |

| SPECIFICATION | QUALITY CONTROL | QUALITY ASSURANCE |
|---|---|---|
| **SCOPE:** This work element applies to the LARW, Class A West~~Class A, Class A North~~, and 11e.(2) embankments. | | |
| **AERIAL SURVEY REQUIREMENTS:** An aerial survey of the disposal cells and permitted area shall be performed between August 15 and September 15 each year.<br><br>The aerial survey shall be performed by a registered land surveyor.<br><br>Survey control points shall be identified in the survey report.<br><br>Survey tolerance shall not exceed ± 0.75 ft. | Review the aerial survey report for compliance with this specification. | |
| **ANNUAL AS-BUILT VOLUMES:** Calculate embankment volumes from the aerial survey data using AutoCAD or approved equivalent equipment.<br><br>Provide plan view and cross-sections of the as-built embankment based on the aerial survey data. Include in each cross-section the profile of the maximum authorized waste elevation. Also include in each cross-section the elevation profile of the top of the uppermost approved waste lift (as of the time the lift was approved). Provide a clear key to each cross-section to define the meaning of each symbol and line used.<br><br>For each embankment, report the embankment design capacity, capacity used to date, and remaining capacity. Compare remaining capacity with the surety reserve capacity for each embankment. | | |

**TABLE 2**

**MATERIAL SPECIFICATIONS FOR PORTLAND CEMENT CLSM**

| PROPERTY | TEST METHOD | MINIMUM | MAXIMUM | FREQUENCY |
|---|---|---|---|---|
| WET UNIT WEIGHT | ASTM D6023 | 100 lbs/ft$^3$ | None | 1 Test/100 Cubic Yards/Lift |
| SLUMP<br>**-OR-**<br>FLOW<br>**-OR-**<br>FLOW CONSISTENCY | Energy*Solutions* Slump Test (Appendix B)<br>Energy*Solutions* Efflux Test (Appendix B)<br>Flow Consistency (ASTM D6103) | 8 inches<br>NA<br>8 inches | None<br>26 seconds<br>None | 1 Test/100 Cubic Yards/Lift<br>1 Test/100 Cubic Yards/Lift<br>1 Test/100 Cubic Yards/Lift |
| 28 DAY COMPRESSIVE STRENGTH | ASTM D4832 | 150 psi | None | 1 Test/2000 Cubic Yards Placed at 28 days |
| CEMENT | None | 50 lbs for each cubic yard of CLSM | None | Inspect each load ticket prior to pour |
| POZZOLAN | None | None | 375 lbs for each cubic yard of CLSM | Inspect each load ticket prior to pour |
| AGGREGATE SIZE | Gradation Test Certificate from Batch Plant | Percent Passing / Sieve<br>100 / 3/8"<br>60 / #8 | Percent Passing / Sieve<br>30 / 100 | 1 Test/Pour day if material is received form exterior batch plant<br>or<br>1 certification/stockpile if material is received from site batch plant.<br><br>**Gradation certificate shall be received by QC Technician prior to pouring any CLSM** |

**TABLE 3**

**MATERIAL SPECIFICATIONS FOR FLY ASH CLSM**

| PROPERTY | TEST METHOD | MINIMUM | MAXIMUM | FREQUENCY |
|---|---|---|---|---|
| WET UNIT WEIGHT | ASTM D6023 | 100 lbs/ft$^3$ | None | 1 Test/100 Cubic Yards/Lift |
| FLOWABILITY | ASTM D6103 | NA | 11-inch spread | 1 Test/100 Cubic Yards/Lift |
| 28 DAY COMPRESSIVE STRENGTH | ASTM D4832 | 150 psi | None | 1 Test/2000 Cubic Yards Placed at 7 days<br>1 Test/2000 Cubic Yards Placed at 28 days |
| TYPE F FLY ASH | None | 40.5% of design mix | 50.5% of design mix | Inspect each load ticket prior to pour |
| TYPE C FLY ASH | None | 25.1% of design mix | 35.1% of design mix | Inspect each load ticket prior to pour |
| WATER | None | 23.0% of design mix | 25.4% of design mix | Inspect each load ticket prior to pour |
| ACTIVATORS | None | 0.19% of design mix | 0.21% of design mix | Inspect each load ticket prior to pour |

# Attachment 9

# Construction Material Information

# CLIVE FACILITY

# CLASS A WEST (CAW)
# CLAY RESOURCE CALCULATIONS

**October 4, 2011**

**For**
**Utah Division of Radiation Control**
**195 North 1950 West**
**Salt Lake City, UT 84114-4850**

**By**
**Energy*Solutions*, LLC**
**423 West 300 South, Suite 200**
**Salt Lake City, UT 84101**

Calculations Performed by:

PROFESSIONAL ENGINEER
DAVID F. BOOTH
No. 189500
STATE OF UTAH

10/4/11

David F. Booth, P.E. Date

Calculations Checked by:

Vern C. Rogers 4 Oct 2011

Vern C. Rogers, Ph.D. Date

ENERGYSOLUTIONS

Project No. 10014 Description CAW: CLAY RESOURCE Date 9/21/11

By D. BOOTH Chkd. By Sheet 1 of 20

PROBLEM: ESTIMATE CLAY BORROW RESOURCE ON ENERGYSOLUTIONS PROPERTY AND COMPARE WITH MATERIAL NEEDS FOR EMBANKMENT CONSTRUCTION (@ TOTAL BUILD-OUT)

METHOD: LAYOUT POTENTIAL BORROW AREAS IN SECTION 29 USING AUTOCAD. DETERMINE CLAY DEPTH FROM PAST BOREHOLES AND TEST PITS. THEN ESTIMATE QUANTITIES BY MULTIPLING AREA BY DEPTH.

ASSUMPTIONS:

1) REMOVE UPPER 6" OF MATERIAL DURING THE CLEARING AND GRUBBING OF THE BORROW AREAS.
2) LEAVE 2 FT OF CLAY ABOVE THE SAND LAYER(S) TO MINIMIZE PRECIPITATION INFILTRATION.
3) ASSUME THE VARIOUS LAYERS OF CLAY DEPOSITS WILL BE BLENDED, AS PER CURRENT MINING PRACTICES.

ENERGYSOLUTIONS

Project No. 10014 Description CAU: CLAY RESOURCE Date 9/21/11
By D. BOOTH Chkd. By Sheet 2 of 20

CALCULATIONS: REFER TO FOLLOW SPREADSHEET & FIGURES.

AREA 1:

USE LOGS FROM BOREHOLES 05-1, 05-2, 05-3 05-4, 05-6, 05-7 TO DETERMINE AVERAGE THICKNESS OF THE CLAY LAYERS. REFER TO FIG F FOR AREA CALC. AND SPREADSHEET FOR VOL CALCULATION.

VOL = 651,268 $yd^3$

AREA 2:

USE LOGS FROM BOREHOLES 05-8 & 05-11 AND ~~LOGS~~ RESULTS FROM TEST PITS S29-TP1, S29-TP2 & S29-TP3 TO DETERMINE AVE THICKNESS OF CLAY. REFER TO FIG F FOR AREA CALC AND SPREADSHEET FOR VOL CALC.

VOL = 305,719 $yd^3$

ENERGYSOLUTIONS

Project No. 10014 Description CAW: CLAY RESOURCE Date 9/21/11

By D. BOOTH Chkd. By Sheet 3 of 20

AREA 3:

USE LOG FROM BOREHOLE 05-10 AND RESULTS FROM TEST PITS S29-TP4, S29-TP5 & S29-TP6 TO DETERMINE AVE. THICKNESS OF CLAY. REFER TO FIGURE F FOR AREA CALC AND SPREAD-SHEET FOR VOL CALC.

VOL = 1,046,019 $yd^3$

AREA 4:

THERE ARE NO BOREHOLES OR TEST PITS FOR THIS AREA. BOREHOLE 05-1 IS THE CLOSET DATA POINT NEAR THE SW CORNER OF THE AREA. IT IS REASONABLE TO ASSUME THAT CLAY DEPOSITS ~~AREA~~ EXTEND INTO THIS AREA. IT IS ALSO REASONABLE TO ASSUME A CLAY DEPTH (THICKNESS) OF 8.5 FT THROUGHOUT THE AREA.

REFER TO FIG F & SPREADSHEET FOR AREA & VOL CALCS.

VOL = 1,188,889 $yd^3$

ENERGYSOLUTIONS

Project No. 10014 Description CAW: CLAY RESOURCE Date 9/21/11

By D. BOOTH Chkd. By Sheet 4 of 20

REFERENCES:

* BOREHOLES - THE BOREHOLES & RELATED LOGS ~~WERE~~ ARE FROM A GEOTECHNICAL INVESTIGATION PERFORMED FOR ENERGYSOLUTIONS BY RB&G, "ENVIROCARE NEW CLIVE FACILITIES", JUNE 2005. BOREHOLE LOGS FOR THE RELEVANT BOREHOLES ARE EXTRACTED FROM THE REFERENCED REPORT AND INCLUDED IN THESE CALCS.

* TEST PITS - THE TEST PITS WERE EXCAVATED BY ENERGYSOLUTIONS AND THE VARIOUS CLAY LAYER WERE MEASURED AND IDENTIFIED BY QUALIFIED QC PERSONNEL. THE ATTACHED DRAWING, 04062 C-05, WAS PREPARED AND CHECKED BY ENERGYSOLUTIONS STAFF AS PART OF A SITE WIDE RESOURCE MAPPING.

THE EXCAVATIONS WERE PERFORMED IN JAN, 2005.

ENERGYSOLUTIONS

Project No. 10014 Description CAU: CLAY RESOURCE Date 9/21/11
By D. BOOTH Chkd. By Sheet 5 of 20

RESULTS / CONCLUSIONS:

THE TOTAL ESTIMATED CLAY BORROW FOR THE 4 AREAS SHOWN ON FIG F IS 3,191,894 $yd^3$. THIS IS 1.7 TIMES THE CALCULATED CLAY BORROW NEED FOR ALL ASPECTS OF EMBANKMENT CONSTRUCTION.

IF THE CLAY BORROW THICKNESS FOR EACH AREA WAS REDUCED BY 2 FT, THE TOTAL BORROW WOULD BE 2,308,430 $yd^3$ OR STILL 1.2 TIMES THAT REQUIRED.

THEREFORE, THERE IS ~~MORE~~ AN ABUNDANCE OF CLAY MATERIAL ON ENERGYSOLUTION PROPERTY TO MEET CONSTRUCTION NEEDS.

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**SECTION 29 TEST PITS & BOREHOLES**

| ID | CLAY DEPTH (FT) |
|---|---|
| S29_TP1 | 11 |
| S29_TP2 | 10.5 |
| S29_TP3 | 11 |
| S29_TP4 | 9.5 |
| S29_TP5 | 12 |
| S29_TP6 | 10 |
| 05_1 | 9.5 |
| 05_2 | 8.7 |
| 05_3 | 15.7 |
| 05_4 | 9.8 |
| 05_6 | 10.8 |
| 05_7 | 13.2 |
| 05_8 | 9 |
| 05_10 | 11 |
| 05_11 | 9.5 |

MAXIMUM ESTIMATED CLAY BORROW QUANTITIES.

**SECTION 29 CLAY BORROW ESTIMATE**

| | | | | | |
|---|---|---|---|---|---|
| **Area 1** | | | **Area 2** | | |
| 05_1 | 9.5 | ft of clay | S29_TP1 | 11 | ft of clay |
| 05_2 | 8.7 | ft of clay | S29_TP2 | 10.5 | ft of clay |
| 05_3 | 15.7 | ft of clay | S29_TP3 | 11 | ft of clay |
| 05_4 | 9.8 | ft of clay | 05_8 | 9 | ft of clay |
| 05_6 | 10.8 | ft of clay | 05_11 | 9.5 | ft of clay |
| 05_7 | 13.2 | ft of clay | | | |
| Average | 11.3 | ft of clay | Average | 10.2 | ft of clay |
| Mined Clay | 8.8 | subtract 2.5 ft* | Mined Clay | 7.7 | subtract 2.5 ft* |
| Area | 2,002,000 | ft2 | Area | 1,072,000 | ft2 |
| Borrow Vol | 651,268 | yd3 | Borrow Vol | 305,719 | yd3 |
| **Area 3** | | | **Area 4** | | |
| S29_TP4 | 9.5 | ft of clay | 05_1 | 9.5 | ft of clay |
| S29_TP5 | 12 | ft of clay | | Use a conservative | ft of clay |
| S29_TP6 | 10 | ft of clay | | depth of 8.5 | ft of clay |
| 05_10 | 11 | ft of clay | | | ft of clay |
| | | | | | ft of clay |
| Average | 10.6 | ft of clay | Average | 8.5 | ft of clay |
| Mined Clay | 8.1 | subtract 2.5 ft* | Mined Clay | 6.0 | subtract 2.5 ft* |
| Area | 3,476,000 | ft2 | Area | 5,350,000 | ft2 |
| Borrow Vol | 1,046,019 | yd3 | Borrow Vol | 1,188,889 | yd3 |
| **Total Clay Available Borrow** | | | **3,191,894** | **yd3** | |
| **Total Clay Borrow Needed** | | | **1,900,952** | **yd3** | |
| "Safety Factor" | | | 1.7 | | |

* Assume that 0.5 ft is lost to clearing and grubbing and that 2 ft is left in situ to minimize precipitation infiltration.

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**SECTION 29 TEST PITS & BOREHOLES**

| ID | CLAY DEPTH (FT) |
|---|---|
| S29_TP1 | 11 |
| S29_TP2 | 10.5 |
| S29_TP3 | 11 |
| S29_TP4 | 9.5 |
| S29_TP5 | 12 |
| S29_TP6 | 10 |
| 05_1 | 9.5 |
| 05_2 | 8.7 |
| 05_3 | 15.7 |
| 05_4 | 9.8 |
| 05_6 | 10.8 |
| 05_7 | 13.2 |
| 05_8 | 9 |
| 05_10 | 11 |
| 05_11 | 9.5 |

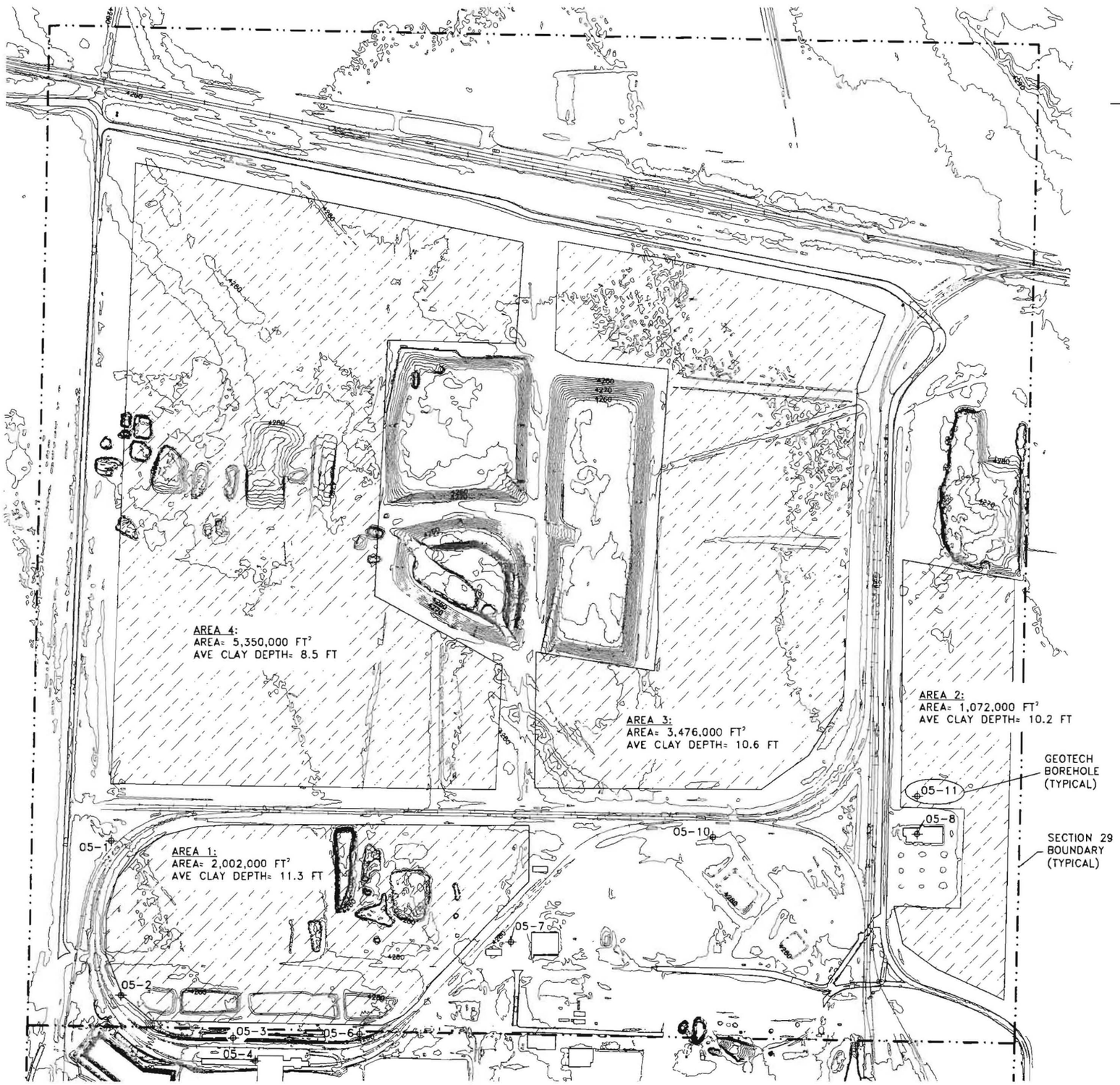
QUANTITIES IF CLAY BORROW DEPTHS ARE REPLACED BY 2 FT.

**SECTION 29 CLAY BORROW ESTIMATE**

| | | | | | |
|---|---|---|---|---|---|
| **Area 1** | | | **Area 2** | | |
| 05_1 | 9.5 | ft of clay | S29_TP1 | 11 | ft of clay |
| 05_2 | 8.7 | ft of clay | S29_TP2 | 10.5 | ft of clay |
| 05_3 | 15.7 | ft of clay | S29_TP3 | 11 | ft of clay |
| 05_4 | 9.8 | ft of clay | 05_8 | 9 | ft of clay |
| 05_6 | 10.8 | ft of clay | 05_11 | 9.5 | ft of clay |
| 05_7 | 13.2 | ft of clay | | | |
| Average | 11.3 | ft of clay | Average | 10.2 | ft of clay |
| Mined Clay | 6.8 | subtract 2.5 ft* | Mined Clay | 5.7 | subtract 2.5 ft* |
| Area | 2,002,000 | ft2 | Area | 1,072,000 | ft2 |
| Borrow Vol | 504,207 | yd3 | Borrow Vol | 226,311 | yd3 |
| **Area 3** | | | **Area 4** | | |
| S29_TP4 | 9.5 | ft of clay | 05_1 | 9.5 | ft of clay |
| S29_TP5 | 12 | ft of clay | | Use a conservative | ft of clay |
| S29_TP6 | 10 | ft of clay | | depth of 8.5 | ft of clay |
| 05_10 | 11 | ft of clay | | | ft of clay |
| | | | | | ft of clay |
| Average | 10.6 | ft of clay | Average | 8.5 | ft of clay |
| Mined Clay | 6.1 | subtract 2.5 ft* | Mined Clay | 4.0 | subtract 2.5 ft* |
| Area | 3,476,000 | ft2 | Area | 5,350,000 | ft2 |
| Borrow Vol | 785,319 | yd3 | Borrow Vol | 792,593 | yd3 |
| **Total Clay Available Borrow** | | | **2,308,430** | **yd3** | |
| **Total Clay Borrow Needed** | | | **1,900,952** | **yd3** | |
| "Safety Factor" | | | 1.2 | | |

* Assume that 0.5 ft is lost to clearing and grubbing and that 2 ft is left in situ to minimize precipitation infiltration.

8/20




AREA 1:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 5c572
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 2001933.2305

AREA 2:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 83140
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 1072058.1094

AREA 3:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 83138
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 3475847.8618

AREA 4:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 83134
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 5350993.0248

300 0 300 600

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
10/4/11
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 10/4/11 | DFB | FOR LICENSING; INFORMATION ONLY |

ENERGYSOLUTIONS

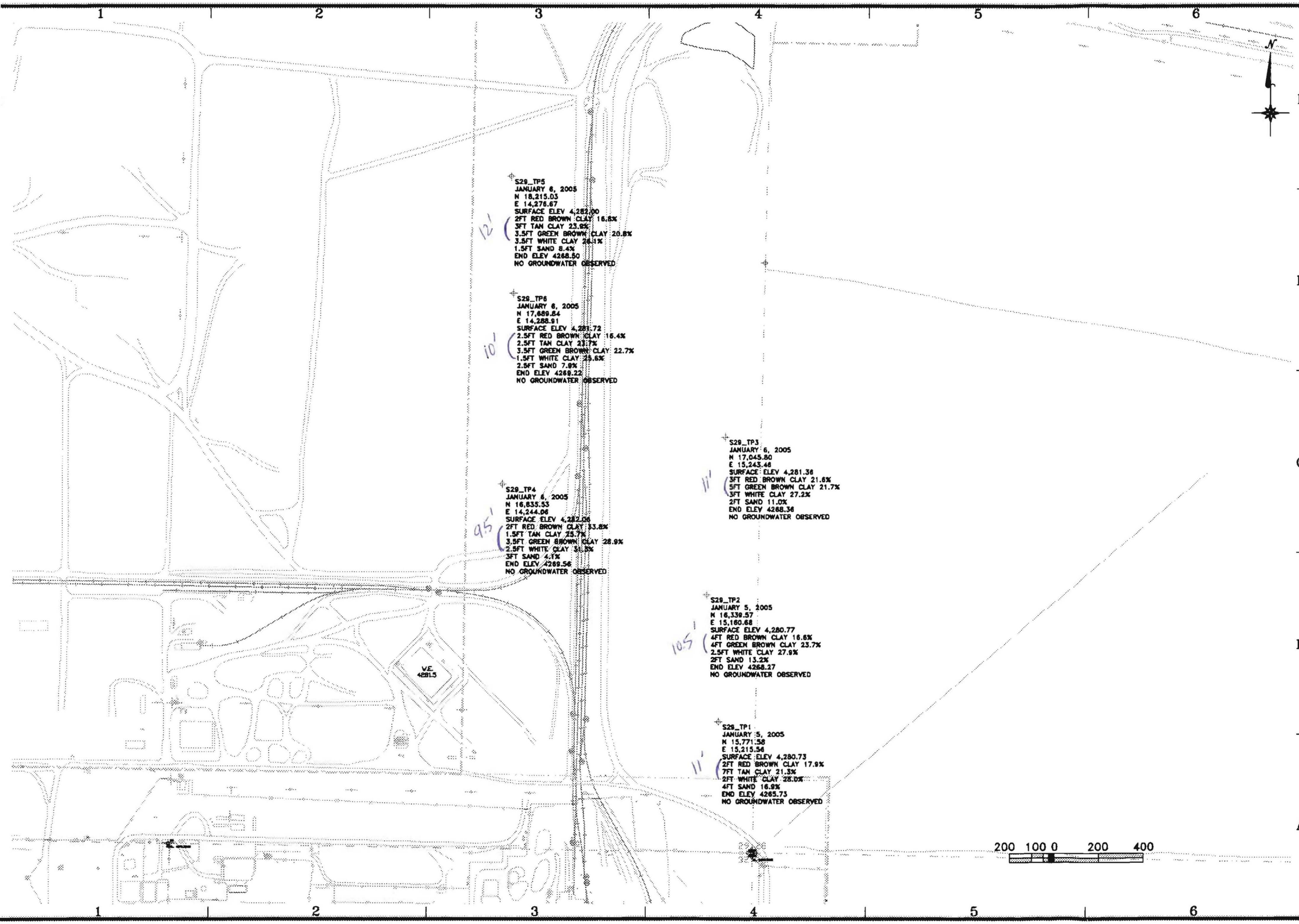
ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST
CLAY RESOURCE MAP & CALCULATIONS
CLIVE, UTAH

FINAL DRAWING

DRAWN BY D. BOOTH
REVIEWED BY V. ROGERS
APPROVED BY D. BOOTH
SCALE AS NOTED DATE 09/19/11 REV. 1

10014
FIGURE D

9/20




| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|

ENVIROCARE OF UTAH, INC.
THE SAFE ALTERNATIVE

ENVIROCARE "CLIVE" FACILITY
CLAY RESOURCE ASSESSMENT
SECTION 29 TEST PIT LOCATIONS
CLIVE, UTAH

FOR INFORMATION ONLY

D. SQUIRES
D. BOOTH
D. BOOTH
1"=200' 01/27/05

04062
C-05

# DRILL HOLE LOG

BORING NO. 05-1

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITIES
PROJECT NO.: 200501.017
CLIENT: ENVIROCARE OF UTAH. L.L.C.
DATE: 5/3/05
LOCATION: SEE SITE PLAN: N 16258, E 10536
ELEVATION: ~4274.3'
DRILLER: T. KERN
LOGGED BY: R. JOHNSON, V.N.B.
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ DRY AFTER 24 HOURS: ▽ NOT MEASURED

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2 | 3,7,9 | CL | brown, slightly moist, very stiff | | | | | | | | |
| | | | | | | | LEAN CLAY | | | | | | | | |
| | | | | 15 | 1,1,1 0.40 | CL | brown, slightly moist, firm | | | | | | | | |
| 4270 | 5 | | | 18 | Pushed 0.66 | CL-2 CL | brown, moist, stiff / lt. gray, moist, stiff | 92.5 | 36.1 | 39 | 18 | | | | UC |
| | | | | | | | LEAN CLAY | | | | | | | | |
| | 15 | | | 16 | 1,1,3 1.00+ | CL | lt. gray-brown, moist, very stiff | | | | | | | | |
| 4265 | 10 | | | 14 | 8,9,14 | SC | lt. brown, dry, med. dense | | | | | | | | |
| | | | | | | | CLAYEY/SILTY FINE SAND | | | | | | | | |
| | | | | 18 | Pushed | CL | lt. brown, moist, firm | | | | | | | | |
| | | | | | | | LEAN CLAY | | | | | | | | |
| 4260 | 15 | | | 17 | 7,7,9 | SC | lt. gray, dry, med. dense | | | | | | | | |
| | | | | | | | CLAYEY FINE SAND | | | | | | | | |
| 4255 | 20 | | | 17 | 4,6,7 0.39 | CL | lt. gray-brown, slightly moist, firm | | | | | | | | |
| | | | | | | | SANDY LEAN CLAY | | | | | | | | |
| 4250 | 25 | | | | | | | | | | | | | | |
| 4245 | 30 | | | | | | | | | | | | | | |

06/15/2005
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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

RB&G ENGINEERING INC.
Provo, Utah

10/20

# DRILL HOLE LOG

BORING NO. 05-2

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITES
PROJECT NO.: 200501.017
CLIENT: ENVIROCARE OF UTAH, L.L.C.
DATE: 5/3/05
LOCATION: SEE SITE PLAN: N 15441, E 10591
ELEVATION: ~4273.7'
DRILLER: T. KERN
LOGGED BY: R. JOHNSON, V.N.B.
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: DRY AFTER 24 HOURS: NOT MEASURED

| Elev. (Feet) | Depth (Feet) | Lith-ology | SAMPLE Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 16 | 1,6,8 0.24 | CL | lt. brown, dry, crumbly, stiff, w/roots | | | | | | | | |
| 4270 | | | | 17 | Pushed 0.68 | CL-2 | lt. gray-brown, moist, stiff LEAN CLAY | 85.0 | 37.7 | 40 | 20 | | | | CT |
| | 5 | | | 18 | 1,1,1 0.38 | CL | lt. gray-brown, moist, firm | | | | | | | | |
| 4265 | | | | 14 | Pushed | CL-2 | brown, slightly moist, hard | 84.5 | 39.1 | 48 | 27 | | | | CT |
| | 10 | | | 17 | 10,12,8 | SC | brown, dry, med. dense CLAYEY SAND | | | | | | | | |
| 4260 | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | |
| 4255 | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | |

06/15/2005
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RB&G ENGINEERING INC.
Provo, Utah

**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

11/20

# DRILL HOLE LOG

BORING NO. 05-3

Sheet: 1 of 2

PROJECT: ENVIROCARE - CLIVE NEW FACILITIES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 15216, E 11194
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER

PROJECT NO.: 200501.017
DATE: 5/3/05 TO 5/4/05
ELEVATION: ~4274.0'
LOGGED BY: R. JOHNSON, V.N.B.

DEPTH TO WATER - INITIAL: ▽ 26.5'? AFTER 24 HOURS: ▽ NOT MEASURED

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (in.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 15 | 2,5,9 | CL | lt. brown, dry, firm, w/roots & pinholes | | | | | | | | |
| 4270 | 5 | | | 18 | 2,5,9 1.00+ | CL | gray-brown, slightly moist, very stiff, w/rusty-orange nodules — LEAN CLAY | | | | | | | | |
| | | | | 16 | Pushed 0.88 | CL-2 | lt. gray, moist, stiff | 90.1 | 36.7 | 41 | 20 | | | | UC |
| 4265 | | | | 18 | 5,7,9 0.75 | ML | red-brown, slightly moist, med. dense — SANDY SILT | | | | | | | | |
| | 10 | | | 15 | 4,7,11 1.00+ | SM | lt. brown, dry, med. dense — SILTY SAND | | 4.5 | | | 0 | 78 | 22 | |
| | | | | | | CL | lt. brown, moist, very stiff | | | | | | | | |
| 4260 | | | | 17 | 4,5,10 0.85 | CL | lt. gray-brown, slightly moist, stiff — LEAN CLAY | | | | | | | | |
| | 15 | | | 17 | ~~Pushed~~ | CL | lt. brown | | | | | | | | |
| | | | | | | SM | | | | | | | | | |
| | | | | 18 | 5,9,8 | SM | lt. brown, moist, med. dense | | 11.3 | | | 0 | 68 | 32 | |
| 4255 | 20 | | | 16 | 1,5,7 0.82 | SM | lt. brown, dry, med. dense, 5" lt. brown sandy clay — SILTY SAND | | | | | | | | |
| 4250 | 25 | | | 16 | Pushed | SM | lt. brown | | | | | | | | |
| | | | | | | SM | lt. brown, moist, med. dense | | | | | | | | |
| | | | | 18 | 5,7,5 0.48 | CL | lt. gray, moist, firm | | | | | | | | |
| 4245 | 30 | | | 18 | 0,3,2 0.80 | CL | lt. blue-gray, moist, stiff — LEAN CLAY | | | | | | | | |
| 4240 | 35 | | | 17 | Pushed 0.75 | CL | lt. blue-gray, moist, stiff | | | | | | | | |
| 4235 | 40 | | | 18 | 3,3,5 1.00+ | CL | lt. blue-gray, moist, stiff — LEAN CLAY W/SANDY CLAY LAYERS | | | | | | | | |
| 4230 | 45 | | | 13 | Pushed | CL | lt. brown — SANDY CLAY | | | | | | | | |
| | | | | | | ML | | | | | | | | | |
| 4225 | 50 | | | | | | SANDY SILT | | | | | | | | |

15.7'

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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

RB&G ENGINEERING INC.
Provo, Utah

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# DRILL HOLE LOG

BORING NO. 05-3

Sheet: 2 of 2

PROJECT: ENVIROCARE - CLIVE NEW FACILITIES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 15216, E 11194
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ 26.5'? AFTER 24 HOURS: ▽ NOT MEASURED

PROJECT NO.: 200501.017
DATE: 5/3/05 TO 5/4/05
ELEVATION: NOT MEASURED
LOGGED BY: R. JOHNSON, V.N.B.

| Elev. (Feet) | Depth (Feet) | Lith-ology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ■ | 12 | 1,3,5<br>0.64 | ML | brown, slightly moist, stiff, low to med. plasticity | SANDY SILT | | | | | | | | |
| 4220 | 55 | | ☒ | 15 | Pushed | SM | brown | SILTY SAND | | | | | | | | |
| | | | ■ | 14 | 6,11,12 | SM | brown, very moist, med. dense | | | | | | | | | |
| 4215 | 60 | | ■ | 18 | 0,4,5<br>0.46 | CL-ML | brown, moist, firm | CLAYEY SILT W/SAND | | | | | | | | |
| 4210 | 65 | | ☒ | 12 | Pushed | SM | | SILTY SAND | | | | | | | | |
| | | | ■ | 18 | 10,28,27 | SM | brown, very moist, dense | | | | | | | | | |
| 4205 | 70 | | ■ | 16 | 3,3,7<br>0.54 | CL<br>CL | lt. gray, moist, stiff<br>lt. gray, very moist, firm | LEAN CLAY W/SAND<br>SANDY LEAN CLAY | | | | | | | | |
| 4200 | 75 | | ☒ | 10 | Pushed<br>0.48 | ML | brown, moist, firm | SANDY SILT | | | | | | | | |
| | | | ■ | 18 | 9,11,15 | SM | brown, very moist, med. dense | SILTY SAND | | | | | | | | |
| 4195 | 80 | | ■ | 18 | 3,13,19 | CL<br>ML<br>CL | lt. brown<br>lt. gray, moist, stiff | SANDY CLAY<br>SANDY SILT<br>GRAVELLY CLAY | | | | | | | | |
| 4190 | 85 | | ■ | 18 | 4,22,32<br>0.41 | SM | lt. brown, moist, firm<br>brown, very moist, very dense | INTERBEDDED LEAN CLAY & SANDY SILT<br>SILTY SAND W/GRAVEL | | | | | | | | |
| 4185 | 90 | | ■ | 14 | 18,43,50/4" | CL | lt. red-brown, dry to slightly moist, hard | CLAY W/GRAVEL | | | | | | | | |
| 4180 | 95 | | | | | | | | | | | | | | | |
| 4175 | 100 | | | | | | | | | | | | | | | |

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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

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Provo, Utah

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# DRILL HOLE LOG

BORING NO. 05-4

Sheet: 1 of 2

PROJECT: ENVIROCARE - CLIVE NEW FACILITIES
PROJECT NO.: 200501.017
CLIENT: ENVIROCARE OF UTAH, L.L.C.
DATE: 5/6/05
LOCATION: SEE SITE PLAN: N 15094, E 11312
ELEVATION: ~4274.2'
DRILLER: T. KERN
LOGGED BY: R. JOHNSON, V.N.B.
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ 28.2' AFTER 24 HOURS: ▽ NOT MEASURED

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ■ | 18 | 3,9,10 1.00+ | CL | lt. brown, slightly moist, very stiff | | | | | | | | |
| 4270 | 5 | | ☒ | 16 | Pushed 0.62 | CL-2 | lt. brown, moist, stiff — LEAN CLAY | 93.4 | 30.5 | 44 | 22 | | | | UC |
| | | | ■ | 17 | 0/12",4 0.58 | CL | lt. brown, moist, stiff | | | | | | | | |
| 4265 | 10 | | ☒ | 18 | Pushed | CH | lt. brown, moist, stiff — FAT CLAY | 86.4 | 35.4 | 53 | 32 | | | | UC |
| | | | ■ | 18 | 6,13,14 | SM | lt. brown, dry, med. dense — SILTY SAND | | | | | | | | |
| 4260 | | | ☒ | - | Pushed 0.56 | SM ML | lt. gray-brown, moist, stiff — SILT W/SAND LAYERS | 110.0 | 16.3 | 19 | 2 | | | | CT |
| | 15 | | ■ | 18 | 5,9,7 | SM | lt. brown, dry, med. dense — SILTY SAND | | 6.8 | | | 0 | 85 | 15 | |
| 4255 | 20 | | ☒ | 18 | Pushed | SM | lt. brown, dry | | | | | | | | |
| | | | ■ | 18 | 6,8,9 | SM | lt. brown, dry, med. dense | | | | | | | | |
| 4250 | 25 | | ■ | 0.5 | 2,3,2 | CL | brown, moist, stiff | | | | | | | | |
| 4245 | | | ■ | 18 | 0.42 3,1,1 0.31 | CL | lt. gray, very moist, firm | | | | | | | | |
| | 30 | | ☒ | 18 | Pushed 0.65 | CL-2 | lt. blue-gray, very moist, stiff — SANDY LEAN CLAY | | 30.7 | 43 | 22 | | | | UC |
| 4240 | 35 | | ■ | 18 | 5,13,14 0.42 | CL | lt. blue-gray, moist, firm | | | | | | | | |
| 4235 | 40 | | ☒ | 18 | Pushed 0.72 | CL-2 | lt. blue-gray, moist, stiff | 101.2 | 25.1 | 33 | 18 | | | | CT UC |
| 4230 | 45 | | ■ | 18 | 10,10,9 1.00+ | CL-ML/CL | lt. gray-brown, moist, very stiff — LEAN CLAY TO SILTY CLAY | | | | | | | | |
| 4225 | 50 | | | | | | | | | | | | | | |

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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

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Provo, Utah

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# DRILL HOLE LOG

BORING NO. 05-4

Sheet: 2 of 2

PROJECT: ENVIROCARE - CLIVE NEW FACILITIES — PROJECT NO.: 200501.017
CLIENT: ENVIROCARE OF UTAH, L.L.C. — DATE: 5/6/05
LOCATION: SEE SITE PLAN: N 15094, E 11312 — ELEVATION: ~4274.2'
DRILLER: T. KERN — LOGGED BY: R. JOHNSON, V.N.B.
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ 28.2' AFTER 24 HOURS: ▽ NOT MEASURED

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 16 | Pushed | SM | | | | | | | | | |
| | | | | 18 | 1,7,20 | SM | brown, wet, med. dense — VERY SILTY FINE SAND W/FEW SANDY SILT LENSES | | | | | | | | |
| 4220 | 55 | | | 18 | 7,14,14 0.49 | SM | brown, wet, med. dense | | | | | | | | |
| | | | | | | ML | red-brown, moist, firm — SILT W/SAND | | | | | | | | |
| 4215 | 60 | | | 18 | Pushed 0.54 | CL-2 | brown, moist, stiff — LEAN CLAY | 79.7 | 41.0 | 44 | 20 | | | | UC CT |
| 4210 | 65 | | | 18 | 12,30,45 0.46 | SM | brown, very moist, very dense — VERY SILTY VERY FINE SAND | | | | | | | | |
| 4205 | 70 | | | 18 | Pushed 0.56 | CL-2 | lt. gray, moist, stiff — SANDY LEAN CLAY | 100.9 | 21.7 | 30 | 17 | | | | UC CT |
| 200 | 75 | | | 18 | 11,10,13 | ML | brown, moist, med. dense, non-plastic — SANDY SILT | | | | | | | | |
| 4195 | 80 | | | | | | | | | | | | | | |
| 4190 | 85 | | | | | | | | | | | | | | |
| 4185 | 90 | | | | | | | | | | | | | | |
| 4180 | 95 | | | | | | | | | | | | | | |
| 4175 | 100 | | | | | | | | | | | | | | |

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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

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# DRILL HOLE LOG

BORING NO. 05-6

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITIES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 15236, E 11868
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ 28.9' AFTER 24 HOURS: ▽ NOT MEASURED

PROJECT NO.: 200501.017
DATE: 5/3/05
ELEVATION: ~4276.0'
LOGGED BY: R. JOHNSON, V.N.B.

| Elev. (Feet) | Depth (Feet) | Lith-ology | Sample Type | Rec. (in.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4275 | | | | 14 | 3,5,7 | CL | lt. brown, slightly moist, hard, w/roots | | | | | | | | | |
| | | | | 20 | Pushed 0.59 | CL-2 | lt. brown, moist, stiff, w/rusty-ornge nodules | LEAN CLAY | 83.9 | 36.8 | 42 | 23 | | | | CT |
| 4270 | 5 | | | 18 | 0/12",1 0.51 | CL | lt. brown, moist, stiff, w/lt. gray nodules | | | | | | | | | |
| | | | | 20 | Pushed 0.68 | CL | brown, slightly moist, stiff | SANDY LEAN CLAY | | | | | | | | |
| 4265 | 10 | | | ~~17~~ | ~~4,8,13~~ | CL | brown, slightly moist | | | | | | | | | |
| | | | | | | SC | brown, dry, med. dense | CLAYEY FINE SAND | | | | | | | | |
| | | | | 18 | 6,11,10 0.75 | CL | lt. gray-brown, slightly moist, stiff | SANDY LEAN CLAY | | | | | | | | |
| 4260 | 15 | | | 17 | Pushed | SM | brown, moist<br>lt. brown, dry | SILTY SAND | 95.6 | 12.1 | | | 0 | 82 | 18 | |
| | | | | 17 | 2,5,7 0.69 | CL | lt. gray, slightly moist, stiff | FINE SANDY CLAY W/SAND LENSES | | | | | | | | |
| 4255 | 20 | | | 18 | 2,8,17 0.88 | CL | lt. gray-brown, moist, stiff | | | | | | | | | |
| | | | | | | SC | lt. gray-brown, dry, dense | CLAYEY FINE SAND | | | | | | | | |
| 4250 | 25 | | | 15 | Pushed 0.76 | CL-2 | lt. red-brown, moist, stiff | LEAN CLAY | 81.9 | 39.3 | 43 | 23 | | | | CT |
| 4245 | 30 | | | 18 | 0/12",1 0.14 | CL | lt. groy, moist to wet, soft, w/rusty-brown nodules | | | | | | | | | |
| 4240 | 35 | | | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | | | |

10.8'

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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

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Provo, Utah

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# DRILL HOLE LOG

BORING NO. 05-7

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 15723, E 12681
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ DRY AFTER 24 HOURS: ▽ NOT MEASURED

PROJECT NO.: 200501.017
DATE: 5/3/05
ELEVATION: ~4280.4'
LOGGED BY: R. JOHNSON, V.N.B.

| Elev. (Feet) | Depth (Feet) | Lith-ology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4280 | | | | 8 | 3,6,8 | CL | lt. brown, moist, stiff — LEAN CLAY | | | | | | | | |
| | | | | 15 | Pushed 0.35 | CH | lt. gray, moist, firm — FAT CLAY | 71.7 | 38.2 | 59 | 34 | | | | CT |
| | 5 | | | | | | | | | | | | | | |
| 4275 | | | | 18 | 0/12",1 0.51 | CL | gray-brown, moist, stiff | | | | | | | | |
| | | | | 18 | Pushed 0.40 | CL-2 | lt. gray, moist, firm — LEAN CLAY | 77.3 | 34.0 | 41 | 19 | | | | CT |
| | 10 | | | | | | | | | | | | | | |
| 4270 | | | | 18 | 0/18" 0.31 | CL | lt. gray, moist, firm | | | | | | | | |
| | 13.2' | | | | | | | | | | | | | | |
| | | | | 16 | 3,4,4 | SM | brown, slightly moist, stiff — SILTY SAND | | | | | | | | |
| | 15 | | | | | | | | | | | | | | |
| 4265 | | | | 14 | 7,14,14 | SM | brown, moist, med. dense | | | | | | | | |
| | | | | | | CL | brown, slightly moist, stiff — SANDY LEAN CLAY | | | | | | | | |
| | 20 | | | | | | | | | | | | | | |

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**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

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# DRILL HOLE LOG

BORING NO. 05-8

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 16292, E 14844
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ DRY AFTER 24 HOURS: ▽ NOT MEASURED

PROJECT NO.: 200501.017
DATE: 5/3/05
ELEVATION: ~4281.7'
LOGGED BY: R. JOHNSON, V.N.B.

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 16 | 4,5,5 | CL | lt. brown, dry to slightly moist, hard, w/white nodules | | | | | | | | |
| 4280 | | | | | | | | | | | | | | | |
| | | | | 8 | Pushed 0.77 | CL-1 | lt. brown-tan, very moist, hard, w/rusty-orange nodules | 105.1 | 21.8 | 25 | 11 | | | | UC |
| | | | | | | | LEAN CLAY | | | | | | | | |
| | 5 | | | 14 | 1,2,2 0.85 | CL | lt. brown, slightly moist, stiff, w/rusty-orange nodules | | | | | | | | |
| 4275 | | | | | | | | | | | | | | | |
| | 9' | | | 16 | Pushed | CL-2 | lt. brown, very moist, hard | | 28.4 | 46 | 24 | | | | |
| | | | | | | SM | | | | | | | | | |
| | 10 | | | 15 | 2,4,5 | SM | lt. brown, dry, loose | | | | | | | | |
| | | | | | | | SILTY SAND | | | | | | | | |
| 4270 | | | | | | | | | | | | | | | |
| | | | | 17 | Pushed | CL | lt. brown, slightly moist, hard, crushed end of tube | | | | | | | | |
| | | | | | | | SANDY LEAN CLAY | | | | | | | | |
| | 15 | | | 17 | 5,6,9 0.44 | CL | lt. brown, slightly moist, stiff | | | | | | | | |
| 4265 | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | |

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## LEGEND

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test

RB&G ENGINEERING INC.
Provo, Utah

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# DRILL HOLE LOG

BORING NO. 05-10

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 16277, E 13757
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: DRY AFTER 24 HOURS: NOT MEASURED

PROJECT NO.: 200501.017
DATE: 5/3/05
ELEVATION: ~4284.0'
LOGGED BY: R. JOHNSON, V.N.B.

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 14 | 3,3,3 0.55 | CL | brown, slightly moist, stiff | | | | | | | | |
| 4280 | | | | 15 | 2,3,2 1.00+ | CL | lt. gray, slightly moist, very stiff | | | | | | | | |
| | 5 | | | 15 | Pushed 0.56 | CL-2 | lt. gray-brown, moist, stiff LEAN CLAY | 85.2 | 35.3 | 39 | 17 | | | | CT UC |
| 4275 | | | | 24 | 1/12",1/12" 0.30 | CL | lt. gray, moist, firm | | | | | | | | |
| | 10 | | | 18 | 0/9",1/3",5 0.62 | CL | gray-brown, moist, stiff | | | | | | | | |
| | | | | | | SM | rusty-red-brown, dry, med. dense SILTY SAND | | | | | | | | |
| 4270 | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | |
| 4265 | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | |

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RB&G ENGINEERING INC.
Provo, Utah

**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test
SG - Specific Gravity Test

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# DRILL HOLE LOG

BORING NO. 05-11

Sheet: 1 of 1

PROJECT: ENVIROCARE - CLIVE NEW FACILITES
CLIENT: ENVIROCARE OF UTAH, L.L.C.
LOCATION: SEE SITE PLAN: N 16492, E 14844
DRILLER: T. KERN
EQUIP./DRILL METHOD: CME-75 / H.S. AUGER
DEPTH TO WATER - INITIAL: ▽ DRY AFTER 24 HOURS: ▽ NOT MEASURED

PROJECT NO.: 200501.017
DATE: 5/5/05
ELEVATION: ~4281.5'
LOGGED BY: R. JOHNSON, V.N.B.

| Elev. (Feet) | Depth (Feet) | Lithology | Sample Type | Rec. (In.) | Blows Per 6" & Torvane (tsf) | USCS | Material Description | Dry Density, pcf | Moisture Content, % | Atter. Liquid Limit, % | Atter. Plasticity Index, % | Gradation Gravel, % | Gradation Sand, % | Gradation Silt/Clay, % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 16 | 2,4,5 0.30 | CL | lt. brown, dry to slightly moist, firm | | | | | | | | |
| 4280 | | | | | | | | | | | | | | | |
| | | | | 17 | 4,5,8 0.82 | CL-1 | lt. brown, moist, stiff | | 19.3 | 31 | 10 | | | | |
| | | | | | | | LEAN CLAY | | | | | | | | |
| | 5 | | | 11 | Pushed | CL-2 | lt. brown, very moist, stiff | 104.8 | 22.6 | 34 | 17 | | | | UC |
| 4275 | | | | | | | | | | | | | | | |
| | 9.5 | | | 18 | Pushed 0.80 | CL-2 | white, very moist, stiff | | 30.5 | 42 | 19 | | | | |
| | 10 | | | 18 | 5,6,6 0.50 | SM | lt. brown, dry, med. dense SILTY SAND | | | | | | | | |
| 4270 | | | | | | CL | lt. brown, slightly moist, stiff | | | | | | | | |
| | | | | 18 | 5,7,10 | CL | lt. brown, dry, stiff SANDY LEAN CLAY | | | | | | | | |
| | 15 | | | 17 | 6,12,12 1.00+ | SM | lt. brown, dry, med. dense SILTY SAND | | | | | | | | |
| 4265 | | | | | | | | | | | | | | | |
| | 20 | | | | | | | | | | | | | | |

06/15/2005
05:47:12 PM

**LEGEND**

2,3,2 ← Blow Count per 6"
0.45 ← Torvane (tsf)
Disturbed Sample
Undisturbed Sample
Groundwater Elevation

UC - Unconfined Compression Test
CT - Consolidation Test

RB&G ENGINEERING INC.
Provo, Utah

20/20

# CLIVE FACILITY

# CLASS A WEST (CAW)
# CLAY & ROCK BORROW
# CALCULATIONS

REVISION FOR COVER DESIGN CHANGES

**November 4, 2011**

**For**
**Utah Division of Radiation Control**
**195 North 1950 West**
**Salt Lake City, UT 84114-4850**

**By**
**Energy*Solutions*, LLC**
**423 West 300 South, Suite 200**
**Salt Lake City, UT 84101**



ve 11/4/11

ENERGYSOLUTIONS

Project No. 10014 Description CAW: ROCK CALCS REVISION Date 11/4/11
By D. BOOTH Chkd. By Ann Rogers Sheet 1 of 3

PROBLEM: REVISE COVER (ROCK) QUANTITIES TO REFLECT CHANGES IN COVER DESIGN:

METHOD:

SAME APPROACH AS IN ORIGINAL CALCS.
ONLY INCREASE AFFECTED LAYER THICKNESSES.
REFER TO ATTACHED REVISED DWG 10014-C04.

TYPE A & B RIPRAP INCREASES BY 0.5' ✓
(2' THICKNESS) ✓
TYPE B FILTER INCREASES BY 1' BUT ✓
ONLY ON SIDE SLOPES. (1.5' THICKNESS) ✓

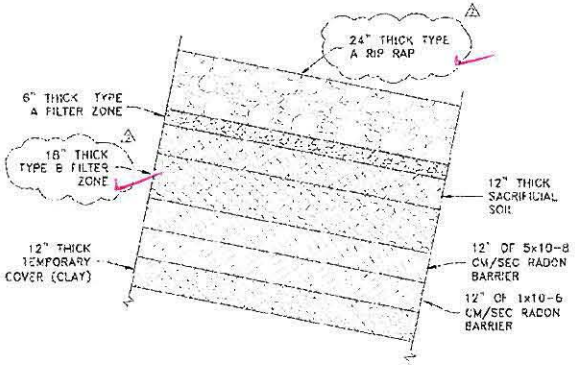
RESULTS:

SEE ATTACHED TABLE (PAGE 3) FOR REVISED QUANTITIES.

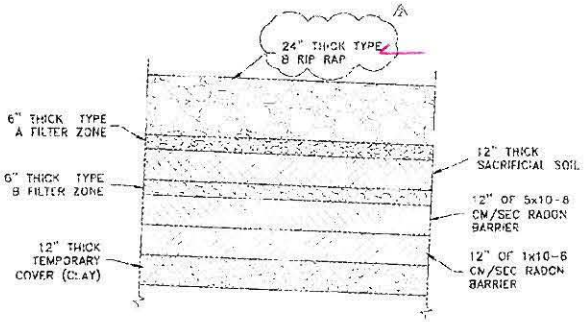
TOTAL REQUIRED RESOURCE IS INCREASED BY 212,108 yd³ ✓

PROFESSIONAL ENGINEER
DAVID BOOTH
No. 189500
11/4/11
STATE OF UTAH

11/4/11




1 DETAIL-SIDE SLOPE
C02 NTS TYPICAL SIDE SLOPE COVER DETAIL




2 DETAIL-TOP SLOPE
C02 NTS TYPICAL TOP SLOPE COVER DETAIL

COVER MATERIAL GRADATIONS (ASTM C-136)

TYPE A RIP RAP
D100<= 16 INCH
D90 <= 12 INCH
D50 >= 4-1/2 INCH
D10 >= 2 INCH
D5 >= NO. 200 SIEVE

TYPE B RIP RAP
D100<= 4-1/2 INCH
D50 >= 1-1/4 INCH
D10 >= 3/4 INCH
D5 >= NO. 200 SIEVE

TYPE A FILTER ZONE
D100<= 6 INCH
D70 <= 3 INCH
D50 <= 1.57 INCH (40 mm)
D15 <= .85 INCH (22 mm)
D10 >= NO. 10 SIEVE (2mm)
D5 >= NO. 200 SIEVE

TYPE B FILTER & SACRIFICIAL SOIL
TYPE B FILTER & SACRIFICAIL SOIL MATERIAL GRADATIONS ARE DETERMINED BY THE FOLLOWING SPECIFICATION:

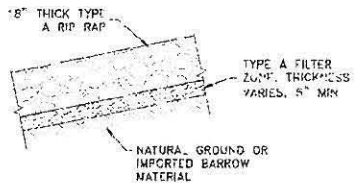
D15 FILTER / D85 SOIL MUST BE < 5

D50 FILTER / D50 SOIL MUST BE <= 25

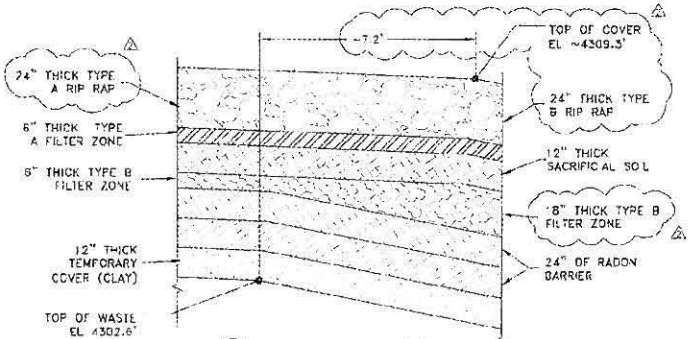
D15 FILTER / D15 SOIL MUST BE >= 4

TYPE B FILTER MIN PERMEABILITY = 3.5 cm/sec

SACRIFICIAL SOIL MIN MOISTURE @ 15 atm = 3.5%




3 DETAIL-DITCH OUTER SLOPE
C02 NTS TYPICAL PERIMETER DITCH COVER DETAIL




4 DETAIL-SHOULDER
C02 1"=4'

| NO | DATE | DESCRIPTION OF CHANGE |
|---|---|---|
| 1 | 11/30/11 | ISSUED FOR CONSTRUCTION. INCREASED RIP RAP TO 24" AND SOIL SLOPE TYPE B FILTER TO 18" |
| 2 | 10/14/11 | DESIGN REVIEW. INCREASED RIPRAP THICKNESS & ADDED RADIO SPEC |
| 3 | 4/28/11 | OPTIONAL LATERAL |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
SECTIONS AND DETAILS, 2 OF 2
CLIVE, UTAH

FINAL DRAWING

D. BOOTH
C. HUTSON
D. BOOTH
AS NOTED 04/28/11

10014
C04

2/3

12/4/11

## Class A West Cover Quantities

| COVER MATERIALS | AREA (ft2) HORZ. | ADJ. FACTOR | AREA (ft2) ADJ. | THICKNESS (ft) | VOLUME (yd3) |
|---|---|---|---|---|---|
| Cover Area (to ditch centerline) | 5,950,435 | NA | | | |
| Total Cover Area (to ditch outside limits) | 6,147,578 | NA | | | |
| Top Slope | 4,128,092 | 1.0008 | 4,131,394 | | |
| Temporary Cover (clay) | | | | 1.0 | 153,015 |
| Radon Barrier (clay) | | | | 2.0 | 306,029 |
| Erosion Materials (rock) | | | | 4.0 | 612,058 |
| Side Slope (to ditch centerline) | 1,822,343 | 1.0198 | 1,858,426 | | |
| Temporary Cover (clay) | | | | 1.0 | 68,831 |
| Radon Barrier (clay) | | | | 2.0 | 137,661 |
| Erosion Materials (rock) | | | | 5.0 | 344,153 |
| Outer Ditch Slope Area (2 layers) | 197,143 | 1.0198 | 201,046 | | |
| Erosion Materials (rock) | | | | 2.0 | 14,892 |
| LINER MATERIALS | | | | | |
| Total Liner | 5,996,476 | NA | NA | 2.0 | 444,183 |
| Liner to be Constructed | 1,085,701 | NA | NA | 2.0 | 80,422 |
| Total Liner Protective Cover | 5,996,476 | NA | NA | 1.0 | 222,092 |
| Liner Protective Cover to be Constructed | 1,085,701 | NA | NA | 1.0 | 40,211 |
| **TOTAL CLAY MATERIAL (BORROW)** | | | | | **786,169** |
| TOTAL SAND & GRAVEL PRODUCTS | | | | | 971,104 |
| BORROW FACTOR | | | | | 1.18 |
| **TOTAL SAND & GRAVEL BORROW** | | | | | **1,145,902** |

Note: Areas are calculated from design drawings using AutoCAD.

Note: No credit is taken for existing temporary cover.

Updated: 11/4/11

12 11/4/11

# United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Salt Lake City Field Office
2370 South 2300 West
Salt Lake City, Utah 84119
ph: (801) 977-4300; Fax: (801) 977-4397
www.ut.blm.gov/saltlake_fo


OCT 1 2 2011

TAKE PRIDE IN AMERICA

BY: .....

IN REPLY REFER TO:
3600, (UTW011)
U-062744

Mr. David F. Booth, PE
Director of Engineering
ENERGYSOLUTIONS
423 W 300 S, Ste 200
Salt Lake City, Utah 84101

OCT 11 2011

Dear Mr. Booth,

On September 1, 2011, you contacted the Salt Lake Field Office inquiring about documentation as to the potential volume of mineral materials (gravel) located in the "Central Grayback 24" community pit, located in T. 1 N., R. 12 W., section 24, serialized U-062744.

I checked the file and the Central Grayback 24 community pit U-062744, actually covers four square miles in that location. All of section(s) 23, 24, 25 and 26, but only the S1/2SW1/4 (80 acres) of section 24 have been cleared at this time for gravel sales.

The case file had documentation that 40 acres of the 80 acres contains at least 750,000 cubic yards of gravel. I completed further volume calculations and determined that a conservative estimate of the amount of gravel just within the 80 acres could contain at least 1.6 million cubic yards.

If you have any questions regarding this matter, please contact me at (801)977-4371.

Sincerely,

Larry Garahana, PG
Salt Lake Field Office Geologist

# PEPG ENGINEERING, L.L.C.

Civil Engineering
Land Surveying
Wetlands
Land Planning
Environmental
Construction
Services

January 13, 2004

To: David Shockey P.E., Director of Engineering
Envirocare of Utah

**Reference:** Preliminary report for Envirocare of Utah gravel exploration at C3

October 30, 2003 PEPG Engineering began field exploration on site C3; Samples were taken with the following results and documentation.

**Gravel Exploration Site C3**

Initially and within the original boundaries for C3 eighteen points were identified for excavation and material evaluation. During the exploration the boundaries as well as the total number of points were expanded, the points were expanded to 27 locations, with the boundaries extended to 50 ft. beyond the outer points.

Excavation was accomplished with a Cat 325 Excavator with an excavation reach of 20+ ft. The material encountered and or the reach of the excavator determined the depth at each excavation point. Each point has been documented with pictures and a brief description of the excavation operation and material encountered (attachments).

Average Coarse Material Gradation for site C3:

| | |
|---|---|
| Percent 4"- | 82.75% |
| Percent 12"- | 13.7% |
| Percent 18"- | 3.6% |
| Percent Over 18" | Not Identified |

Average Fine Material Gradation for Site C3:

| Sample Wt. Lbs. | 218.3 | | |
|---|---|---|---|
| Sieve Size | Weight Ret. | % Ret. | % Pass |
| + 1", - 4" | 49.4 | 22.6 | 77.4 |
| + 3/4", - 1" | 11.6 | 5.3 | 72.1 |
| - 3/4" | 157.2 | 72.0 | 0.1 |
| Sum | 218.3 | 99.9 | |

**Site C3 Summary:**

- The extended exploration area for C3 covers and estimated surface area of 1,200,000.00 square feet, with an average estimated material depth of 25 ft, with an additional possible material depth of 15 ft.
- Site C3 appears to be very favorable for obtaining the necessary coarse granular material needed for the Envirocare operation.
- The excavations reveled various materials from silts to very large boulders and ledge rock, solidified and calcified materials were also found. 40% of the graded material was over 1 inch material.
- To facilitate the mining operation and because of the calcified material and ledge rock encountered in may be necessary to drill and blast portions of this site.
- Because this area is within an existing mining facility there will be minimal impact to the area or surroundings, many roads exist, however they will require some improvement and up grading.



421 West 12300 South #400 • Draper, Ut 84020 • Telephone (801) 562-2521 • Fax (801) 562-2551

Clearing and Grubbing:

As shown in the attached photographs this area contains native grass and scrub brush that will require removal prior to mining of the underlying material. It is estimated this removal process will impact the top 12 inches of material. When mining of the area is complete the removed material will facilitate the reclamation of the mined or impacted area

In lieu of grubbing the surface material may be cleaned of all organic material with a screening operation, which would them produce usable granular material from the surface material.

Estimated Available Material:

- Proven and Probable available material to an estimated 25 ft. depth within the exploration area is 1,100,00.00 cu yds.
- Possible additional material to an additional depth of 15 ft. is 660,000.00 cu yds.
- It appears that this initial area can be expanded to an adjacent North East area that contains additional amounts of materials.
- It will be necessary to improve and or realign the existing haul road into this area this operation will also produce usable material above and beyond the proven and probable amount identified.

For additional information please contact Jay Smith at office telephone 801 562-2521 or cellular telephone 801 870-8821.

Sincerely,

T. Jay Smith
Laboratory Supervisor, Quality Control Manager

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1017 |

| | |
|---|---|
| Date: | 5-Nov-03 |
| Excavation Depth: | 6' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 6', encountered solid calcified rock, Material consisted of fine soils and large rocks of 18"+. With the exception of the large boulders the fines are similar to w 1018. | |

| | |
|---|---|
| Percent 4"- | 52.25% |
| Percent 12"- | 33.4% |
| Percent 18"- | 14.7% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1018 |

| | |
|---|---|
| Date: | 5-Nov-03 |
| Excavation Depth: | 8' |

| Description of Material: |
|---|
| Excavated to 8' in depth. Material consisted of large 18" minus with smaller gravel and fines. Material was similar to location 1021. Encountered calcified layer at 3' to 4.5', loose from 4.5' to 8', then solid calcification. |

| | |
|---|---|
| Percent 4"- | 81.25% |
| Percent 12"- | 11.1% |
| Percent 18"- | 7.7% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1019 |

| | |
|---|---|
| Date: | 30-Oct-03 |
| Excavation Depth: | 4' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 4'. Encountered solid calcified material, unable to break out. As shown by picture, this area contains large 12"+ boulders. No gradation performed. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1020 |

| | |
|---|---|
| Date: | 31-Oct-03 |
| Excavation Depth: | 6.5 |

| Description of Material: | |
|---|---|
| Excavated to a depth of 6.5'. Material consisted of fine soils and loose 12"+ boulders as shown in two pictures. Calcification was not encountered. A gradation was not performed. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1021 |

| | |
|---|---|
| Date: | 6-Nov-03 |
| Excavation Depth: | 7.5 |

| Description of Material: | |
|---|---|
| Excavated to a depth of 7.5'. Consisted of small 12" minus gravel. Not calcified together. | |

| | |
|---|---|
| Percent 4"- | 84.73% |
| Percent 12"- | 15.3% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1022 |

| | |
|---|---|
| Date: | 6-Nov-03 |
| Excavation Depth: | 9' |

| Description of Material: |
|---|
| Excavated to a depth of 9'. Material consisted of 12" minus. No calcification found, comparable to 1033. |

| | |
|---|---|
| Percent 4"- | 58.86% |
| Percent 12"- | 41.1% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1023 |

| | |
|---|---|
| Date: | 6-Nov-03 |
| Excavation Depth: | 12' |

| Description of Material: |
|---|
| Excavated to a depth of 12'. Material consisted of soils and loose 12" minus gravel. Two combined 1.2 cu yd buckets only produced 185 lbs of 4" to 12" material. Material is comparable to 1022 only smaller aggregate. No picture taken. |

| | |
|---|---|
| Percent 4"- | 96.68% |
| Percent 12"- | 3.3% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1024 |

| | |
|---|---|
| Date: | 30-Oct-03 |
| Excavation Depth: | 3' |

| Description of Material: | |
|---|---|

Excavated to a depth of 3'. Top 3' consisted of soils, fine sand, and some larger boulders. At 3' it appeared that ledge rock was encountered. There were no visible seams in the material and no sign of calcification. In vain the excavation was enlarged. No gradation was performed, no pictures taken.

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1025 |

| | |
|---|---|
| Date: | 5-Nov-03 |
| Excavation Depth: | 12' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 12'. Material consisted of soils and loose 12" minus gravel. Two combined 1.2 cu yd buckets only produced 326 lbs of 4" to 12" material. Material is comparable to 1022. No picture taken. | |

| | |
|---|---|
| Percent 4"- | 92.10% |
| Percent 12"- | 5.9% |
| Percent 18"- | 2.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1026 |

| | |
|---|---|
| Date: | 5-Nov-03 |
| Excavation Depth: | 11' |

| Description of Material: | |
|---|---|

Excavated to a depth of 11'. Material consisted of soils and loose 12" minus gravel. Two combined 1.2 cu yd buckets only produced 119 lbs of 4" to 12" material. Material is comparable to 1022.

| | |
|---|---|
| Percent 4"- | 97.86% |
| Percent 12"- | 2.1% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1027 |

| | |
|---|---|
| Date: | 6-Nov-03 |
| Excavation Depth: | 10.0 |

| Description of Material: |
|---|
| Excavated to a depth of 10'. Material consisted of soils and loose 18" minus gravel. No calcification. |

| | |
|---|---|
| Percent 4"- | 82.55% |
| Percent 12"- | 10.0% |
| Percent 18"- | 7.5% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1028 |

| | |
|---|---|
| Date: | 30-Oct-03 |
| Excavation Depth: | 18" |

| Description of Material: | |
|---|---|
| Excavated to a depth of 18". Encountered solid calcified material, unable to break up. No gradation performed and no Pictures taken. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1029 |

| | |
|---|---|
| Date: | 30-Oct-03 |
| Excavation Depth: | 13' |

| | |
|---|---|
| Description of Material: | |
| Loose gravel consisting of -18". Encountered calcified (cemented) material at 13'. | |
| | |

| | |
|---|---|
| Percent 4"- | 71.76% |
| Percent 12"- | 22.0% |
| Percent 18"- | 6.3% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1030 |

| | |
|---|---|
| Date: | 30-Oct-03 |
| Excavation Depth: | 13' |

| Description of Material: |
|---|
| Loose gravel consisting of 18" minus. Encountered calcified (cemented) material at 13'. Only one bucket screened. |

| | |
|---|---|
| Percent 4"- | 84.29% |
| Percent 12"- | 10.6% |
| Percent 18"- | 5.2% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | East of 1030 |

| | |
|---|---|
| Date: | 11-Jul-03 |
| Excavation Depth: | |

| Description of Material: | |
|---|---|
| North East of 1030. Excavated face wall of previous mine near the bottom of the slope. Soil and sand with 12 to 18 inch boulders. Two pictures, no gradation. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1031 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 20+' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 20+ feet. Fine grained sand, with sporadic small aggregates. No gradation performed. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1032 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | |

| Description of Material: | |
|---|---|
| Location 1032 was located in a previous haul road that was constructed during the previous mining operation. Because of this, 1032 was not excavated. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1033 |

| | |
|---|---|
| Date: | 6-Nov-03 |
| Excavation Depth: | 13' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 13'. Material consisted of soils and loose 12" minus gravel. | |

| | |
|---|---|
| Percent 4"- | 86.36% |
| Percent 12"- | 13.6% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1034 |

| | |
|---|---|
| Date: | 30-Oct-03 |
| Excavation Depth: | 14' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 14'. Material consisted of soils and loose 12" minus gravel. Encountered fine sand at 10'. Top material similar to 1033. Two buckets screened for a combined wight of 5571 lbs. | |

| | |
|---|---|
| Percent 4"- | 89.65% |
| Percent 12"- | 10.3% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | North of 1034 |

| | |
|---|---|
| Date: | 5-Nov-03 |
| Excavation Depth: | 8' |

| Description of Material: | |
|---|---|
| Large sand deposit. Excavated to a depth of 8'. Material consisted of sandy over burden from previous excavation work. At 8' encountered ledge rock. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1035 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 4.5' |

| Description of Material: | |
|---|---|
| East of 1032 on Plateau in native. Excavated 4.5' deep, encountered soil and sands with large boulders. At 4.5', the boulders were very tight and held together with soil and sands. At the 4.5' depth, there was no sign of calcification or ledge rock. Two Pictures. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1036 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 9' |

| Description of Material: | |
|---|---|
| Excavated to 9' deep. Majority is 12" to 18" minus, with top 4' soils, bottom more gravel with no soils. Very tight, non calcified. | |

| | |
|---|---|
| Percent 4"- | 77.74% |
| Percent 12"- | 12.2% |
| Percent 18"- | 10.1% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1037 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 15' |

| Description of Material: |
|---|
| Excavated to a depth of 15'. Material consisted of soils and loose 12" minus gravel. Picture taken, two buckets of material were graded, minimal 12". Similar to 1030. |

| | |
|---|---|
| Percent 4"- | 90.27% |
| Percent 12"- | 9.7% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1038 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 11.5' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 11.5'. Loose materials consisting of fine soils and small aggregate. | |

| | |
|---|---|
| Percent 4"- | 94.93% |
| Percent 12"- | 5.1% |
| Percent 18"- | 0.0% |
| Percent Over 18" | 0.0% |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1039 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 30" |

| Description of Material: | |
|---|---|
| Excavated to a depth of 30". Material consisted of soils and loose 12" minus gravel with some larger boulders. At 30" encountered calcified material, unable to break through. Picture taken, no gradation. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | Site 3 |
| Field Location: | 1042 |

| | |
|---|---|
| Date: | 6-Nov-03 |
| Excavation Depth: | 2' |

| Description of Material: | |
|---|---|
| 150' So of 1020. Excavated to a depth of 2'. Top material consisted of soils and loose 12" minus gravel. At 2' encountered calcified material, unable to break through. No gradation, no picture. | |

| | Wt. -4" | Wt. -12" | Wt. -18" | Over 18" |
|---|---|---|---|---|
| Bucket 1 | | | | |
| Sub Total | 0.0 | 0.0 | 0.0 | 0.0 |
| Bucket 2 | | | 0.0 | 0.0 |
| Sub Total: | | 0.0 | 0.0 | 0.0 |
| Sub total: | 0.0 | | | |

| | |
|---|---|
| Bucket 2 Total Weight: | 0.0 |
| Bucket 1 & 2 Combined Weight: | 0.0 |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

Approved / Technician

**PEPG ENGINEERING, L.L.C.**

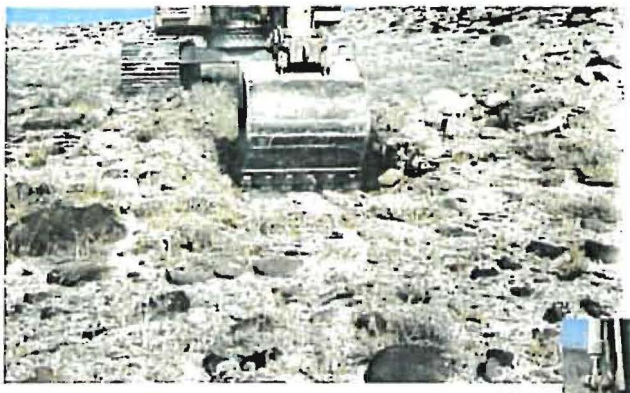
Envirocare Rock & Sand Exploration

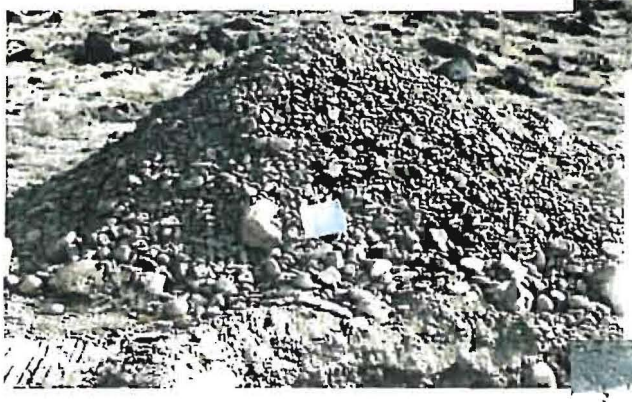
| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1043 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 12' |

| Description of Material: | |
|---|---|
| South of 1024, near edge of plateau. Excavated to a depth of 12". Soil and 12-inch + rock down to 6 ft. At 6 ft encountered smaller partially calcified rock down to 12 ft. No gradation, four pictures. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |





**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | 1044 |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | 12' |

| Description of Material: | |
|---|---|
| Excavated to a depth of 12". Soil and rock to 10 ft. At 10 ft encountered sandy silt with large 12 to 18 inch boulders. No visible calcification, no gradation, three pictures. | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | North Face |

| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | |

| Description of Material: | |
|---|---|
| North of 1030. Excavated the face wall of previous mine near the bottom of the slope. The top 4 ft, soil and small rock. From 4 to 7 ft., found 2 to 3 inch gravel. Below 7 ft, sand with silt. Picture taken, no gradation | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |

**PEPG ENGINEERING, L.L.C.**

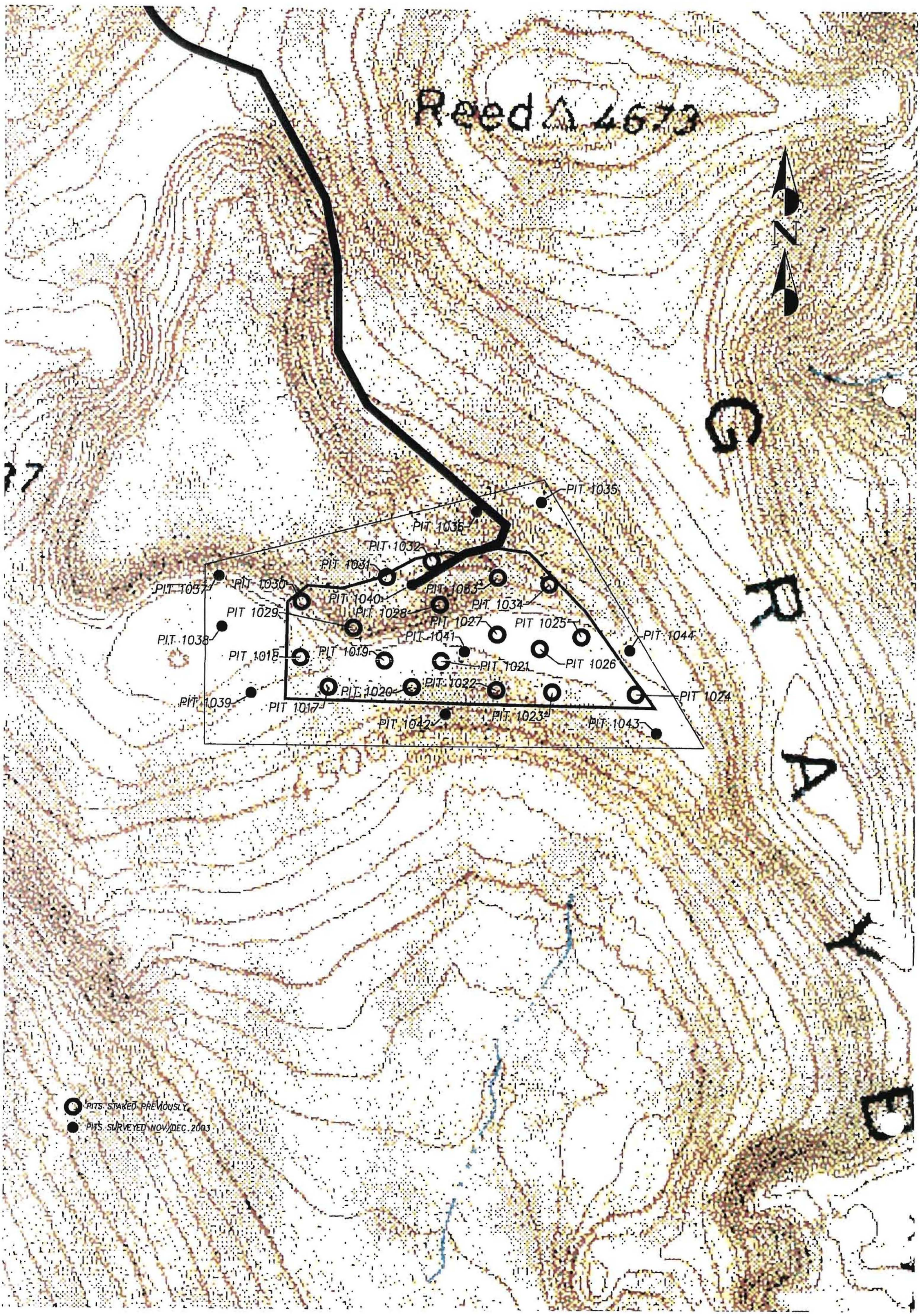
Envirocare Rock & Sand Exploration

| | |
|---|---|
| Project No.: | 6108-0318 |
| Site Location: | C 3 |
| Field Location: | North West Face |

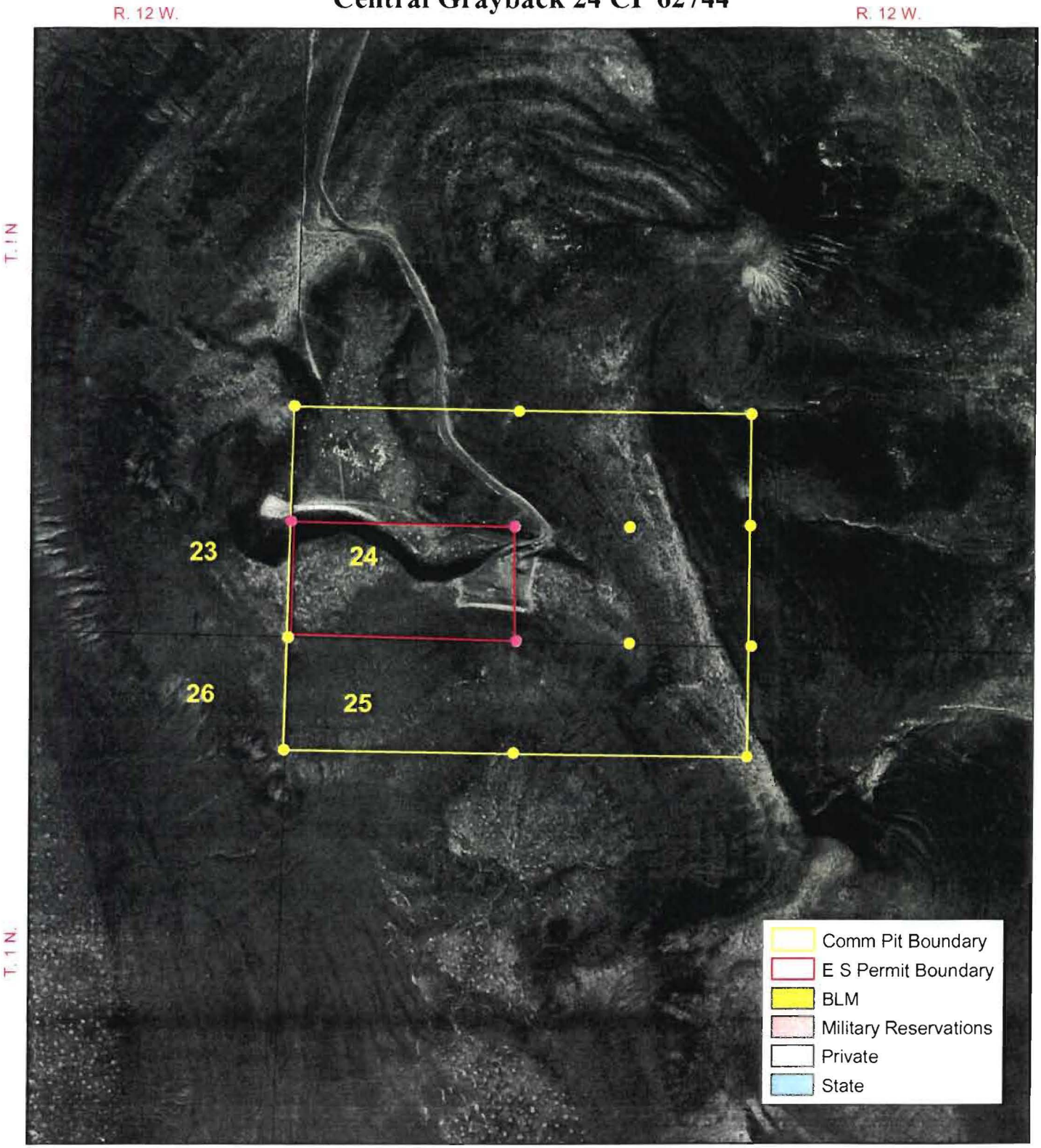
| | |
|---|---|
| Date: | 7-Nov-03 |
| Excavation Depth: | |

| Description of Material: | |
|---|---|
| North West of 1030. Excavated the face wall of previous mine near the bottom of the slope. The top 5 to 6 ft, soil and small rock. At 6 ft encountered light gray sand & silt. Picture taken, no gradation | |

| | |
|---|---|
| Percent 4"- | |
| Percent 12"- | |
| Percent 18"- | |
| Percent Over 18" | |


Reed △ 4673
N
PIT 1035
PIT 1036
PIT 1032
PIT 1031
PIT 1037
PIT 1030
PIT 1040
PIT 1033
PIT 1034
PIT 1029
PIT 1028
PIT 1027
PIT 1025
PIT 1044
PIT 1038
PIT 1041
PIT 1018
PIT 1019
PIT 1021
PIT 1026
PIT 1022
PIT 1020
PIT 1024
PIT 1039
PIT 1017
PIT 1023
PIT 1042
PIT 1043
PITS STAKED PREVIOUSLY
PITS SURVEYED NOV/DEC 2003

# Central Grayback 24 CP 62744




LOCATION

UTAH

0.25 0.125 0 0.25 Miles

1:9,169

April 22, 2008

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
SALT LAKE FIELD OFFICE

This product may not meet BLM standards for accuracy and content. Different data sources and input scales may cause misalignment of data layers. Transportation network has not been verified.

MWH
MONTGOMERY WATSON HARZA

November 20, 2007

Mr. David F. Booth, P.E.
Director of Engineering
Energy*Solutions*, Inc.
423 West 300 South, Suite 200
Salt Lake City, UT 84101

Re: Comparison of two gravel borrow areas on the Grayback Hills, Tooele County

Dear Mr. Booth:

This letter-report is a summary of observations and interpretations I have made with respect to two gravel borrow areas in the Grayback Hills north of the Energy*Solutions* facility near Clive in Tooele County, Utah. I visited the subject areas on November 16, 2007, with Mr. Sean McCandless, Mr.Reed Bangerter and Mr. Daniel Shrum of Energy*Solutions*.

The first borrow area visited is just west of the center of Section 18, T1S, R11W, at an elevation of about 4,320 feet above mean sea level (amsl). The pit is designated by BLM as *Community Pit, U77751*. Clasts in the pit range from sand to small boulder size, are poorly sorted, subangular to round, with about 90 percent gray to dark gray limestone and 10 percent dark gray igneous extrusive trachyandesite and basalt (Black et al., 1999), with a trace of quartzite. Many of the free clasts are coated with tufa, a common cement in Lake Bonneville beach gravel deposits in the area, and the clasts in undistrurbed portions of the pit are cemented to variable degree.

The second borrow area is about four miles north of the Community Pit, near Section 24, T1N, R12W, at an elevation of about 4,530 feet amsl. This pit is designated as *62744 (E)* by BLM. Gravel in this pit is composed of the same lithologies, with generally the same sorting and rounding as that in the Community Pit, but with about 80 percent limestone and 20 percent igneous extrusives. Overall, the clast sizes are slightly smaller than those at the Community Pit. The portion of the gravel deposit that has recently been mined appears to have been a barrier beach that protected a small lagoon from the main body of the lake. Cementation of the gravel in this pit is variable, as in the Community Pit.

The Grayback Hills are composed of limestone and quartzite mapped as Permian-Pennsylvanian Oquirrh Formation, which is as much as 10,000 feet thick in western Utah (Hintze, 1980). Igneous extrusives form a resistant cap on the Grayback Hills, and are mapped as Pliocene-age basalt/rhyolite (Hintze, 1980).

10619 South Jordan Gateway
Suite 100
Salt Lake City, Utah
84095

Tel. 801 617-3200
Fax 801 617-4200

Delivering Innovative Projects and Solutions Worldwide

I interpret the gravel deposits at both borrow locations to be late Pleistocene Lake Bonneville transgressive beach deposits; the beach gravels at the Community Pit location are mantled in places with horizontally bedded fine sand/silt Lake Bonneville lake-bottom deposits that were deposited after the transgression, during subsequent deep-lake phases. Because the Grayback Hills are composed of only two bedrock formations and are isolated from sources of other lithologies by more than ten miles, and because the near-shore, high-energy environment in which the gravels were deposited was similar at both locations, it is not surprising that the gravels at both of the subject pits have very similar lithology, size, degree of rounding, and cementation characteristics.

It has been a pleasure working with you on this project, and I look forward to the opportunity to be of further service to Energy*Solutions*. If you have any questions or require additional information, please do not hesitate to contact me at (801) 617-3237.

Sincerely,

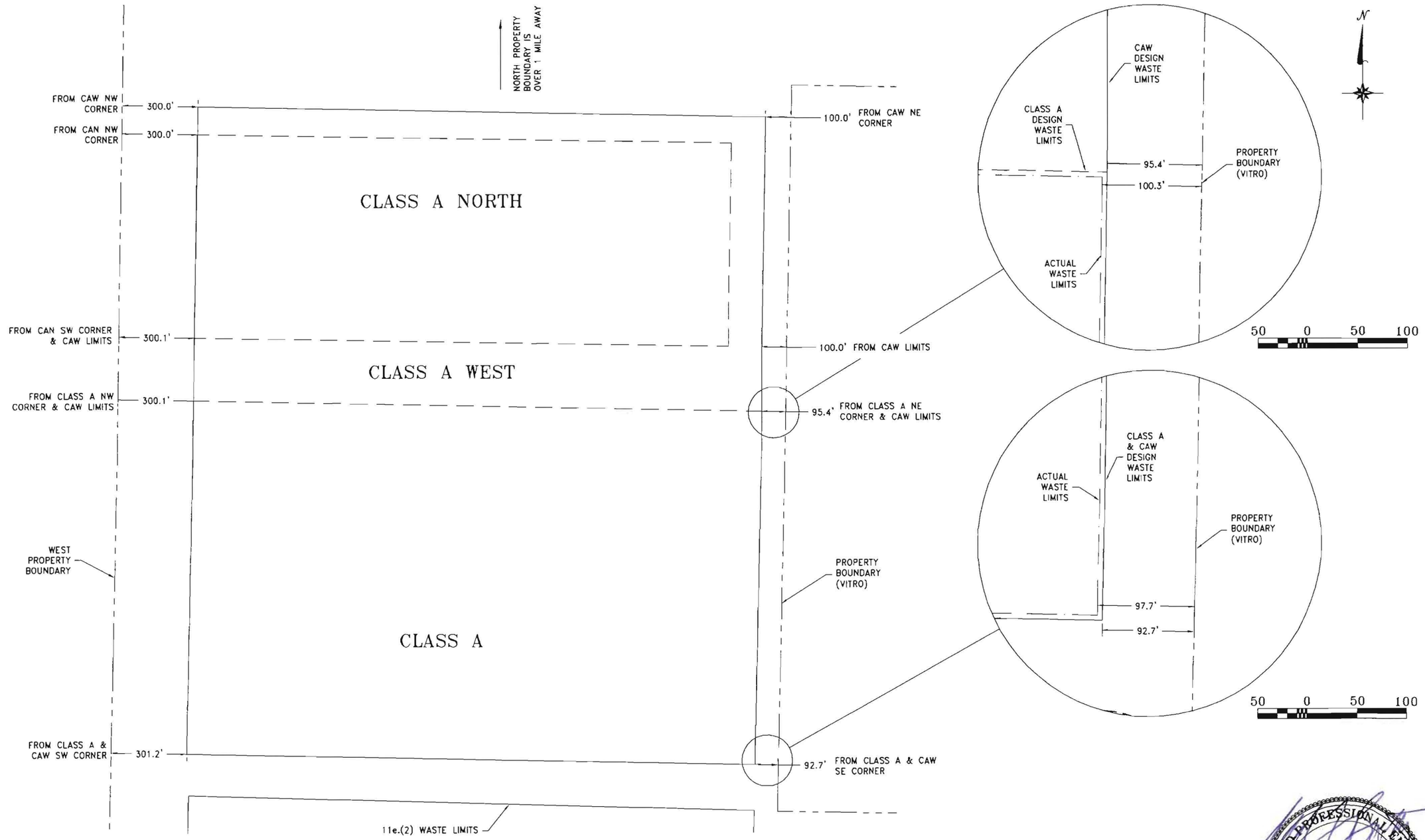
MWH AMERICAS, INC.

John D. Garr, P.G.
Supervising Hydrogeologist
Utah License No. 5251936-2250

REFERENCES

Black,, B.D., Solomon, B.J. and Harty, K.M., 1999, Geology and geologic hazards of Tooele Valley and the West Desert Hazardous Industry Area, Tooele County, Utah; Utah Geological Survey Special Study 96, 65 p.

Hintze, L.F., 1980, Geologic map of Utah: Utah Geological and Mineral Survey, scale 1:500,000, 2 plates.




LEGEND:

- CAW DESIGN WASTE LIMITS
- PROPERTY BOUNDARY
- CLASS A AND CLASS A NORTH EMBANKMENTS DESIGN WASTE LIMITS

NOTE:
WASTE ALONG THE EAST BOUNDARY OF THE CLASS A EMBANKMENT WAS PLACED A MINIMUM OF 5 FT INSIDE OF THE DESIGN WASTE LIMITS TO ACCOMMODATE 1 FT OF TEMPORARY COVER. THIS "WASTE OFFSET" WAS REQUIRED BY THE CQA/QC MANUAL SPECIFICATIONS THAT APPLIED AT THE TIME OF CONSTRUCTION. THEREFORE, THE WASTE LIMITS ARE ACTUALLY AT LEAST 5 FT WEST OF THE DESIGN LIMITS AS SHOWN IN THE TWO INSERTS ABOVE.

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
10/4/11
STATE OF UTAH

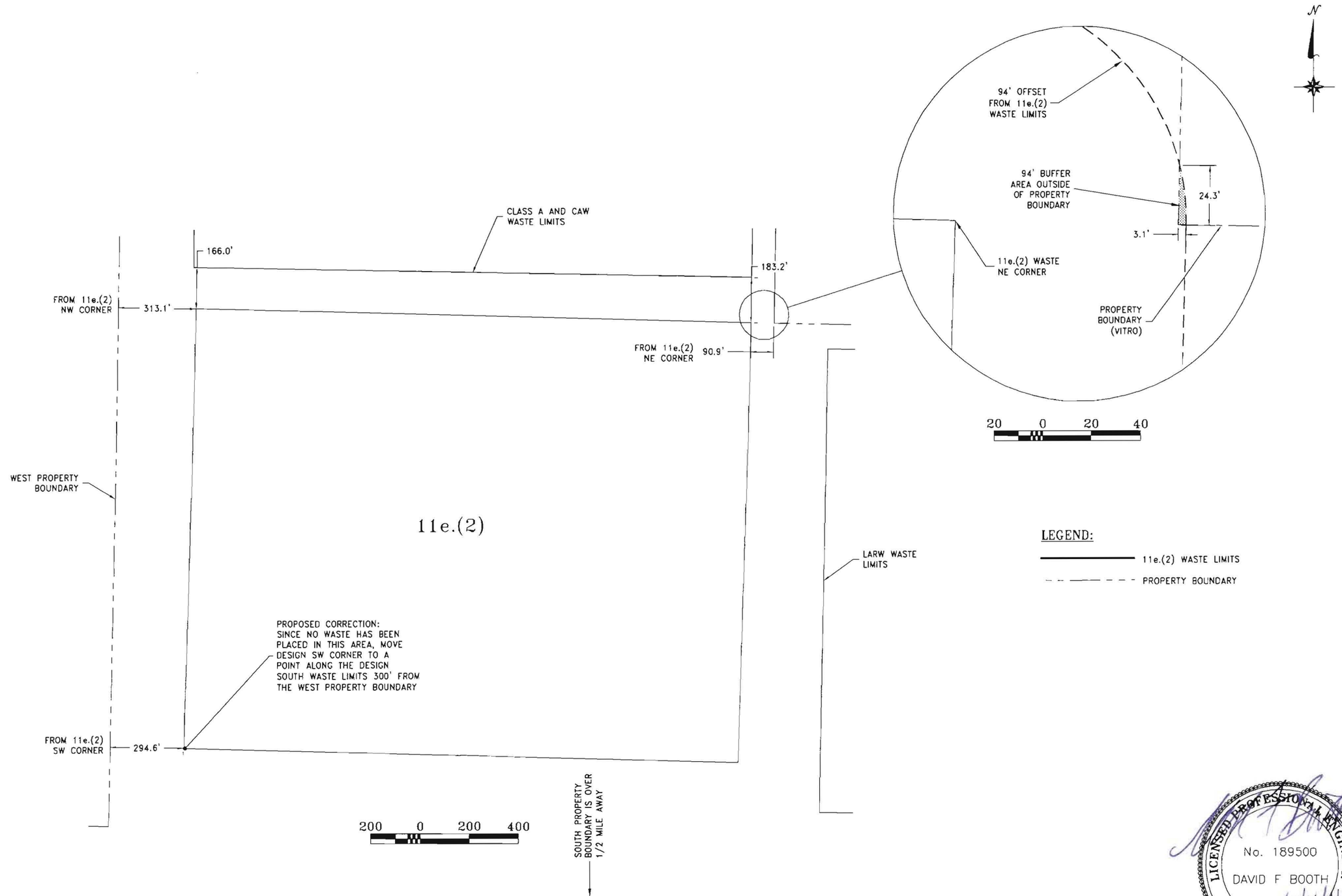
| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 10/4/11 | DFB | FOR LICENSING INFORMATION (INTERROGATORIES) |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT BUFFER ZONES: CAW
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY: D. BOOTH
REVIEWED BY: B. DICK
APPROVED BY: D. BOOTH
SCALE: AS NOTED DATE: 08/31/11 REV.:
DRAWING NO.: 10014
Figure A




LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
10/4/11
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 10/4/11 | DFB | FOR LICENSING INFORMATION (INTERROGATORIES) |

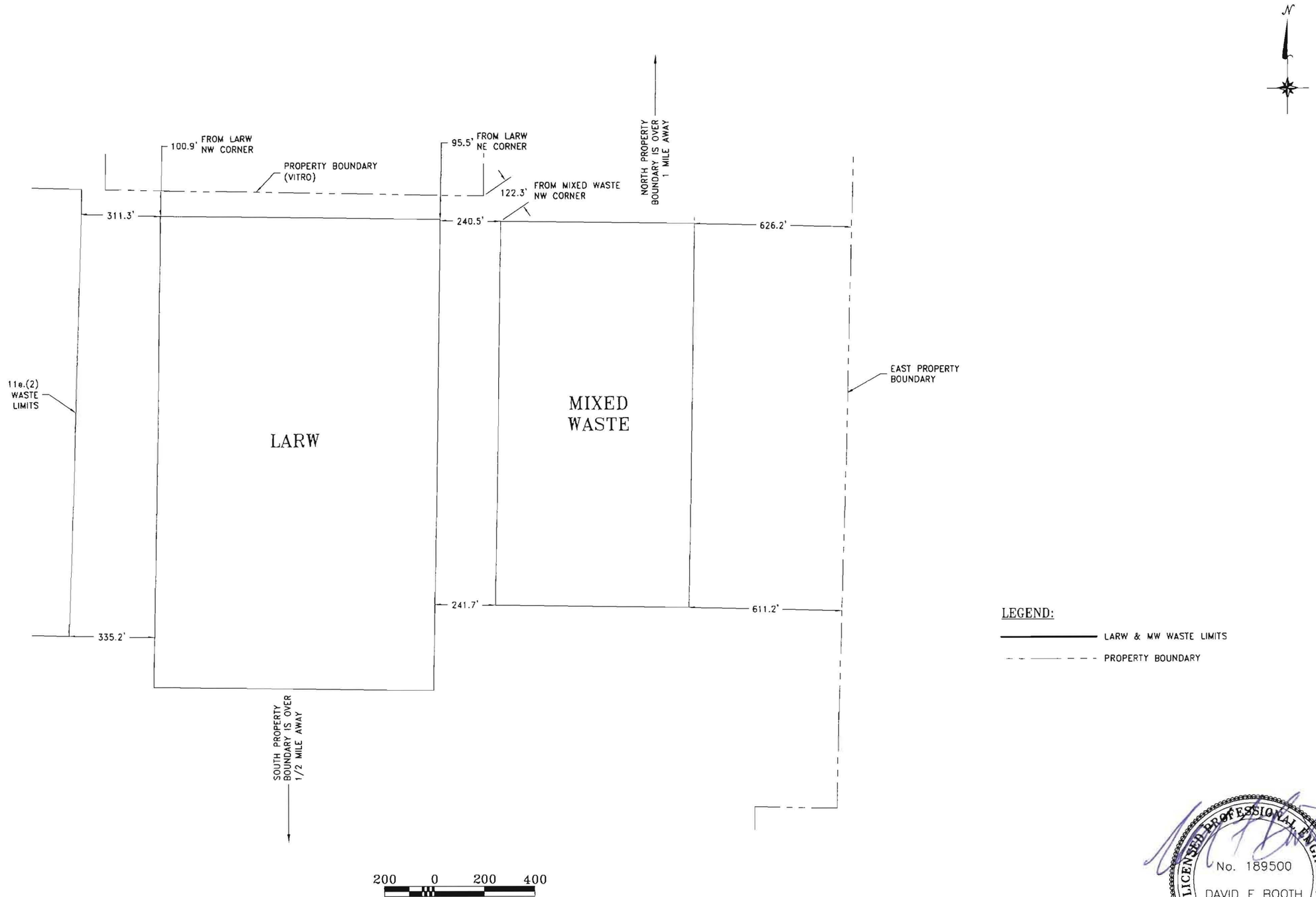
ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT BUFFER ZONES: 11e.(2)
CLIVE, UTAH

FINAL DRAWING

DRAWN BY D. BOOTH
REVIEWED BY B. DICK
APPROVED BY D. BOOTH
SCALE AS NOTED DATE 08/31/11 REV.

DRAWING NO. 10014
Figure B




LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
10/4/11
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 10/4/11 | DFB | FOR LICENSING INFORMATION (INTERROGATORIES) |

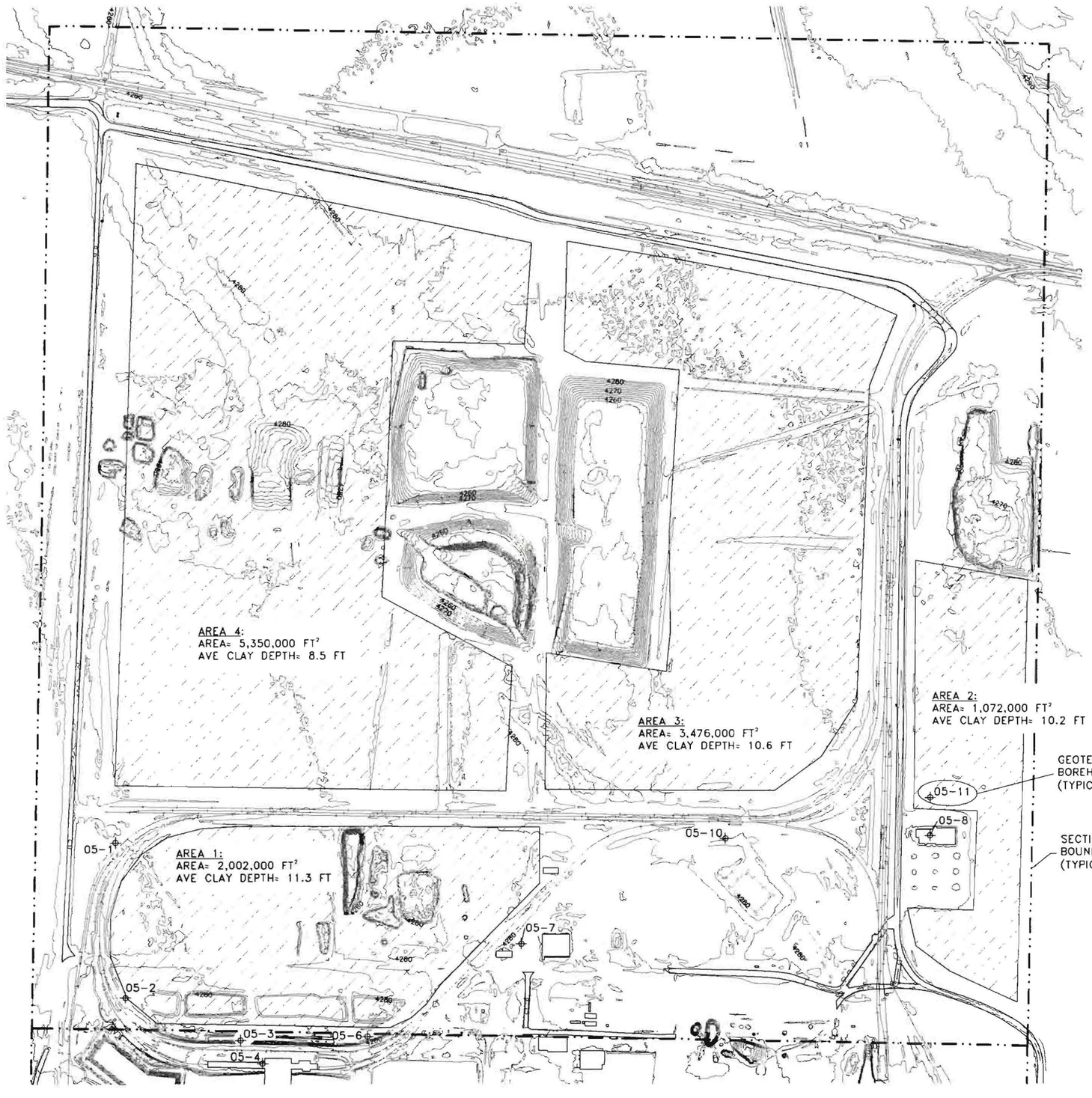
ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
EMBANKMENT BUFFER ZONES: LARW & MIXED WASTE
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY: D. BOOTH
REVIEWED BY: B. DICK
APPROVED BY: D. BOOTH
SCALE: AS NOTED DATE: 08/31/11 REV.:

DRAWING NO. 10014
Figure C




N

AREA 1:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 5c572
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 2001933.2305

AREA 2:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 83140
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 1072058.1094

AREA 3:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 83138
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 3475847.8618

AREA 4:
HATCH Layer: "TEXT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Handle = 83134
Hatch pattern ANSI36
Annotative: No
Hatch scale 450.0000
Hatch angle 0
Associative
Area 5350993.0248

300 0 300 600

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
10/4/11
STATE OF UTAH

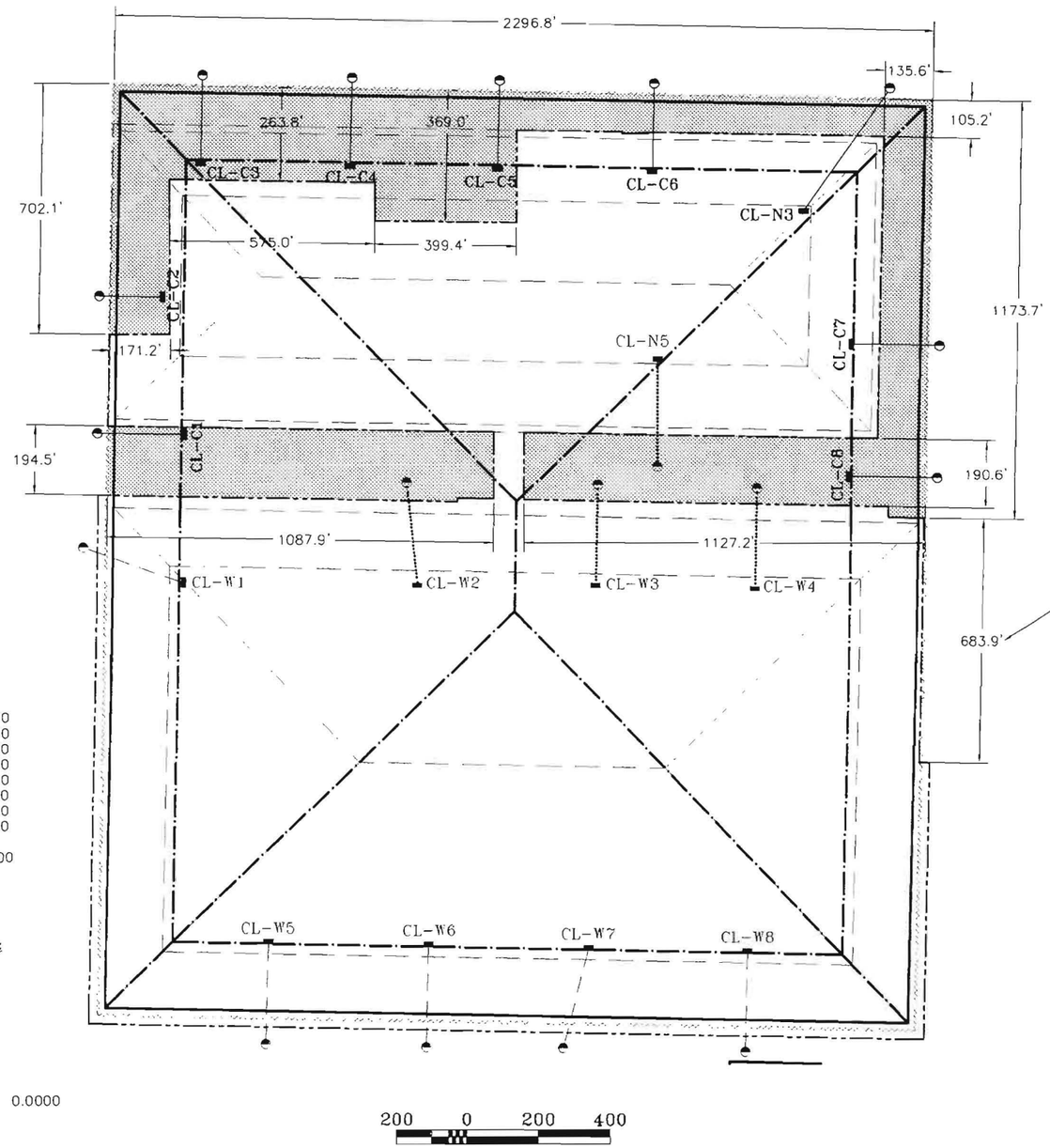
| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 10/4/11 | DFB | FOR LICENSING: INFORMATION ONLY |

ENERGYSOLUTIONS

ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST
CLAY RESOURCE MAP & CALCULATIONS
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY D. BOOTH
REVIEWED BY V. ROGERS
APPROVED BY D. BOOTH
SCALE AS NOTED DATE 09/19/11 REV
DRAWING NO. 10014
FIGURE D




LINER IN THIS AREA NEEDS TO BE EXTENDED A MINIMUM OF 6 FT BEYOND CURRENT LIMITS PRIOR TO FINAL COVER CONSTRUCTION (~3134 FT²)

**TOTAL CAW LINER AREA (20' OFFSET FROM WASTE LIMITS):**

LWPOLYLINE Layer: "CAW LINER LIMITS"
Space: Model space
Linetype scaling = 0.1000
Handle = 9a04d
Closed
Constant width 0.0000
area 5996476.1591
perimeter 9814.7504

| | | | |
|---|---|---|---|
| at point | X=10344.5728 | Y=13655.5460 | Z=4265.0000 |
| at point | X=10320.7181 | Y=12235.7612 | Z=4265.0000 |
| at point | X=12620.3716 | Y=12188.7842 | Z=4265.0000 |
| at point | X=12644.1199 | Y=13608.9075 | Z=4265.0000 |
| at point | X=12644.2551 | Y=13865.2989 | Z=4265.0000 |
| at point | X=12661.6369 | Y=14797.3731 | Z=4265.0000 |
| at point | X=10365.3505 | Y=14844.2813 | Z=4265.0000 |
| at point | X=10344.5731 | Y=13655.5595 | Z=4265.0000 |
| bulge | 0.0002 | | |
| center | X=10364.5700 | Y=13655.2100 | Z=4265.0000 |
| radius | 20.0000 | | |
| start angle | 179d | | |

**TOTAL CAW REMAINING (TO BE BUILT) LINER AREA (AS OF 9/16/11):**

HATCH Layer: "LINER_TO BE BUILT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Linetype scaling = 10.0000
Handle = 99e8c
Hatch pattern SOLID
Associative
Area 1082566.5121
Origin X= 0.0000 Y= 0.0000 Z= 0.0000

**PLUS:**

HATCH Layer: "LINER_TO BE BUILT"
Space: Model space
Color: 6 (magenta) Linetype: "BYLAYER"
Linetype scaling = 10.0000
Handle = 9a065
Hatch pattern SOLID
Associative
Area 3133.6624
Origin X= 0.0000 Y= 0.0000 Z= 0.0000

**LEGEND:**

- CAW WASTE LIMITS
- CAW WASTE BREAK LINES
- CLASS A & CLASS A NORTH DESIGN WASTE LIMITS
- CAW DESIGN LINER LIMITS
- COMPLETED LINER LIMITS
- CL-XY EXISTING LYSIMETER
- CL-XY PROPOSED LYSIMETER
- CL-XY EXISTING OR CURRENT PLANNED LYSIMETER TO BE ABANDONED
- CLAY LINER REQUIRED TO BE CONSTRUCTED FOR CAW AREA= 1,085,701 FT²

NOTE:
LYSIMETER CL-N3 IS CURRENTLY UNDER CONSTRUCTION (AS OF 9/1/11)

LICENSED PROFESSIONAL ENGINEER
No. 189500
DAVID F BOOTH
10/4/11
STATE OF UTAH

| DATE | BY | DESCRIPTION OF CHANGE |
|---|---|---|
| 10/4/11 | DFB | FOR LICENSING: INFORMATION ONLY |

ENERGYSOLUTIONS
ENERGYSOLUTIONS "CLIVE" FACILITY
CLASS A WEST EMBANKMENT
CONSTRUCTED CLAY LINER MAP
CLIVE, UTAH

FINAL DRAWING

DRAFTED BY D. BOOTH
REVIEWED BY G. DUTSON
APPROVED BY D. BOOTH
SCALE AS NOTED DATE 09/02/11 REV. 1
DRAWING NO. 10014
FIGURE E

# Attachment 10

# Rock Cover Design Calculations

# CLIVE FACILITY

# CLASS A WEST (CAW)
# ROCK COVER DESIGN CALCULATIONS

**February 22, 2012**

**For**
**Utah Division of Radiation Control**
**195 North 1950 West**
**Salt Lake City, UT 84114-4850**

**By**
**Energy*Solutions*, LLC**
**423 West 300 South, Suite 200**
**Salt Lake City, UT 84101**

## 1.0 INTRODUCTION

Rock cover design calculations have been conducted for the Class A West (CAW) Embankment utilizing the methodologies described in NUREG-1623 and NUREG/CR-4620. Additional calculations discussions and calculations have been made for the adequacy of all of the design layers covering the radon barrier of the CAW Embankment.

## 2.0 ROCK COVER DESIGN

The following CAW embankment parameters have been taken from Drawing 10014 C01, Revision 1 and 10014 C02, Revision 0:

Top Slope Length ($L_T$) = 942 feet = 0.18 miles

Top Slope ($S_T$) = 4% (0.04)

Top Slope Elevation Difference ($H_T$) = (942)(0.04) = 37.68 feet

Side Slope Length ($L_S$) = 188 feet = 0.036 miles

Side Slope ($S_S$) = 20% (0.2)

Side Slope Elevation Difference ($H_S$) = (188)(0.2) = 37.6 feet

<u>Step 1.</u> Drainage areas for the top slop ($A_T$) and side slope ($A_S$) on a unit-width basis:

$A_T$ = (942)(1)/43560 = 0.022 acres

$A_S$ = (942 + 188)(1)/43560 = 0.026 acres

<u>Step 2.</u> Time of Concentrations for top slope ($t_{c,T}$) and side slope ($t_{c,S}$) using the Kirpich Method:

$t_c = [(11.9)(L)^3/H)]^{0.385}$

$t_{c,T}$ = 0.088 hours = 5.26 minutes

$t_{c,S}$ = 0.089 + 0.014 hours = 0.101 hours = 6.08 minutes

<u>Step 3.</u> Determine Probable Maximum Precipitation (PMP) and PMP Intensities of the Top Slope ($i_T$) and side slope ($i_S$) based on the Time of Concentrations described in Step 2.

<u>PMP Computation:</u>

All calculation sheets described in the following narrative are provided in Appendix A to these calculations.

The 1-hour PMP for the watershed surrounding the Clive facility was initially derived in the HEC-1 and HEC-2 Analysis document created by Bingham Environmental for the LARW License Renewal (Bingham, 1996). This value was calculated using the methodology of HMR 49 as discussed in NUREG/CR-4620. This document calculated a 1-hour PMP of 6.10 inches for the Clive watershed.

For the design of high and moderate hazard dams in Utah, state regulations (R655-11-4) require the use of HMR 49 as well as assessment information from Utah Climate Center studies (Jensen, 1995 and Jensen, 2003) when estimating the PMP for the area of concern.

Typical PMP calculation methodology is to compute the value based on the most probable local storm and on the most probable general storm and then compare the two values and choose the larger of the two as the PMP for the area of concern. The general storm computations are done using the worksheet in Table 6.1 of HMR 49 and the local storm computations using the Table 6.3a worksheet.

*General Storm.* The calculations of Table 6.1 in HMR 49 begin with a drainage average value from the 24-hr convergence PMP figures within the text. Jensen, 2002 has refined and localized the convergence PMPs for the state of Utah and suggests that these values be used in place of the convergence values in HMR 49; all other calculations are to be as described in HMR 49. Figure 1 of Jensen, 2002 describes a 72-Hour Point PMP range of 12.9-13.3 inches for the Clive watershed (for conservatism, assume 13.3 inches for these calculations). The ratio between the 72-hour and the 24-hour PMP is defined in Table 2.7 of HMR 49 as 1.23. Therefore, the Clive-specific 24-hr convergence PMP for the calculation is 13.3/1.23 = 10.8 inches. The remaining calculations are shown in the calculation sheet in Appendix A. A spreadsheet version of these calculations, with an accompanying graph is also provided in Appendix A. Completing the graph back to the origin and interpolating the PMP depth at 1-hour yields a calculated 1-hr PMP of approximately 0.8 inches.

*Local Storm.* Jensen, 1995 agrees with the average 1-hr 1-mi$^2$ PMP for drainage in Figure 4.5 of HMR 49; however, the documents differ considerably on durational variation and areal reduction of the storm. The Clive-specific Table 6.3a calculations are shown in Appendix A. Step 4

uses the data in Table 13 and Step 6 the data from Table 15 in Jensen, 1995. All calculations are based on the Clive watershed area of approximately 46 square miles. These calculations yield a 1-hr PMP of 1.37 inches. This is higher than the 0.8 inch PMP calculated from the general storm and therefore should be applicable for the Clive watershed.

As a conservative step, the rock cover calculations within this document utilize the original Bingham, 1996 calculated 1-hr PMP of 6.1 inches as computed directly from HMR 49. The use of this PMP yields an extra internal safety factor of 4.45 into the calculations.

Top slope and side slope PMPs were derived from the 1-hour PMP through extrapolation within Table 2.1 of NUREG/CR-4620 for the specific time of concentration on each slope. The following values were calculated:

$PMP(t_{c,T})$ = 2.80 inches/hour

$PMP(t_{c,S})$ = 2.97 inches/hour

Rainfall intensities, for use in the Rational Formula, are computed as follows:

$i = PMP(t_c) * 60/t_c$

$i_T$ = 31.93 inches/hour

$i_S$ = 29.31 inches/hour

Step 4. Assuming a runoff coefficient (C) of 0.8 (based on the example situation described in Section 2.4 of NUREG-1623), the peak flow rates are calculated using the Rational Formula as follows:

$Q = CiA$

$Q_T = (0.8)(31.93)(0.022) = 0.552$ cfs/ft

$Q_S = (0.8)(29.31)(0.026) = 0.608$ cfs/ft

Step 5. The required rock size for the top slope is calculated using the iterative Safety Factors Method as:

**$D_{50,T}$ = 1.06 inches**

For the side slope, the Stephenson Method yields the following median rock size:

**$D_{50,S}$ = 2.92 inches**

Furthermore, the Abt/Johnson Method described in Section 2.2.2 of NUREG-1623 calculates the following median rock sizes:

$D_{50} = 5.23(S)^{0.43}[(1.35)Q]^{0.56}$

$\mathbf{D_{50,T} = 5.23(0.04)^{0.43}[(1.35)(0.547)]^{0.56} = 1.11 \text{ inches}}$

$\mathbf{D_{50,S} = 5.23(0.2)^{0.43}[(1.35)(0.602)]^{0.56} = 2.34 \text{ inches}}$

However, because the rock used at the site is typically more rounded than expected for this formula, the newly developed formula, as described by Abt et. al. (Abt, 2008), may be utilized for more precision. This analysis is as follows:

$D_{50} = 7.66C_u^{0.70}S^{0.70}Q^{0.68}$

Where $C_u$ is the Coefficient of Uniformity of the material and is defined as:

$C_u = D_{60}/D_{10}$

From Drawing 10014 C04, Revision 1, Type B Rip Rap is used on the top slope and Type A Rip Rap on the side slope. Gradations of each of these materials are also provided in Drawing 10014 C04, Revision 1. These data were plotted on a semi-logarithmic mechanical analysis graph and the $D_{60}$'s estimated. The following $C_u$'s were projected:

$D_{60,T} \sim 1.6$ inches and $D_{10,T} = 0.75$ inches

$C_{u,T} \sim 2.13$

$D_{60,S} \sim 5.8$ inches and $D_{10,S} = 2$ inches

$C_{u,S} \sim 2.90$

Therefore, the calculated median riprap sizes for rounded rock are as follows:

$\mathbf{D_{50,T} = 7.66(2.13)^{0.70}(0.04)^{0.70}(0.547)^{0.68} = 0.91 \text{ inches}}$

$\mathbf{D_{50,S} = 7.66(2.90)^{0.70}(0.20)^{0.70}(0.602)^{0.68} = 3.73 \text{ inches}}$

Step 6. Filter Requirements

Filter criteria within NUREG/CR-4620 provides ratios between the $D_{15}$ of the overlying layer (designated 'filter' in the guidance) compared with the $D_{85}$ of the base media. The suggested criteria are that the ratios remain less than 5 to prevent upward migration of the bedding into the riprap and less than 10 to ensure erosion of the bedding material is prevented. From the information in Drawing 10014 C04, Revision 1, and extrapolating on a semi-logarithmic

mechanical analysis graph of the gradations, the following information is gathered:

| | |
|---|---|
| $D_{85}$ (Filter) | ~ 4.2 inches |
| $D_{15}$ (Top Riprap) | ~ 0.81 inches |
| $D_{15}$ (Side Riprap) | ~ 2.2 inches |

The calculated ratio's are as follows:

$$\frac{D_{15}(\text{Top Riprap})}{D_{85}(\text{Type A Filter})} = 0.19$$

$$\frac{D_{15}(\text{Side Riprap})}{D_{85}(\text{Type A Filter})} = 0.52$$

These ratios meet the suggested specifications from NUREG/CR-4620.

Furthermore, the gradation for the sacrificial soil, as described in Drawing 10014 C04, Revision 1, uses this $D_{15}/D_{85}$ criterion as the basis for the layer and therefore the erosion requirements will be met.

Step 7. Determine Riprap Layer Thickness

In accordance with Section 2.1.2 of NUREG-1623, the riprap layer thickness should be greater than the largest rock ($D_{100}$) or 1.5 times the $D_{50}$, whichever is greater.

From Drawing 10014 C04, Revision 1, the largest rock within the Type B riprap on the top slope is 4.5 inches and 1.5 times the $D_{50}$ is (1.5)(1.25) = 1.875 inches; therefore, the top slope riprap layer should be greater than 4.5 inches thick.

For the side slope, the Type A riprap $D_{100}$ is 16 inches and 1.5 times the $D_{50}$ is (1.5)(4.5) = 6.75 inches; therefore, the side slope riprap thickness should be greater than 16 inches.

## 3.0 TYPE A FILTER LAYER ANALYSIS

The effectiveness of the Type A Filter Zone to minimize internal erosion of the underlying sacrificial soil layer is assessed by calculating the interstitial velocities associated with the rock. Interstitial velocities within the Type A Filter Rock may be calculated using the following equation, as presented by Leps (Leps, 1973) and provided as equation 4.37 in NUREG/CR-4620:

$$V_V = Wm^{0.5} i^{0.54}$$

Table 4.1 in NUREG/CR-4620 provides empirically derived values for $Wm^{0.5}$ in inches/second based upon the median rock size in the filter layer. From Drawing 10014 C04, Revision 1, for the Type A Filter Layer, $D_{50}$ = 1.57 inches. Extrapolating from Table 4.1 yields a $Wm^{0.5}$ value of 13.94 inches/second.

The parameter i in the interstitial velocity equation above is the hydraulic gradient of the water within the filter layer. The hydraulic gradient is defined as the difference in water head (in feet) between two points, divided by the distance between those points. Under worst-case saturated conditions, the hydraulic gradient will be equal to the slope.

Based on this information, the worst-case interstitial velocities for the top and side slopes within the Type A Filter Layer is calculated as follows:

$$V_{V,T} = (13.94)(0.04)^{0.54} = 2.45 \text{ inches/second} = 0.20 \text{ feet/second}$$

$$V_{V,S} = (13.94)(0.2)^{0.54} = 5.85 \text{ inches/second} = 0.49 \text{ feet/second}$$

The text of NUREG/CR-4620 notes that this calculation describes turbulent flow through the rockfill. The text also states that "the procedure is considered applicable to well graded rockfill provided that the material smaller than one inch is less than 30%." From Drawing 10014 C04, Revision 1, 30% of the Type A Filter material is less than 0.85 inches; therefore, this material is right on the edge of applicability for this equation. However, if more fines are present, the turbulent flow calculated by the equation above will be slower and be more laminar in nature; therefore, this calculation provides a conservative upper bound of the interstitial velocity in the filter layer at the interface with the sacrificial soil layer.

Table 4.9 of NUREG/CR-4620 provides permissible velocities that prevent erosion over cohesive materials. The sacrificial soil layer below the Type A Filter is considered a loosely compacted coarse sandy clay material. From Table 4.9, a loosely compacted sandy clay material has an erosion limiting velocity of 1.48 feet/second.

Two alternative analytical methods of calculating interstitial velocity within the Type A Filter Layer have been used to verify the calculation described above: the method described in NUREG/CR-4651, Vol. 2 (1988) and the method by Stephenson described in Codell (1990). These alternative analyses are described below:

<u>NUREG/CR-4651</u>

Equation 5.3 in NUREG/CR-4651 provides an empirical equation derived from interstitial velocity experiments within different sized rock layers. The resulting

equation is only a function of the slope and the $D_{10}$ of the rock (in inches). The interstitial velocity (in feet/second) equation is:

$$V = 0.232\ (gD_{10}S)^{1/2}$$

where g is the acceleration due to gravity in feet per second squared (32.2 ft/sec$^2$). From Drawing 10014 C04, the D10 of the Type A Filter Layer is 2 mm or 0.0787 inches. Using this information, the calculated top slope interstitial velocity is 0.073 ft/sec and the side slope interstitial velocity is 0.16 ft/sec. These calculated values are both about one-third of those calculated using the conservative assumptions and the NUREG/CR-4620 methodology above.

STEPHENSON (CODELL)

Codell (1990) describes a method developed by Stephenson in 1979 for velocities through rock layers. This method has several steps and requires an iterative solution for the interstitial velocity. Several assumptions have been made regarding the parameters of the rock. These assumptions are explained below. The empirical formula for the interstitial velocity is:

$$V = n\left(\frac{Sgd}{K`}\right)^{1/2}$$

where n = porosity of rock (conservatively assume **0.45** based on measured properties of rock within Table 1 of the Codell reference)

S = slope (0.04 top slope; 0.2 side slope)

g = acceleration of gravity = 32.2 ft/sec$^2$

d = representative rock diameter (in feet). This should be the harmonic mean diameter of the rock; however, due to the fineness of the lowest 5% of the Type A Filter Rock, the harmonic diameter is calculated at approximately 0.06 inches; therefore, a conservative assumption of representative diameter using the $D_{50}$ is used for this analysis. Therefore, d = 1.57 inches = 0.131 feet.

K` = dimensionless friction factor, defined as

$$K` = K + 800/Re$$

where K = 1 for smooth marbles to 4 for sharp crushed rock (conservatively assume 1 for this analysis)

Re = Reynolds Number = $dV/\nu n$

where $\nu$ = kinematic viscosity = $1.052 \times 10^{-5}$ $ft^2/s$ for water at 70 ˚F.

An iterative solution for the interstitial velocity can be calculated using the conservative parameters described above. The results show an interstitial velocity within the Type A Filter Layer of 0.17 ft/sec on the top slope and 0.40 ft/sec on the side slope. These values are very comparable and slightly less than those calculated using the NUREG/CR-4620 methodology.

## 4.0 DRAINAGE (TYPE B) FILTER LAYER ANALYSIS

Established gradation ratios have been provided in the literature to ensure migration of fine particles does not occur between differing layers. Specifically, migration of fine particles must be eliminated for lateral drainage layers so that they do not become plugged; thereby impeding the lateral flow and, consequently, compromising the design of the cover.

The Cedergren reference (Cedergren, 1989) goes into detail about gradation criteria from the works of Bertram as well as the U.S. Army Corps of Engineers. This reference describes three criteria that should be met to assure the filter will perform as designed and will not become plugged from migration of base soils. These three criteria are as follows:

$$\frac{D_{15}(\text{filter})}{D_{85}(\text{soil})} \leq 5$$

$$\frac{D_{15}(\text{filter})}{D_{15}(\text{soil})} \geq 4$$

$$\frac{D_{50}(\text{filter})}{D_{50}(\text{soil})} \leq 25$$

The first ratio is known as the piping ratio and ensures that particles will not migrate from the base soil layer into the filter layer; thereby guaranteeing that the permeability of the drainage layer will not be compromised over time due to infiltration of particles. The second ratio prevents the build-up of hydrostatic pressures in the filter layer. The third ratio is a recommendation by the U.S. Army Corps of Engineers that the grain-size curves of the adjacent layers be close to parallel.

Chapter 26 of the Natural Resource Conservation Service National Engineering Handbook (NRCS, 1994) provides a definition for base soils as “the soil immediately adjacent to a filter or drainage zone through which water may pass.” Furthermore, this reference also provides similar gradation criteria to Cedergren, with a caveat that “piping of susceptible base soils can occur when seepage gradients or pressures are high enough to produce erosive discharge velocities in the base soil.”

From these definitions and requirements, the CAW drainage layer (Type B Filter) design will be adequate if the sacrificial soil/Type B Filter interface meets the three criteria

described above, and that the interstitial velocities within the Type B Filter Layer are slow enough to not erode the underlying compacted clay radon barrier.

The design gradations described in Drawing 10014 C04, Revision 1, meets the sacrificial soil/Type B Filter Layer criteria by definition. For the interstitial velocity upon the radon barrier criteria, Table 4.9 in NUREG/CR-4620 describes a limiting velocity of 5.41 ft/sec for very compacted clay. Rearranging the Leps interstitial velocity equation described in Section 3.0 above (equation 4.37 of NUREG/CR-4620) and substituting the known factors of 5.41 ft/sec (64.92 inch/sec) and a slope of 0.2 (side slope), the following limiting value for the $Wm^{0.5}$ parameter is obtained:

$$Wm^{0.5} = \frac{V_V}{S^{0.54}} = \frac{64.92}{0.2^{0.54}} = 154.8 \text{ inch/sec}$$

Using this calculated value, from Table 4.1 in NUREG/CR-4620, the back-calculated maximum $D_{50}$ within the Type B Filter Layer is greater than 48-inches; therefore, there are no limiting criteria for this 6-inch layer, and the interstitial velocity within the layer will not erode the underlying radon barrier.

Although there is no limit to the size of the filter layer interfacing with the radon barrier clay, a design interstitial velocity may nevertheless be estimated assuming a reasonable median rock size of one-inch. Assuming this size, the $Wm^{0.5}$ value from Table 4.0 of NUREG/CR-4620 is 11.2. Then the velocity on the radon barrier over the top slope is calculated at 0.055 feet per second and over the side slope is calculated at 0.12 feet per second.

## 5.0 CONCLUSIONS

The rock cover design method provided in Section 2.0 of this report calculate maximum rock median sizes for the riprap layer as 1.11 inches for the top slope and 3.73 inches for the side slope. These calculations take into account the gradation and roundness of the rock in response to a PMP storm at the Clive facility. The design specifications for these materials, as presented in Drawing 10014 C04, Revision 1, are median sizes of 1.25 inches for the top slope and 4.5 inches for the side slope. Both of these median sizes meet the calculated criteria with calculated safety factors of 1.25/1.11 = 1.13 for the top slope and 4.5/3.73 = 1.21 for the side slope.

The design filter layer underlying the riprap easily meets the $D_{15}/D_{85}$ criteria as described in NUREG/CR-4620 for minimization of migration of the filter layer into the riprap. Furthermore, specifications on the sacrificial soil gradations ensure that migration of material between the sacrificial soil layer and the Type A Filter layer will be minimized. Additionally, using permissible velocities from Table 4.9 of NUREG/CR-4620, worst-case interstitial velocities at the surface of the sacrificial soil layer will not cause erosion of that layer. Safety factors for this parameter are 1.48/0.20 = 7.40 for the top slope and 1.48/0.49 = 3.02 for the side slope.

The design specifications described in Drawing 10014 C04, Revision 1, ensure that the gradations of the sacrificial soil and Type B Filter Layers meet the criteria necessary for an adequate lateral drainage layer. Furthermore, erosion of the underlying radon barrier will not occur, with estimated velocities of 0.055 and 0.12 feet per second on the top and side slopes, respectively. Safety factors for these estimated flows are 5.41/0.055 ~ 98 on the top slope and 5.41/0.12 ~ 45 on the side slope.

The calculations within this document demonstrate that the design riprap rock cover for the CAW Embankment is adequate, providing the required erosion protection for the embankment as described in NUREG-1623. The design filter layer underlying the riprap provides the necessary protection against rock migration through the layers and erosion of the underlying sacrificial soil layer. The design lateral drainage layer will not become plugged and will retain its permeability throughout the life of the embankment and will protect the radon barrier from erosion.

## 6.0 REFERENCES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## 7.0 CERTIFICATIONS

Calculations Performed by:

2/22/2012

Timothy L. Orton, P.E. Date

Calculations Checked by:

2/22/2012

David F. Booth, P.E. Date

# APPENDIX A

# PMP COMPUTATIONS

# Bingham, 1996 PMP Calculations

Table 6.3A.--Local-storm PMP computation, Colorado River, Great Basin and California drainages. For drainage average depth PMP. Go to table 6.3B if areal variation is required.

Drainage ENVIROCARE Area ~50 $mi^2$ ($km^2$)
Latitude 40N Longitude 114W Minimum Elevation <5000 ft (m)

Steps correspond to those in sec. 6.3A.

1. Average 1-hr 1-$mi^2$ (2.6-$km^2$) PMP for drainage [fig. 4.5]. 10 in. (~~mm~~)

2. a. Reduction for elevation. [No adjustment for elevations up to 5,000 feet (1,524 m): 5% decrease per 1,000 feet (305 m) above 5,000 feet (1,524 m)]. 100 %

   b. Multiply step 1 by step 2a. 10 in. (~~mm~~)

3. Average 6/1-hr ratio for drainage [fig. 4.7]. 1.38

| | Duration (hr) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1/4 | 1/2 | 3/4 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 4. Durational variation for 6/1-hr ratio of step 3 [table 4.4]. | 63 | 83 | 93 | 100 | 118 | 126 | 132 | 137 | 140 | % |
| 5. 1-$mi^2$ (2.6-$km^2$) PMP for indicated durations [step 2b X step 4]. | 6.3 | 8.3 | 9.3 | 10 | 11.8 | 12.6 | 13.2 | 13.7 | 14.0 | in. (~~mm~~) |
| 6. Areal reduction [fig. 4.9]. | 47 | 54 | 57 | 61 | 65 | 68 | 69 | 71 | 72 | % |
| 7. Areal reduced PMP [steps 5 X 6]. | 2.96 | 4.48 | 5.3 | 6.1 | 7.67 | 8.56 | 9.11 | 9.73 | 10.08 | in. (~~mm~~) |
| 8. Incremental PMP [successive subtraction in step 7]. | | | | 6.1 | 1.57 | 0.89 | 0.55 | 0.62 | 0.35 | in. (~~mm~~) |
| | 2.96 | 1.52 | 0.82 | 0.8 | } 15-min. increments | | | | | |
| 9. Time sequence of incremental PMP according to: | | | | | | | | | | |
| Hourly increments [table 4.7]. | | | | 0.55 | 0.89 | 6.1 | 1.57 | 0.62 | 0.35 | in. (~~mm~~) |
| Four largest 15-min. increments [table 4.8]. | | | | 2.96 | 1.52 | 0.82 | 0.8 | | | in. (~~mm~~) |

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage ENVIROCARE Area ~50 $mi^2$ ($km^2$)

Latitude 40 N, Longitude 114 W of basin center

Month AUGUST (TYPICALLY HIGHEST)

| Step | Duration (hrs) 6 | 12 | 18 | 24 | 48 | 72 |
|---|---|---|---|---|---|---|
| **A. Convergence PMP** | | | | | | |
| 1. Drainage average value from one of figures 2.5 to 2.16 | 10.5 in. (~~mm~~) | | | | | |
| 2. Reduction for barrier-elevation [fig. 2.18] | 50 % | | | | | |
| 3. Barrier-elevation reduced PMP [step 1 X step 2] | 5.25 in. (~~mm~~) | | | | | |
| 4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. | 67 | 85 | 94 | 100 | 116 | 123 % |
| 5. Convergence PMP for indicated durations [steps 3 X 4] | 3.51 | 4.46 | 4.94 | 5.25 | 6.09 | 6.46 in. (~~mm~~) |
| 6. Incremental 10 $mi^2$ (26 $km^2$) PMP [successive subtraction in step 5] | 3.51 | 0.95 | 0.48 | 0.31 | 0.84 | 0.37 in. (~~mm~~) |
| 7. Areal reduction [select from figs. 2.28 and 2.29] | 96 | 99 | 99 | 99 | 100 | 100 % |
| 8. Areally reduced PMP [step 6 X step 7] | 3.37 | 0.94 | 0.48 | 0.31 | 0.84 | 0.37 in. (~~mm~~) |
| 9. Drainage average PMP [accumulated values of step 8] | 3.37 | 4.31 | 4.79 | 5.10 | 5.94 | 6.31 in. (~~mm~~) |
| **B. Orographic PMP** | | | | | | |
| 1. Drainage average orographic index from figure 3.11a to d. (Revised) | 4 in. (~~mm~~) | | | | | |
| 2. Areal reduction [figure 3.20] | 97 % | | | | | |
| 3. Adjustment for month [one of figs. 3.12 to 3.17] | 100 % | | | | | |
| 4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] | 3.88 in. (~~mm~~) | | | | | |
| 5. Durational variation [table ~~3.8~~] [3.9] | 30 | 57 | 80 | 100 | 159 | 187 % |
| 6. Orographic PMP for given durations [steps 4 X 5] | 1.16 | 2.21 | 3.10 | 3.88 | 6.17 | 7.26 in. (~~mm~~) |
| **C. Total PMP** | | | | | | |
| 1. Add steps A9 and B6 | 4.53 | 6.52 | 7.89 | 8.98 | 12.11 | 13.57 in. (~~mm~~) |
| 2. PMP for other durations from smooth curve fitted to plot of computed data. | | | | | | |
| 3. Comparison with local-storm PMP (see sec. 6.3). | | | | | | |

# Clive-Specific PMP Calculations

Table 6.1.--General-storm PMP computations for the Colorado River and Great basin

Drainage Clive Area ~50 mi$^2$ (km$^2$)

~ Latitude 40N, Longitude 113W of basin center

Month August

| Step | Duration (hrs) 6 | 12 | 18 | 24 | 48 | 72 |
|---|---|---|---|---|---|---|
| **A. Convergence PMP** | | | | | | |
| 1. Drainage average value from one of figures 2.5 to 2.16 | 10.8 in. (mm) | | | | | |
| 2. Reduction for barrier-elevation [fig. 2.18] | 50 % | | | | | |
| 3. Barrier-elevation reduced PMP [step 1 X step 2] | 5.4 in. (mm) | | | | | |
| 4. Durational variation [figs. 2.25 to 2.27 and table 2.7]. | 67 | 85 | 94 | 100 | 116 | 123 % |
| 5. Convergence PMP for indicated durations [steps 3 X 4] | 3.62 | 4.59 | 5.08 | 5.40 | 6.26 | 6.64 in. (mm) |
| 6. Incremental 10 mi$^2$ (26 km$^2$) PMP [successive subtraction in step 5] | 3.62 | 0.97 | 0.49 | 0.32 | 0.86 | 0.38 in. (mm) |
| 7. Areal reduction [select from figs. 2.28 and 2.29] | 96 | 99 | 99 | 99 | 100 | 100 % |
| 8. Areally reduced PMP [step 6 X step 7] | 3.47 | 0.96 | 0.48 | 0.32 | 0.86 | 0.38 in. (mm) |
| 9. Drainage average PMP [accumulated values of step 8] | 3.47 | 4.44 | 4.92 | 5.24 | 6.10 | 6.48 in. (mm) |
| **B. Orographic PMP** | | | | | | |
| 1. Drainage average orographic index from figure 3.11a to d. | 4 in. (mm) | | | | | |
| 2. Areal reduction [figure 3.20] | 97 % | | | | | |
| 3. Adjustment for month [one of figs. 3.12 to 3.17] | 100 % | | | | | |
| 4. Areally and seasonally adjusted PMP [steps 1 X 2 X 3] | 3.88 in. (mm) | | | | | |
| 5. Durational variation [table 3.6] | 30 | 57 | 80 | 100 | 159 | 187% |
| 6. Orographic PMP for given durations [steps 4 X 5] | 1.16 | 2.21 | 3.10 | 3.88 | 6.17 | 7.26 in. (mm) |
| **C. Total PMP** | | | | | | |
| 1. Add steps A9 and B6 | 4.64 | 6.65 | 8.02 | 9.12 | 12.27 | 13.74 in. (mm) |

2. PMP for other durations from smooth curve fitted to plot of computed data.

3. Comparison with local-storm PMP (see sec. 6.3).

## Table 6.1. General-storm PMP computations using the Jensen, 2003 72-Hour Point PMP General Storm

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A. | Step 1 | | 10.8 | in | | | |
| | Step 2 | | 50% | | | | |
| | Step 3 | | 5.4 | in | | | |
| | **Duration** | **6** | **12** | **18** | **24** | **48** | **72** |
| | Step 4 | 67% | 85% | 94% | 100% | 116% | 123% |
| | Step 5 | 3.62 | 4.59 | 5.08 | 5.40 | 6.26 | 6.64 |
| | Step 6 | 3.62 | 0.97 | 0.49 | 0.32 | 0.86 | 0.38 |
| | Step 7 | 96% | 99% | 99% | 99% | 100% | 100% |
| | Step 8 | 3.47 | 0.96 | 0.48 | 0.32 | 0.86 | 0.38 |
| | Step 9 | 3.47 | 4.44 | 4.92 | 5.24 | 6.10 | 6.48 |
| B. | Step 1 | | 4 | in | | | |
| | Step 2 | | 97% | | | | |
| | Step 3 | | 100% | | | | |
| | Step 4 | | 3.88 | | | | |
| | Step 5 | 30% | 57% | 80% | 100% | 159% | 187% |
| | Step 6 | 1.16 | 2.21 | 3.10 | 3.88 | 6.17 | 7.26 |
| C. | | 4.64 | 6.65 | 8.02 | 9.12 | 12.27 | 13.74 |

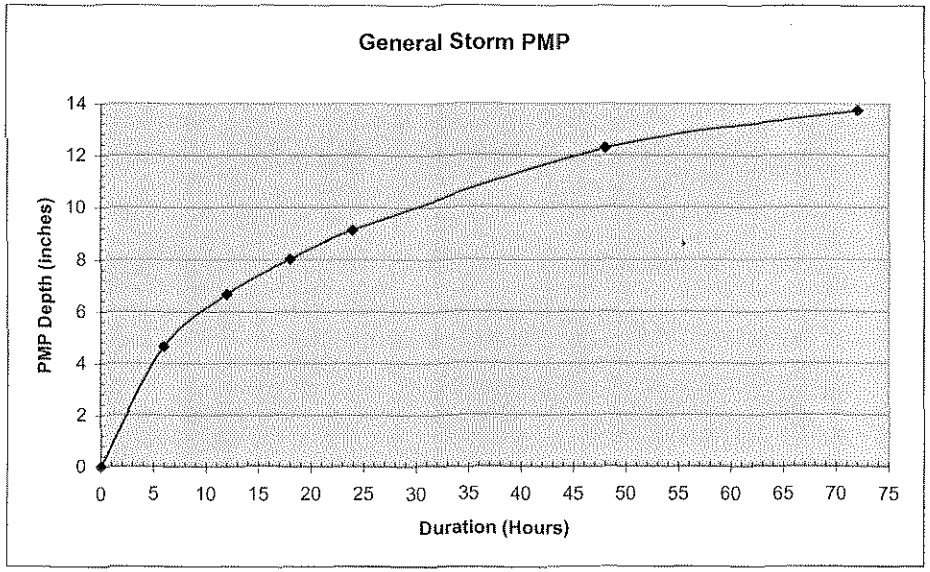

Table 6.3A.--Local-storm PMP computation, Colorado River, Great Basin and California drainages. For drainage average depth PMP. Go to table 6.3B if areal variation is required.

Drainage Clive Area ~46 mi$^2$ (~~km$^2$~~)
Latitude 40 N Longitude 113 W Minimum Elevation <5000 ft (~~m~~)

Steps correspond to those in sec. 6.3A.

1. Average 1-hr 1-mi$^2$ (2.6-km$^2$) PMP for drainage [fig. 4.5]. 10 in. (~~mm~~)

2. a. Reduction for elevation. [No adjustment for elevations up to 5,000 feet (1,524 m): 5% decrease per 1,000 feet (305 m) above 5,000 feet (1,524 m)]. 100 %

   b. Multiply step 1 by step 2a. 10 in. (~~mm~~)

3. Average 6/1-hr ratio for drainage [fig. 4.7]. 1.38

| | Duration (hr) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1/4 | 1/2 | 3/4 | 1 | 2 | 3 | 4 | 5 | 6 | |
| 4. Durational variation for 6/1-hr ratio of step 3 [~~table 4.4~~]. (Jensen, 1995 Table 13) | 50 | 74 | 90 | 100 | 110 | 112 | 114 | 115 | 115 | % |
| 5. 1-mi$^2$ (2.6-km$^2$) PMP for indicated durations [step 2b X step 4]. | 5.00 | 7.40 | 9.00 | 10.00 | 11.00 | 11.20 | 11.35 | 11.45 | 11.50 | in. (~~mm~~) |
| 6. Areal reduction [~~fig. 4.9~~]. (Jensen, 1995 Table 15) | 6.85 | 10.13 | 12.32 | 13.69 | 15.06 | 15.33 | 15.54 | 15.68 | 15.74 | % |
| 7. Areal reduced PMP [steps 5 X 6]. | 0.34 | 0.75 | 1.11 | 1.37 | 1.66 | 1.72 | 1.76 | 1.80 | 1.81 | in. (~~mm~~) |
| 8. Incremental PMP [successive subtraction in step 7]. | | | | 1.37 | 0.29 | 0.06 | 0.05 | 0.03 | 0.01 | in. (~~mm~~) |
| | 0.34 | 0.41 | 0.36 | 0.26 | } 15-min. increments | | | | | |
| 9. Time sequence of incremental PMP according to: | | | | | | | | | | |
| Hourly increments [table 4.7]. | | | | 0.03 | 0.06 | 1.37 | 0.29 | 0.05 | 0.01 | in. (~~mm~~) |
| Four largest 15-min. increments [table 4.8]. | | | | 0.41 | 0.36 | 0.34 | 0.26 | | | in. (~~mm~~) |