DRC-2009-C0060240

From: Loren Morton
To: Harold Roberts
CC: Bob Baird; Dane Finerfrock; John Hultquist
Date: 10/29/2009 5:27 PM
Subject: RE: Denison Mines: Cell 4B Environmental Report - URS Round 1
Attachments: Cell4BER Rnd1 091029a.doc

Harold,

Thanks. The URS Round 1 Interrogatory for the Cell 4B Environmental Report is attached.

Please call me if you would like to schedule a conference call to discuss.

Loren

>>> Harold Roberts <HRoberts@denisonmines.com> 10/29/09 5:00 PM >>>

Loren:
Let's proceed on this basis.

Harold Roberts
Executive Vice President, US Operations

t: (303) 389-4160 | f: (303) 389-4125
1050 17th Street, Suite 950, Denver, CO 80265
DENISON MINES (USA) CORP
www.denisonmines.com (http://www.denisonmines.com/)

From: Loren Morton [mailto:LMORTON@utah.gov]
Sent: Thursday, October 29, 2009 4:24 PM
To: Harold Roberts
Cc: Ron Hochstein; Bob Baird; Dane Finerfrock; John Hultquist
Subject: Denison Mines: Cell 4B Environmental Report - URS Round 1

Harold,

The purpose of this email is to document our discussion this morning about how the DRC will change how we get the URS interrogatories for the Cell 4B Environmental Report (ER) to DUSA.

UTAH DIVISION OF RADIATION CONTROL

DENISON MINES (USA) CORP

INTERROGATORIES FROM REVIEW OF LICENSE AMENDMENT REQUEST AND ENVIRONMENTAL REPORT FOR CELL 4B UNDER UAC R313-24 AND UAC R317-6

INTERROGATORIES – ROUND 1

OCTOBER 29, 2009

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
ASTM	American Society for Testing and Materials
BAT	Best Available Technology
Cell 4B ER	Environmental Report submitted in support of the Cell 4B License Amendment Request.
CFR	Code of Federal Regulations
CL, CH and CL-ML	Soil classes under Unified Soil Classification System
cm	centimeter
DCGL	Derived concentration guideline
DG	Draft Regulatory Guide (NRC)
Division	Utah Radiation Control Division
DOE	U.S. Department of Energy
DQO	Data quality objective
DUSA	Denison Uranium (USA) Corporation
D&M	Dames & Moore, Inc.
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
FES	Final Environmental Statement
FWPCA	Federal Water Pollution Control Act
g	gram
gpd, gal/day	gallons per day
gpm	gallons per minute
GW and GP	Soil classes under Unified Soil Classification System
IUC	International Uranium Corporation
kg	kilogram
km	kilometer; 1000 meters

lb	pound (16 ounces)
m	meter
mg/l	milligram per liter
mi	mile
millirem	one thousandth of one Roentgen Equivalent Man
mm	millimeter, 0.001 meter
m^2s	square meter second; used as a measure of radon flux, e.g., pCi/m^2s
NRC	U.S. Nuclear Regulatory Commission
NUREG	Series of reports prepared and issued by staff of USNRC
pCi	picocurie; 10^{-12} curie
RCRA	Resource Conservation and Recovery Act
rem	Roentgen Equivalent Man
RG	Regulatory Guide (NRC)
s	second
SC, SP, and SW	Soil classes under Unified Soil Classification System
TDS	total dissolved solids
TEDE	Total Effective Dose Equivalent
UAC	Utah Administrative Code
UMETCO	UMETCO Minerals Corporation
URS	URS Corporation, including Washington Division
USGS	US Geological Survey
yd, yd^2	yard, square yards
5h:1v	five horizontal units (5h) to one vertical unit (1v); represents slope or steepness

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01A/01: ENVIRONMENTAL ANALYSIS - RADIOLOGICAL AND NONRADIOLOGICAL IMPACTS

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(a) An assessment of the radiological and nonradiological impacts to the public health from the activities to be conducted pursuant to the license or amendment;

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Tabulate, analyze, summarize, and report changes of observed meteorological conditions that have occurred since they were last updated. Incorporate changes of observed meteorological conditions into projections of radiation doses to the general public (refer to Interrogatory White Mesa Cell 4B 10CFR40.65(a)(1)-07/01). Alternatively, demonstrate that the impacts of such changes on projected radiation doses to persons potentially exposed to releases from the proposed Cell 4B are inconsequential.

Estimate the maximum annual external dose (millirems) that would be received by an individual at the nearest site boundary from direct radiation during operations and following closure of proposed Cell 4B. Provide an appendix describing the models, assumptions, and inputs used in these calculations.

Identify and assess hazards and risks to human health and the environment created by all potential constituents of concern at a site. Characterize the source term for all constituents of concern and identify any potential or future groundwater contamination. Identify the pathways the constituents of concern will likely follow including ingestion of contaminated water and ingestion of contaminated foods. Identify points of exposure. Estimate the concentrations or doses those constituents will likely produce at the location where humans or environmental populations could be reasonably exposed. Define the spatial distributions of the various constituents of concern of existing contaminant plumes. Provide a reasonably conservative or best estimate and sensitivity of the potential health effects caused by human exposure to potential constituents of concern. Identify and evaluate the risks posed by the potential constituents of concern to environmental populations. Estimate the likelihood of human and environmental exposure. Project impacts at the point of exposure over a 1,000-year time frame.

Establish a spectrum of potential accidents involving the proposed Cell 4B by classes of occurrence and appropriately evaluate each class of accidents. Discuss measures that DUSA has implemented or will implement to prevent accidents and demonstrate that such measures are adequate. Describe emergency plans and training for responding to accidents.

BASIS FOR INTERROGATORY:

The ER gives no indication that DUSA has updated the meteorological data base and the representations of monthly and annual average conditions. Either the data base and its analyses should be updated and revised information incorporated into other analyses or explanation should be provided to demonstrate that the data base and related analyses have already been updated.

The effects of accidents should be reviewed and updated to account for any incremental effects that may be attributable in the future to Cell 4B after it has been placed into operation and following final closure.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01B/01: ENVIRONMENTAL ANALYSIS - IMPACT ON WATERWAYS AND GROUNDWATER

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(b) An assessment of any impact on waterways and groundwater resulting from the activities conducted pursuant to the license or amendment;

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Provide updated information on use and characteristics of groundwater and surface water resources, including aquifer horizontal and vertical permeabilities and other physical/hydraulic properties, well drawdown characteristics for existing wells, and information on present and projected future uses of groundwater and surface water in the area surrounding the mill site within a minimum 10-mile radius.

Provide updated information on surface water and groundwater quality for potentially impacted surface waters and groundwater out to at least a 1-mile radius from the site. Please define the chemical characteristics of existing groundwater and surface water and identify methods utilized for completing monitoring groundwater and surface water quality.

BASIS FOR INTERROGATORY:

The most current (most recent) information regarding existing groundwater and surface water resources, surface water and groundwater quality, and groundwater and surface water uses in the area within 5 miles of the site that was reviewed was submitted in the Reclamation Plan White Mesa Mill, Blanding, Utah in 2000 (IUC 2000). The information provided includes only up to the late 1990's and needs to be updated to reflect recent and current information and conditions. Updated information on surface water and groundwater resources and updated data on permitted water rights for groundwater and surface water in the region surrounding the site needs to be provided to assess if there any significant changes in nearby water uses or water availability that could affect or be affected by activities at the site and in and around Cell 4B. Updated information on project future surface water and groundwater uses in the surrounding region within at least a 1-mil radius of the active mill site needs to be provided to satisfy guidelines contained in NRC RG 3.8. Updated groundwater, surface water and groundwater quality data

may be obtained from a variety of resources such as consults (e.g., USGS National Water Information System: Web Interface).

REFERENCES:

DUSA 2008. Denison Mines USA Corporation. Environmental Report In Support of Construction Tailings Cell 4B, White Mesa Uranium Mill, Blanding, Utah, April 30, 2008.

IUC 2000 International Uranium Corp., Reclamation Plan White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Revision 3.0. July 2000.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01C/01: ENVIRONMENTAL ANALYSIS – ALTERNATIVES

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(c) Consideration of alternatives, including alternative sites and engineering methods, to the activities to be conducted pursuant to the license or amendment; and

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Add a section to the ER that discusses the second alternative identified in the introduction to Chapter 11, namely, "Amend the license to include the construction of Cell 4B with such additional conditions as are considered necessary or appropriate to protect public health, safety, and the environment. . . ."

Estimate the increase in operating and closure costs that has occurred since the costs were estimated for the last license renewal. Justify the statement that the ". . . costs associated with the operation of the Mill have not changed significantly but the benefits have become more evident over time as the number of uranium mills has dwindled and the demand for uranium milling services from local miners and the industry as whole has increased." Present and justify the criteria used for assessing and comparing benefits and costs where these are expressed in nonmonetary or qualitative terms.

Summarize and update estimated costs and benefits that were earlier estimated and reported (namely Tables 11.0-1 and 11.0-2 originally presented in D&M 1978). Provide additional support using current information for the statement at page 34 of the Cell 4B ER that "There have been no significant changes to the costs [and benefits] associated with the Mill since the last license renewal in 1997 . . . ." Provide a benefit-cost evaluation in the form of a narrative accompanied by tables and charts.

Present or cite and summarize (including concise citations) objective evidence that supports the Cell 4B ER statement on page 31 that "The Mill has demonstrated that it is capable of continuing to operate in a manner that satisfies all regulatory standards and ALARA goals . . . ." Explain how the Notice and Violation and Groundwater Corrective Action Order issued by the Utah Department of Environmental Quality in 1999 affects confidence that amending the license to allow construction

of Cell 4B will be successfully accomplished and properly operated. Explain why the necessity for this Notice and Violation and Groundwater Corrective Action Order and DUSA's responses do not affect the Division's confidence that the Mill will continue ". . . operate in a manner that satisfies all regulatory standards . . . ."

BASIS FOR INTERROGATORY:

It is appropriate not to address alternatives to the site or milling process, since the mill has been and is licensed and constructed and is operating. It is also appropriate not to address engineering alternatives to the design of the proposed Cell 4B, since the Division has approved a substantially similar design for construction of Cell 4A and its radiological performance is projected to be below regulatory limits.

Although the second alternative identified in Section 11.0 of the ER is not discussed in the section, any additional license conditions that might result from this review will be considered viable.

The factors used in evaluating the viability of alternatives to the proposed action include:

- Benefit to the regional community, including independent mining operations.
- Benefit to the uranium industry as a whole in the United States.
- Minimal incremental impact on public health, safety, and the environment that would result from approving the proposed alternative.
- The Groundwater Quality Discharge Permit issued to the Licensee provides additional protection for public health and the environment.
- The Mill's track record showing safe operation in compliance with regulatory standards and ALARA goals.

URS judges these factors to be reasonably comprehensive.

Since 1997, general construction costs have escalated by about 35 to 45 percent. It is not obvious that such a shift in costs does not affect the cost-benefit evaluation.

Although the ER identifies costs and benefits, no basis is presented for selecting the requested alternative. The tradeoffs between costs and benefits necessary to justify the requested alternative should be presented and justified.

The statement at page 34 of the Cell 4B ER that "There have been no significant changes to the costs [and benefits] associated with the Mill since the last license renewal in 1997 . . . ." is provided without justification or elaboration. Although the statement may well be true, sufficient changes have occurred in the yellowcake supply industry and in the costs of construction and operations that additional information, discussion, and evaluation in support of the statement is warranted.

The statement at page 31 of the Cell 4B ER that ". . . the Mill has operated since its inception in compliance with all applicable regulatory standards and ALARA goals and is capable of

continuing to operate in compliance with such standards and goals" potentially contradicts the fact that the Utah Department of Environmental Quality issued a Notice and Violation and Groundwater Corrective Action Order in 1999 and that DUSA continues to submit Environmental Monitoring reports in response to that order. This apparent contradiction, as it relates to the requested license amendment, requires elaboration and clarification.

REFERENCES:

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

D&M 1978 Dames & Moore, "White Mesa Uranium Project, San Juan County, Utah" Environmental Report prepared for Energy Fuels Nuclear, Inc., January 30, 1978.

NRC 1997 U.S. Nuclear Regulatory Commission 1997, "Environmental Assessment for Renewal of Source Materials License No. SUA-1358", prepared by USNRC in support of license renewal application, Docket No. 40-8681, February 1997.

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01D/01: ENVIRONMENTAL ANALYSIS – LONG-TERM IMPACTS

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

> (d) Consideration of the long-term impacts including decommissioning, decontamination, and reclamation impacts, associated with activities to be conducted pursuant to the license or amendment.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Please provide an updated Reclamation Plan that considers the current concept of fully utilizing Cells 4A and 4B for tailings management, including the long term stabilization and disposal of tailings. The updated Reclamation Plan must account for the use of these two cells for disposal, which will directly impact the length of slopes, precipitation runoff rates and volumes, design of the top cap, and design of the cap side slopes including rock sizing and fill depth. Assess and report the geotechnical stability of the tailings impoundment, including slope stability, liquefaction, and settlement. Prepare and submit the updated Reclamation Plan, and, in particular, discuss the final cover and long-term stabilization design for the facility, including Cell 4B (and Cell 4A), according to requirements of NUREG-1620 and in accordance with 10CFR40 – Appendix A, Criteria 6(3) and 6A(1). Address slope stability, liquefaction, and settlement in accordance with NUREG-1620. Address the hydrologic characteristics of the site, including flooding potential, and erosion protection features of the tailings impoundment. Address the radiation protection design of the tailings disposal impoundment cover for radon and gamma attenuation. Evaluate the potential for settlement of the tailings impoundment and cracking of the radon barrier that might result. Address plans for reclaiming and restoring lands disturbed by mining and milling activities. Estimate costs to implement the Reclamation Plan activities and state the financial Arrangements necessary to provide required financial assurances. Assess and describe the long-term environmental impacts resulting from all proposed reclamation activities.

Estimate decontamination criteria derived concentration guidelines (DCGLs) for primary radionuclides. State data quality objectives (DQOs) for radiological surveys and sampling. Provide final verification (status survey) plans and procedures.

BASIS FOR INTERROGATORY:

In response to this requirement, DUSA has prepared a discussion of the long term impacts related to site operations in Section 14 of the Environmental Report. The discussion is purposefully brief and refers the reviewer primarily to the FES (implying 'Final Environmental Statement Related to Operation of the White Mesa Uranium Project", May 1979 (1979 FES)), and secondarily to the "Mill's Reclamation Plan" (implying "Reclamation Plan, White Mesa Mill, Blanding, Utah, Revision 3, July 2000" (Reclamation Plan)) and the "2000 EA". The last of these documents was not defined in the Environmental Report, so an assumption was made of the reference to "Environmental Assessment for Renewal of Source Material License No. SUA-1358", dated February 1997 (1997 EA). Section 14.0 of the ER also references Section 8 of the "February, 2007 License Renewal Application". Neither the 1997 ("2000") EA, nor the License Renewal Application, nor the 2000 Reclamation Plan contained detailed descriptions of the long-term impacts due to the licensed activities. The Final Environmental Statement (FES) provides adequate analysis of the long-term effects of the mill's construction, operation, decommissioning, and reclamation. However, the FES states in summary, "Assuming reclamation efforts will be successful, long term impacts to the soil are not expected to be significant". Similar statements are made with respect to other environmental media at the site.

The existing Reclamation Plan presents a reclamation concept that is significantly different than what is currently being considered. The Reclamation Plan suggests that only Cell 2 and 3 will be contained beneath the final site cap, and that wastes contained in Cell 4A (which is described as "unused") would be consolidated within Cell 3. Under the current concept, Cell 4A is fully utilized, as well as Cell 4B, neither of which is recognized in the 2000 Reclamation Plan. Inclusion of these two additional cells beneath the final site cap will ultimately increase the top closure cap area by over 50%. This significant increase in cap area will ultimately impact the overland flow of precipitation, the potential for erosion of the top cap, and the volume of runoff running down the south slope. These parameters must be included in the Reclamation Plan and the long-term impacts analysis.

REFERENCES:

DUSA 2008. Denison Mines USA Corporation. Environmental Report In Support of Construction Tailings Cell 4B, White Mesa Uranium Mill, Blanding, Utah, April 30, 2008.

IUC 2000 International Uranium Corp., Reclamation Plan White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Revision 3.0. July 2000.

NUREG–1748 U.S. Nuclear Regulatory Commission, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." Washington, DC, 2001.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the

Uranium Mill Tailings Radiation Control Act of 1978." Washington DC, June 2003.

10 CFR 40 — Appendix A to Part 40 – Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content.

DG-3024 — U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

RG 3.8 — U.S. Nuclear Regulatory Commission, "Regulatory Guide 3.8; Preparation of Environmental Reports for Uranium Mills", Washington DC, October 1982.

INTERROGATORY WHITE MESA CELL 4B 10CFR40.26(C)(2)-02/01: GENERAL LICENSE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.26(c)(2): The general license in paragraph (a) of this section is subject to the documentation of daily inspections of tailings or waste retention systems and the immediate notification of the Executive Secretary, of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or of any unusual conditions (conditions not contemplated in the design of the retention system) that if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas; and any additional requirements the Executive Secretary may by order deem necessary. The licensee shall retain this documentation of each daily inspection as a record for three years after each inspection is documented.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40.31(H)-03/01: APPLICATION FOR SPECIFIC LICENSES

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.31(h): An application for a license to receive, possess, and use source material for uranium or thorium milling or byproduct material, as defined in 10CFR40, at sites formerly associated with such milling shall contain proposed written specifications relating to milling operations and the disposition of the byproduct material to achieve the requirements and objectives set forth in Appendix A of 10CFR40. Each application must clearly demonstrate how the requirements and objectives set forth in Appendix A of 10CFR40 have been addressed. Failure to clearly demonstrate how the requirements and objectives in Appendix A have been addressed shall be grounds for refusing to accept an application.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

INTERROGATORY WHITE MESA CELL 4B 10CFR40.61-06/01: RECORDS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.61:

(a) Each person who receives source or byproduct material pursuant to a license issued pursuant to the regulations in 10CFR40 shall keep records showing the receipt, transfer, and disposal of this source or byproduct material as follows:

(1) The licensee shall retain each record of receipt of source or byproduct material as long as the material is possessed and for three years following transfer or disposition of the source or byproduct material.

(2) The licensee who transferred the material shall retain each record of transfer or source or byproduct material until the Executive Secretary terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(3) The licensee shall retain each record of disposal of source or byproduct material until the Executive Secretary terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(4) If source or byproduct material is combined or mixed with other licensed material and subsequently treated in a manner that makes direct correlation of a receipt record with a transfer, export, or disposition record impossible, the licensee may use evaluative techniques (such as first-in-first-out), to make the records that are required by 10CFR40 account for 100 percent of the material received.:

(b) The licensee shall retain each record that is required by the regulations in 10CFR40 or by license condition for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, each record must be maintained until the Executive Secretary terminates the license that authorizes the activity that is subject to the recordkeeping requirement.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40.65(A)(1)-07/01: EFFLUENT MONITORING REPORTING REQUIREMENTS.

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.65(a)(1): Each licensee authorized to possess and use source material in uranium milling … shall . . . within 60 days after January 1 and July 1 of each year thereafter, submit a report to the Executive Secretary; which report must specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous six months of operation, and such other information as the Executive Secretary may require the licensee to estimate maximum potential annual radiation doses to the public resulting from effluent releases. If quantities of radioactive materials released during the reporting period are significantly above the licensee's design objectives previously reviewed as part of the licensing action, the report shall cover this specifically. On the basis of such reports and any additional information the Executive Secretary may obtain from the licensee or others, the Executive Secretary may from time to time require the licensee to take such action as the Executive Secretary deems appropriate.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Assess the extent to which meteorological characteristics in the vicinity of the facility have changed since the Environmental Report was revised to account for such changes. Present revised meteorological characteristics.

BASIS FOR INTERROGATORY:

Updated meteorological characteristics at the facility should be provided to ensure that baseline meteorological conditions to be used for assessing potential increases of concentration of monitored effluent constituents are representative of current conditions.

Populations are concentrated generally north-northeast and south-southeast from the centroid of the tailings area. Air monitoring stations BHV-1 and BHV-2 are located to detect releases from the facility with winds generally from the south-southwest toward Blanding. Air monitoring station BHV-6 is located to detect releases from the facility with winds from the northwest or north-northwest toward the community of White Mesa. URS judges this arrangement to be satisfactory.

REFERENCES:

DG-3024	U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.
NUREG-1620	U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.
RG 1.23	U.S. Nuclear Regulatory Commission, "Regulatory Guide 1.23 (Safety Guide 23); Onsite Meteorological Programs", Washington, DC, February 1972**.**
RG 3.8	U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B 10CFR40.INTRODUCTION-08/01: CAPACITY OF TAILINGS OR WASTE SYSTEMS OVER THE LIFETIME OF MILL OPERATIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40. Appendix A, Introduction: The specifications must be developed considering the expected full capacity of tailings or waste systems and the lifetime of mill operations. Where later expansions of systems or operations may be likely (for example, where large quantities of ore now marginally uneconomical may be stockpiled), the amenability of the disposal system to accommodate increased capacities without degradation in long-term stability and other performance factors must be evaluated .

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40 APPENDIX A, INTRODUCTION-09/01: ALTERNATIVE REQUIREMENTS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40. Appendix A, Introduction: … Licensees or applicants may propose alternatives to the specific requirements in this appendix. The alternative proposals may take into account local or regional conditions, including geology, topography, hydrology, and meteorology. The Executive Secretary may find that the proposed alternatives meet the Executive Secretary's requirements if the alternatives will achieve a level of stabilization and containment of the sites concerned, and a level of protection for public health, safety, and the environment from radiological and nonradiological hazards associated with the sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements of this Appendix and the standards promulgated by the Utah Administrative Code, Rule R317-6, Ground Water Quality Protection.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Detemined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40 APPENDIX A, CRITERION 1-10/01: PERMANENT ISOLATION WITHOUT ONGOING MAINTENANCE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40 Appendix A, Criterion 1: The general goal or broad objective in siting and design decisions is permanent isolation of tailings and associated contaminants by minimizing disturbance and dispersion by natural forces, and to do so without ongoing maintenance. For practical reasons, specific siting decisions and design standards must involve finite times (e.g., the longevity design standard in Criterion 6). The following site features which will contribute to such a goal or objective must be considered in selecting among alternative tailings disposal sites or judging the adequacy of existing tailings sites:

- Remoteness from populated areas;
- Hydrologic and other natural conditions as they contribute to continued immobilization and isolation of contaminants from ground-water sources; and
- Potential for minimizing erosion, disturbance, and dispersion by natural forces over the long term.

The site selection process must be an optimization to the maximum extent reasonably achievable in terms of these features.

In the selection of disposal sites, primary emphasis must be given to isolation of tailings or wastes, a matter having long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs. While isolation of tailings will be a function of both site and engineering design, overriding consideration must be given to siting features given the long-term nature of the tailings hazards.

Tailings should be disposed of in a manner that no active maintenance is required to preserve conditions of the site.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Refer to Section 14.0 of the Environmental Report and the Reclamation Plan, White Mesa Mill, Blanding, Utah (IUC 2000):

Please demonstrate that previously submitted analyses of slope stability, settlement, and liquefaction are applicable to the design of Cell 4B and that confidence exists that Cell 4B will remain stable following closure, reclamation, and stabilization.

Please provide information, analyses, and discussion to demonstrate that tailings will be disposed of in a manner that requires no active maintenance to preserve conditions of the site or to protect human health and the environment from hazards the tailings might otherwise present. To the extent that such information, analyses, and discussion have been presented previously, please summarize pertinent information, including concise citations to previously submitted documents, and justify their applicability to the Cell 4B closure design.

BASIS FOR INTERROGATORY:

Because the site and facility have already been licensed, URS WD judges siting and site characterization to satisfy applicable requirements.

Although aspects of stability (including slope stability, settlement, and liquefaction) are discussed in general terms in the 2000 Reclamation Plan, DUSA should demonstrate that these aspects of stability as they relate to the specific design proposed for Cell 4B are covered by the analyses previously presented for Cell 4A and/or earlier cells, or alternatively, provide new analyses that are appropriate for assessing the long-term stability of Cell 4B.

REFERENCES:

IUC 2000 — International Uranium Corp., Reclamation Plan White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Revision 3.0. July 2000.

DG-3024 — U.S. Nuclear Regulatory Commission, “Standard Format and Content Of License Applications for Conventional Uranium Mills,” Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 — U.S. Nuclear Regulatory Commission, “Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act”, NUREG-1620, June, 2003.

RG 3.8 — U.S. Nuclear Regulatory Commission, “Preparation of Environmental Reports for Uranium Mills,” Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 2-11/01: PROLIFERATION

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40 Appendix A, Criterion 2: To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations, byproduct material from in situ extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote above ground extraction operations must be disposed of at existing large mill tailings disposal sites; unless, considering the nature of the wastes, such as their volume and specific activity, and the costs and environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 3-12/01: PLACEMENT BELOW GRADE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 3: The "prime option" for disposal of tailings is placement below grade, either in mines or specially excavated pits (that is, where the need for any specially constructed retention structure is eliminated). The evaluation of alternative sites and disposal methods performed by mill operators in support of their proposed tailings disposal program (provided in applicants' environmental reports) must reflect serious consideration of this disposal mode. In some instances, below grade disposal may not be the most environmentally sound approach, such as might be the case if a ground-water formation is relatively close to the surface or not very well isolated by overlying soils and rock. Also, geologic and topographic conditions might make full below grade burial impracticable: For example, bedrock may be sufficiently near the surface that blasting would be required to excavate a disposal pit at excessive cost, and more suitable alternative sites are not available. Where full below grade burial is not practicable, the size of retention structures, and size and steepness of slopes associated exposed embankments must be minimized by excavation to the maximum extent reasonably achievable or appropriate given the geologic and hydrologic conditions at a site. In these cases, it must be demonstrated that an above grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 4-13/01: LOCATION AND DESIGN REQUIREMENTS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 4: The following site and design criteria must be adhered to whether tailings or wastes are disposed of above or below grade.

(a) Upstream rainfall catchment areas must be minimized to decrease erosion potential and the size of the floods which could erode or wash out sections of the tailings disposal area.

(b) Topographic features should provide good wind protection.

(c) Embankment and cover slopes must be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as possible to those which would be provided if tailings were disposed of below grade; this could, for example, lead to slopes of about 10 horizontal to 1 vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided, and compensating factors and conditions which make such slopes acceptable should be identified.

(d) A full self-sustaining vegetative cover must be established or rock cover employed to reduce wind and water erosion to negligible levels.

Where a full vegetative cover is not likely to be self-sustaining due to climatic or other conditions, such as in semi-arid and arid regions, rock cover must be employed on slopes of the impoundment system. The Executive Secretary will consider relaxing this requirement for extremely gentle slopes such as those which may exist on the top of the pile.

The following factors must be considered in establishing the final rock cover design to avoid displacement of rock particles by human and animal traffic or by natural process, and to preclude undercutting and piping:

- Shape, size, composition, and gradation of rock particles (excepting bedding material average particles size must be at least cobble size or greater);
- Rock cover thickness and zoning of particles by size; and
- Steepness of underlying slopes.

Individual rock fragments must be dense, sound, and resistant to abrasion, and must be free from cracks, seams, and other defects that would tend to unduly increase their destruction by water and frost actions. Weak, friable, or laminated aggregate may not be used.

Rock covering of slopes may be unnecessary where top covers are very thick (or less); bulk cover materials have inherently favorable erosion resistance characteristics; and, there is

negligible drainage catchment area upstream of the pile and good wind protection as described in points (a) and (b) of this Criterion.

Furthermore, all impoundment surfaces must be contoured to avoid areas of concentrated surface runoff or abrupt or sharp changes in slope gradient. In addition to rock cover on slopes, areas toward which surface runoff might be directed must be well protected with substantial rock cover (rip rap). In addition to providing for stability of the impoundment system itself, overall stability, erosion potential, and geomorphology of surrounding terrain must be evaluated to assure that there are not ongoing or potential processes, such as gully erosion, which would lead to impoundment instability.

(e) The impoundment may not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in this criterion, the term "capable fault" has the same meaning as defined in section III(g) of Appendix A of 10 CFR Part 100. The term "maximum credible earthquake" means that earthquake which would cause the maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material.

(f) The impoundment, where feasible, should be designed to incorporate features which will promote deposition. For example, design features which promote deposition of sediment suspended in any runoff which flows into the impoundment area might be utilized; the object of such a design feature would be to enhance the thickness of cover over time.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Indicate, out to 8-km (5-mi) radius, the nature and extent of present and projected land use (e.g., agriculture, livestock raising, dairies, pasturelands, residences, wildlife preserves, sanctuaries, hunting areas, industries, recreation, transportation) and any recent trends such as major or unexpected changes in population or industrial land use patterns.

Identify the location, nature, and amounts of present and projected ground-water use (e.g., water supplies, irrigation, reservoirs, recreation, and transportation) within 16 km (10 mi) of the site and the present and projected population (during the active life of the mill) associated with each use point. Information provided for each use point should include:

- *Location*
- *Distance from mill*
- *Withdrawal rate*
- *Return rates*
- *Type of water use*
- *Depth of wells*

- *Groundwater elevation*
- *Drawdown rates*
- *Source and projection of water-use estimates*

Provide descriptive information to give recent changes in the locations and populations of neighboring schools; facilities; hospitals; and residential areas within 8 km (5 mi).

Demonstrate that soils in the area where Cell 4B will be constructed are not unstable because of their physical or chemical properties, locations, and dimensions. Address compressibility; rate of consolidation; shear strength (including, for sensitive soils, possible loss of shear strength resulting from strain-softening); liquefaction potential; permeability; dispersion characteristics; swelling and shrinkage; long-term moisture content for radon barrier material; and cover cracking.

Update records of historical ground-water-level fluctuations at the site.

Please state the proposed maximum slope of the stabilized tailings impoundment that includes the Cell 4B area. Justify any slope steeper than 5h:1v and explain why gentler slopes are impracticable. Identify and justify any design enhancements incorporated to provide assurance that the stabilized impoundment will remain stable without reliance on active measures following closure.

Describe measures taken to stabilize the final cover system following closure that includes the Cell 4B area.

Discuss the most recent data on seismic events in the region that are applicable to the White Mesa site and identify any implications for design criteria applicable to the design of the facility, including the final closure design for Cell 4B, for ensuring long-term stability; and present and justify the results of any design calculations prepared to incorporate any revised design criteria.

Identify any changes in the nature and extent of present and projected land use (e.g., agriculture, livestock raising, dairies, pasturelands, residences, wildlife preserves, sanctuaries, hunting areas, industries, recreation, transportation) that have occurred since the 1978 ER (D&M 1978) was prepared. Identify any recent trends such as major or unexpected changes in population or industrial patterns have occurred since the 1978 ER (D&M 1978) was prepared.

Provide in tabular form for each of the 22-1/2-degree sectors, the distances [to a distance of 8 km (5 mi)] from the center of the site to the following:

- *Nearest cattle (or other meat animals) grazing on natural forage, with types and numbers of animals specified.*
- *Nearest game animals consumed by sportsmen.*
- *Nearest residence.*
- *Nearest site boundary.*

- *Nearest vegetable garden larger than 50 m^2 (60 yd^2) in area. The type of crop and amounts produced should be noted.*

Provide data on annual production and distribution of meat (kg) and truck farming produce (kg) within an 80-km (50-mi) radius from the proposed facility. Provide information on grazing season (months of year) and feeding regimens for cattle. Please provide specific information on actual consumption of the meat from cattle and game animals.

Identify any changes in the locations, natures, and amounts of present and projected surface and ground-water use (e.g., water supplies, irrigation, reservoirs, recreation, and transportation) within 16 km (10 mi) of the site. Identify any changes in the present and projected population (during the active life of the mill) associated with each use point, where appropriate.

Summarize and tabulate data on changes in both present and projected future water use; locate users on maps of legible scale. Tabulations should include:

- *Location: Changes in locations of water users.*
- *Distances of user from mill.*
- *Withdrawal rate: Changes in present and projected withdrawal rates (in liters per second or cubic meters per second) for each water use, including seasonal variability.*
- *Return rates: Changes in present and projected return rates (in liters per second or cubic meters per second), if appropriate, including seasonal variability..*
- *Type of water use: Changes in types of water use for each location, e.g., municipal, industrial, irrigation, stock/game watering.*
- *In addition, for ground-water use: Indicate changes in depths of wells, groundwater elevation, and drawdown rates and characterize the use of each aquifer.*
- *Source and projection of water-use estimates: Where use rates are anticipated to change over the life of the project and beyond, indicate projections and the source of the projection information.*

Provide changes in the projected population by direction and distance from the site within a 5-mile radius of the mill for the anticipated life of the mill. Identify and discuss significant transient or seasonal population variations, including the bases for assumptions and projections.

Provide an evaluation of changes in prominent meteorological parameters prevailing at the site that have occurred since the 1978 ER (D&M 1978) was prepared. Summarize site meteorology based on meteorological measurements taken onsite and at nearby representative stations, including:

- *Quarterly and annual wind rose presentation for the 16 compass directions.*
- *Quarterly and annual wind speed, wind direction, and atmospheric stability data in joint frequency form at heights representative of effluent releases.*

- *Total precipitation and evaporation by month.*
- *Diurnal and monthly averages and extremes of temperature and humidity*
- *Monthly wind characteristics including speeds and direction, annual joint frequency of windspeed, and direction by stability category*
- *Data on precipitation*
- *Frequency of occurrence and effects of storms.*

To the extent warranted by changes in site meteorology, Identify and justify changes in design features that may result from any changes in design basis events.

Present and justify background concentrations of radionuclides in groundwater that has resulted from responding to recent Division directives (URS 2008).

Present and justify parameter values used to characterize mill tailings, including the following:

- *Compressibility and rate of consolidation*
- *Shear strength, including, for sensitive soils, possible loss of shear strength resulting from strain-softening*
- *Liquefaction potential*
- *Permeability*
- *Dispersion characteristics*
- *Swelling and shrinkage*
- *Long-term moisture content for radon barrier material*
- *Cover cracking*

Provide a detailed description of the applicable field and laboratory investigations and testing that were completed, and summarize material properties (e.g., permeability, moisture-density relationships, gradation, shrinkage and dispersive characteristics, resistance to freeze-thaw degradation, cracking potential, and chemical compatibility, including any amendment materials)

Present details (including sketches) of the disposal cell cover termination at boundaries, with any considerations for safely accommodating subsurface water flows.

Provide a schematic diagram displaying various disposal cell layers and thicknesses. Establish the particle size gradation of the disposal cell bedding layer and the rock layer to ensure stability against particle migration during the period of regulatory interest.

Demonstrate that the effects of possible freeze-and-thaw cycles on soil strength and radon barrier effectiveness do not compromise their long-term stability or ability to function as required. Demonstrate that freezing and formation of ice crystals and lenses will not cause

heaving. Demonstrate that soil is not susceptible to frost heave, considering that uniformly graded soils containing more than 10 percent of particles smaller than 0.02 mm and well-graded soils with more than 3 percent of particles smaller than 0.02 mm are susceptible.

Present an analysis of the potential for cracks to develop in the disposal cell cover as a result of differential settlement and shrinkage.

Demonstrate that any geomembranes included in the final cover(s) are adequate for the proposed disposal cell cover and describe their major properties (e.g., physical, mechanical, and chemical). Discuss methods for membrane installation. Demonstrate that the shear strength of the interface between compacted clay and geomembranes is appropriately considered in the stability analyses under both static and dynamic loads is noted.

Demonstrate that information on site characterization, slope stability, settlement, and liquefaction used in the disposal cell cover design appropriately is appropriately reflected in the evaluation, and therefore, constitutes inputs that would contribute to the demonstration of disposal cell design compliance with the regulations.

Demonstrate that the design erosion protection covers for the site conform to the suggested criteria in NUREG–1623 (NRC 2002). Demonstrate that the proposed cover design will meet longevity requirements without the use of active maintenance.

BASIS FOR INTERROGATORY:

The 2000 Reclamation Plan suggests that only Cell 2 and 3 will be contained beneath the final site cap, and that wastes contained in Cell 4A (which is described as “unused”) would be consolidated within Cell 3. Under the current concept, Cell 4A is fully utilized, as well as Cell 4B, neither of which is recognized in the 2000 Reclamation Plan. Inclusion of these two additional cells beneath the final site cover(s) will ultimately increase the top closure cover area by over 50%. A discussion of the final facility closure design that includes final closure of additional disposal areas (e.g., Cells 4A and 4B) and that accurately reflects current site development plans and current site conditions needs to be provided.

REFERENCES:

DG-3024	U.S. Nuclear Regulatory Commission, “Standard Format and Content Of License Applications for Conventional Uranium Mills,” Draft Regulatory Guide DG-3024, May, 2008.
NUREG-1620	U.S. Nuclear Regulatory Commission, “Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act”, NUREG-1620, June, 2003.
RG 3.8	U.S. Nuclear Regulatory Commission, “Preparation of Environmental Reports for Uranium Mills,” Regulatory Guide 3.8, October, 1992.

D&M 1978 Dames & Moore, "White Mesa Uranium Project, San Juan County, Utah" Environmental Report prepared for Energy Fuels Nuclear, Inc., January 30, 1978.

NRC 2002 U.S. Nuclear Regulatory Commission, *Design of Erosion Protection for Long-Term Stabilization*. NUREG-1623. Final Report. T.L. Johnson September 2002. U.S. N.R.C., Washington DC, 1988.

URS 2008 URS Corporation "Completeness Review for the Revised Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corporation's White Mesa Mill Site, San Juan County, Utah", Memorandum from Robert Sobocinski and Brian Harper (URS) to Loren Morton (Utah Division of Radiation Control), 39400260.10200, June 16, 2008.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(1)-14/01: GROUND-WATER PROTECTION STANDARDS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(1): The primary ground-water protection standard is a design standard for surface impoundments used to manage uranium and thorium byproduct material. Unless exempted under paragraph 5A(3) of this criterion, surface impoundments (except for an existing portion) must have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water, or surface water) during the active life of the facility, provided that impoundment closure includes removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate. For impoundments that will be closed with the liner material left in place, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(2)-15/01: LINER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(2): The liner required by paragraph 5A(1) above must be:

(a) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

(b) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and

(c) Installed to cover all surrounding earth likely to be in contact with the wastes or leachate.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(4)-17/01: PREVENT OVERTOPPING

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(4): A surface impoundment must be designed, constructed, maintained, and operated to prevent overtopping resulting from normal or abnormal operations, overfilling, wind and wave actions, rainfall, or run-on; from malfunctions of level controllers, alarms, and other equipment; and from human error.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(5)-18/01: DIKES

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(5): When dikes are used to form the surface impoundment, the dikes must be designed, constructed, and maintained with sufficient structural integrity to prevent massive failure of the dikes. In ensuring structural integrity, it must not be presumed that the liner system will function without leakage during the active life of the impoundment.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(1)-19/01: COVER AND CLOSURE AT END OF MILLING OPERATIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(1): In disposing of waste byproduct material, licensees shall place an earthen cover (or approved alternative) over tailings or wastes at the end of milling operations and shall close the waste disposal area in accordance with a design which provides reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct materials, and radon-220 from thorium byproduct materials, to the atmosphere so as not to exceed an average release rate of 20 picocuries per square meter per second (pCi/m^2s) to the extent practicable throughout the effective design life determined pursuant to (1)(i) of this Criterion. In computing required tailings cover thicknesses, moisture in soils in excess of amounts found normally in similar soils in similar circumstances may not be considered. Direct gamma exposure from the tailings or wastes should be reduced to background levels. The effects of any thin synthetic layer may not be taken into account in determining the calculated radon exhalation level. If non-soil materials are proposed as cover materials, it must be demonstrated that these materials will not crack or degrade by differential settlement, weathering, or other mechanism, over long-term intervals.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Please provide an updated Reclamation Plan that includes the proposed design of the final cover systems for the disposal cells, including Cells 4A and 4B, and addresses the design of the radon barrier layer(s), including thickness and assumptions regarding initial and long-term moisture content(s) in the radon barrier(s).

Provide an assessment of long-term radon emission rates for the final cover system(s). Include assumptions and present and describe analysis methodologies used.

Address the radiation protection design of the tailings disposal impoundment cover for radon and gamma attenuation and assess the potential for settlement of the tailings impoundment and resulting cracking of the radon barrier.

BASIS FOR INTERROGATORY:

The 2000 Reclamation Plan suggests that only Cell 2 and 3 will be contained beneath the final site cap, and that wastes contained in Cell 4A (which is described as “unused”) would be consolidated within Cell 3. Under the current concept, Cell 4A is fully utilized, as well as Cell 4B, neither of which is recognized in the 2000 Reclamation Plan. Inclusion of these two additional cells beneath the final site cover(s) will ultimately increase the top closure cover area

by over 50%. A discussion of the radon barrier characteristics in the final closure cover(s) and an analysis of the effectiveness of these radon barrier layers in limiting long-term radon emissions through the final closure cover(s) need to be presented.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

IUC 2000 International Uranium (USA) Corporation (IUC): Reclamation Plan – White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Rev. 3, July 2000.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(2)-20/01: VERIFY EFFECTIVENESS OF FINAL RADON BARRIER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(2): As soon as reasonably achievable after emplacement of the final cover to limit releases of radon-222 from uranium byproduct material and prior to placement of erosion protection barriers or other features necessary for long-term control of the tailings, the licensee shall verify through appropriate testing and analysis that the design and construction of the final radon barrier is effective in limiting releases of radon-222 to a level not exceeding 20 pCi/m^2s averaged over the entire pile or impoundment using the procedures described in 40 CFR part 61, appendix B, Method 115, or another method of verification approved by the Executive Secretary as being at least as effective in demonstrating the effectiveness of the final radon barrier.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(3)-21/01: PHASED EMPLACEMENT OF FINAL RADON BARRIER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(3): When phased emplacement of the final radon barrier is included in the applicable reclamation plan, the verification of radon-222 release rates required in paragraph (2) of this criterion must be conducted for each portion of the pile or impoundment as the final radon barrier for that portion is emplaced.

INTERROGATORY STATEMENT:

Provide information regarding the schedule for and manner of placement of the final radon barrier over the disposal cell areas, including Cell 4B. Describe any proposed phasing of radon barrier placement. Describe methods to be used to verify the effectiveness of these radon barrier layers in limiting long-term emissions (e.g., radon) through the final closure cover(s.

BASIS FOR INTERROGATORY:

The 2000 Reclamation Plan (IUC 2000) suggests that only Cell 2 and 3 will be contained beneath the final site cap, and that wastes contained in Cell 4A (which is described as "unused") would be consolidated within Cell 3. Under the current concept, Cell 4A is fully utilized, as well as Cell 4B, neither of which is recognized in the 2000 Reclamation Plan. Inclusion of these two additional cells beneath the final site cover(s) will ultimately increase the top closure cover area by over 50%. A discussion of the schedule for and manner of any phased placement of the radon barrier as part of the construction of the final closure cover(s) needs to be presented.

REFERENCES:

IUC 2000	International Uranium (USA) Corporation (IUC): Reclamation Plan – White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Rev. 3, July 2000.
10 CFR 40	Appendix A to Part 40 – Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(4)-22/01: REPORT RADON BARRIER EFFECTIVENESS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(4): Within ninety days of the completion of all testing and analysis relevant to the required verification in paragraphs (2) and (3) of 10CFR40, Appendix A, Criterion 6, the uranium mill licensee shall report to the Executive Secretary the results detailing the actions taken to verify that levels of release of radon-222 do not exceed 20 pCi/m^2s when averaged over the entire pile or impoundment. The licensee shall maintain records until termination of the license documenting the source of input parameters including the results of all measurements on which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine compliance. These records shall be kept in a form suitable for transfer to the custodial agency at the time of transfer of the site to DOE or a State for long-term care if requested

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(5)-23/01: ELEVATED RADIUM CONCENTRATIONS IN COVER MATERIALS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(5): Near surface cover materials (i.e., within the top three meters) may not include waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to ensure that surface radon exhalation is not significantly above background because of the cover material itself.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Demonstrate that adequate quantities are available of all proposed rock cover materials of suitable characteristics required for construction (such as provided in Section 7.2.1 of NUREG 1623) of all remaining covers if DUSA requests are granted.

Demonstrate that the radium concentrations of candidate rock materials do not exceed background levels for the vicinity of the White Mesa facility and will not appreciably affect radon fluxes projected for the cover system following construction.

BASIS FOR INTERROGATORY:

Implementing the proposed design, if found acceptable, depends on availability of adequate quantities of suitable materials. Demonstration must be provided that adequate quantities are reasonably and practically available.

REFERENCES:

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

NUREG 1623 U.S. Nuclear Regulatory Commission, "Design of Erosion Protection for Long-Term Stability", NUREG-1623, September 2002.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(6)-24/01: CONCENTRATIONS OF RADIONUCLIDES OTHER THAN RADIUM IN SOIL

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(6): The design requirements in this criterion for longevity and control of radon releases apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land, averaged over areas of 100 square meters, which, as a result of byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15 cm below the surface.

Byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at levels which are as low as is reasonably achievable. If more than one residual radionuclide is present in the same 100-square-meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site must be submitted for approval. The use of decommissioning plans with benchmark doses which exceed 100 mrem/yr, before application of ALARA, requires the approval of the Executive Secretary after consideration of the recommendation of the staff of the Executive Secretary. This requirement for dose criteria does not apply to sites that have decommissioning plans for soil and structures approved before June 11, 1999.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

RG 3.8 U.S. Nuclear Regulatory Commission, “Preparation of Environmental Reports for Uranium Mills,” Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(7)-25/01: NONRADIOLOGICAL HAZARDS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(7): The licensee shall also address the nonradiological hazards associated with the wastes in planning and implementing closure. The licensee shall ensure that disposal areas are closed in a manner that minimizes the need for further maintenance. To the extent necessary to prevent threats to human health and the environment, the licensee shall control, minimize, or eliminate post-closure escape of nonradiological hazardous constituents, leachate, contaminated rainwater, or waste decomposition products to the ground or surface waters or to the atmosphere.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6A(1)-26/01: COMPLETION OF FINAL RADON BARRIER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6A(1): For impoundments containing uranium byproduct materials, the final radon barrier must be completed *as expeditiously as practicable considering technological feasibility* after the pile or impoundment ceases operation in accordance with a written, Executive Secretary-approved reclamation plan. (The term *as expeditiously as practicable considering technological feasibility* as specifically defined in the Introduction of this appendix includes factors beyond the control of the licensee.) Deadlines for completion of the final radon barrier and, if applicable, the following interim milestones must be established as a condition of the individual license: windblown tailings retrieval and placement on the pile and interim stabilization (including dewatering or the removal of freestanding liquids and recontouring). The placement of erosion protection barriers or other features necessary for long-term control of the tailings must also be completed in a timely manner in accordance with a written, Executive Secretary-approved reclamation plan.

INTERROGATORY STATEMENT:

Provide information regarding the schedule for and manner of placement of the final radon barrier over the disposal cell areas, including Cell 4B. Demonstrate that the final radon barrier will be placed as expeditiously as practicable considering technological feasibility after the disposal cell areas or impoundments cease operation.

BASIS FOR INTERROGATORY:

The 2000 Reclamation Plan (IUC 2000) suggests that only Cell 2 and 3 will be contained beneath the final site cap, and that wastes contained in Cell 4A (which is described as "unused") would be consolidated within Cell 3. Under the current concept, Cell 4A is fully utilized, as well as Cell 4B, neither of which is recognized in the 2000 Reclamation Plan. Inclusion of these two additional cells beneath the final site cover(s) will ultimately increase the top closure cover area by over 50%. A discussion of the schedule for and manner of radon barrier placement as part of the construction of the final closure cover(s) needs to be presented.

REFERENCES:

IUC 2000 — International Uranium (USA) Corporation (IUC): Reclamation Plan – White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Rev. 3, July 2000.

10 CFR 40 — Appendix A to Part 40 – Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the

Extraction or Concentration of Source Material From Ores Processed Primarily for Their Source Material Content.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 7-29/01: PREOPERATIONAL AND OPERATIONAL MONITORING PROGRAMS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 7: At least one full year prior to any major site construction, a preoperational monitoring program must be conducted to provide complete baseline data on a milling site and its environs. Throughout the construction and operating phases of the mill, an operational monitoring program must be conducted to measure or evaluate compliance with applicable standards and regulations; to evaluate performance of control systems and procedures; to evaluate environmental impacts of operation; and to detect potential long-term effects.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 8-30/01: EFFLUENT CONTROL DURING OPERATIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 8: Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable. The primary means of accomplishing this must be by means of emission controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to control emissions at the source. Notwithstanding the existence of individual dose standards, strict control of emissions is necessary to assure that population exposures are reduced to the maximum extent reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not covered by tailings solution and emissions from yellowcake drying and packaging operations. During operations and prior to closure, radiation doses from radon emissions from surface impoundments of uranium or thorium byproduct materials must be kept as low as is reasonably achievable.

Checks must be made and logged hourly of all parameters (e.g., differential pressures and scrubber water flow rates) that determine the efficiency of yellowcake stack emission control equipment operation. The licensee shall retain each log as a record for three years after the last entry in the log is made. It must be determined whether or not conditions are within a range prescribed to ensure that the equipment is operating consistently near peak efficiency; corrective action must be taken when performance is outside of prescribed ranges. Effluent control devices must be operative at all times during drying and packaging operations and whenever air is exhausting from the yellowcake stack. Drying and packaging operations must terminate when controls are inoperative. When checks indicate the equipment is not operating within the range prescribed for peak efficiency, actions must be taken to restore parameters to the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging operations must cease as soon as practicable. Operations may not be restarted after cessation due to off-normal performance until needed corrective actions have been identified and implemented. All these cessations, corrective actions, and restarts must be reported to the Executive Secretary, in writing, within ten days of the subsequent restart.

To control dusting from tailings, that portion not covered by standing liquids must be wetted or chemically stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where they are disposed of below grade and the tailings surface is not exposed to wind. Consideration must be given in planning tailings disposal programs to methods which would allow phased covering and reclamation of tailings impoundments because this will help in controlling particulate and radon emissions during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic controls do not apply, operators shall develop written operating procedures specifying the methods of control which will be utilized.

Milling operations producing or involving thorium byproduct material must be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as a result of exposures to the planned discharge of radioactive materials, radon-220 and its daughters excepted, to the general environment.

Uranium and thorium byproduct materials must be managed so as to conform to the applicable provisions of Title 40 of the Code of Federal Regulations, Part 440, "Ore Mining and Dressing Point Source Category: Effluent Limitations Guidelines and New Source Performance Standards, subpart C, Uranium, Radium, and Vanadium Ores Subcategory," as codified on January 1, 1983.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Provide current information and analyses that demonstrate that milling operations are and will be conducted so that all airborne effluent releases are reduced to levels that are as low as is reasonably achievable (ALARA). Include an analysis of the efficiency of the equipment as designed and operated that prevent radiation exposures to employees and members of the public and that limit such exposures to ALARA levels.

Provide a description of mill waste and effluent control systems and equipment for minimizing to as low as is reasonably achievable the quantities of materials released into the environment. Specify quantities, concentrations, and physical, chemical, and radiological characteristics of all materials released that depend upon characteristics of ore being processed and state how these parameters affect projected dose rates. Average and maximum release rates should be addressed plus all pertinent supporting information such as assumptions and computational methods used.

Please present and discuss information concerning any cumulative buildup of radionuclides in the environment. Summarize data, assumptions, and models used in determining radioactivity concentrations and burdens. Estimate the maximum radionuclide concentrations that may be present in important local flora and local and migratory fauna. Values of bioaccumulation factors used in preparing the estimates should be based on site-specific data if available; otherwise, values from the literature may be used. The applicant should tabulate and reference the values of bioaccumulation factors used in the calculations.

Describe in detail the proposed effluent and environmental monitoring programs, including methods and procedures for measuring concentrations and quantities of both radioactive and non-radioactive materials released to the environs from the proposed Cell 4B and neighboring cells. In the description of the proposed monitoring programs, include the technical basis used to determine that environmental concentrations comply with applicable regulatory requirements Describe the proposed sampling program to determine concentrations of airborne radioactive materials (including radon) during routine and non-routine operations, maintenance, and cleanup activities. In the description of the sampling program, address the following:

- *Criteria for determining sampling locations with respect to process operations and personnel occupancy,*
- *Frequency of sampling,*
- *Type of analyses,*
- *Sensitivity of overall sampling and analyses,*
- *Action levels,*
- *Management audits,*
- *Corrective action requirements,*
- *Instrumentation calibration frequency, and*
- *Procedures for sample analyses and instrument calibration (in an appendix).*

Describe the detection monitoring program to be used to determine whether process effluents are reaching site ground water supplies from Cell 4B and neighboring cells. Describe the planned monitoring to detect the presence of process effluents in any local surface waters. Provide the technical basis for the monitoring programs, including the number and location of monitoring stations, the criteria used for locating sampling stations and determining sampling frequency, and action levels and corrective action requirements. Provide procedures for sample collection and analyses for the constituents of concern found in tailings liquor in an appendix.

BASIS FOR INTERROGATORY:

Since the license was initially issued, many technological innovations have been made. These improvements create the possibility that ALARA levels of airborne effluent release levels are lower than originally judged reasonable. DUSA should identify and evaluate new options to demonstrate whether additional airborne emissions control measures are currently reasonable.

To the extent that ores likely to be currently processed differ in their physical, chemical, and radiological characteristics, projected release s from the facility will also differ. These differences should be identified, and their effects quantified.

The 1978 ER erroneously states that “Radioactive material added to the environment will not accumulate but will become diluted and dispersed into a much wider area, becoming undetectable within a short distance from the mill [page 5-6 of D&M 1978].” This statement

may be true for instantaneous concentrations in the atmosphere, but ignores potential biodegradation and the deposition of particulate matter that accumulates downwind from the operating mill and tailings impoundments over time. Additional evaluation is required to demonstrate the current condition and the potential that radioactive concentrations might yet accumulate to the extent that additional measures should be taken now to preclude hazards that can reasonably be avoided.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 8A-31/01: DAILY INSPECTIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 8A: Daily inspections of tailings or waste retention systems must be conducted by a qualified engineer or scientist and documented. The licensee shall retain the documentation for each daily inspection as a record for three years after the documentation is made. The Executive Secretary must be immediately notified of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or of any unusual conditions (conditions not contemplated in the design of the retention system) that is not corrected could indicate the potential or lead to failure of the system and result in a release of tailings or waste into unrestricted areas.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 9-32/01: FINANCIAL SURETY ARRANGEMENTS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 9: Financial surety arrangements must be established by each mill operator prior to the commencement of operations to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas. The amount of funds to be ensured by such surety arrangements must be based on Executive Secretary-approved cost estimates in a Executive Secretary-approved plan for (1) decontamination and decommissioning of mill buildings and the milling site to levels which allow unrestricted use of these areas upon decommissioning, and (2) the reclamation of tailings and/or waste areas in accordance with technical criteria delineated in Section I of this Appendix. The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and evaluates alternatives for mitigating these impacts. The surety must also cover the payment of the charge for long-term surveillance and control required by Criterion 10. In establishing specific surety arrangements, the licensee's cost estimates must take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work. In order to avoid unnecessary duplication and expense, the Executive Secretary may accept financial sureties that have been consolidated with financial or surety arrangements established to meet requirements of other Federal or state agencies and/or local governing bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance and control, provided such arrangements are considered adequate to satisfy these requirements and that the portion of the surety which covers the decommissioning and reclamation of the mill, mill tailings site and associated areas, and the long-term funding charge is clearly identified and committed for use in accomplishing these activities. The licensee's surety mechanism will be reviewed annually by the Executive Secretary to assure, that sufficient funds would be available for completion of the reclamation plan if the work had to be performed by an independent contractor. The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs. Regardless of whether reclamation is phased through the life of the operation or takes place at the end of operations, an appropriate portion of surety liability must be retained until final compliance with the reclamation plan is determined.

This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance would be provided with a surety instrument which is written for a specified period of time (e.g., 5 years) yet which must be automatically renewed unless the surety notifies the beneficiary (the Executive Secretary) and the principal (the licensee) some reasonable time (e.g., 90 days) prior to the renewal date of their intention not to renew. In such a situation the surety

requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief period of time to allow at least 60 days for the regulatory agency to collect.

Proof of forfeiture must not be necessary to collect the surety so that in the event that the licensee could not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The conditions described above would have to be clearly stated on any surety instrument which is not open-ended, and must be agreed to by all parties. Financial surety arrangements generally acceptable to the Executive Secretary are:

(a) Surety bonds;

(b) Cash deposits;

(c) Certificates of deposits;

(d) Deposits of government securities;

(e) Irrevocable letters or lines of credit; and

(f) Combinations of the above or such other types of arrangements as may be approved by the Executive Secretary. However, self insurance, or any arrangement which essentially constitutes self insurance (e.g., a contract with a State or Federal agency), will not satisfy the surety requirement since this provides no additional assurance other than that which already exists through license requirements.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, “Standard Format and Content Of License Applications for Conventional Uranium Mills,” Draft Regulatory Guide DG-3024, May, 2008.

NRC 1988 U.S. Nuclear Regulatory Commission, “Technical Position on Financial Assurances for Restoration, Decommissioning, and Long-Term Surveillance and Control of Uranium Recovery Facilities”, Washington DC, 1988.

NUREG-1620 U.S. Nuclear Regulatory Commission, “Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites

Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 10-33/01: COSTS OF LONG-TERM SURVEILLANCE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 10: A minimum charge of [$855,000 (2008 dollars)] to cover the costs of long-term surveillance must be paid by each mill operator to the general treasury of the United States or to an appropriate State agency prior to the termination of a uranium or thorium mill license.

If site surveillance or control requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in Criterion 12 (e.g., if fencing is determined to be necessary), variance in funding requirements may be specified by the Executive Secretary. In any case, the total charge to cover the costs of long-term surveillance must be such that, with an assumed 1 percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The total charge will be adjusted annually prior to actual payment to recognize inflation. The inflation rate to be used is that indicated by the change in the Consumer Price Index published by the U.S. Department of Labor, Bureau of Labor Statistics.

INTERROGATORY STATEMENT:

Provide an engineering estimate of the costs attributable to the proposed Cell 4B of conducting long-term surveillance in compliance with all requirements applicable to US DOE's long-term stewardship program. Demonstrate that the estimated cost will be acceptable to US DOE.

BASIS FOR INTERROGATORY:

The Division must be assured that the amounts of financial assurances proposed for the facility will be acceptable to the US DOE under its long-term stewardship program.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.3-35/01: GROUND WATER DISCHARGE PERMIT APPLICATION

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6 in lieu of 10CFR40 Appendix A, Criterion 5B(1) thru 5H, Criterion 7A, and Criterion 13. In turn, UAC R317-6-6.3 outlines the content requirements of a State Ground Water Discharge Permit (Permit) application.

Unless otherwise determined by the Executive Secretary, the application for a permit to discharge wastes or pollutants to ground water shall include the following complete information:

A. The name and address of the applicant and the name and address of the owner of the facility if different than the applicant. A corporate application must be signed by an officer of the corporation. The name and address of the contact, if different than above, and telephone numbers for all listed names shall be included.

B. The legal location of the facility by county, quarter-quarter section, township, and range.

C. The name of the facility and the type of facility, including the expected facility life.

D. A plat map showing all water wells, including the status and use of each well, Drinking Water source protection zones, topography, springs, water bodies, drainages, and man-made structures within a one-mile radius of the discharge. The plat map must also show the location and depth of existing or proposed wells to be used for monitoring ground water quality. Identify any applicable Drinking Water source protection ordinances and their impacts on the proposed permit.

E. Geologic, hydrologic, and agricultural description of the geographic area within a one-mile radius of the point of discharge, including soil types, aquifers, ground water flow direction, ground water quality, aquifer material, and well logs.

F. The type, source, and chemical, physical, radiological, and toxic characteristics of the effluent or leachate to be discharged; the average and maximum daily amount of effluent or leachate discharged (gpd), the discharge rate (gpm), and the expected concentrations of any pollutant (mg/l) in each discharge or combination of discharges. If more than one discharge point is used, information for each point must be given separately.

G. Information which shows that the discharge can be controlled and will not migrate into or adversely affect the quality of any other waters of the state, including the applicable surface water quality standards, that the discharge is compatible with the receiving ground water, and that the discharge will comply with the applicable class TDS limits, ground water quality standards, class protection levels or an alternate concentration limit proposed by the facility.

H. For areas where the ground water has not been classified by the Board, information on the quality of the receiving ground water sufficient to determine the applicable protection levels.

I. A proposed sampling and analysis monitoring plan which conforms to EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/600/R-98/018, February 1998) and includes a description, where appropriate, of the following:

1. ground water monitoring to determine ground water flow direction and gradient, background quality at the site, and the quality of ground water at the compliance monitoring point;

2. installation, use and maintenance of monitoring devices;

3. description of the compliance monitoring area defined by the compliance monitoring points including the dimensions and hydrologic and geologic data used to determine the dimensions;

4. monitoring of the vadose zone;

5. measures to prevent ground water contamination after the cessation of operation, including post-operational monitoring;

6. monitoring well construction and ground water sampling which conform where applicable to the Handbook of Suggested Practices for Design and Installation of Ground-Water Monitoring Wells (EPA/600/4-89/034, March 1991), ASTM Standards on Ground Water and Vadose Investigations (1996), Practical Guide for Ground Water Sampling EPA/600/2-85/104, (November 1985) and RCRA Ground Water Monitoring Technical Enforcement Guidance Document (1986), unless otherwise specified by the Executive Secretary;

7. description and justification of parameters to be monitored;

8. quality assurance and control provisions for monitoring data.

J. The plans and specifications relating to construction, modification, and operation of discharge systems.

K. The description of the ground water most likely to be affected by the discharge, including water quality information of the receiving ground water prior to discharge, a description of the aquifer in which the ground water occurs, the depth to the ground water, the saturated thickness, flow direction, porosity, hydraulic conductivity, and flow systems characteristics.

L. The compliance sampling plan which in addition to the information specified in the above item I includes, where appropriate, provisions for sampling of effluent and for flow monitoring in order to determine the volume and chemistry of the discharge onto or below the surface of the ground and a plan for sampling compliance monitoring points and appropriate nearby water wells. Sampling and analytical methods proposed in the application must conform with the most appropriate methods specified in the following references unless otherwise specified by the Executive Secretary:

1. Standard Methods for the Examination of Water and Wastewater, twentieth edition, 1998; Library of Congress catalogue number: ISBN: 0-87553-235-7.

2. E.P.A. Methods, Methods for Chemical Analysis of Water and Wastes, 1983; Stock Number EPA-600/4-79-020.

3. Techniques of Water Resource Investigations of the U.S. Geological Survey, (1998); Book 9.

4. Monitoring requirements in 40 CFR parts 141 and 142, 2000 ed., Primary Drinking Water Regulations and 40 CFR parts 264 and 270, 2000 ed.

5. National Handbook of Recommended Methods for Water-Data Acquisition, GSA-GS edition; Book 85 AD-2777, U.S. Government Printing Office Stock Number 024-001-03489-1.

M. A description of the flooding potential of the discharge site, including the 100-year flood plain, and any applicable flood protection measures.

N. Contingency plan for regaining and maintaining compliance with the permit limits and for reestablishing best available technology as defined in the permit.

O. Methods and procedures for inspections of the facility operations and for detecting failure of the system.

P. For any existing facility, a corrective action plan or identification of other response measures to be taken to remedy any violation of applicable ground water quality standards, class TDS limits or permit limit established under R317-6-6.4E. which has resulted from discharges occurring prior to issuance of a ground water discharge permit.

Q. Other information required by the Executive Secretary.

R. All applications for a groundwater discharge permit must be performed under the direction, and bear the seal, of a professional engineer or professional geologist.

S. A closure and post closure management plan demonstrating measures to prevent ground water contamination during the closure and post closure phases of an operation.

Reference can be made to DG-3024 (e.g., Sections 3.1 through 3.3), NUREG-1620 (e.g., Sections 2.6.3 and 2.7.3), and RG 3.8 (e.g., Sections 1, 3.3, and 4.1) as appropriate for additional guidance on topics listed above.

INTERROGATORY STATEMENT:

Provide a detailed geologic map for the site, including the footprint area and vicinity of proposed Cell 4B. Include geologic cross sections with geology to characterize the surface and subsurface conditions in the Cell 4B area.

Provide additional information on the potential presence and distribution of fractures and/or joints, and uncemented/higher permeability intervals in the unsaturated and saturated zone portions of the Dakota Sandstone and Burro Canyon geologic units underlying the site area, including the footprint area of and downgradient vicinity of proposed Cell 4B. Define and provide information regarding all present and assumed future potential points of discharge for effluent or leachate, including sump collection areas of the disposal cells as applicable, Provide

information on the relationship between any inferred fractures and/or joints, and uncemented/higher permeability intervals and the potential future location(s) of seepage from the disposal cells, including Cell 4B. Evaluate and discuss the potential effects of such features on permeability values and other aquifer properties and evaluate their potential effects on groundwater flow pathways and flow rates, including estimated contaminant travel times to the perched groundwater zone, beneath and downgradient of the disposal cells, including Cell 4B. Summarize the potential impacts of such fractures/joints in these formations on the predicted performance of containment systems that will be installed in the waste disposal/containment cells, including Cell 4B.

Provide information to demonstrate that existing groundwater compliance monitoring wells MW-5, MW-12, and MW-15 would be preserved and maintained during Cell 4B construction operations. Describe measures to be implemented to protect these monitoring wells during cell construction and provide criteria to be used for determining that repair or replacement of these wells is required if damage occurs to any of these wells during Cell 4B construction.

Please provide well logs for wells MW-3, MW-4, MW-5, MW-11, MW-12, MW-14, MW-15, MW-20, MW-21, MW-22, MW-23, and temporary perched water zone wells TW4-4 and TW4-5.

BASIS FOR INTERROGATORY:

U.S. N.R.C. Regulatory Guide 3.8 (NRC 1982), Section 2.5 specifies that detailed geological data at building sites and in the vicinity of tailings or other effluent impoundments, sanitary landfills, spoil disposal areas, and sewage disposal facilities should be included in licensing submittals related to license applications/license amendment requests. This guide specifies that these geologic data should include strike and dip and lateral and vertical distribution of permeable layers, shales, and clays, and data on any fault, fracture, or joint pattern that may exist. This guide also specifies that locations of local outcroppings where seepage from landfills, dumps, impoundments, and sewage facilities is likely to occur should be noted.

U.S. N.R.C. Regulatory Draft Guidance DG-3024 (NRC 2008), Section 2.4.1, specifies that geologic aspects of the site need to be described in licensing submittals related to license applications/license amendment requests. This guidance document also specifies that the broad features and general characteristics of the site and environs, including stratigraphy and structural geology should be noted and documented, and characteristics of the subsurface soil or rock, including identification and evaluation of zones of deformation that might act as conduits for contaminants, be described.

The 1978 Environmental Report (e.g., see Dames & Moore 1978., p. 2-106) indicates the following: "…jointing is common in the exposed Dakota-Burro Canyon sandstones along the mesa's rim…more often than not, the primary joints are parallel to the cliff faces and the secondary joints are almost perpendicular to the primary joints… two sets of joint attitudes exist [in these sandstone units] ..to the west side of the project site…These sets range from N.10-18^0 E and N.60-85 E^0 and nearly parallel to the cliff faces".

In addition, information provided by UMETCO (UMETCO 1993, p, 2-3) indicates that "during an investigation of the White Mesa site, a number of fracture attitudes were measured (in the Dakota and Burro Canyon sandstone units) along the rims of Corral and Cottonwood Canyons [in the general site area], ..(with) analysis of the data indicating the presence of two joint sets… [and] distances between the joints in each set varies from 5 to 20 feet, …the primary joints strike from north-south to $N20^0$ E with a vector mean of $N11^0$ E and the secondary fractures have a strike ranging between $N40^0$ W to $N60^0$ W with a vector mean of $N47^0$ W… All joint sets observed were near vertical to vertical."

A number of borings previously were drilled within and south and southwest (downgradient) of the Cell 4B footprint (e.g., Borings 16, 19, 20, 22, 24, 26, 27, and 28) (D & M 1978). The depth of most of these borings ranged from 9 ft to approximately 24 ft below ground surface, with the exception of two borings that extended to approximately 127 ft (Boring 19) and approximately 133 ft (Boring 28). The boring log for Borehole No. 19 (see Dames & Moore 1978, Plate A-9; International Uranium Corporation [IUC] 2000, Figure 1.5.3-1), installed in the same general vicinity as the proposed Cell 4B footprint, indicates considerable horizontal fracturing may be present at one or more depth zones within the Dakota Sandstone unit underlying and/or adjacent to the area of proposed Cell 4B. That boring log also indicates the occurrence of some orange iron staining and considerable limonite staining along bedding fractures (which suggest zones of localized movement of water) as well as some uncemented zones of rock within the Dakota Sandstone materials. Furthermore, the boring log for Borehole No. 28, drilled about 2,200 feet south of the proposed Cell 4B footprint (Dames & Moore [D & M] 1978, Plate A-11) also suggests that fractures and/or uncemented zones may exist at one or more depth intervals in the Dakota and/or Burro Canyon sandstone units in the general vicinity of the White Mesa Mill disposal cells.

An injection test conducted within the Dakota unit in Boring 19 penetrating the Dakota and Burro Canyon units yielded permeability values that differed by more two orders of magnitude, depending on whether the tested interval spanned a zone containing "considerable near horizontal fracturing and some orange staining" (permeability of 9.12×10^{-4} cm/cec) or had no reported fracturing (permeability 6.77×10^{-6} cm/sec). These data suggest that fractures and/or variable conditions present within this unit underlying and downgradient of the disposal cells area could affect groundwater flow rates, and possibly also locally affect the direction of groundwater flow beneath the site. By inference, joint sets, fracture networks, and uncemented zones in the Dakota and Burro Canyon units could allow for flow in directions different than those currently inferred.

Also, the 1978 Environmental Report (D & M 1978, p. 2-107) indicates that "the Dakota Sandstone… is poorly to highly cemented…[and] losses of drilling fluids during the subsurface geotechnical investigation [that was conducted at the White Mesa mill site] indicate that open fractures or very permeable layers exist within the formation…."

The information summarized above is consistent with the information provided in the 2008 ER which states (DUSA 2008, pp. 6 and 12) that "No significant joints or fractures within the Dakota Sandstone or Burro Canyon Formation have been documented in any wells or borings

installed across the site (Knight Piesold, 1998). Any fractures observed in cores collected from site borings are typically cemented, showing no open space".

Additional information needs to be provided to resolve/explain the above discrepancies and inconsistencies. Joint sets, fractures and/or variably uncemented intervals in the geologic units underlying and downgradient of the disposal cell areas could likely effect groundwater flow rates and groundwater flow directions beneath and downgradient of the site, including creating the potential for preferential flow pathways. Limited data are available regarding the presence and potential distribution of these features in these areas, especially at deeper depths, leading to uncertainties in groundwater flow characteristics in the perched water zone beneath and downgradient of the disposal cells exists. Additional information needs to be provided on the potential distribution of these features in order to allow a more comprehensive review of potential impacts of subsurface characteristics of the Dakota and Burro Canyon Formation on subsurface seepage and to evaluate potential seepage flow pathways from the disposal cell areas, including Cell 4B.

Information presented in Appendix A of the ER (Hydro Geo Chem, Inc. [HGCI] 2008) also indicates that "relatively high permeabilities measured at MW-11, located on the southeastern margin of the downgradient edge of tailings Cell 3, and at MW-14, located on the downgradient edge of tailings cell 4[A], of 1.4 x 10-3 cm/s and 7.5 x 10-4 cm/s, respectively (UMETCO 1993), may indicate that this zone [of higher permeability]extends beneath the southeastern margin of the [disposal] cells". This report also states, however, that additional available borehole data suggests that "this zone of higher permeability within the perched water zone does not appear to exist downgradient (south-southwest) of the tailings cells…" The appropriateness of this conclusion has not been reviewed, pending further review of copies of additional boring logs requested by this interrogatory.

Additional geologic information for the subsurface materials beneath Cell 4B is also needed to support review of a proposed blasting plan for the Cell 4B area.

EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/600/R-98/018, February 1998) specifies that a description of the plans and specifications relating to construction, modification, and operation of discharge systems be included, and that information on the installation, use and maintenance of monitoring devices should be provided. Section 10.2, Proposed Additional Groundwater Monitoring, of the Environmental Report (DUSA 2008) specifies that two new wells will be installed and utilized for monitoring, in addition to the wells already incorporated in the compliance monitoring program as described in the Groundwater Discharge Permit. Monitoring wells MW-5, MW-12, MW-15, and MW-16 are some of the wells that are incorporated in the compliance monitoring program. These wells are located in areas that could be disturbed during construction of Cell 4B, according to Figures 7, 8, 10, and 11 of the Environmental Report. These wells are part of the proposed compliance monitoring program and therefore should be maintained and preserved. Information should be provided to explain measures to be taken to ensure these wells will be protected during construction, criteria to repair wells if damaged during construction, and/or a plan included to decommission and replace these wells if necessary, in accordance with EPA and applicable State of Utah well construction/well abandonment standards. The 2009 Technical Specifications for the Construction of Cell 4B

Lining System, Section 1.01 (Geosyntec 2009), address the abandonment of existing monitoring well MW-16; however, there is no discussion of the need to protect, repair, or decommission and replace monitoring wells MW-5, MW-12, or MW-15 if damage to these wells were to occur.

Well specifications and/or boring logs need to be provided for the wells considered in the proposed compliance monitoring program. Boring logs for the specified boreholes also need to be provided as supporting data. Boring logs for wellbores WMMW-16 through WMMW-19 are already included in UMETCO 1993.

REFERENCES:

D & M 1978 — Environmental Report - White Mesa Uranium Project, San Juan County, Utah for Energy Fuels Nuclear, Inc. January 30, 1978.

D & M 1978 — Environmental Report - White Mesa Uranium Project, San Juan County, Utah for Energy Fuels Nuclear, Inc. January 30, 1978.

DUSA 2008. — Denison Mines USA Corporation. Environmental Report In Support of Construction Tailings Cell 4B, White Mesa Uranium Mill, Blanding, Utah, April 30, 2008.

Geosyntec 2009 — Geosyntec Consultants, Technical Specifications for the Construction of Cell 4B Lining System, White Mesa Mill, Blanding, Utah, January 2009.

IUC 2000 — International Uranium (USA) Corporation (IUC): Reclamation Plan – White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Rev. 3, July 2000.

DG-3024 — U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 — U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 — U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

UGW370004 — Utah Department of Environmental Quality, Division of Water Quality, "Ground Water Discharge Permit", UGW370004 issued to Denison Mines (USA) Corp. of Denver, CO, expires March 8, 2010.

UMETCO 1993 — UMETCO Minerals Corporation; Peel Environmental Services. Groundwater Study, White Mesa Mill. January 1993.

HGCI 2008 Hydro Geo Chem Inc., "Site Hydrogeology, Estimation Of Groundwater Travel Times And Recommended Additional Monitoring Wells For Proposed Tailings Cell 4b White Mesa Uranium Mill Site Near Blanding, Utah" (included as Appendix A to the Environmental Report), report dated January 8, 2008.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.4-36/01: ISSUANCE OF DISCHARGE PERMIT

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.4 in lieu of comparable requirements in 10CFR40:

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:

1. the applicant demonstrates that the applicable class TDS limits, ground water quality standards protection levels, and permit limits established under R317-6-6.4E will be met;

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; and

4. there is no impairment of present and future beneficial uses of the ground water.

B. The Board mayapprove an alternate concentration limit for a new facility if:

1. The applicant submits a petition for an alternate concentration limit showing the extent to which the discharge will exceed the applicable class TDS limits, ground water standards or applicable protection levels and demonstrates that:

a. the facility is to be located in an area of Class III ground water;

b. the discharge plan incorporates the use of best available technology;

c. the alternate concentration limit is justified based on substantial overriding social and economic benefits; and,

d. the discharge would pose no threat to human health and the environment.

2. One or more public hearings have been held by the Board in nearby communities to solicit comment.

C. The Executive Secretary may issue a ground water discharge permit for an existing facility provided:

1. the applicant demonstrates that the applicable class TDS limits, ground water quality standards and protection levels will be met;

2. the monitoring plan, sampling and reporting requirements are adequate to determine compliance with applicable requirements;

3. the applicant utilizes treatment and discharge minimization technology commensurate with plant process design capability and similar or equivalent to that utilized by facilities that produce similar products or services with similar production process technology; and,

4. there is no current or anticipated impairment of present and future beneficial uses of the ground water.

D. The Board may approve an alternate concentration limit for a pollutant in ground water at an existing facility or facility permitted by rule under R317-6-6.2 if the applicant for a ground water discharge permit shows the extent the discharge exceeds the applicable class TDS limits, ground water quality standards and applicable protection levels that correspond to the otherwise applicable ground water quality standards and demonstrates that:

1. steps are being taken to correct the source of contamination, including a program and timetable for completion;

2. the pollution poses no threat to human health and the environment; and

3. the alternate concentration limit is justified based on overriding social and economic benefits.

E. An alternate concentration limit, once adopted by the Board under R317-6-6.4B or R317-6-6.4D, shall be the pertinent permit limit.

F. A facility permitted under this provision shall meet applicable class TDS limits, ground water quality standards, protection levels and permit limits.

G. The Board may modify a permit for a new facility to reflect standards adopted as part of corrective action.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To complete the application for a Utah Ground Water Discharge Permit (Permit), provide the following information or identify documents in which DUSA has already provided such information:

- *An updated plat map showing all water wells, including the status and use of each well, Drinking Water source protection zones, topography, springs, water bodies, drainages, and man-made structures within a one-mile radius of the discharge. The plat map must also show the location and depth of existing or proposed wells to be used for monitoring ground water quality. Identify any applicable Drinking Water source protection ordinances and their impacts on the proposed permit.*
- *Geologic, hydrologic, and agricultural description of the geographic area within a one-mile radius of the point of discharge, including soil types, aquifers, ground water flow direction, ground water quality, aquifer material, and well logs.*

- *The type, source, and chemical, physical, radiological, and toxic characteristics of the effluent or leachate to be discharged; the average and maximum daily amount of effluent or leachate discharged (gpd), the discharge rate (gpm), and the expected concentrations of any pollutant (mg/l) in each discharge or combination of discharges. If more than one discharge point is used, information for each point must be given separately.*
- *Information which shows that the discharge can be controlled and will not migrate into or adversely affect the quality of any other waters of the state, including the applicable surface water quality standards, that the discharge is compatible with the receiving ground water, and that the discharge will comply with the applicable class TDS limits, ground water quality standards, class protection levels or an alternate concentration limit proposed by the facility.*
- *For areas where the ground water has not been classified by the Board, information on the quality of the receiving ground water sufficient to determine the applicable protection levels.*
- *A proposed sampling and analysis monitoring plan which conforms to EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/600/R-98/018, February 1998) and includes a description, where appropriate, of the following:*
    - ✓ *Ground water monitoring to determine ground water flow direction and gradient, background quality at the site, and the quality of ground water at the compliance monitoring point;*
    - ✓ *Installation, use and maintenance of monitoring devices;*
    - ✓ *Description of the compliance monitoring area defined by the compliance monitoring points including the dimensions and hydrologic and geologic data used to determine the dimensions;*
    - ✓ *Monitoring of the vadose zone;*
    - ✓ *Measures to prevent ground water contamination after the cessation of operation, including post-operational monitoring;*
    - ✓ *Monitoring well construction and ground water sampling which conform where applicable to the Handbook of Suggested Practices for Design and Installation of Ground-Water Monitoring Wells (EPA/600/4-89/034, March 1991), ASTM Standards on Ground Water and Vadose Investigations (1996), Practical Guide for Ground Water Sampling EPA/600/2-85/104, (November 1985) and RCRA Ground Water Monitoring Technical Enforcement Guidance Document (1986), unless otherwise specified by the Executive Secretary;*
    - ✓ *Description and justification of parameters to be monitored;*
    - ✓ *Quality assurance and control provisions for monitoring data.*
- *The plans and specifications relating to construction, modification, and operation of discharge systems.*

- *The description of the ground water most likely to be affected by the discharge, including water quality information of the receiving ground water prior to discharge, a description of the aquifer in which the ground water occurs, the depth to the ground water, the saturated thickness, flow direction, porosity, hydraulic conductivity, and flow systems characteristics.*
- *For any existing facility, a corrective action plan or identification of other response measures to be taken to remedy any violation of applicable ground water quality standards, class TDS limits or permit limit established under R317-6-6.4E. which has resulted from discharges occurring prior to issuance of a ground water discharge permit.*
- *Contingency plan for regaining and maintaining compliance with the permit limits and for reestablishing best available technology as defined in the permit.*
- *A closure and post closure management plan demonstrating measures to prevent ground water contamination during the closure and post closure phases of an operation.*

Provide information including narrative descriptions, figures, table, drawings, analyses, and supporting documentation to demonstrate that:

- *Applicable class TDS limits, ground water quality standards and protection levels will be met if the proposed amendment is granted.*
- *The monitoring plan, including sampling and reporting commitments, are adequate to determine compliance with applicable requirements.*
- *DUSA utilizes treatment and discharge minimization technology commensurate with plant process design capability and similar or equivalent to that utilized by facilities that produce similar products or services with similar production process technology.*
- *DUSA projects that no impairment of present and future beneficial uses of the ground water will result from the proposed amendment.*

BASIS FOR INTERROGATORY:

The Division requires additional information relevant to the measures taken to protect groundwater and their projected effectiveness.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, “Standard Format and Content of License Applications for Conventional Uranium Mills,” Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, “Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites

Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.9-37/01: PERMIT COMPLIANCE MONITORING

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.9 in lieu of comparable requirements in 10CFR40:

A. Ground Water Monitoring

The Executive Secretary may include in a ground water discharge permit requirements for ground water monitoring, and may specify compliance monitoring points where the applicable class TDS limits, ground water quality standards, protection levels or other permit limits are to be met.

The Executive Secretary will determine the location of the compliance monitoring point based upon the hydrology, type of pollutants, and other factors that may affect the ground water quality. The distance to the compliance monitoring points must be as close as practicable to the point of discharge. The compliance monitoring point shall not be beyond the property boundaries of the permitted facility without written agreement of the affected property owners and approval by the Executive Secretary.

B. Performance Monitoring

The Executive Secretary may include in a ground water discharge permit requirements for monitoring performance of best available technology standards.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Provide information demonstrating that the proposed groundwater monitoring system, including the proposed new monitoring wells (MW-33 and MW-34) installed downgradient of future Cell 4B, together with well MW-14 and MW-15 (if preserved), and the other existing downgradient monitoring wells, *are sufficient in number, are properly located, and are properly designed to provide reasonable assurance of providing timely, reliable, and representative data for detecting potential future releases from the disposal cells, including Cell 4B, considering the potential distribution of fractures and/or joints, and uncemented intervals*/higher permeability zones *in the subsurface geologic units underlying/downgradient of the disposal cells area.*

Evaluate whether an alternative conceptual model or models (such as one incorporating "preferential" flow through fractures, joints, uncemented/higher permeability zones, etc., and/or different hypothetical future source term [leakage] locations, such as from beneath one or more sumps in one or more of the disposal cells including Cell 4B), if considered, would affect the locations, screened interval(s), and/or required number of POC wells for providing timely/reliable detection of potential releases from the disposal cells area.

BASIS FOR INTERROGATORY:

NUREG-1620 (NRC 2003), Section 4.3.3.4, requires that the compliance monitoring program implemented at this type of facility monitor all ground-water exposure pathways to assure that any potential exceedances of the proposed alternate concentration limit will be detected before the license is terminated. The guidance provided in NUREG-1620 indicates that the compliance monitoring well locations should not be restricted solely to the point of compliance. Some locations between the point of compliance and the points of exposure should be included to assure the identified aquifer attenuation mechanisms are reducing the hazardous constituent concentrations to the predicted levels, and indicates that the applicable maximum contaminant level, background concentration, or other maximum permissible limit should be used as the compliance monitoring limit for wells at the points of exposure, in those cases where compliance monitoring is conducted at the points of exposure.

A specific evaluation of the proposed downgradient groundwater monitoring well locations, well spacing, and well screened intervals relative to postulated future contaminant plume locations and dimensions that could emanate from the disposal cell areas, including Cell 4B, needs to be provided. The information provided needs to be sufficient to allow review of the suitability and adequacy of the proposed compliance monitoring network. The compliance monitoring program needs to reflect the range of hydrogeologic/groundwater flow conditions (e.g., including preferential flow through fractures, joints, and or uncemented/higher permeability zones) that are reasonably foreseeable as applicable to the site.

REFERENCES:

DUSA 2008. Denison Mines USA Corporation. Environmental Report In Support of Construction Tailings Cell 4B, White Mesa Uranium Mill, Blanding, Utah, April 30, 2008.

DG-3024 U.S. Nuclear Regulatory Commission, “Standard Format and Content Of License Applications for Conventional Uranium Mills,” Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, “Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act”, NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, “Preparation of Environmental Reports for Uranium Mills,” Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-38/01: BACKGROUND WATER QUALITY DETERMINATION

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.10 in lieu of comparable requirements in 10CFR40:

A. Background water quality contaminant concentrations shall be determined and specified in the ground water discharge permit. The determination of background concentration shall take into account any degradation.

B. Background water quality contaminant concentrations may be determined from existing information or from data collected by the permit applicant. Existing information shall be used, if the permit applicant demonstrates that the quality of the information and its means of collection are adequate to determine background water quality. If existing information is not adequate to determine background water quality, the permit applicant shall submit a plan to determine background water quality to the Executive Secretary for approval prior to data collection. One or more up-gradient, lateral hydraulically equivalent point, or other monitoring wells as approved by the Executive Secretary may be required for each potential discharge site.

C. After a permit has been issued, permittee shall continue to monitor background water quality contaminant concentrations in order to determine natural fluctuations in concentrations. Applicable up-gradient, and on-site ground water monitoring data shall be included in the ground water quality permit monitoring report.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.12-40/01: SUBMISSION OF DATA

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.12 in lieu of comparable requirements in 10CFR40:

A. Laboratory Analyses

All laboratory analysis of samples collected to determine compliance with these regulations shall be performed in accordance with standard procedures by the Utah Division of Laboratory Services or by a laboratory certified by the Utah Department of Health.

B. Field Analyses

All field analyses to determine compliance with these regulations shall be conducted in accordance with standard procedures specified in R317-6-6.3.L.

C. Periodic Submission of Monitoring Reports

Results obtained pursuant to any monitoring requirements in the discharge permit and the methods used to obtain these results shall be periodically reported to the Executive Secretary according to the schedule specified in the ground water discharge permit.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

Provide evidence demonstrating that all laboratory analysis of samples collected to determine compliance with groundwater protection standards have been performed in accordance with standard procedures by the Utah Division of Laboratory Services or by a laboratory certified by the Utah Department of Health.

Provide evidence demonstrating that all field analyses to determine compliance with groundwater protection standards have been conducted in accordance with standard procedures specified in R317-6-6.3.L.

BASIS FOR INTERROGATORY:

No statements have been provided in the ER or the 2000 Reclamation Plan to indicate that the specified applicable standard procedures have been met for the sample analyses that have been performed or sample analysis results submitted.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.13-41/01: REPORTING OF MECHANICAL PROBLEMS OR DISCHARGE SYSTEM FAILURES

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.13 in lieu of comparable requirements in 10CFR40:

The permittee shall notify the Executive Secretary within 24 hours of the discovery of any mechanical or discharge system failures that could affect the chemical characteristics or volume of the discharge. A written statement confirming the oral report shall be submitted to the Executive Secretary within five days of the failure.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-42/01: CORRECTION OF ADVERSE EFFECTS

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.14 in lieu of comparable requirements in 10CFR40:

A. If monitoring or testing indicates that the permit conditions may be or are being violated by ground water discharge operations or the facility is otherwise in an out-of-compliance status, the permittee shall promptly make corrections to the system to correct all violations of the discharge permit.

B. The permittee, operator, or owner may be required to take corrective action as described in

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

DG-3024	U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.
NUREG-1620	U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.
RG 3.8	U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-43/01: OUT-OF-COMPLIANCE STATUS

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.16 in lieu of comparable requirements in 10CFR40:

A. Accelerated Monitoring for Probable Out-of-Compliance Status

If the value of a single analysis of any compliance parameter in any compliance monitoring sample exceeds an applicable permit limit, the facility shall:

1. Notify the Executive Secretary in writing within 30 days of receipt of data;

2. Immediately initiate monthly sampling if the value exceeds both the background concentration of the pollutant by two standard deviations and an applicable permit limit, unless the Executive Secretary determines that other periodic sampling is appropriate, for a period of two months or until the compliance status of the facility can be determined.

B. Violation of Permit Limits

Out-of-compliance status exists when:

1. The value for two consecutive samples from a compliance monitoring point exceeds:

a. one or more permit limits; and

b. the background concentration for that pollutant by two standard deviations (the standard deviation and background (mean) being calculated using values for the ground water pollutant at that compliance monitoring point) unless the existing permit limit was derived from the background pollutant concentration plus two standard deviations; or

2. The concentration value of any pollutant in two or more consecutive samples is statistically significantly higher than the applicable permit limit. The statistical significance shall be determined using the statistical methods described in Statistical Methods for Evaluating Ground Water Monitoring Data from Hazardous Waste Facilities, Vol. 53, No. 196 of the Federal Register, Oct. 11, 1988 and supplemental guidance in Guidance For Data Quality Assessment (EPA/600/R-96/084 January 1998).

C. Failure to Maintain Best Available Technology Required by Permit

1. Permittee to Provide Information

In the event that the permittee fails to maintain best available technology or otherwise fails to meet best available technology standards as required by the permit, the permittee shall submit to the Executive Secretary a notification and description of the failure according to R317-6-6.13. Notification shall be given orally within 24 hours of the permittee's discovery of the failure of best available technology, and shall be followed up by written notification,

including the information necessary to make a determination under R317-6-6.16.C.2, within five days of the permittee's discovery of the failure of best available technology.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-44/01: PROCEDURE WHEN A FACILITY IS OUT-OF-COMPLIANCE

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.17 in lieu of comparable requirements in 10CFR40:

A. If a facility is out of compliance the following is required:

1. The permittee shall notify the Executive Secretary of the out of compliance status within 24 hours after detection of that status, followed by a written notice within 5 days of the detection.

2. The permittee shall initiate monthly sampling, unless the Executive Secretary determines that other periodic sampling is appropriate, until the facility is brought into compliance.

3. The permittee shall prepare and submit within 30 days to the Executive Secretary a plan and time schedule for assessment of the source, extent and potential dispersion of the contamination, and an evaluation of potential remedial action to restore and maintain ground water quality and insure that permit limits will not be exceeded at the compliance monitoring point and best available technology will be reestablished.

4. The Executive Secretary may require immediate implementation of the contingency plan submitted with the original ground water discharge permit in order to regain and maintain compliance with the permit limit standards at the compliance monitoring point or to reestablish best available technology as defined in the permit.

5. Where it is infeasible to re-establish BAT as defined in the permit, the permittee may propose an alternative BAT for approval by the Executive Secretary.

Refer to Appendix A for relevant NRC regulatory guidance.

INTERROGATORY STATEMENT:

To Be Determined.

BASIS FOR INTERROGATORY:

To Be Determined.

REFERENCES:

DG-3024 U.S. Nuclear Regulatory Commission, "Standard Format and Content Of License Applications for Conventional Uranium Mills," Draft Regulatory Guide DG-3024, May, 2008.

NUREG-1620 U.S. Nuclear Regulatory Commission, "Standard Review Plan (NUREG–1620) for Staff Reviews of Reclamation Plans for Mill Tailings Sites Under Title II of The Uranium Mill Tailings Radiation Control Act", NUREG-1620, June, 2003.

RG 3.8 U.S. Nuclear Regulatory Commission, "Preparation of Environmental Reports for Uranium Mills," Regulatory Guide 3.8, October, 1992.

APPENDIX A
REGULATORY BASES

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01A/01: ENVIRONMENTAL ANALYSIS - RADIOLOGICAL AND NONRADIOLOGICAL IMPACTS

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(a) An assessment of the radiological and nonradiological impacts to the public health from the activities to be conducted pursuant to the license or amendment;

Relevant NRC Guidance

Geology and Soils (Land)

Regulatory Guide (RG) 3.8, Section 6.1.4.1: Those geological and soil studies designed to determine the environmental impact of the construction or operation of the mine/mill should be described. The description should include identification of the sampling pattern and the justification for its selection, the sampling method, holding periods, preanalysis treatment, and analytic techniques. Other geological and soil studies (e.g., those conducted in support of safety analyses) should be briefly summarized and reference made to the relevant reports for a more detailed presentation.

Exposure Pathways

RG 3.8, Section 5.2.1: The various possible pathways for radiation exposure of humans should be identified and described in textual and flow chart format.

Discuss any exposure pathways, if they exist, involving radionuclide accumulation in specific components of the environment.

Liquid Effluents

RG 3.8, Section 5.2.2: Estimate the expected annual average concentrations of radioactive nuclides . . . in receiving water at locations where water is consumed or otherwise used by human beings or where it is inhabited by biota of significance to human food chains. Specify the dilution factors used in preparing the estimates and the locations where the dilution factors are applicable. Consideration should be given to the absence of mixing and dilution because of factors such as channeling.

Determine the expected radionuclide concentrations in aquatic and terrestrial organisms significant to human food chains. Use . . . bioaccumulation factors [based on site-specific data if available; otherwise, values from the literature may be used].

Using the above information and any other necessary supporting data, calculate the total annual body and significant organ doses (millirems) to individuals in the population . . . from all exposure pathways related to receiving water, i.e., all sources of internal and external exposure. Provide, as an appendix, details of the models and assumptions used in these calculations.

Airborne Effluents

RG 3.8, Section 5.2.3: From release rates of airborne radioactivity and meteorological data . . . estimate total annual body and significant organ doses (millirems) to individuals exposed at the point of maximum ground-level concentrations offsite, individuals exposed at the site boundary in the direction of the prevailing wind, individuals exposed at the site boundary nearest to the sources of emission, and individuals exposed at the residence expected to receive the highest dose commitments. Assume annual average meteorological conditions. Identify locations of points of release (e.g., stacks, roof vents, tailings ponds and beach areas, and ore storage areas) used in calculations.

Estimate deposition of radioactive materials on food crops and pasture grass and any bioaccumulation in the human food chain. Estimate total annual body doses (millirems) and significant annual doses received by other organs via such potential pathways.

Provide an appendix describing the models used in these calculations.

Direct Radiation

RG 3.8, Section 5.2.4: The applicant should provide an estimate of the maximum annual external dose (millirems) that would be received by an individual at the nearest site boundary from direct radiation. Provide an appendix describing the models and assumptions used in these calculations.

Effects of Sanitary and Other Waste Discharges

RG 3.8, Section 5.4: Describe and discuss the environmental impact associated with sanitary and other mill waste systems.

Other Effects

RG 3.8, Section 5.5: Discuss any effects of operation that do not clearly fall under any single topic [addressed above]. These may include changes in land and water use at the project site, interaction of the facility with other existing or projected neighboring facilities, effect of ground-water withdrawal on ground-water resources in the vicinity of the mine and mill, effects of construction and operation of roads, transmission corridors, and railroads, effects on fish and wildlife resource usage, effects of changes in surface-water availability on biotic populations, and disposal of solid and liquid wastes other than those already discussed.

Hazard Assessment

NUREG-1620, Section 4.3.3.1: The hazard assessment identifies all potential constituents of concern at a site. A potential constituent of concern is any compound that

may be in or could be derived from the uranium mill tailings at a licensed site. A non-inclusive list of constituents of concern is in UAC R317-6. The risks and hazards to human health and the environment associated with those constituents are also identified and evaluated to determine whether an alternate concentration limit should be proposed for those constituents, if the subsequent exposure assessment concludes that an exposure is reasonably likely. Once a constituent of concern is released into the ground-water, it is classified as a hazardous constituent for the purpose of regulatory compliance, as described in 10 CFR Part 40, Appendix A, Criterion 5B(2). The hazard assessment should include the following:

(1) The source term for all constituents of concern is adequately characterized and the extent of existing and potential future ground-water contamination is determined.

The source term characterization provides relevant information about the facility including: (a) the mechanical and chemical processes used to recover the uranium, (b) the types and quantities of the reagents used in milling, (c) the physical and chemical composition of the uranium-bearing ore, and (d) the historical and current waste and tailings management practices. This information is considered, in conjunction with the physical and chemical composition of the tailings and the type and distribution of existing contaminants, such as the location of waste discharge points, retaining structures for wastes, and waste constituents. The source characterization should provide reliable estimates of the release rates of hazardous constituents as well as constituent distributions.

(2) The assessment identifies and evaluates the risks and hazards presented by the identified constituents of concern, including the human cancer risk caused by exposure to radioactive and non-radioactive constituents of concern, along with other health hazards that may be caused by the chemical toxicity of those constituents. The human cancer risk should be evaluated for individual constituents, including radioactive and carcinogenic chemicals, and compared with the maximum permitted risk level. The health effects of non-radioactive and non-carcinogenic constituents that are chemically toxic will be evaluated considering their risk-specific dose levels. It may be necessary to calculate a hazard index using the reference doses for those chemicals that have threshold effects. The hazard index is the ratio of calculated intake to the reference dose. An acceptable hazard index must be less than one. These evaluations distinguish between the health effects associated with threshold and non-threshold constituents. Mutagenic, teratogenic, and synergistic effects are considered in the analysis, if applicable, based on toxicological testing, or structure-activity relationships.

The following additional information on constituent properties is provided, as applicable: (a) density, solubility, valence state, vapor pressure, viscosity, and partitioning coefficient; (b) presence and effects of complexing ligands and chelating agents that may enhance constituent mobility; (c) potential for a constituent to degrade because of biological, chemical, and physical processes;

and (d) constituent attenuation properties, considering such processes as ion exchange, sorption, precipitation, dissolution, and ultrafiltration. This information would also be applied in the exposure assessment.

(3) The assessment provides a reasonably conservative or best estimate of the potential health effects caused by human exposure to the hazardous constituent. The potential health effects for each constituent with a proposed alternate concentration limit must be identified, and related to appropriate exposure limits and dose-response relationships from available literature or databases. Sources of exposure limit and dose-response information include the EPA's maximum concentration limits for drinking water, reference doses, or risk-specific doses. Reference doses are the amounts of chemically toxic constituents to which humans may be daily exposed without suffering adverse effects.

Risk-specific doses are the amounts of proven or suspected carcinogenic constituents to which humans can be daily exposed, without increasing their risk of contracting cancer above a specified risk level. The reference dose and risk-specific dose assessment assume a human mass of 70 kg [154 lb] and consumption of 2 liters of water per day [0.53 gal/day]. More stringent criteria may apply if sensitive populations are exposed to hazardous constituents. Maximum concentration limits, reference doses, and/or risk-specific doses, can be used to show compliance with the risk level and hazard indexes. The technical basis for a risk assessment can be based on the dose-response relationships described in the scientific literature searches or toxicological research, in the absence of applicable maximum concentration limits, reference doses, or risk-specific doses. The exposure analysis should distinguish between threshold (toxic) and non-threshold (carcinogenic) effects associated with human exposure, as well as teratogenic, fetotoxic, mutagenic, and synergistic effects.

The maximum concentration limits, reference doses, and risk-specific doses for most hazardous constituents can be obtained from the EPA (http://www.epa.gov), the Agency for Toxic Substances and Disease Registry (http://www.atsdr.cdc.gov/atsdrhome.html), or other government institutions and universities. Effects from radioactivity can be obtained from the International Commission on Radiological Protection, and the National Council on Radiation Protection and Measurement.

Previously established and documented health-based constituent concentration limits are used in the hazard assessment as a basis for proposing alternate concentration limit values at specific sites.

(4) The assessment identifies and evaluates the risks posed by the hazardous constituents to environmental populations. Adverse effects on aquatic and terrestrial wildlife, plants, agricultural crops, livestock, and physical structures should be considered. Examples of these adverse effects are: (a) contaminant-induced changes in the biota, (b) loss or reduction of unique or critical habitats, and (c) jeopardy to endangered or threatened species. The NRC must initiate special consultation with the U.S. Fish and Wildlife Service, in accordance with

50 CFR Part 17, if endangered or threatened species occur on the site or could be impacted by site activities. NUREG–1748 . . . should be consulted for initiating this consultation.

Similar to the human risk evaluation, the environmental risk evaluation identifies any acute and sub-chronic effects on environmental populations caused by exposure to the hazardous constituents. Bioaccumulation and food chain interactions are considered when evaluating adverse effects. A comparison of the estimated constituent concentrations to the appropriate federal or State water-quality criteria should be part of the evaluation of potential effects on aquatic wildlife.

When appropriate, the hazard assessment considers potential damage to physical structures such as foundations, underground pipes, and roads. The applicant should demonstrate that the forecasted constituent concentrations will not result in any significant degradation or loss of function, as a result of contamination exposure. As an example, excessive concentrations of dissolved salts could result in accelerated corrosion of underground utility piping.

Exposure Assessment

NUREG-1620, Section 4.3.3.2: The purpose of the exposure assessment is to evaluate the potential harm to human health and the environment from the hazards identified in the hazard assessment. The exposure assessment takes into account site-specific circumstances that may reduce or enhance the potential for exposure to hazardous constituents. This assessment identifies and evaluates hazardous constituent exposure pathways, and provides forecasts of human and environmental population responses, based on the projected constituent concentrations, dose levels, and available information on the radiological and chemical toxicity effects of the constituents. The assessment also addresses the underlying assumptions, variability, and uncertainty of the projected health and environmental effects. Exposure pathways should be identified and evaluated using water classification and water use standards, along with existing and anticipated water uses. Agricultural, industrial, domestic, municipal, environmental, and recreational water uses should also be considered, as they pertain to the site and surrounding areas. The exposure assessment must provide adequate information regarding potential effects on ground-water resources, and the above water uses, to support NRC's environmental review under 10 CFR Part 51. NUREG–1748 . . . should be consulted for the details of this review.

Proposed human exposure levels should be reasonably conservative, defensible, and sufficiently protective to avoid a substantial present or potential hazard to people for the forecasted duration of the contamination. A proposed alternate concentration limit that does not exceed an excess lifetime risk of fatal cancer on the order of 10-4 is acceptable for an average exposed individual at the point of exposure, when considering the potential for the health risks from human exposure to known or suspected carcinogens contained in untreated ground-water used for drinking water.

The exposure assessment must identify the point of compliance, where the proposed alternate concentration limit will be measured; and the points of exposure, where the human health and environmental exposures could occur. The assessment identifies the maximum permissible levels of hazardous constituents at the point of compliance that are protective of human health and the environment at the point of exposure. This is accomplished by evaluating human and environmental exposure to each of those constituents evaluated in the hazard assessment, and then showing the proposed alternate concentration limit will not result in an unacceptable exposure of human health or the environment to those hazards. The exposure assessment should include the following:

(1) The exposure assessment evaluates the pathways the hazardous constituents will likely follow and the concentration or dose those constituents will likely produce at the location where humans or environmental populations could be reasonably exposed. All likely pathways that could transport significant amounts of hazardous constituents in the ground water and hydraulically connected surface water should be identified and evaluated. The hazardous constituent concentrations and projected distributions for each pathway should be best estimates or reasonably conservative representations of the rate, extent, and direction of the constituent transport.

The ground-water pathway evaluation provides projected contaminant distributions, including contaminant transport, degradation, and attenuation mechanisms between the point of compliance and the point of exposure. The evaluation generally provides information on: (a) site hydrogeologic characteristics, including ground-water flow direction and rates; (b) background water quality; and (c) estimated transport rates, geochemical attenuation, and concentrations of hazardous constituents in the ground water and hydraulically connected surface water. Projections should be calibrated on the basis of site-specific information. The projected attenuation rate may rely on constituent concentration measurements at the point of compliance and the point of exposure, taken over an adequate period of time, when there is great uncertainty in the attenuation rate derived from laboratory measurements or literature sources.

(2) The pathway evaluation provides the spatial distribution of the various hazardous constituents of existing contaminant plumes. This information can be used to calibrate contaminant fate and transport models in the exposure assessment and also identifies the components of the source term that have already been released from the tailings. The contaminant extent characterization includes: (a) the type and distribution of hazardous constituents in the ground water and the source(s) of the contamination; (b) the monitoring program used to delineate and characterize hazardous constituent distribution; and (c) supporting documentation of the sampling, laboratory analysis, and quality assurance programs that show the fulfillment of the site monitoring programs. Such information is used to assess present human and environmental population exposure to elevated concentrations of hazardous constituents, calibrate contaminant transport models, and evaluate projected future exposures. Computer codes may be used to evaluate the pathways for hazardous constituent transport.

The acceptance criteria for ground-water fate and transport computer modeling are contained in standard review plan Section 4.4.3.

(3) The human exposure evaluation considers two potential exposure pathways: (a) ingestion of contaminated water and (b) ingestion of contaminated foods. Other pathways that may impact human health, such as dermal contact and inhalation, are also to be considered, but need not always be assessed, unless it is determined that these exposures could result in significant hazards to human health or the environment.

Human exposure is evaluated primarily on the basis of the extent to which people are using, and are likely to use, contaminated water from the site. Site-specific water uses are determined on the basis of the following considerations: (a) ground-water quality in the site area and present water uses; (b) statutory or legal constraints and institutional controls on water use in the site area; (c) federal, state, or other ground-water classification criteria and guidelines; (d) applicable water-use criteria, standards, and guidelines; and (e) availability and characteristics of alternate water supplies.

Exposure determinations should consider existing and potential water uses. Potential uses include those that are reasonably expected to occur (i.e., anticipated use) and uses that are compatible with the untreated background water quality (i.e., possible use). Past water uses may be included as existing or potential uses. Water resource classification of existing and potential water use should include (a) domestic and municipal drinking water use; (b) fish and wildlife propagation, (c) special ecological communities uses: and (d) industrial, agricultural, and recreational uses. The classification of existing and potential water uses at the facility should be consistent with federal, state, and local water use inventories.

The cumulative effects of human exposure to hazardous constituents at the proposed alternate concentration limits, and to other constituents present in contaminated groundwater, will be maintained at a level adequate to protect public health. The combined effects from both radiological and non-radiological constituents should be considered. Guidance for cumulative impact assessment is contained in NUREG–1748 . . . and additional guidance is found in Council on Environmental Quality (1997).

(4) Potential responses of environmental or non-human populations to the various hazardous constituents are evaluated if such populations can realistically be exposed to contaminated ground water or hydraulically connected surface water. Terrestrial and aquatic wildlife, plants, livestock, and crops are included in this evaluation. A detailed environmental exposure evaluation should be performed in the absence of available information that could readily be used to show there will be no substantial environmental impacts caused by ground-water contamination from the site. The evaluation should provide: (a) inventories of potentially exposed environmental populations; (b) recommended tolerance or exposure limits; (c) contaminant interactions and their cumulative effects on exposed populations; (d) projected responses of environmental populations that result from

exposure to hazardous constituents; and (e) anticipated changes in populations, independent of the hazardous constituent exposure. Alternatively, the evaluation may demonstrate that environmental hazards are not anticipated, because exposure will not occur.

The potential for adverse effects, such as (a) contamination-induced biotic changes; (b) loss or reduction of unique or critical habitats; and (c) jeopardizing endangered species, should also be described. Aquatic wildlife effects are evaluated by comparing estimated constituent concentrations with federal and state water quality criteria. Terrestrial wildlife exposure to constituents through direct exposure and food-web interactions should be considered. The NRC must initiate special consultation with the U.S. Fish and Wildlife Service, in accordance with 50 CFR Part 17, if endangered or threatened species occur on the site or could be impacted by site activities. NUREG–1748 . . . should be consulted for initiating this consultation.

Agricultural effects from both direct and indirect exposure pathways, crop impacts, reduced productivity, and bioaccumulation of constituents should be considered. Reasonably conservative estimates of constituent concentrations are compared with federal and state water quality criteria to estimate agricultural effects associated with constituent exposure. Additionally, crop exposures through contaminated soil, shallow ground-water uptake, and irrigation, along with livestock exposure through direct ingestion of contaminated water and indirect exposure through grazing, should be assessed.

(5) Points of exposure are identified. A point of exposure is any location where people, wildlife, or other species could reasonably be exposed to hazardous constituents from ground water contaminated by uranium mill tailings. For example, the point(s) of exposure may be represented by one or more domestic wells that might withdraw contaminated ground water; or it may be represented by springs, rivers, streams, or lakes into which contaminated ground water might discharge. The point of exposure is used to assess the potential hazard(s) to human health and the environment and effects on the ground-water resource.

An alternate concentration limit for a hazardous constituent is established at the point of compliance. The point of exposure may be situated at some distance from the point of compliance, allowing hazardous constituent concentrations to diminish through dispersion, attenuation, or sorption within the aquifer. As a result, an alternate concentration limit may be set at a concentration that is higher at the point of compliance location than a limit that would be protective of human health and environment, as long as the hazardous constituent will not result in an unacceptable hazard to human health and the environment at the point of exposure. In most cases, the point of exposure is located at the downgradient edge of land that will be transferred to either the federal government or the state for long-term institutional control.

The applicant for an alternate concentration limit should make every reasonable effort to keep the point of exposure at the long-term care site boundary. If this

cannot be achieved, a good-faith effort must be made to acquire the land between the license area boundary and the point of exposure, for ultimate transfer to the long-term custodian. If the land cannot be acquired through a good-faith effort, then institutional controls other than ownership by the long-term custodian may be initiated. These institutional controls must be enforceable, durable, and legally defensible; and will be applied in addition to the numerical limits of the proposed alternate concentration limit. This approach must be reviewed as an alternative to the specific regulatory requirements contained in 10 CFR Part 40, Appendix A, Criterion 5B(6).

A distant point of exposure may be justified when human or environmental exposure is effectively impossible. This option could be justified on the basis that extremely rugged terrain cannot be physically accessed or the long-term care custodian would ensure that ground water from the contaminated aquifers between the disposal site and the point of exposure would not be used. In some rare instances, a distant point of exposure could be established without invoking land ownership by a long-term custodian. Under these circumstances, the previously described institutional controls should be invoked. Human and environmental exposures are considered effectively impossible when the ground water is inaccessible or unsuitable for use. Land ownership or long-term custody will not be an issue for establishing a distant point of exposure if human and environmental exposures are effectively impossible.

When a distant point of exposure is involved, the applicant must coordinate the use of this option with the NRC. The NRC and the applicant must verify whether the state or the federal government will be the long-term site custodian, after the license is terminated. The applicant must then secure a commitment from that party to take custody of the site. The applicant or the NRC must then secure written assurance that the appropriate federal or state agency will accept the transfer of the specific property, including land in excess of that needed for tailings disposal. Alternate concentration limits may not be established at sites involving a distant point of exposure until the licensee agrees to transfer the title to the land, and the appropriate federal or state government commits to take such land, including the land between the point of compliance and point of exposure that is in excess of the land used for disposal of byproduct material.

If the licensee chooses to keep the mill property under a specific license and apply for an alternate concentration limit as part of a compliance monitoring program, the licensee must still coordinate the use of a distant point of exposure with the NRC as described above.

(6) The likelihood of human and environmental exposure is determined. The probability of human and environmental exposure is often difficult to establish quantitatively. Consequently, defensible qualitative estimates of the exposure likelihood are often necessary. These can be characterized as either:

(a) Reasonably likely—when exposure has or could have occurred in the past, or available information indicates that exposure to contamination may reasonably occur during the contamination period.

(b) Reasonably unlikely—when exposure could have occurred in the past, but will probably not occur in the future, either because initial incentives for water use have been removed, or because available information indicates that no incentives for water use are currently identifiable, based on foreseeable technological developments.

(7) Exposure impacts are adequately evaluated through time. It is acceptable to project impacts at the point of exposure during a 1,000-year time frame. This is consistent with the design standard of 10 CFR Part 40, Appendix A, Criterion 6(1).

Accidents

Draft Regulatory Guide (DG)-3024, Section 6: Establish a spectrum of potential mill accidents ranging from trivial to serious by classes of occurrence and appropriately evaluate each class of accidents. It should discuss measures that the applicant has implemented to prevent accidents and demonstrate the adequacy of the methods. Emergency plans and training for coping with accidents should also be described. For example, the applicant should discuss potential accidental fires in terms of occurrence, prevention, detection and suppression mechanisms (both manual and automatic), and emergency plans for coping with them. The applicant should also discuss the adequacy of the emergency response program.

Mill Accidents Involving Radioactivity

RG 3.8, Section 7.1: Provide accident analyses for a spectrum of accidents that might occur ranging in severity from trivial (essentially no release of radioactivity to the environment) to very large releases. Each class within the spectrum should be characterized by an occurrence rate or probability and its potential consequences, if any. Examples of accidents resulting in large releases would be a tornado striking the mill or the failure of a waste retention system resulting from an act of nature or improper operation. Examples of accidents resulting in small releases would be a fire or explosion in a solvent extraction circuit or failure of the air cleaning system serving the yellowcake area during operation. An example of a trivial accident would be the malfunction of mill process equipment or the rupture of a vessel containing mill solutions.

Other Accidents

RG 3.8, Section 7.3: In addition to accidents that can release radioactivity to the environs, there may be accidents that, although radioactive materials are not involved, do have consequences that affect the environment. Such accidents as chemical explosions or fires, steam boiler failures, and leakage or rupture of vessels containing toxic materials can have significant environmental impacts. These possible accidents and associated effects should be identified and evaluated.

Summary of Annual Radiation Doses

RG 3.8, Section 5.2.5: The applicant should provide estimates of the maximum annual doses (millirems) that could be received via all pathways by an individual at the site boundary and at the nearest residence.

The applicant should also present a table that summarizes the estimated radiation dose to the regional population (within 80-km) from mill and mine related sources using values calculated in previous sections. The tabulation should include (a) the total annual doses (man-rems) to the population . . . from all water-related pathways and (b) the total annual doses (man-rems) to the population attributable to airborne effluents.

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01B/01: ENVIRONMENTAL ANALYSIS - IMPACT ON WATERWAYS AND GROUNDWATER

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(b) An assessment of any impact on waterways and groundwater resulting from the activities conducted pursuant to the license or amendment;

Relevant NRC Guidance

RG 3.8 , Section 2.7.1: Describe the hydrology of the region that affects the local ground-water aquifers, formations, sources. Indicate the recharge potential of the immediate plant area, including vertical and horizontal permeabilities of the natural and modified terrain, as well as that of tailing disposal areas, and indicate gradients and seasonal variations in ground-water levels beneath the site.

Sufficient site-specific data should be furnished for the evaluation of the effects of construction and operation of the facility on established ground-water tables and usage, this being an especially important for consideration of dewatering operations in associated mines.

Descriptions of the major aquifers in the area should include piezometric contour maps, hydraulic gradients, permeabilities for representative geologic features, total and effective porosities, bulk density estimates, storage coefficients, dispersion and distribution (sorption) coefficients, descriptions of pertinent geologic formations and soil types, including formation depth throughout the site and to the nearest downgradient well or water body, chemical and radiological properties, and time histories of ground-water fluctuations.

The applicant should provide data concerning any drawdown of ground water that may be caused by withdrawals from neighboring major industrial, agricultural, or municipal wells.

DG-3024, , Section 2.3.1: Describe regional and local ground water aquifers, formations, sources, and sinks; describe the recharge potential of the immediate plant area, including vertical and horizontal permeabilities of the natural and modified terrain, as well as that of tailings areas; describe the present and projected regional use and tabulate existing private users within the area influenced by the proposed activities and all local and regional public users (e.g., amounts, water levels, locations, and drawdown); and describe gradients and seasonal variations in ground water levels beneath the site.

Surface Water

RG 3.8, Section 6.1.1: If a body of surface water may be affected by the proposed activities, the applicant should describe the programs by which the background condition of the water and the related ecology were determined. If a natural water body has already been subjected to environmental stress from pollutant sources, the nature of this stress and its consequences should be evaluated. The applicant should estimate the potential quality of the affected water body.

Physical and Chemical Parameters (Ground Water)

RG 3.8, Section 6.1.2.1: The properties and configuration of the local aquifer will have been defined in sufficient detail . . . to permit a reasonable projection of effects of proposed activities on the ground water. Methods for obtaining information on ground-water levels and ground-water quality should be described.

Models (Ground Water)

RG 3.8, Section 6.1.2.2: Models may be used to predict such effects as changes in ground-water levels, dispersion of contaminants, and eventual transport through aquifers to surface water bodies and downgradient wells. The models should be described and supporting evidence for their reliability and validity presented.

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01C/01: ENVIRONMENTAL ANALYSIS – ALTERNATIVES

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(c) Consideration of alternatives, including alternative sites and engineering methods, to the activities to be conducted pursuant to the license or amendment; and

Relevant NRC Guidance

Alternatives to the Proposed Action

RG 3.8, Section 10: . . . the applicant's choice of a particular mill at a particular site and the location of project structures on the site should be supported through a comparative evaluation of available alternatives. To the extent possible, the applicant should discuss all parameters for the available alternatives. The NRC will consider all available alternatives that may reduce or avoid adverse environmental, social, and economic effects expected to result from construction and operation of the proposed milling and mining project. The NRC will not specify in advance which alternatives should be selected by the applicant for consideration. The applicant should make this selection and also make clear the basis and rationale for the choices in regard to number, availability, suitability, and factors limiting the range of alternatives that might avoid some or all of the environmental effects previously identified. Particular attention should be placed on the relationship between tailings management alternatives and mill site and process alternatives.

In the discussion of tailings management alternatives, consideration should be given to the following siting, design, and operation performance objectives developed by the staff in addition to the [following] technical criteria . . . .:

1. Locate the tailings isolation area remote from people to reduce population exposures to the maximum extent reasonably achievable.

2. Locate the tailings isolation area so that disruption and dispersion by natural forces is eliminated or reduced to the maximum extent reasonably achievable.

3. Design the isolation area so that seepage of toxic materials into the ground-water system would be eliminated or reduced to the maximum extent reasonably achievable.

4. Eliminate the blowing of tailings to unrestricted areas during normal operating conditions and prior to final reclamation.

Benefit – Cost Analysis

RG 3.8, Section 11: The applicant's benefit-cost statement should be presented. The presentation should be made in the form of a narrative with accompanying tables and charts. It should make clear what the applicant considers to be the important benefits and costs of the proposed facility and why, in the judgment of the applicant, the former outweigh the latter.

The applicant should develop criteria for assessing and comparing benefits and costs where these are expressed in nonmonetary or qualitative terms. The rationales for the selection among mill-site alternatives, as well as among subsystem alternatives, should be presented. In any case, the applicant should carefully describe any aggregation of effects and discuss in detail the tradeoffs that were made in order to justify the proposed operation. If any of the

benefits or costs are deleted from the applicant's analysis, the rationale for doing so should be explained. The applicant should key all the terms used in the benefit-cost analysis to the relevant sections of the environmental report.

INTERROGATORY WHITE MESA CELL 4B UAC R313-24-3-01D/01: ENVIRONMENTAL ANALYSIS - LONG-TERM IMPACTS

REGULATORY BASIS:

UAC R313-24-3:

(1) Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following:

(d) Consideration of the long-term impacts including decommissioning, decontamination, and reclamation impacts, associated with activities to be conducted pursuant to the license or amendment.

Relevant NRC Guidance

Mill Decommissioning

DG-3024, Section 8.1: Provide the proposed plan for removing and disposing of structures, tanks, and equipment used in conjunction with the uranium milling operations, including the plan for managing all hazardous and radioactive materials. In the decommissioning plan, consider approaches for identifying radiological hazards before initiating dismantlement of structures and equipment and for detection and cleanup of removable contamination from such structures and equipment in order to minimize occupational radiation exposure. Describe appropriate survey methods for determining the extent of equipment contamination before initiating decontamination work. Focus, in particular, on those parts of the mill process system that are likely to have accumulated contamination over long time periods (e.g., pipes, ventilation, equipment, effluent control systems, and facilities and equipment used in or near the yellowcake dryer area). Describe any plans for the decontamination of equipment for release for unrestricted use.

Site and Tailings Reclamation

DG-3024, Section 8.2: Provide the proposed plan for reclamation of the site and tailings impoundment that demonstrates compliance with the applicable requirements of Appendix A to 10 CFR Part 40. In the plan, describe the overall reclamation design and construction considerations of the tailings impoundment. Assess the geotechnical stability aspects of the tailings impoundment, including slope stability and liquefaction. In addition, address the hydrologic characteristics of the site, including flooding potential, and erosion protection features of the tailings impoundment. Include strategies for the protection of water resources, including plans to prevent the spread of both hazardous and

radioactive contaminants from the processing site and tailings storage area into ground water or surface water and to implement corrective action in the event these bodies become contaminated during operations. Address the radiation protection design of the tailings disposal impoundment cover for radon and gamma attenuation and the potential for settlement of the tailings impoundment and resulting cracking of the radon barrier. Include measures for cleanup of windblown tailings and other soils contaminated from mill operations and for sampling and surveys to document that soils have been cleaned to acceptable levels. Address the means for disposing of any ore remaining on site following the cessation of mill operations. (See NUREG-1620, "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978," issued June 2003 (Ref. 16), for additional detailed information on the scope and content of a reclamation plan.)

Decommissioning and Reclamation

RG 3.8, Section 9: The applicant should describe in depth its plans for mill decommissioning and site reclamation.

Detailed discussions should be provided for the following:

1. Plans for reclaiming and restoring lands disturbed by mining and milling activities. These plans should provide sufficient details for the staff to assess the suitability of these plans when compared to other alternatives (e.g., horizontal-vertical slope, type of cover, sources and thicknesses of cover materials, revegetation species, and schedule of events from shutdown through final reclamation).

2. A technical and financial feasibility assessment on methods and costs of mill decommissioning and site reclamation, including tailings area.

3. Financial arrangements to be made (such as bonding arrangements) to ensure that adequate funds will be available for mill decommissioning, site reclamation, and restoration when operations are concluded.

Decommissioning Plan for Land and Structures

NUREG-1620, Section 5.2.3: The decommissioning plan will be acceptable if it meets the following criteria:

(1) The plan contains procedures to identify and place within the disposal cell, all soils on and adjacent to the processing site that are in excess of the standards in 10 CFR Part 40, Appendix A, Criterion 6(6), due to site activities. The plan is substantiated by the radiological characterization data and site history.

(2) Appropriate soil background values (different geological areas may need separate background values) for Ra-226, and for U-nat, Th-230, and/or Th-232, as appropriate, have been proposed with supporting data.

(3) If elevated levels of uranium or thorium are expected to remain in the soil after the Ra-226 criteria have been met, the licensee has used the radium benchmark dose approach in Appendix H for developing decommissioning criteria for these radionuclides.

(4) To ensure consistency of measurement data, instrumentation and procedures used for soil background analyses and the radium-gamma correlation are the same or very similar to those proposed to provide verification data. The instrumentation has the appropriate sensitivity, and procedures are adequate to provide reliable data.

(5) A detailed quality assurance and quality control plan for all aspects of decommissioning is provided. In addition to the basis for accepting or rejecting data, a procedure for sampling additional grids when a verification Ra-226 sample fails to meet the standard is provided.

(6) Final verification (status survey) procedures are adequate to demonstrate compliance with the soil and structure cleanup standards. Survey instruments are specified and will be properly calibrated and tested. The proposed verification soil sampling density takes into consideration detection limits of sample analyses, the extent of expected contamination (unaffected area could have fewer measurements than affected areas), and limits to the gamma survey for the potentially contaminated area to be sampled. The gamma guideline value to be used for verification has been appropriately chosen. Also, there is a commitment to provide the verification soil radium-gamma correlation and the number of verification grids that had additional removal because of excessive Ra-226 values, to confirm that the gamma guideline value was adequate. The plan provides for adequate data collection beyond the excavation boundary (buffer zone). For structures to remain onsite, adequate plans/procedures to demonstrate compliance with the limits for the surface activity dose in Appendix H of this standard review plan have been developed.

(7) The plan indicates the location of records important to decommissioning procedures for protection of health and safety and demonstrates that decommissioning will be completed as soon as practicable, as required by 10 CFR 40.42 and Appendix A, Criterion 6A.

(8) The decommissioning cost estimate is itemized in sufficient detail and a basis (source) for each cost is provided. The total cost is reasonable for the area of the site and the expected decommissioning activities.

(9) The plan adequately describes the control of non-radiological hazards associated with the wastes as required by 10 CFR Part 40, Appendix A, Criterion 6(7).

(10) As required by Appendix A, Criteria 9 and 10, the licensee must maintain a financial surety, within the specific license, for the surface reclamation and decommissioning, with the surety sufficient to recover the anticipated cost and time frame for achieving compliance, and include the long-term surveillance. Guidance on establishing financial surety is presented in NRC (1988, 1997). Appendix C to this standard review plan provides an outline of the cost elements appropriate for establishing surety amounts for conventional uranium mills. Any staff assessment of surety amounts is reasonably consistent with the applicant’s assessment

INTERROGATORY WHITE MESA CELL 4B 10CFR40.26(C)(2)-02/01: GENERAL LICENSE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.26(c)(2): The general license in paragraph (a) of this section is subject to the documentation of daily inspections of tailings or waste retention systems and the immediate notification of the Executive Secretary, of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or of any unusual conditions (conditions not contemplated in the design of the retention system) that if not corrected could lead to failure of the system and result in a release of tailings or waste into unrestricted areas; and any additional requirements the Executive Secretary may by order deem necessary. The licensee shall retain this documentation of each daily inspection as a record for three years after each inspection is documented.

INTERROGATORY WHITE MESA CELL 4B 10CFR40.31(H)-03/01: APPLICATION FOR SPECIFIC LICENSES

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.31(h): An application for a license to receive, possess, and use source material for uranium or thorium milling or byproduct material, as defined in 10CFR40, at sites formerly associated with such milling shall contain proposed written specifications relating to milling operations and the disposition of the byproduct material to achieve the requirements and objectives set forth in appendix A of 10CFR40. Each application must clearly demonstrate how the requirements and objectives set forth in appendix A of 10CFR40 have been addressed. Failure to clearly demonstrate how the requirements and objectives in appendix A have been addressed shall be grounds for refusing to accept an application.

Relevant NRC Guidance

Corporate Organization and Administrative Procedures

> **DG-3024, Section 5.1**: Provide a detailed description of the proposed organization, including authority and responsibility of each level of management and/or supervision in regard to development, review, approval, implementation, and adherence to operating procedures, radiation safety programs, environmental and ground water monitoring programs, quality assurance programs, routine and nonroutine maintenance activities, and changes in any of the above.

Management Control Program

> **DG-3024, Section 5.2**: Describe the proposed management control program and administrative procedures to ensure that all activities will be conducted in accordance with

written operating procedures that site radiation safety staff review and approve at specified frequencies. This program should provide a method for ensuring that any nonroutine work or maintenance activity that is not covered by an effective operating procedure is conducted in accordance with a special work permit, reviewed and approved by the radiation safety staff.

Management Audit and Inspection Program

DG-3024, Section 5.3: Describe the proposed management audit and internal inspection program, including types and scopes of reviews and inspections, their frequencies, and related action levels and corrective action measures that may be needed. Identify, by management position, the individual responsible for each phase of the audit and inspection program.

Qualifications

DG-3024, Section 5.4: Describe the minimum qualifications and experience required for personnel in the applicant's proposed organization who will be assigned the responsibility for developing, conducting, and administering the radiation safety program for the mill. The qualifications of the individuals proposed for these positions should be provided in an appendix. (In cases where specific individual appointments may not have been made when an application is filed, minimum specifications will suffice.)

Training

DG-3024, Section 5.5: Describe the proposed employee radiological protection training program, including the content of the initial training or indoctrination, testing, on-the-job training, and the extent and frequency of retraining. In conformance with 10 CFR 19.12, "Instruction to Workers" (Ref. 11), provide in an appendix a copy of the proposed written radiological safety instructions that will be given to employees. These instructions should include provisions for personal hygiene (including washing), surveying for contamination before eating or leaving the mill, wearing personnel monitoring devices and respirators, applying good housekeeping requirements, cleaning up dust and spills within the mill, and initiating emergency action in the event of accidents.

Security

DG-3024, Section 5.6: Describe the measures for preventing unauthorized entry into the controlled area. (See 10 CFR 20.1901, "Caution Signs," through 10 CFR 20.1905, "Exemptions to Labeling Requirements.")

Quality Assurance

DG-3024, Section 7: Describe the quality assurance program for all phases of the milling project, including design, construction, startup, operation, and the radiation safety program (including the in-plant, effluent, and environmental monitoring programs). It should also discuss the corrective action measures established to ensure that conditions adverse to quality are identified and corrected and that the cause of significant conditions adverse to quality is determined and corrective action taken to preclude repetition. (See

Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Inception Through Normal Operations to License Termination) Effluent Streams and the Environment" (Ref. 15), for guidance on a method the NRC staff considers acceptable for use in designing and implementing programs to ensure the quality of measurement results for radioactive materials in the effluents from, and the environment outside of, facilities that process, use, or store radioactive materials during all phases of the facility's life cycle.).

INTERROGATORY WHITE MESA CELL 4B 10CFR40.61-06/01: RECORDS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.61:

(a) Each person who receives source or byproduct material pursuant to a license issued pursuant to the regulations in 10CFR40 shall keep records showing the receipt, transfer, and disposal of this source or byproduct material as follows:

(1) The licensee shall retain each record of receipt of source or byproduct material as long as the material is possessed and for three years following transfer or disposition of the source or byproduct material.

(2) The licensee who transferred the material shall retain each record of transfer or source or byproduct material until the Executive Secretary terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(3) The licensee shall retain each record of disposal of source or byproduct material until the Executive Secretary terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(4) If source or byproduct material is combined or mixed with other licensed material and subsequently treated in a manner that makes direct correlation of a receipt record with a transfer, export, or disposition record impossible, the licensee may use evaluative techniques (such as first-in-first-out), to make the records that are required by 10CFR40 account for 100 percent of the material received.:

(b) The licensee shall retain each record that is required by the regulations in 10CFR40 or by license condition for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, each record must be maintained until the Executive Secretary terminates the license that authorizes the activity that is subject to the recordkeeping requirement.

INTERROGATORY WHITE MESA CELL 4B 10CFR40.65(A)(1)-07/01: EFFLUENT MONITORING REPORTING REQUIREMENTS.

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40.65(a)(1): Each licensee authorized to possess and use source material in uranium milling … shall . . . within 60 days after January 1 and July 1 of each year thereafter, submit a report to the Executive Secretary; which report must specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous six months of operation, and such other information as the Executive Secretary may require the licensee to estimate maximum potential annual radiation doses to the public resulting from effluent releases. If quantities of radioactive materials released during the reporting period are significantly above the licensee's design objectives previously reviewed as part of the licensing action, the report shall cover this specifically. On the basis of such reports and any additional information the Executive Secretary may obtain from the licensee or others, the Executive Secretary may from time to time require the licensee to take such action as the Executive Secretary deems appropriate.

Relevant NRC Guidance

Mill Effluent Monitoring (Proposed Operational Monitoring Program)

> **RG 3.8, Section 6.2.1.1**: Describe the proposed effluent monitoring program for liquid and airborne effluents. Discuss the sensitivity limits for detecting radioactivity corresponding to routinely expected release rates. List the effluent streams, if any, that will not be monitored and provide a brief rationale for the absence of monitoring. Also, provide criteria for setting threshold levels for corrective action and describe the actions to be taken if these levels are exceeded.

Environmental Radiological Monitoring (Proposed Operational Monitoring Program)

> **RG 3.8, Section 6.2.1.2**: The operational monitoring program should be described in detail, with specific attention given to the organisms and other types of samples to be collected, sampling locations and frequency, the analyses to be performed on each sample, the analytical sensitivity (detection threshold) for each analysis, and the criteria for investigating increases of concentration of material detected in the environs.

Meteorological Monitoring (Proposed Operational Monitoring Program)

> **RG 3.8, Section 6.2.3**: The applicant's program for monitoring meteorological phenomena should be described.

INTERROGATORY WHITE MESA CELL 4B 10CFR40.INTRODUCTION-08/01: CAPACITY OF TAILINGS OR WASTE SYSTEMS OVER THE LIFETIME OF MILL OPERATIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40. Appendix A, Introduction: The specifications must be developed considering the expected full capacity of tailings or waste systems and the lifetime of mill operations. Where later expansions of systems or operations may be likely (for example, where large quantities of ore now marginally uneconomical may be stockpiled), the amenability of the disposal system to accommodate increased capacities without degradation in long-term stability and other performance factors must be evaluated .

INTERROGATORY WHITE MESA CELL 4B 10CFR40 APPENDIX A, INTRODUCTION-09/01: ALTERNATIVE REQUIREMENTS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40. Appendix A, Introduction: … Licensees or applicants may propose alternatives to the specific requirements in this appendix. The alternative proposals may take into account local or regional conditions, including geology, topography, hydrology, and meteorology. The Executive Secretary may find that the proposed alternatives meet the Executive Secretary‘s requirements if the alternatives will achieve a level of stabilization and containment of the sites concerned, and a level of protection for public health, safety, and the environment from radiological and nonradiological hazards associated with the sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements of this Appendix and the standards promulgated by the Utah Administrative Code, Rule R317-6, Ground Water Quality Protection.

Relevant NRC Guidance:

Proposed Alternate Concentration Limit

NUREG-1620, Section 4.3.3.3: The applicant’s assessment of ground-water corrective action alternatives should be reviewed in conjunction with the hazard assessment and the exposure assessment. Past, current, and proposed practicable corrective actions are identified and evaluated against the costs and benefits associated with implementing each corrective action alternative. The corrective action assessment should demonstrate that the proposed alternate concentration limit is as low as is reasonably achievable, considering practicable corrective actions, as required by 10 CFR Part 40 Appendix A, Criterion 5B(6). A principal way of demonstrating this is by estimating and comparing the benefits imparted by a corrective action measure against the cost of implementing that measure.

For some sites, a corrective action assessment may have already been completed, as part of a ground-water corrective action program under Criterion 5D of Appendix A to 10 CFR Part 40, as described in standard review plan Section 4.4.3. A ground-water corrective action assessment typically (a) identifies several practicable corrective action alternatives; (b) assesses the technical feasibility, costs, and benefits of each alternative; and (c) selects an appropriate corrective action for achieving compliance with the ground-water protection standards established at the site. The corrective action assessment should include the following:

(1) A complete range of realistic and reasonable corrective action alternatives for achieving compliance with the ground-water standards currently in the license and the proposed alternate concentration limit is described and evaluated. The identified alternatives should be comprehensive, including all engineering-feasible alternatives, both passive and active, or any appropriate sequential combination of alternatives. The analyzed corrective action alternative should not simply be a compendium of the most elaborate and expensive alternatives. The description of each alternative should be conceptual in nature, but contain sufficient detail so the reviewer can independently verify the reasonableness of each corrective action measure. Although conceptual, the alternate descriptions should also contain sufficient detail for completing a coarse cost estimate of each alternative for the cost and benefit analysis.

For past and current corrective actions, site-specific operational and monitoring data should be included to show the effectiveness of those measures. The evaluation may include information from literature sources or documented experience from other sites for those corrective actions that have not been implemented at the site but appear to be practicable. The evaluation should also include projections of the hazardous constituent concentration that each corrective action would likely produce at specific times at the point of compliance and the point of exposure. It is important that the reviewer assure that the range of reasonable corrective actions listed in the application is complete. The suitability of a corrective action should be determined strictly on the technical and engineering information needed to design and implement a particular measure. The economic constraints for implementing a particular measure should not be used to eliminate a corrective action method from the evaluation.

(2) The direct benefits of implementing the corrective actions have been determined by estimating the current and projected resource value of the pre-contaminated ground water. Estimates of pre-contaminated ground-water value should be based on water rights, availability of alternate water supplies, and forecasted water use demands. The value of a contaminated water resource is generally equal to the cost of a domestic or municipal drinking water supply or the cost of water supplied from an alternate source to replace the contaminated resource. The absence of available alternate water supplies increases the relative value of a potentially contaminated water resource. The indirect benefits are determined by assessing the avoidance of adverse health effects from exposure to contaminated water, the prevention of land value depreciation, and any benefits

accrued from performing the corrective action, including timeliness of remediation. The reviewer should verify the water yields; costs for developing alternate water supply sources; and legal, statutory, or other administrative constraints on the use and development of the water resources.

(3) The costs associated with performing a corrective action alternative to achieve the target concentrations include (a) the capital costs for designing, and constructing the alternative; (b) operation and maintenance costs; (c) costs associated with demonstrating compliance with the standards; and (d) decommissioning costs after the corrective action is completed.

(4) The "as low as is reasonably achievable" analysis is performed on target concentration levels that are at or below the limit determined to be protective of human health and the environment. At least three target concentration levels that can reasonably be attained by the practicable corrective actions should be evaluated. The goals should be (a) meaningfully different, (b) reasonably attainable by practicable corrective action, and (c) at or below the levels identified in the hazard assessment.

The "as low as is reasonably achievable" analysis typically considers (a) the direct and indirect benefits of implementing each corrective action to achieve the target concentration levels; (b) the costs of performing the corrective action to achieve the target concentrations; and (c) a determination whether any of the evaluated corrective action alternatives will reduce contaminant levels below the proposed alternate concentration limit, considering the benefits and costs of implementing the alternative.

The applicant should also provide a comparison among the costs associated with performing the various corrective action alternatives to achieve the target concentrations, the value of the pre-contaminated ground-water resource, and the benefits of achieving each target concentration. A proposed alternate concentration limit is considered as low as is reasonably achievable if the comparison of the costs to achieve the target concentrations lower than the alternate concentration limit are far in excess of the value of the resource and the benefits associated with performing the corrective action alternative. If the value and benefits clearly exceed the costs or the comparison is nearly equal, the proposed alternate concentration limit should be revised to the lower target concentration providing the greatest value and benefit compared to the cost.

The cost and benefit analysis should not be limited to a simple financial accounting of the costs for each corrective action alternative. Costs and benefits should also be discussed for qualitative subjects, such as environmental degradation or enhancement. The cost and benefit analysis is not simply a mathematical formula from which to justify economic parameters. Other qualitative factors should be discussed and weighed in the decision. The cost and benefits analysis provides input to determine the relative merits of various corrective action alternatives; however, the proposed alternate concentration limit must ultimately assure protection of public health and the environment.

The as low as is reasonably achievable analysis for non-radiological constituents should be similar to the as low as is reasonably achievable analysis for radiological constituents except a "dollar per person-rem avoided" value would not be calculated. Additionally, once nonradiological constituent are below regulatory maximum concentration levels, the licensee ha no further obligation to reduce the constituent concentrations.

INTERROGATORY WHITE MESA CELL 4B 10CFR40 APPENDIX A, CRITERION 1-10/01: PERMANENT ISOLATION WITHOUT ONGOING MAINTENANCE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40 Appendix A, Criterion 1: The general goal or broad objective in siting and design decisions is permanent isolation of tailings and associated contaminants by minimizing disturbance and dispersion by natural forces, and to do so without ongoing maintenance. For practical reasons, specific siting decisions and design standards must involve finite times (e.g., the longevity design standard in Criterion 6). The following site features which will contribute to such a goal or objective must be considered in selecting among alternative tailings disposal sites or judging the adequacy of existing tailings sites:

- Remoteness from populated areas;
- Hydrologic and other natural conditions as they contribute to continued immobilization and isolation of contaminants from ground-water sources; and
- Potential for minimizing erosion, disturbance, and dispersion by natural forces over the long term.

The site selection process must be an optimization to the maximum extent reasonably achievable in terms of these features.

In the selection of disposal sites, primary emphasis must be given to isolation of tailings or wastes, a matter having long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs. While isolation of tailings will be a function of both site and engineering design, overriding consideration must be given to siting features given the long-term nature of the tailings hazards.

Tailings should be disposed of in a manner that no active maintenance is required to preserve conditions of the site.

Relevant NRC Guidance: Refer also to Interrogatory UAC R313-24-3-01D/01 above.

Slope Stability

NUREG-1620, Section 2.2.3: The analysis of slope stability will be acceptable if it meets the following criteria:

(1) Slope characteristics are properly evaluated.

(a) Cross sections and profiles of natural and cut slopes whose instability would directly or indirectly affect the control of radioactive materials are presented in sufficient number and detail to enable the reviewer to select the cross sections for detailed stability evaluation.

(b) Slope steepness is a minimum of five horizontal units (5h) to one vertical unit (1v) or less. The use of slopes steeper than 5h:1v is considered an alternative to the requirements in 10 CFR Part 40, Appendix A, Criterion 4(c). When slopes steeper than 5h:1v are proposed, a technical justification should be offered as to why a 5h:1v or flatter slope would be impractical and compensating factors and conditions are incorporated in the slope design for assuring long-term stability.

(c) Locations selected for slope stability analysis are determined considering the location of maximum slope angle, slope height, weak foundation, piezometric level(s), the extent of rock mass fracturing (for an excavated slope in rock), and the potential for local erosion.

(2) An appropriate design static analysis is presented.

(a) The analysis includes calculations with appropriate assumptions and methods of analysis (NRC, 1977). The effect of the assumptions and limitations of the methods used is discussed and accounted for in the analysis. Acceptable methods for slope stability analysis include various limit equilibrium analysis or numerical modeling methods.

(b) The uncertainties and variability in the shape of the slope, the boundaries and parameters of the several types of soils and rocks within and beneath the slope, the material properties of soil and rock within and beneath the slope, the forces acting on the slope, and the pore pressures acting within and beneath the slope are considered.

(c) Appropriate failure modes during and after construction and the failure surface corresponding to the lowest factor of safety are determined. The analysis takes into account the failure surfaces within the slopes, including through the foundation, if any.

(d) Adverse conditions such as high water levels from severe rain and the probable maximum flood are evaluated.

(e) The effects of toe erosion, incision at the base of the slope, and other deleterious effects of surface runoff are assessed.

(f) The resulting safety factors for slopes analyzed are comparable to the minimum acceptable values of safety factors for slope stability analysis given in NRC Regulatory Guide 3.11 . . . .

(3) Appropriate analyses considering the effect of seismic ground motions on slope stability are presented.

(a) Evaluation of overall seismic stability, using pseudostatic analysis or dynamic analysis, as appropriate (U.S. Army Corps of Engineers, 1977; NRC, 1977). Alternatively, a dynamic

analysis following Newmark (1965) can be carried out to establish that the permanent deformation of the disposal cell from the design seismic event will not be detrimental to the disposal cell. The reviewer should verify that the yield acceleration or pseudostatic horizontal yield coefficient necessary to reduce the factor of safety against slippage of a potential sliding mass to 1.0 in a "Newmark-type" analysis has been adequately estimated (Seed and Bonaparte, 1992).

(b) An appropriate analytical method has been used. A number of different methods of analysis are available (e.g., slip circle method, method of slices, and wedge analysis) with several variants of each (Lambe and Whitman, 1979; U.S. Army Corps of Engineers, 1970b; NRC, 1977; Bromhead, 1992). Limit-equilibrium analysis methods do not provide information regarding the variation of strain within the slope and along the slip surface. Consequently, there is no assurance that the peak strength values used in the analysis can be mobilized simultaneously along the entire slip surface unless the material shows ductile behavior (Duncan, 1992). Residual strength values should be evaluated if mobilized shear strength at some points is less than the peak strength. The reviewer should ensure that appropriate conservatism has been incorporated in the analysis using the limit equilibrium methods. The limit equilibrium analysis methodologies may be replaced by other techniques, such as finite element or finite difference methods. If any important interaction effects cannot be included in an analysis, the reviewer must determine that such effects have been treated in an approximate but conservative fashion. The engineering judgment of the reviewer should be used in assessing the adequacy of the resulting safety factors (NRC, 1983a,b).

(c) For dynamic loads, the dynamic analysis includes calculations with appropriate assumptions and methods (NRC, 1977; Seed, 1967; Lowe, 1967; Department of the Navy, 1982a,b,c; U.S. Army Corps of Engineers, 1970a,b, 1971, 1972; Bureau of Reclamation, 1968). The effect of the assumptions and limitations of the methods used is discussed and accounted for in the analysis.

(d) For dynamic loads, a pseudostatic analysis is acceptable in lieu of dynamic analysis if the strength parameters used in the analysis are conservative, the materials are not subject to significant loss of strength and development of high pore pressures under dynamic loads, the design seismic coefficient is 0.20 or less, and the resulting minimum factor of safety suggests an adequate margin, as provided in NRC Regulatory Guide 3.11 (NRC, 1977).

(e) For pseudostatic analysis of slopes subjected to earthquake loads, an assumption is made that the earthquake imparts an additional horizontal force acting in the direction of the potential failure (U.S. Army Corps of Engineers, 1970b, 1977; Goodman, 1989). The critical failure surface obtained in the static analysis is used in this analysis with the added driving force. Minimum acceptable values for safety factors of slope stability analysis are given in Regulatory Guide 3.11 (NRC, 1977).

(f) The assessment of the dynamic stability considers an appropriate design level seismic event and/or strong ground motion acceleration, consistent with that identified in Chapter 1 of this review plan. Influence of local site conditions on the ground motions associated with the design level event is evaluated. The design seismic coefficient to be used in the

pseudostatic analysis is either 67 percent of the peak ground acceleration at the foundation level of the tailings piles for the site or 0.1g, whichever is greater.

(g) If the design seismic coefficient is greater than 0.20g, then the dynamic stability investigation (Newmark, 1965) should be augmented by other appropriate methods (i.e., finite element method), depending on specific site conditions.

(h) In assessing the effects of seismic loads on slope stability, the effect of dynamic stresses of the design earthquake on soil strength parameters is accounted for. As in a static analysis, the parameters such as geometry, soil strength, and hydrodynamic and pore pressure forces are varied in the analysis to show that there is an adequate margin of safety.

(i) Seismically induced displacement is calculated and documented. There is no universally accepted magnitude of seismically induced displacement for determining acceptable performance of the disposal cell (Seed and Bonaparte, 1992; Goodman and Seed, 1966). Surveys of five major geotechnical consulting firms by Seed and Bonaparte (1992) indicate that the acceptable displacement is from 15 to 30 cm [6 to 12 in.] for tailings piles. The reviewer should ensure that this criterion is also augmented by provisions for periodic maintenance of the slope(s).

(j) Where there is potential for liquefaction, changes in pore pressure from cyclic loading are considered in the analysis to assess the effect of pore pressure increase on the stress-strain characteristics of the soil and the post-earthquake stability of the slopes. Liquefaction potential is reviewed using Section 2.4 of this review plan. Evaluations of dynamic properties and shear strengths for the tailings, underlying foundation material, radon barrier cover, and base liner system are based on representative materials properties obtained through appropriate field and laboratory tests (NRC, 1978, 1979).

(k) The applicant has demonstrated that impoundments will not be located near a capable fault on which a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand might occur.

(4) Provision is made to establish a vegetative cover, or other erosion prevention, to include the following considerations:

(a) The vegetative cover and its primary functions are described in detail. This determination should be made with respect to any effect the vegetative cover may have on reducing slope erosion and should be coordinated with the reviewer of standard review plan Chapter 3. If strength enhancement from the vegetative cover is taken into account, the methodology should be appropriate (Wu, 1984).

(b) In arid and semi-arid regions, where a vegetative cover is deemed not self-sustaining, a rock cover is employed on slopes of the mill tailings. If credit is taken for strength enhancement from rock cover, the reviewer should confirm that appropriate methodology has been presented. The design of a rock cover, where a self-sustaining vegetative cover is not practical, is based on standard engineering practice. Standard review plan Chapter 3 discusses this item in detail.

(5) Any dams meet the requirements of the dam safety program if the application demonstrates the following:

(a) The dam is correctly categorized as a low hazard potential or a high hazard potential structure using the definition of the U.S. Federal Emergency Management Agency.(b) If the dam is ranked as a high hazard potential, an acceptable emergency action plan consistent with the Federal Emergency Management Agency guide (U.S. Federal Emergency Management Agency, 1998) has been developed.

(6) The use of steeper slopes as an alternative to the requirements in 10 CFR, Part 40, Appendix A, will be found acceptable if the following are met:

(a) An equivalent level of stabilization and containment and protection of public health, safety, and the environment is achieved.

(b) A site-specific need for the alternate slopes is demonstrated.

Settlement

NUREG-1620, Section 2.3.3: The analysis of tailings settlement will be acceptable if it meets the following criteria:

(1) Computation of immediate settlement follows the procedure recommended in NAVFAC DM–7.1 (Department of the Navy, 1982). If a different procedure is used, the basis for the procedure is adequately explained. The procedure recommended in NAVFAC DM–7.1 (Department of the Navy, 1982) for calculation of immediate settlement is adequate if applied incrementally to account for different stages of tailings emplacement. If this method is used, the reviewer should verify that the computation of incremental tailings loading and the width of the loaded area, as well as the determination of the undrained modulus and Poisson's ratio, have been computed and documented. Settlement of tailings arises from compression of soil layers within the disposal cell and in the underlying materials. Because compression of sands occurs rapidly, compression of sand layers in the disposal cell and foundations must be considered in the assessment of immediate settlement. However, the contribution of immediate settlement to consolidation settlement cannot be ignored. Clay layers and slime undergo instantaneous elastic compression controlled by their undrained stiffness as well as long-term inelastic compression controlled by the processes of consolidation and creep (NRC, 1983a).

(2) Each of the following is appropriately considered in calculating stress increments for assessment of consolidation settlement:

(a) Decrease in overburden pressure from excavation

(b) Increase in overburden pressure from tailings emplacement\

(c) Excess pore-pressure generated within the disposal cell

(d) Changes in ground-water levels from dewatering of the tailings

(e) Any change in ground-water levels from the reclamation action

(3) Material properties and thicknesses of compressible soil layers used in stress change and volume change calculations for assessment of consolidation settlement are representative of in situ conditions at the site.

(4) Material properties and thicknesses of embankment zones used in stress change and volume change calculations are consistent with as-built conditions of the disposal cell.

(5) Values of pore pressure within and beneath the disposal cell used in settlement analyses are consistent with initial and post-construction hydrologic conditions at the site.

(6) Methods used for settlement analyses are appropriate for the disposal cell and soil conditions at the site. Contributions to settlement by drainage of mill tailings and by consolidation/compression of slimes and sands are considered. Both instantaneous and time-dependent components of total and differential settlements are appropriately considered in the analyses (NRC, 1983a,b,c). The procedure recommended in NAVFAC DM–7.1 (Department of the Navy, 1982) for calculation of secondary compression is adequate.

(7) The disposal cell is divided into appropriate zones, depending on the field conditions, for assessment of differential settlement, and appropriate settlement magnitudes are calculated and assigned to each zone.

(8) Results of settlement analyses are properly documented and are related to assessment of overall behavior of the reclaimed pile.

(9) An adequate analysis of the potential for development of cracks in the radon/infiltration barrier as a result of differential settlements is provided (Lee and Shen, 1969).

Liquifaction Potential

NUREG-1620, Section 2.4.3: The analysis of the liquefaction potential will be acceptable if the following criteria are met:

(1) Applicable laboratory and/or field tests are properly conducted (NRC, 1978, 1979; U.S. Army Corps of Engineers, 1970, 1972).

(2) Data for all relevant parameters for assessing liquefaction potential are adequately collected and the variability has been quantified.

(3) Methods used for interpretation of test data and assessment of liquefaction potential are consistent with current practice in the geotechnical engineering profession (Seed and Idriss, 1971, 1982; National Center for Earthquake Engineering Research, 1997). An assessment of the potential adverse effects that complete or partial liquefaction could have on the stability of the embankment may be based on cyclic triaxial test data obtained from undisturbed soil samples taken from the critical zones in the site area (Seed and Harder, 1990; Shannon & Wilson, Inc. and Agbabian-Jacobsen Associates, 1972).

(4) If procedures based on laboratory tests combined with ground response analyses are used, laboratory test results are corrected to account for the difference between laboratory and field conditions (NRC, 1978; Naval Facility Engineering Command, 1983).

(5) The time history of earthquake ground motions used in the analysis is consistent with the design seismic event.

(6) If the potential for complete or partial liquefaction exists, the effects such liquefaction could have on the stability of slopes and settlement of tailings are adequately quantified.

(7) If a potential for global liquefaction is identified, mitigation measures consistent with current engineering practice or redesign of tailings ponds/embankments are proposed and the proposed measures provide reasonable assurance that the liquefaction potential has been eliminated or mitigated.

(8) If minor liquefaction potential is identified and is evaluated to have only a localized effect that may not directly alter the stability of embankments, the effect of liquefaction is adequately accounted for in analyses of both differential and total settlement and is shown not to compromise the intended performance of the radon barrier. Additionally, the disposal cell is shown to be capable of withstanding the liquefaction potential associated with the expected maximum ground acceleration from earthquakes. The licensee may use post-earthquake stability methods (e.g., Ishihara and Yoshimine, 1990) based on residual strengths and deformation analysis to examine the effects of liquefaction potential. Furthermore, the effect of potential localized lateral displacement from liquefaction, if any, is adequately analyzed with respect to slope stability and disposal cell integrity.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 2-11/01: PROLIFERATION

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40 Appendix A, Criterion 2: To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations, byproduct material from in situ extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote above ground extraction operations must be disposed of at existing large mill tailings disposal sites; unless, considering the nature of the wastes, such as their volume and specific activity, and the costs and environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 3-12/01: PLACEMENT BELOW GRADE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 3: The "prime option" for disposal of tailings is placement below grade, either in mines or specially excavated pits (that is, where the need for any specially constructed retention structure is eliminated). The evaluation of alternative sites and disposal methods performed by mill operators in support of their proposed tailings disposal program (provided in applicants' environmental reports) must reflect serious consideration of this disposal mode. In some instances, below grade disposal may not be the most environmentally sound approach, such as might be the case if a ground-water formation is relatively close to the surface or not very well isolated by overlying soils and rock. Also, geologic and topographic conditions might make full below grade burial impracticable: For example, bedrock may be sufficiently near the surface that blasting would be required to excavate a disposal pit at excessive cost, and more suitable alternative sites are not available. Where full below grade burial is not practicable, the size of retention structures, and size and steepness of slopes associated exposed embankments must be minimized by excavation to the maximum extent reasonably achievable or appropriate given the geologic and hydrologic conditions at a site. In these cases, it must be demonstrated that an above grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 4-13/01: LOCATION AND DESIGN REQUIREMENTS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 4: The following site and design criteria must be adhered to whether tailings or wastes are disposed of above or below grade.

(a) Upstream rainfall catchment areas must be minimized to decrease erosion potential and the size of the floods which could erode or wash out sections of the tailings disposal area.

(b) Topographic features should provide good wind protection.

(c) Embankment and cover slopes must be relatively flat after final stabilization to minimize erosion potential and to provide conservative factors of safety assuring long-term stability. The broad objective should be to contour final slopes to grades which are as close as possible to those which would be provided if tailings were disposed of below grade; this could, for example, lead to slopes of about 10 horizontal to 1 vertical (10h:1v) or less steep. In general, slopes should not be steeper than about 5h:1v. Where steeper slopes are proposed, reasons why a slope less steep than 5h:1v would be impracticable should be provided, and compensating factors and conditions which make such slopes acceptable should be identified.

(d) A full self-sustaining vegetative cover must be established or rock cover employed to reduce wind and water erosion to negligible levels.

Where a full vegetative cover is not likely to be self-sustaining due to climatic or other conditions, such as in semi-arid and arid regions, rock cover must be employed on slopes of the impoundment system. The Executive Secretary will consider relaxing this requirement for extremely gentle slopes such as those which may exist on the top of the pile.

The following factors must be considered in establishing the final rock cover design to avoid displacement of rock particles by human and animal traffic or by natural process, and to preclude undercutting and piping:

- Shape, size, composition, and gradation of rock particles (excepting bedding material average particles size must be at least cobble size or greater);
- Rock cover thickness and zoning of particles by size; and
- Steepness of underlying slopes.

Individual rock fragments must be dense, sound, and resistant to abrasion, and must be free from cracks, seams, and other defects that would tend to unduly increase their destruction by water and frost actions. Weak, friable, or laminated aggregate may not be used.

Rock covering of slopes may be unnecessary where top covers are very thick (or less); bulk cover materials have inherently favorable erosion resistance characteristics; and, there is negligible drainage catchment area upstream of the pile and good wind protection as described in points (a) and (b) of this Criterion.

Furthermore, all impoundment surfaces must be contoured to avoid areas of concentrated surface runoff or abrupt or sharp changes in slope gradient. In addition to rock cover on slopes, areas toward which surface runoff might be directed must be well protected with substantial rock cover (rip rap). In addition to providing for stability of the impoundment system itself, overall stability, erosion potential, and geomorphology of surrounding terrain must be evaluated to assure that there are not ongoing or potential processes, such as gully erosion, which would lead to impoundment instability.

(e) The impoundment may not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in this criterion, the term "capable fault" has the same meaning as defined in section III(g) of Appendix A of 10 CFR Part 100. The term "maximum credible earthquake" means that earthquake which would cause the maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material.

(f) The impoundment, where feasible, should be designed to incorporate features which will promote deposition. For example, design features which promote deposition of sediment suspended in any runoff which flows into the impoundment area might be utilized; the object of such a design feature would be to enhance the thickness of cover over time.

Relevant NRC Guidance

Site Location and Layout

RG 3.8, Section 2.1: Provide a map that shows the site and its location with respect to State, county, and other political subdivisions. On detailed maps, show the location of the boundary of the proposed restricted area (10 CFR Part 20); the applicant's property; adjacent properties, including water bodies, wooded areas, and farms; nearby settlements; industrial plants, parks, and other public facilities; and transportation links (railroads, highways, waterways). Indicate total acreage owned or leased by the applicant and that part occupied by or which will be modified for the mine and mill. Indicate other existing and proposed uses of applicant's property and the acreage devoted to these uses.

Describe any plans for site modifications such as a visitors' center. A contour map of the site should also be supplied with elevation contours of an interval suitable to show significant variations of the site environs and drainage gradients. In addition, indicate if the site is in the vicinity of a flood plain. This information should be supplied as separate maps, if required, for clarity.

Site Area

RG 3.8, Section 3.1: A map of the site area should be included; it should clearly show the following:

1. The location of the site boundary.

2. The location and orientation of principal structures within the site area. Principal structures should be identified as to function, e.g., mines, ore crushing structures, chemical separation and storage, ore stock piles, waste rock dumps, tailings disposal areas, retention and settling ponds, explosive magazines, housing areas, administration buildings, yellowcake storage areas, parking lots.

3. The boundary lines of any restricted areas, access to which are to be controlled by fences or other means.

4. A scale that will permit the measurement of distances with reasonable accuracy.

5. True north.

Geography

DG-3024, Section 2.1.1: Provide a geographic description of the area in which the mill is located, including (1) maps showing the location of the site with respect to State, county, and local subdivisions, plus nearby inhabited areas, and transportation links and (2) maps (topographic, if available) showing the mill, mill perimeter, tailings location, exclusion area boundary, company property, abutting and adjacent properties, nearby water bodies, inhabited areas, and any other relevant details related to the local geography.

Land Use and Demographic Surveys (Land)

RG 3.8, Section 6.1.4.2: The applicant should describe its program for identifying the actual land use in the site environs and for acquiring demographic data for the region.

Uses of Adjacent Lands and Waters

RG 3.8, Section 2.2: Indicate, within an 8-km (5-mi) radius, the nature and extent of present and projected land use (e.g., agriculture, livestock raising, dairies, pasturelands, residences, wildlife preserves, sanctuaries, hunting areas, industries, recreation, transportation) and any recent trends such as major or unexpected changes in population or industrial patterns. Note whether any other nuclear fuel cycle facilities are located or are proposed within an 80-km (50-mi) radius of the site.

Provide in tabular form for each of the 22-1/2-degree sectors centered on one of the 16 compass points, i.e., north, north northeast, etc., the distances [to a distance of 8 km (5 mi)] from the center of the site to the following:

- Nearest cattle (or other meat animals) grazing on natural forage, with types and numbers of animals specified.
- Nearest game animals consumed by sportsmen.
- Nearest residence.
- Nearest site boundary.
- Nearest vegetable garden larger than 50 m^2 (60 yd^2) in area. The type of crop and amounts produced should be noted.

Where possible, the applicant should provide specific information on actual consumption of the meat from cattle and game animals.

Provide data on annual production and distribution of meat (kg) and truck farming produce (kg) within an 80-km (50-mi) radius from the proposed facility. Provide information on grazing season (months of year) and feeding regimens for cattle. Agricultural production, crop yield, grazing, and feeding data may be obtained from sources such as local, State, and Federal agricultural agencies, agricultural agents, and other reliable sources.

Identify the location, nature, and amounts of present and projected surface and ground-water use (e.g., water supplies, irrigation, reservoirs, recreation, and transportation) within 16 km (10 mi) of the site and the present and projected population (during the active life of the mill) associated with each use point, where appropriate.

Data on both present and projected future water use should be summarized and tabulated; users should be located on maps of legible scale. Tabulations should include:

1. Location: Include symbols shown on maps identifying the location of water users. Provide map coordinates if appropriate.

2. Distance from mill.

3. Withdrawal rate: Provide present and projected withdrawal rate (in liters per second or cubic meters per second) for each water use.

4. Return rates: Provide present and projected return rates (in liters per second or cubic meters per second), if appropriate.

5. Type of water use: Provide type of water use for each location, e.g., municipal, industrial, irrigation, stock/game watering.

6. In addition, for ground-water use: Indicate depth of wells, groundwater elevation, and drawdown rates and characterize the use of each aquifer.

7. Source and projection of water-use estimates: Where use rates are anticipated to change over the life of the project and beyond, indicate projections and the source of the projection information. Sources for such projections may be available from users or planning agencies at different levels of government.

For items 3 and 4 above, if use varies significantly seasonally, indicate monthly values.

Provide data on the annual recreational and commercial fish catch from waters within an 8-km (5-mi) radius of the site. Report the catch by principal species, location, and amount used for human consumption (note amounts consumed locally).

Population Distribution

RG 3.8, Section 2.3: Population data presented should be based on the most recent census data. On a map of suitable scale that identifies places of significant population grouping, such as cities and towns, within an 80-km (50-mi) radius, concentric circles should be drawn with the mill at the center point, at distances of 0.1, 0.5, 1.0, 2.0, 3.0, 4.0, 5.0, 10.0, 20.0, 30.0, 40.0, 50.0, 60.0, 70.0 and 80.0 kilometers. The circles should be divided into 22-1/2-degree sectors with each sector centered on one of the 16 compass points (with reference to true north, i.e., north-northeast, northeast, etc.). A table (see table in Appendix A) appropriately keyed to the map should provide the current residential population within each area for the expected first year of mill operation and census years through the anticipated life of the mill. The tables should provide separate and cumulative population totals for each sector and annular ring. Distance to the nearest residence should be noted for each sector. The basis for population projections should be described.

Descriptive material should include tables giving the population of neighboring schools, plants, hospitals and residential areas within 8 km (5 mi). Visitor statistics for such areas

as sports facilities, residential areas, and parks within 8 km (5 mi) of the project site(s) should also be included.

Demography

DG-3024, Section 2.1.2: Describe the potentially affected population within a 5-mile radius of the mill. Provide current resident population information based on most recent census data and the projected population for the anticipated life of the mill. Identify and discuss significant transient or seasonal population variations, including the bases for assumptions and projections.

Meteorology

RG 3.8, Section 2.8: Provide a description of the meteorological diffusion characteristics of the site and its surrounding area. The description should include the use of data collected for at least one annual cycle from an onsite or nearby local meteorological station, plus examination of additional regional meteorological information. Sufficient data should be included to permit independent staff evaluation and assessment of atmospheric diffusion characteristics.

The following data concerning site meteorology from meteorological measurements taken onsite and at nearby representative stations should be presented:

1. Quarterly and annual wind rose presentation for the 16 compass directions.

2. Quarterly and annual wind speed, wind direction, and atmospheric stability data in joint frequency form at heights representative of effluent releases.

3. Total precipitation and evaporation by month.

This information should be fully documented as to validity of its representation of expected long-term conditions at and near the site.

Present the joint wind speed-stability-direction frequencies (in item 2 above) in tabular form, giving the frequencies as fractions when using 5-year National Weather Service summaries or as number of occurrences when using only 1 or 2 years of onsite data. The data should be presented for each of the 16 compass directions, and the stability categories should be established to conform as closely as possible with those of Pasquill.* In addition, the annual average inversion height should be provided from other nearby weather stations.

Guidance on acceptable onsite meteorological measurements and data format for nuclear reactors is presented in Regulatory Guide 1.23, "Onsite Meteorological Programs." Staff guidance should be requested for adaptation of relevant portions of this document to the specific mill project. See Appendix A of this regulatory guide for appropriate format for meteorological data.

In addition, this section should provide a discussion of general climatology, the existing levels of air pollution and their effects on site operations, the relationship of the

meteorological data gathered on a regional basis to local data, the impact of the local terrain and large lakes and other bodies of water on meteorological conditions in the area, and the occurrence of severe weather in the area and its effects. Data on diurnal and monthly averages and extremes of temperature and humidity should also be provided.

DG-3024, Section 2.2: Provide a meteorological description of the site and surrounding area. Include sufficient information to permit the NRC staff to independently evaluate the atmospheric diffusion characteristics of the local area. State the sources of information and data supplied, including (1) diurnal and monthly averages and extremes of temperature and humidity, (2) monthly wind characteristics including speeds and direction, annual joint frequency of windspeed, and direction by stability category, (3) data on precipitation, and (4) frequency of occurrence and effects of storms.

RG 3.8, Section 6.1.3.1: Identify sources of meteorological data used in the atmospheric transport models . . . . Locations and elevations of observation stations, instrumentation, and frequency and duration of measurements should be specified both for the applicant's measuring activities and for activities of governmental agencies or other organizations on whose information the applicant intends to rely. Guidance for an acceptable meteorological measurement program for nuclear reactors is presented in Regulatory Guide 1.23 (Safety Guide 23), "Onsite Meteorological Programs." See Appendix C for the format for reporting meteorological data. The applicant's description should show the basis for predicting such effects as the dispersion of airborne effluents and should present the methodology for gathering baseline data.

Models (Air)

RG 3.8, Section 6.1.3.2: Any models used by the applicant, either to derive estimates of basic meteorological information or to estimate the effects of effluents, should be described in detail and their validity and accuracy discussed. Staff guidance should be sought in adapting existing guidance to the particular effluents from uranium mines and mills.

Geology and Soils

RG 3.8, Section 2.5: Describe the major geological and soils aspects of the site and its environs. The discussion should note the stratigraphy, structure, and tectonic history. Comment on regional continuity, faulting, dip, and strikes of waterbearing formations that will be affected. An inventory of economically important minerals and energy-related deposits, in addition to the uranium ore, should be included. Any unique mineralogical or paleontological deposits of particular scientific interest should also be noted. Any effect that planned operations might have on the future availability of other mineral resources should be noted.

Detailed geological data at building sites and in the vicinity of tailings or other effluent impoundments, sanitary landfills, spoil disposal areas, and sewage disposal facilities should be included. These data should include strike and dip and lateral and vertical distribution of permeable layers, shales, and clays, and data on any fault, fracture, or joint

pattern that may exist. Locations of local outcroppings where seepage from landfills, dumps, impoundments, and sewage facilities is likely to occur should be noted.

The location of ground water with respect to tailings disposal areas, spoil dumps, liquid impoundments, sanitary landfills, and sewage disposal facilities is important for the assessment of possible ground-water contamination. The discussion should include a statement concerning the hydraulic properties (such as permeability and porosity) of the materials between the ground water and these facilities.

DG-3024, Section 2.4.1: Describe the geologic aspects of the site. Note the broad features and general characteristics of the site and environs, including stratigraphy and structural geology. Describe characteristics of the subsurface soil or rock, including the identification and evaluation of zones of deformation that might act as conduits for contaminants.

Seismology

RG 3.8, Section 2.6 and DG-3024, Section 2.4.2: Discuss the seismicity (including history) of the region. Where possible, associate seismic events with tectonic features identified in the geology discussion. Furnish a regional earthquake epicenter map showing site location.

Hydrologic Description of Site

NUREG-1620, Section 3.1.3: The hydrologic description of the site will be considered acceptable if:

(1) The description of structures, facilities, and erosion protection designs is sufficiently complete to allow independent evaluation of the impact of flooding and intense rainfall.

(2) Site topographic maps are of good quality and of sufficient scale to allow independent analysis of pre- and post-construction drainage patterns.

(3) The reclamation plan contains sufficient information for the staff to independently evaluate the hydraulic designs presented. In general, detailed information is needed for each method that is used to determine the hydraulic designs and erosion protection provided to meet NRC regulations. NUREG–1623 (NRC, 2002) discusses acceptable methods for designing erosion protection to provide reasonable assurance of effective long-term control and, thus, conform to NRC requirements. NUREG–1623 (NRC, 2002) also provides discussions and technical bases for use of specific criteria to meet the 1,000-year longevity requirement, without the use of active maintenance. Specific design methods are provided and form the primary basis for staff review of erosion protection designs.

Surface Water (Hydrology)

RG 3.8, Section 2.7.2: Describe the location, size, shape, and other hydrologic characteristics of water bodies in the environs of the site. Surface-water descriptions for receiving streams should include the channel shape, slope, roughness coefficient, sediment concentrations (suspended), flow records (at nearest gauges), and dispersion coefficients; for ponds and lakes the geometry of the bed, wind currents, and suspended solids (sediment) concentration.

Include a description of upstream and downstream river control structures, and provide a topographic map showing the major hydrologic features.

DG-3024, Section 2.3.2: Describe the location, size, shape, and other hydrologic characteristics of streams, rivers, lakes, marshes, estuaries, and other bodies of water in the environs. Include a description of any upstream and downstream river control structures and downstream water supply users, including location, amount, and purpose (e.g., domestic, agricultural), and provide a map (topographic, if available) showing major hydrologic features of the area. Describe the mill site upstream rainfall catchment areas to determine the potential for flooding and erosion of the tailings disposal area.

Flooding Determinations

NUREG-1620, Section 3.2.3: The flooding determinations for the site will be considered acceptable if: The designs conform to the suggested criteria in Appendix D to NUREG–1623 (NRC, 2002). NUREG–1623 (NRC, 2002) discusses acceptable methods for designing erosion protection to provide reasonable assurance of effective long-term control and to meet NRC requirements. It also presents discussions and technical bases for use of specific criteria to meet the 1,000-year longevity requirement without the use of active maintenance. Acceptable design methods are presented and form the primary basis for staff review of erosion protection designs. These methods were derived from regulatory requirements, other regulatory guidance, staff experience, and various technical studies.

Information pertinent to computation of the design flood is submitted in sufficient detail to enable the staff to perform an independent flood estimate, Specifically:

- Model input parameters are adequate.
- Staff and the reclamation plan estimates of flood levels and peak discharges are in agreement.
- Computational methods for design flood estimates are adequate.

“Worst conditions” postulated in the analysis of upstream dam failures are (1) an approximate 25-year flood on a normal operating reservoir pool level coincident with the dam-site equivalent of the earthquake for which the remedial action project is designed, (2) a flood of about one-half the severity of a probable maximum flood on a normal reservoir pool level coincident with the dam-site equivalent of one-half of the earthquake

for which the remedial action project is designed; and (3) a probable maximum flood (or design flood) on a normal reservoir pool.

Conditions 1 and 2 are applied when the dam is not designed with adequate seismic resistance; Condition 3 is applied when the dam is not designed to safely store or pass the design flood. If the proposed design is based on less than a probable maximum flood event, the licensee offers reasonable assurance of conforming to the stability requirement of at least 200 years. Dam failure analyses are either realistic or conservative, and include locations and sizes of upstream dams, instantaneous failure (complete removal) of the dam embankment, and compute the peak outflow rate.

Surface Water Profiles, Channel Velocities, and Shear Stresses

NUREG-1620, Section 3.3.3: The water surface profiles, channel velocities, and shear stresses calculated for the site will be considered acceptable if: The proposed designs conform to the suggested criteria in Appendix D to NUREG–1623 (NRC, 2002). NUREG–1623 (NRC, 2002) discusses acceptable methods for designing erosion protection to provide reasonable assurance of effective long-term control and to comply with NRC requirements. This document also contains discussions and technical bases for use of specific criteria to meet the 1,000-year longevity requirement without the use of active maintenance. Specific design methods are presented, and reasonable similarity to these methods forms the primary basis for staff acceptance of erosion protection designs. Specifically:

- Localized flood depths, velocities, and shear stresses used in models for rock size determination or soil cover slope analysis conform to the guidance presented in Appendix D to NUREG–1623 (NRC, 2002).

- For off-site flooding effects, computational models have been correctly and appropriately used and the data from the models have been correctly interpreted.

- Acceptable models and input parameters have been used in all the various portions of the flood analyses and the resulting flood forces have been adequately accommodated.

Ground Water (Hydrology)

RG 3.8, Section 2.7.1: Describe the hydrology of the region that affects the local ground-water aquifers, formations, sources, and sinks. Describe the recharge potential of the immediate plant area, including vertical and horizontal permeabilities of the natural and modified terrain, as well as that of tailing disposal areas. Indicate gradients and seasonal variations in ground-water levels beneath the site. Furnish sufficient site-specific data for the evaluation of the effects of construction and operation of the facility on established ground-water tables and usage. This is especially important for consideration of dewatering operations in associated mines.

Descriptions of the major aquifers in the area should include piezometric contour maps, hydraulic gradients, permeabilities for representative geologic features, total and effective porosities, bulk density estimates, storage coefficients, dispersion and distribution

(sorption) coefficients, descriptions of pertinent geologic formations and soil types, including formation depth throughout the site and to the nearest downgradient well or water body, chemical and radiological properties, and time histories of ground-water fluctuations.

The applicant should provide data concerning any drawdown of ground water that may be caused by withdrawals from neighboring major industrial, agricultural, or municipal wells.

DG-3024, Section 2.3.1: Describe the regional and local ground water aquifers, formations, sources, and sinks. Describe the recharge potential of the immediate plant area, including vertical and horizontal permeabilities of the natural and modified terrain, as well as that of tailings areas. Describe the present and projected regional use and tabulate existing private users within the area influenced by the proposed activities and all local and regional public users (e.g., amounts, water levels, locations, and drawdown). Describe gradients and seasonal variations in ground water levels beneath the site.

Radiological Surveys

RG 3.8, Section 6.1: Discuss the methods used to determine the preoperational radiation levels at the site and environs and the concentrations of radionuclides in important local and regional biota, soil, sediment, vegetation, air, and surface and ground waters.

Site and Uranium Mill Tailings Characteristics

NUREG-1620, Section 2.1.3: The site characterization information constitutes part of the input data needed for analysis and design of the tailings impoundment facility. The site characterization will be acceptable if it provides the needed input for the design and analysis of the disposal facility and meets the following criteria:

(1) The site stratigraphy is described in sufficient detail to provide an understanding of the site-specific subsurface features, including structural features and other characteristics of underlying soil and rock.

(2) Information on regional and local faults and seismicity, as obtained from field data, published literature, and historical records is presented in sufficient detail to effectively incorporate that information into a geotechnical stability analyses. (Note: This aspect of the review should be coordinated with the geology and seismology review performed in accordance with standard review plan Chapter 1.)

(3) Sampling scope and techniques are appropriate and sufficient to ensure that samples collected are representative of the range of in situ soil conditions, taking into consideration variability and uncertainties in such conditions within the site.

(4) For all soils that might be unstable because of their physical or chemical properties, locations and dimensions are identified and the properties have been documented.

(5) Investigations (including laboratory and field testing) are conducted using appropriate standards published by the American Society for Testing and Materials or the International Society for Rock Mechanics and are sufficient to establish the static and dynamic engineering parameters of borrow materials, other materials, tailings, and underlying soil and rock materials at the site (NRC, 1978, 1979).

(6) A detailed discussion of laboratory sample preparation techniques is presented, when standard procedures are not used. For critical laboratory tests, details such as how saturation of the sample was determined and maintained during testing, or how the pore pressures changed are provided. A detailed and quantitative discussion of the criteria used to verify that the samples were properly taken and tested in sufficient number to define the critical soil parameters for the site is presented. In the case of tailings material (e.g., license amendment reviews), the evaluations of its strength and settlement characteristics are presented in detail.

(7) Parameter values are presented to enable evaluation of properties of mill tailings, borrow materials, other materials, and underlying soil and rock, including the following:

(a) Compressibility and rate of consolidation

(b) Shear strength, including, for sensitive soils, possible loss of shear strength resulting from strain-softening

(c) Liquefaction potential

(d) Permeability

(e) Dispersion characteristics

(f) Swelling and shrinkage

(g) Long-term moisture content for radon barrier material

(h) Cover cracking

(8) Soil stratigraphy and relevant parameters that are used in the geotechnical evaluations (settlement, stability, liquefaction potential, etc.) are discussed in detail.

(9) Records of historical ground-water-level fluctuations at the site as obtained from monitoring local wells and springs and/or by analysis of piezometer and permeability data from tests conducted at the site are presented in sufficient detail to effectively incorporate the information into geotechnical stability analyses. (Note: This aspect of the review should be coordinated with the hydrogeologic characterization review performed according to standard review plan Chapter 4.0.)

The information should be sufficient to provide the required input for the design of the facility and to enable the reviewer to assess compliance with the regulatory requirements, such as site features contributing to waste isolation; facility location with respect to an active fault; and reasonable assurance of control of radiological hazards to be effective for 1,000 years to the extent reasonably achievable, and in any case, for at least 200 years.

Disposal Cell Cover Engineering Design

NUREG-1620, Section 2.5.3: The assessment of the disposal cell cover design and engineering parameters will be acceptable if it meets the following criteria:

(1) Detailed descriptions of the disposal cell material types [e.g., Unified Soil Classification System (Holtz and Kovacs, 1981)] and/or soil mixtures (e.g., bentonite additive) and the basis for their selection are presented. An analysis is included demonstrating that an adequate quantity of the specified borrow material has been identified at the borrow source. The information on borrow material includes boring and test pit logs and compaction test data. The soils that are considered suitable include the Unified Soil Classification System Classes CL, CH, SC, and CL-ML, with desirable characteristics and limitations as listed in Table 3-1 of the "Construction Methods and Guidance for Sealing Penetrations in Soil Covers" (Bennett and Homz, 1991; Bennett and Kimbrell, 1991). The preferred material for the low-permeability layers is inorganic clay soil. This soil should be compacted to a low saturated hydraulic conductivity of at least 1×10^{-7} cm/sec. For drainage layers, cobble types GW, GP, SP, and SW are recommended, with GW and GP being the preferred types (Bennett, 1991). Measures for resisting cracking, heaving, and settlement, and providing protection from burrowing animals, root penetration, and erosion over a long period of time are described.

(2) A sufficiently detailed description of the applicable field and laboratory investigations and testing that were completed, and the material properties (e.g., permeability, moisture-density relationships, gradation, shrinkage and dispersive characteristics, resistance to freeze-thaw degradation, cracking potential, and chemical compatibility, including any amendment materials) are identified (U.S. Army Corps of Engineers, 1970, 1972; Fermulk and Haug, 1990; NRC, 1978, 1979; Lee and Shen, 1969; Spangler and Handy, 1982).

(3) Details are presented (including sketches) of the disposal cell cover termination at boundaries, with any considerations for safely accommodating subsurface water flows.

(4) A schematic diagram displaying various disposal cell layers and thicknesses is provided. The particle size gradation of the disposal cell bedding layer and the rock layer are established to ensure stability against particle migration during the period of regulatory interest (NRC, 1982).

(5) The effect of possible freeze-and-thaw cycles on soil strength and radon barrier effectiveness is adequately considered (e.g., Aitken and Berg, 1968). If the region experiences prolonged freezing, the disposal cell cover may be affected by the freeze-thaw cycle. During freezing, ice crystals and lenses can form in the soil, causing heaving. On the other hand, during melting and thawing, the soil may lose its bearing capacity because of

development of supersaturated conditions (Spangler and Handy, 1982). Major factors affecting growth of ice in soil are the temperature below the freezing point, the capillary characteristics of the soil, and the presence of water. The reviewer should check whether the soil is susceptible to frost heave, considering that uniformly graded soils containing more than 10 percent of particles smaller than 0.02 mm and well-graded soils with more than 3 percent of particles smaller than 0.02 mm are susceptible (Holtz and Kovacs, 1981; Spangler and Handy, 1982). After many freeze-thaw cycles, the soil may become a loose collection of aggregates with significantly reduced overall strength.

(6) A description is given (with sketches) of any penetrations (e.g., monitoring wells) through the disposal cell system, including details of penetration sealing and disposal cell cover integrity. Bennett and Kimbrell (1991) suggest methods for seal design that are acceptable.

(7) An adequate analysis is presented of the potential for development of cracks in the disposal cell cover as a result of differential settlement and shrinkage. Note that cracking issues associated with settlement are discussed in standard review plan Section 2.3.3.

(8) An adequate description of the geomembranes and their major properties (e.g., physical, mechanical, and chemical) is provided if low permeability geomembranes are proposed as a part of the disposal cell cover. Methods for installation of the membranes in accordance with the manufacturer's recommendations are discussed. The shear strength of the interface between compacted clay and geomembranes used in the stability analyses under both static and dynamic loads is noted. The expected service life of the geomembrane is analyzed.

(9) Information on site characterization, slope stability, settlement, and liquefaction used in the disposal cell cover design appropriately reflects the Licensee’s evaluation, and therefore, constitutes inputs that would contribute to the demonstration of disposal cell design compliance with the regulations.

Design of Erosion Protection Covers

NUREG-1620, Section, 3.5.3; The design erosion protection covers for the site will be considered acceptable if: the designs conform to the suggested criteria in NUREG–1623 (NRC, 2002). NUREG–1623 (NRC, 2002) discusses acceptable methods for designing erosion protection to provide reasonable assurance of effective long-term control and, thus, meet NRC requirements. This document also provides discussions and technical bases for use of specific criteria to meet the 1,000-year longevity requirement without the use of active maintenance. Specific acceptance criteria for many of the review areas are presented and form the primary basis for staff review of erosion protection designs. These criteria were derived from regulatory requirements, other regulatory guidance, staff experience, and various technical references. If active maintenance is proposed as an alternative to the designs suggested above, such an approach will be found acceptable if the following criteria are met:

(1) The maintenance approach must achieve an equivalent level of stabilization and containment and protection of public health, safety, and the environment.

(2) The licensee must demonstrate a site-specific need for the use of active maintenance.

(3) The licensee must provide funding for the maintenance by increasing the amount of the required surety. The licensee should also work with the long-term custodian to assess any additional funding requirements related to long-term surveillance and monitoring.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(1)-14/01: GROUND-WATER PROTECTION STANDARDS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(1): The primary ground-water protection standard is a design standard for surface impoundments used to manage uranium and thorium byproduct material. Unless exempted under paragraph 5A(3) of this criterion, surface impoundments (except for an existing portion) must have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water, or surface water) during the active life of the facility, provided that impoundment closure includes removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate. For impoundments that will be closed with the liner material left in place, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility.

Relevant NRC Guidance

Groundwater Protection Standards

NUREG-1620, Section 4.2.3: The development of ground-water protection standards will be acceptable if it meets the following criteria:

(1) Hazardous constituents are identified using the definition given in 10 CFR Part 40, Appendix A, Criterion 5(B).

(2) A point of compliance is established in accordance with 10 CFR Part 40, Appendix A, Criterion 5B(1).

The point of compliance is the location at which the ground water is monitored to determine compliance with the ground-water protection standards. The objective in selecting the point of compliance is to provide the earliest practicable warning that the impoundment is releasing hazardous constituents to the ground water. The point of compliance must be selected to provide prompt indication of ground-water contamination

on the hydraulically downgradient edge of the disposal area. The point of compliance is defined as the intersection of a vertical plane with the uppermost aquifer at the hydraulically downgradient limit of the waste management area.

The "uppermost aquifer" is defined in 10 CFR Part 40, Appendix A, as "the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary." Therefore, a proper selection of the point of compliance includes identification of point of compliance locations in the aquifer nearest to the ground surface, as well as other aquifers that are hydraulically interconnected with that aquifer, as warranted by site-specific conditions.

When tailings are disposed of on site, the NRC generally interprets the downgradient limit of the waste management area to be the edge of the reclaimed tailings side slopes. However, it is not recommended that licensees be required to compromise the cover integrity to install monitoring wells at the actual edge of the reclaimed tailings.

(3) A concentration limit is specified for each of the hazardous constituents. Those limits may be:

(a) Commission-Approved Background Concentrations.

10 CFR Part 40, Appendix A, requires that the Commission-approved background concentration be the concentration limit, except for constituents listed in Table 5C of 10 CFR Part 40, Appendix A, which, if present in excess of background, are subject to the respective maximum concentration limits listed in Table 5C.

Proper statistical methods, such as those discussed in American Society for Testing and Materials Standard D 6312, are used to determine the expected range of naturally occurring background (baseline) concentrations for each constituent of concern. Acceptable statistical techniques are also presented in Haan (1977) and Hirsch, et al. (1992).

(b) Maximum Concentration Limits The respective values given in the table in paragraph 5C of 10 CFR Part 40, Appendix A, must not exceed if the constituent is listed in the table and if the background level of the constituent is below the value listed. Note that the U.S. EPA has revised some of these limits under the Safe Drinking Water Act, therefore, for risk assessments used for an alternate concentration limit proposal, where a drinking water exposure pathway is estimated, the reviewer should refer to the most recent Safe Drinking Water Act maximum concentration limits.

(c) Alternate Concentration Limits Alternate concentration limits are established on a site-specific basis, provided it can be demonstrated that (i) the constituents will not pose a substantial present or potential hazard to human health or the environment, as long as the alternate concentration limits are not exceeded and (ii) the alternate concentration limits are as low as is reasonably achievable, considering practicable corrective actions. Licensees are required to implement detection monitoring programs to detect and identify site-specific hazardous

constituents, and compliance monitoring programs to verify compliance with the established site-specific standards for individual constituents. Standard review plan Sections 4.3.3 and 4.4.3 contain acceptance criteria for determining potential hazards, and for "as low as is reasonably achievable" demonstrations, respectively.

When an applicant proposes alternate concentration limits, the reviewer should recognize that additional site characterization may be necessary to demonstrate the potential risk to human health and the environment is acceptable. Typically, long-term ground-water monitoring will be required to assure that human health and the environment are protected.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(2)-15/01: LINER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(2): The liner required by paragraph 5A(1) above must be:

(a) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

(b) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and

(c) Installed to cover all surrounding earth likely to be in contact with the wastes or leachate.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(4)-17/01: PREVENT OVERTOPPING

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(4): A surface impoundment must be designed, constructed, maintained, and operated to prevent overtopping resulting from normal or abnormal operations, overfilling, wind and wave actions, rainfall, or run-on; from malfunctions of level controllers, alarms, and other equipment; and from human error.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 5A(5)-18/01: DIKES

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 5A(5): When dikes are used to form the surface impoundment, the dikes must be designed, constructed, and maintained with sufficient structural integrity to prevent massive failure of the dikes. In ensuring structural integrity, it must not be presumed that the liner system will function without leakage during the active life of the impoundment.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(1)-19/01: COVER AND CLOSURE AT END OF MILLING OPERATIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(1): In disposing of waste byproduct material, licensees shall place an earthen cover (or approved alternative) over tailings or wastes at the end of milling operations and shall close the waste disposal area in accordance with a design which provides reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years, and (ii) limit releases of radon-222 from uranium byproduct materials, and radon-220 from thorium byproduct materials, to the atmosphere so as not to exceed an average release rate of 20 picocuries per square meter per second (pCi/m^2s) to the extent practicable throughout the effective design life determined pursuant to (1)(i) of this Criterion. In computing required tailings cover thicknesses, moisture in soils in excess of amounts found normally in similar soils in similar circumstances may not be considered. Direct gamma exposure from the tailings or wastes should be reduced to background levels. The effects of any thin synthetic layer may not be taken into account in determining the calculated radon exhalation level. If non-soil materials are proposed as cover materials, it must be demonstrated that these materials will not crack or degrade by differential settlement, weathering, or other mechanism, over long-term intervals.

Relevant NRC Guidance

Site and Tailings Reclamation

> **DG-3024, Section 8.2:** Provide the proposed plan for reclamation of the site and tailings impoundment that demonstrates compliance with the applicable requirements of Appendix A to 10 CFR Part 40. In the plan, describe the overall reclamation design and construction considerations of the tailings impoundment. Assess the geotechnical stability aspects of the tailings impoundment, including slope stability and liquefaction. In addition, address the hydrologic characteristics of the site, including flooding potential, and erosion protection features of the tailings impoundment. Include strategies for the

protection of water resources, including plans to prevent the spread of both hazardous and radioactive contaminants from the processing site and tailings storage area into ground water or surface water and to implement corrective action in the event these bodies become contaminated during operations. Address the radiation protection design of the tailings disposal impoundment cover for radon and gamma attenuation and the potential for settlement of the tailings impoundment and resulting cracking of the radon barrier. Include measures for cleanup of windblown tailings and other soils contaminated from mill operations and for sampling and surveys to document that soils have been cleaned to acceptable levels. Address the means for disposing of any ore remaining on site following the cessation of mill operations. (See NUREG-1620, "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978," issued June 2003, for additional detailed information on the scope and content of a reclamation plan.)

Radon Attenuation

NUREG-1620, Section 5.1.3.1: The radon attenuation design will be acceptable if it meets the following criteria:

(1) The one-dimensional, steady-state gas diffusion theory for calculating radon flux and/or minimum cover thickness is used. An acceptable analytical method for determining the necessary cover thickness to reduce radon flux to acceptable limits or to determine the long-term radon flux from the proposed cover is the computer code RAECOM (NRC, 1984) and the comparable RADON code (NRC, 1989). The main difference between the two codes is that RADON does not have the optimization for cost benefit calculations. The staff will use the RADON code to verify the analysis. Other methods that estimate the average surface radon release from the covered tailings may be acceptable, if it can be shown that these methods produce reliable estimates of radon flux.

(2) With the RAECOM and RADON computer codes, the radon concentration above the top layer is either set to a conservative value of zero or a measured background value is used. The precision number (the level of computational error that is acceptable) is set at 0.001.

(3) The estimates of the material parameters used in the radon flux calculations are reasonably conservative, considering the uncertainty of the values. For all site-specific parameters, supporting information describing the test method and its precision, accuracy, and applicability is provided. The basis for the parameter values and the methods in which the values are used in the analyses are adequately presented. Moisture-dependent parameter values (e.g., radon emanation coefficient and diffusion coefficient) are based on the estimated long-term moisture content of the materials at the disposal site.

The materials testing programs employ appropriate analytical methods and sufficient and representative samples were tested to adequately determine material property values for both cover soils and contaminated materials. In the absence of sufficient test data, conservative estimates are chosen and justified. The quality

assurance program for parameter data is adequate and the data are available for inspection. All parameter values are consistent with anticipated construction specifications and represent expected long-term conditions at the site.

(4) The contaminated material thickness is determined from estimates of total tailings production or waste placement and the areal extent, from boring logs, or changes in elevation from pre- to post-operation. Either the estimated thickness of a tailings source is used, or alternatively, the RADON code default value of 500 cm [16.4 ft] is used (NRC, 1989).

(5) Dry bulk densities of the cover soils and tailings material are determined from Standard Proctor Test data (American Society for Testing and Materials D 698) or Modified Proctor Test data (American Society for Testing and Materials D 1557). Radon barrier materials are usually compacted to a minimum of 95 percent of the maximum dry density as determined by American Society for Testing and Materials D 698 or to a minimum of 90 percent of the maximum dry density as determined by American Society for Testing and Materials D 1557. Field or placement densities to be achieved based on the construction specifications are used in the calculations. If the pile is stabilized in place, the in situ bulk density for the tailings is used in the analysis.

Porosities are measured by mercury porosimetry or another reliable method, or the method for estimating the porosity of cover soils and tailings materials using the bulk density and specific gravity given in Regulatory Guide 3.64 (NRC, 1989) is used.

If a portion of the modeled cover (radon attenuation layers) could be affected by freeze-thaw events, that portion is represented in the model with lower density and corresponding higher porosity values than the unaffected portion. The U.S. Army Corps of Engineers (1988) and the DOE (1988) have demonstrated that freeze-thaw cycles can increase the permeability of compacted clay by 40 to 300 times the original value. For fine-grained soils with some sand (50-percent fines), the DOE conservatively estimated that freeze-thaw cycles could lower the density by 14 percent (DOE, 1992). Also see the discussion in Section 2.5.3 of this standard review plan.

(6) The long-term moisture content that approximates the lower moisture retention capacities of the materials or another justified value is used. Estimated values for the long-term moisture content can be compared with present in situ values to assure that the assumed long-term value does not exceed the present field value. Borrow samples can be taken at a depth of 120 to 500 cm (3.9 to 16.4 ft), but not close to the water table, and the borrow site conditions should be correlated to conditions at the disposal site.

The following methods are acceptable for estimating the long-term soil moisture, but each has limitations:

(a) Laboratory procedures American Society for Testing and Materials D 3152 (fine-textured soils) and American Society for Testing and Materials D 2325 (coarse and medium-textured soils) for capillary moisture test (15-bar suction) corresponding to the moisture content at which permanent wilting of plants occurs (Baver, 1956).

(b) The empirical relationship (Rawls and Brakensiek, 1982) that predicts water retention values of a soil on a volume basis (appears to be more suitable to sandy and silty soil than to clayey soil) and is represented by:

$$c = 0.026 + 0.005x + 0.0158y$$

where c = predicted 15-bar soil water-retention value (volumetric moisture content)

x = percent clay in the soil

y = percent organic matter in the soil

This method takes into consideration the particle-size distribution of the soil. Clay particle sizes are defined here as those less than 0.002 mm in diameter. Organic content measurement is generally determined by reaction with hydrogen peroxide or by exposure to elevated temperature. The volumetric moisture content value derived from this equation should be converted to a weight percentage for application in the RAECOM and RADON codes. Other empirical correlations (Section 7.1.3 of DOE, 1989), if adequately justified, may be acceptable.

(7) Values for Ra-226 activity (pCi/g) are measured directly from tailings samples and other large volume sources of contaminated material, by radon equilibrium gamma spectroscopy (allow at least 10 days for the sealed sample to equilibrate), wet chemistry alpha spectrometry, or an equivalent procedure. If the tailings are fairly uniform in Ra-226 content and the Ra-226 and uranium (U-238) in the ore were approximately in equilibrium, the Ra-226 activity can be estimated from the average ore grade processed at the site, as discussed in Regulatory Guide 3.64 (NRC, 1989). Generally, tailings should be sampled at 90-cm [3-ft] intervals to a depth of 366 cm [12 ft], including representative sampling of slime tailings. More than one layer of contaminated material is represented in the flux model if there are significant differences in Ra-226 content with depth.

Since the disposal cell performance standard deals only with radon generated by the contaminated material, it is acceptable to neglect the Ra-226 activity in the cover soils for modeling flux, provided the cover soils are obtained from materials not associated with ore formations or other radium-enriched materials. If deep {below 61 cm [2 ft]} cover layers contain elevated Ra-226 or Th-230, that material layer and its Ra-226 level is represented in the flux model.

(8) The emanation coefficient has been obtained by using methods provided in Nielson, et al. (1982) and properly documented, or otherwise set to the reasonably conservative (for most soils) code default value of 0.35. A value of 0.20 may be

estimated for tailings based on the literature, if supported by limited site-specific measurements.

(9) The radon diffusion coefficient, D, represents the long-term properties of the materials. The D value is determined from direct measurements or appropriately calculated. The soil should be tested at the design compaction density, with a range of moisture content values that includes the lower moisture retention capacity of the soil so that a radon breakthrough curve can be obtained (DOE, 1989). The calculation of the diffusion coefficient, based on the long-term moisture saturation, and porosity, as proposed in Regulatory Guide 3.64, Section C.1.1.5 (NRC, 1989), and the optional calculation in the RADON code, are acceptable.

(10) The soil cover thickness proposed in the reclamation design is such that the calculated average long-term radon flux is reduced to a level that meets the requirement in 10 CFR Part 40, Appendix A, Criterion 6(1).

Gamma Attenuation

NUREG-1620, Section 5.1.3.2: The proposed cover will reduce the gamma radiation from the byproduct material to local soil background levels, and the licensee proposed an acceptable method to demonstrate this. The data will appear in the reclamation completion report.

Cover Radioactivity Content

NUREG-1620, Section 5.1.3.3: At least the upper 61 cm [2 ft] of the disposal cell cover will contain levels of radioactivity essentially the same as surrounding soils, as demonstrated by an appropriate procedure. The data will be in the reclamation completion report if not available for the reclamation plan.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(2)-20/01: VERIFY EFFECTIVENESS OF FINAL RADON BARRIER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(2): As soon as reasonably achievable after emplacement of the final cover to limit releases of radon-222 from uranium byproduct material and prior to placement of erosion protection barriers or other features necessary for long-term control of the tailings, the licensee shall verify through appropriate testing and analysis that the design and construction of the final radon barrier is effective in limiting releases of radon-222 to a level not exceeding 20 pCi/m^2s averaged over the entire pile or impoundment using the procedures described in 40 CFR part 61, appendix B, Method 115, or another method of verification approved by the Executive Secretary as being at least as effective in demonstrating the effectiveness of the final radon barrier.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(3)-21/01: PHASED EMPLACEMENT OF FINAL RADON BARRIER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(3): When phased emplacement of the final radon barrier is included in the applicable reclamation plan, the verification of radon-222 release rates required in paragraph (2) of this criterion must be conducted for each portion of the pile or impoundment as the final radon barrier for that portion is emplaced.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(4)-22/01: REPORT RADON BARRIER EFFECTIVENESS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(4): Within ninety days of the completion of all testing and analysis relevant to the required verification in paragraphs (2) and (3) of 10CFR40, Appendix A, Criterion 6, the uranium mill licensee shall report to the Executive Secretary the results detailing the actions taken to verify that levels of release of radon-222 do not exceed 20 pCi/m^2s when averaged over the entire pile or impoundment. The licensee shall maintain records until termination of the license documenting the source of input parameters including the results of all measurements on which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine compliance. These records shall be kept in a form suitable for transfer to the custodial agency at the time of transfer of the site to DOE or a State for long-term care if requested

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(5)-23/01: ELEVATED RADIUM CONCENTRATIONS IN COVER MATERIALS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(5): Near surface cover materials (i.e., within the top three meters) may not include waste or rock that contains elevated levels of radium; soils used for near surface cover must be essentially the same, as far as radioactivity is concerned, as that of surrounding surface soils. This is to ensure that surface radon exhalation is not significantly above background because of the cover material itself.

Relevant NRC Guidance

Cover Radioactivity Content

> **NUREG-1620, Section 5.1.3.3**: At least the upper 61 cm [2 ft] of the disposal cell cover will contain levels of radioactivity essentially the same as surrounding soils, as demonstrated by an appropriate procedure. The data will be in the reclamation completion report if not available for the reclamation plan.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(6)-24/01: CONCENTRATIONS OF RADIONUCLIDES OTHER THAN RADIUM IN SOIL

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(6): The design requirements in this criterion for longevity and control of radon releases apply to any portion of a licensed and/or disposal site unless such portion contains a concentration of radium in land, averaged over areas of 100 square meters, which, as a result of byproduct material, does not exceed the background level by more than: (i) 5 picocuries per gram (pCi/g) of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over the first 15 centimeters (cm) below the surface, and (ii) 15 pCi/g of radium-226, or, in the case of thorium byproduct material, radium-228, averaged over 15-cm thick layers more than 15 cm below the surface.

Byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at levels which are as low as is reasonably achievable. If more than one residual radionuclide is present in the same 100-square-meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity). A calculation of the potential peak annual TEDE within 1000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site must be submitted for approval. The use of decommissioning plans with benchmark doses which exceed 100 mrem/yr, before application of ALARA, requires the approval of the Executive Secretary after consideration of the recommendation of the staff of the Executive Secretary. This requirement for dose criteria does not apply to sites that have decommissioning plans for soil and structures approved before June 11, 1999.

Relevant NRC Guidance

Background Radiological Characteristics

> **RG 3.8, Section 2.10**: Regional radiological data should be reported, including both natural background radiation levels and results of measurements of concentrations of radioactive materials occurring in important biota, in soil and rocks, in air, and in regional surface and local ground waters. These data, whether determined during the applicant's preoperational surveillance program or obtained from other sources, should be referenced.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6(7)-25/01: NONRADIOLOGICAL HAZARDS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6(7): The licensee shall also address the nonradiological hazards associated with the wastes in planning and implementing closure. The licensee shall ensure that disposal areas are closed in a manner that minimizes the need for further maintenance. To the extent necessary to prevent threats to human health and the environment, the licensee shall control, minimize, or eliminate post-closure escape of nonradiological hazardous constituents, leachate, contaminated rainwater, or waste decomposition products to the ground or surface waters or to the atmosphere.

Relevant NRC Guidance

Regional Nonradiological Characteristics

> **RG 3.8 Section 2.11**: Regional nonradiological characteristics, particularly those that are similar to expected site-related effluents, should be reported. Data should include such parameters as heavy metals and other potentially toxic substances, atmospheric pollutants, and dusts that could affect water or air quality. Other regional sources of these same materials should be noted along with a discussion of the possible contribution to levels found at the facility site.

Concentrations of Nonradioactive Wastes

> **RG 3.8, Section 5.3**: [T]he specific concentrations of nonradioactive wastes in effluents at the points of discharge should be compared with natural ambient concentrations without the discharge and also compared with applicable standards. The projected effects of the effluents for both acute and chronic exposure of human beings (including those resulting from any long-term buildup in soils and sediments and in the biota) should be identified and discussed. Dilution and mixing of discharges into the receiving environs should be discussed in detail, and estimates of concentrations at various relevant distances from the point of discharge should be provided that relate to factors such as dilution, habitations, wells, and water intakes. The effects on humans from changes in terrestrial and aquatic environments from chemicals that contaminate ground water should be included.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 6A(1)-26/01: COMPLETION OF FINAL RADON BARRIER

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 6A(1): For impoundments containing uranium byproduct materials, the final radon barrier must be

completed *as expeditiously as practicable considering technological feasibility* after the pile or impoundment ceases operation in accordance with a written, Executive Secretary-approved reclamation plan. (The term *as expeditiously as practicable considering technological feasibility* as specifically defined in the Introduction of this appendix includes factors beyond the control of the licensee.) Deadlines for completion of the final radon barrier and, if applicable, the following interim milestones must be established as a condition of the individual license: windblown tailings retrieval and placement on the pile and interim stabilization (including dewatering or the removal of freestanding liquids and recontouring). The placement of erosion protection barriers or other features necessary for long-term control of the tailings must also be completed in a timely manner in accordance with a written, Executive Secretary-approved reclamation plan.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 7-29/01: PREOPERATIONAL AND OPERATIONAL MONITORING PROGRAMS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 7: At least one full year prior to any major site construction, a preoperational monitoring program must be conducted to provide complete baseline data on a milling site and its environs. Throughout the construction and operating phases of the mill, an operational monitoring program must be conducted to measure or evaluate compliance with applicable standards and regulations; to evaluate performance of control systems and procedures; to evaluate environmental impacts of operation; and to detect potential long-term effects.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 8-30/01: EFFLUENT CONTROL DURING OPERATIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 8: Milling operations must be conducted so that all airborne effluent releases are reduced to levels as low as is reasonably achievable. The primary means of accomplishing this must be by means of emission controls. Institutional controls, such as extending the site boundary and exclusion area, may be employed to ensure that offsite exposure limits are met, but only after all practicable measures have been taken to control emissions at the source. Notwithstanding the existence of individual dose standards, strict control of emissions is necessary to assure that population exposures are reduced to the maximum extent reasonably achievable and to avoid site contamination. The greatest potential sources of offsite radiation exposure (aside from radon exposure) are dusting from dry surfaces of the tailings disposal area not covered by tailings solution and emissions from yellowcake drying and packaging operations. During operations and prior to closure, radiation doses from radon emissions from surface impoundments of uranium or thorium byproduct materials must be kept as low as is reasonably achievable.

Checks must be made and logged hourly of all parameters (e.g., differential pressures and scrubber water flow rates) that determine the efficiency of yellowcake stack emission control equipment operation. The licensee shall retain each log as a record for three years after the last entry in the log is made. It must be determined whether or not conditions are within a range prescribed to ensure that the equipment is operating consistently near peak efficiency; corrective action must be taken when performance is outside of prescribed ranges. Effluent control devices must be operative at all times during drying and packaging operations and whenever air is exhausting from the yellowcake stack. Drying and packaging operations must terminate when controls are inoperative. When checks indicate the equipment is not operating within the range prescribed for peak efficiency, actions must be taken to restore parameters to the prescribed range. When this cannot be done without shutdown and repairs, drying and packaging operations must cease as soon as practicable. Operations may not be restarted after cessation due to off-normal performance until needed corrective actions have been identified and implemented. All these cessations, corrective actions, and restarts must be reported to the Executive Secretary, in writing, within ten days of the subsequent restart.

To control dusting from tailings, that portion not covered by standing liquids must be wetted or chemically stabilized to prevent or minimize blowing and dusting to the maximum extent reasonably achievable. This requirement may be relaxed if tailings are effectively sheltered from wind, such as may be the case where they are disposed of below grade and the tailings surface is not exposed to wind. Consideration must be given in planning tailings disposal programs to methods which would allow phased covering and reclamation of tailings impoundments because this will help in controlling particulate and radon emissions during operation. To control dusting from diffuse sources, such as tailings and ore pads where automatic controls do not apply, operators shall develop written operating procedures specifying the methods of control which will be utilized.

Milling operations producing or involving thorium byproduct material must be conducted in such a manner as to provide reasonable assurance that the annual dose equivalent does not exceed 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public as a result of exposures to the planned discharge of radioactive materials, radon-220 and its daughters excepted, to the general environment.

Uranium and thorium byproduct materials must be managed so as to conform to the applicable provisions of Title 40 of the Code of Federal Regulations, Part 440, "Ore Mining and Dressing Point Source Category: Effluent Limitations Guidelines and New Source Performance Standards, subpart C, Uranium, Radium, and Vanadium Ores Subcategory," as codified on January 1, 1983.

Relevant NRC Guidance

Gaseous and Airborne Particulate Materials

> **DG-3024, Section 4.1**: Describe all ventilation, filtration, confinement, and dust collection systems that are used during mill operations to control gaseous radioactive materials. Include the type, specifications, and locations of such systems (e.g., ore transfer points, crushing, grinding). Include an analysis of the efficiency of the equipment as designed and operated to prevent radiation exposures to employees and members of the public and to limit such exposures to as low as is reasonably achievable (ALARA). In

addition, describe mill discharge stacks, including stack heights, types and concentration of effluents discharged, and methods (e.g., scrubbers, filters) for controlling releases of radioactive materials and for limiting such releases to ALARA levels. Provide minimum performance specifications for filtration or scrubber efficiency and air flow for the various mill ventilation, filtration, confinement, and dust collection systems. Provide the frequency of tests and inspections to ensure that system performance specifications are being met. Provide an assessment that demonstrates that the gaseous radioactive waste management systems are capable of limiting exposures of employees and members of the public to gaseous and airborne particulate material in compliance with the requirements of 10 CFR Part 20, "Standards for Protection Against Radiation".

Liquids and Solids

DG-3024, Section 4.2: Where retention systems (e.g., levees, dikes, ponds) are used to prevent the release of liquid or solid wastes containing radioactive material to offsite areas or site ground water bodies, provide the information specified in Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities" (Ref. 9), including a description of the planned program for inservice inspection and surveillance of the waste retention systems. (Applicable information concerning this subject, if provided in Section B.2 of this regulatory guide, need not be repeated here.) Demonstrate that the retention system designs will satisfy the ground water protection requirements of Criterion 5 of Appendix A to 10 CFR Part 40.

If effluents are to be released into waters of the United States, discuss the status of efforts to obtain a water quality certification under Section 401 and discharge permits under Section 402 of the Federal Water Pollution Control Act of 1972, as amended (Ref. 10), or submit copies of these items if they are already issued.

Contaminated Equipment

DG-3024, Section 4.3: Describe the methods for disposing of contaminated waste solids (e.g., filters, filter presses, obsolete or worn-out equipment) that are generated in the milling process.

Sources of Mill Wastes and Effluents

RG 3.8, Section 3.4: Clearly identify the location of release points for all gaseous (include stack heights), liquid, and solid wastes and effluents, including bulk storage locations, i.e., piles of ore or tailings or overburden dumps. Specify quantities, concentrations, and physical, chemical, and radiological characteristics of all materials released. Average and maximum release rates should be included plus all pertinent supporting information such as assumptions and computational methods used. The quantities and concentrations of radioactive and nonradioactive materials that will be released into the environs should be compared with State and other applicable standards.

Suggested formats for supplying this material on radioactive emissions are included as Appendix B of this guide. The tables supplied by the applicant should not be limited to the examples listed, however.

Controls of Mill Wastes and Effluents

RG 3.8, Section 3.5: Provide a description of mill waste and effluent control systems and equipment for minimizing to as low as is reasonably achievable the quantities of materials released into the environment. Identify the operating efficiency of such systems and equipment in relation to current best methods for controlling milling wastes and effluents. Also, identify the factors that affect these efficiencies, and describe the operating practices to be pursued during the life of the proposed project.

For waste retention systems, a design analysis of the integrity of the proposed systems should be provided. This should include:

1. Drawings showing the layout in plan, typical cross sections of all embankments showing proposed design and, if applicable, anticipated future extensions, and other pertinent design details. Embankment designs should include information on heights, top width, side slopes, freeboard, seepage control, and protection of embankment surfaces as well as foundation design. See Regulatory Guide 3.11, "Design, Construction, and Inspection of Embankment Retention Systems for Uranium Mills."

2. The results of soil tests, geologic exploration, foundation materials stability investigations, as well as characteristics of fill material and a description of the construction methods and specifications.

Sanitary and Other Mill Waste Systems

RG 3.8, Section 3.6: Describe any other nonradioactive solid or liquid waste materials, such as sanitary, laundry, and chemical laboratory wastes that may be generated during operation. Describe the manner in which they will be treated and controlled, and describe procedures for disposal.

Means for control and treatment of all systems subject to effluent limitation guidelines and standards of performance under the Federal Water Pollution Control Act (FWPCA) should be described.

The applicant should (a) describe any other airborne effluents (e.g., from diesel engines, gas turbines, heating plants, incinerators) created during project operation, (b) estimate the frequency of release and describe how they will be treated before release to the environment, and (c) estimate the total quantity of pollutants to be discharged annually.

The radionuclide and chemical concentrations in the liquid and gaseous effluents discharged from the site are listed. In this section, the applicant should consider how these effluents are quantitatively distributed in the environment. Specifically, estimates should be provided for the concentration (a) in any water sources, (b) on land areas, and (c) on vegetation (on a per unit area basis) in the environs.

If there are other components of the physical environment that may become contaminated and thus result in the exposure of living organisms to radiation, they should be identified and their radioactivity burden estimated. In addition, information concerning any cumulative buildup of radionuclides in the environment should be presented and discussed. A summary

of data, assumptions, and models used in determining radioactivity concentrations and burdens should be provided.

From considerations of the exposure pathways and the distribution of radioactivity released into the environs, the applicant should estimate the maximum radionuclide concentrations that may be present in important local flora and local and migratory fauna. Values of bioaccumulation factors used in preparing the estimates should be based on site-specific data if available; otherwise, values from the literature may be used. The applicant should tabulate and reference the values of bioaccumulation factors used in the calculations.

Effluents in the Environment

RG 3.8, Section 5.1.2: The radionuclide and chemical concentrations in the liquid and gaseous effluents discharged from the site are listed. In this section, the applicant should consider how these effluents are quantitatively distributed in the environment. Specifically, estimates should be provided for the concentration (a) in any water sources, (b) on land areas, and (c) on vegetation (on a per unit area basis) in the environs.

If there are other components of the physical environment that may become contaminated and thus result in the exposure of living organisms to radiation, they should be identified and their radioactivity burden estimated. In addition, information concerning any cumulative buildup of radionuclides in the environment should be presented and discussed. A summary of data, assumptions, and models used in determining radioactivity concentrations and burdens should be provided.

From considerations of the exposure pathways and the distribution of radioactivity released into the environs, the applicant should estimate the maximum radionuclide concentrations that may be present in important local flora and local and migratory fauna. Values of bioaccumulation factors used in preparing the estimates should be based on site-specific data if available; otherwise, values from the literature may be used. The applicant should tabulate and reference the values of bioaccumulation factors used in the calculations.

Effluent Control Techniques

DG-3024, Section 5.7.1: Describe the proposed systems and procedures designed to minimize in-plant and environmental emissions at each step of the milling process where releases might occur. Provide the minimum performance specifications (e.g., filtration or scrubber efficiency and airflow) for operating the ventilation, filtration, and confinement systems throughout the recovery plant and associated laboratories at their reasonably expected best performance. In addition, provide the frequency of tests and inspections to ensure that these specifications are being met. Include descriptions of the contingency plans to be implemented in the event of equipment failures or spills.

External Radiation Exposure Monitoring Program

DG-3024, Section 5.7.2: Describe the proposed methods, instrumentation, and equipment for determining exposures of employees to external radiation, in conformance with Subpart C, “Occupational Dose Limits,” of 10 CFR Part 20, during routine and nonroutine operations, maintenance, and cleanup activities. In addition, describe the type

of surveys to be conducted, criteria for determining survey locations, frequency of surveys, action levels, management audits, and corrective action requirements. For personnel monitoring devices, such as film badges, indicate the number and category of personnel involved in the program and the sensitivity and range of the devices.

Airborne Radiation Monitoring Program

DG-3024, Section 5.7.3: Describe the proposed sampling program to determine concentrations of airborne radioactive materials (including radon) during routine and nonroutine operations, maintenance, and cleanup activities. (See 10 CFR 20.1204, "Determination of Internal Exposure"; 10 CFR 20.1301, "Dose Limits for Individual Members of the Public"; 10 CFR 20.1501, "General"; and 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose.") In the description of the sampling program, include the following:

- Criteria for determining sampling locations with respect to process operations and personnel occupancy,
- Frequency of sampling,
- Type of analyses,
- Sensitivity of overall sampling and analyses,
- Action levels,
- Management audits,
- Corrective action requirements,
- Instrumentation calibration frequency, and
- Procedures for sample analyses and instrument calibration (in an appendix)

Exposure Calculations

DG-3024, Section 5.7.4: Consistent with the requirements of Subpart C of 10 CFR Part 20, describe the proposed procedure to determine the intake of radioactive materials by personnel in work areas where airborne radioactive materials could exist. Include those exposures incurred during nonroutine operations, maintenance, and cleanup activities as well as during routine activities.

Bioassay Program

DG-3024, Section 5.7.5: Describe the proposed bioassay program to confirm the results derived from the programs identified in subsections B.5.3 [sic] and B.5.4 [sic]. Indicate the number and category of personnel involved in the program, the types and frequencies of bioassays performed, and the action level criteria to be applied to bioassay results. (See 10 CFR 20.1204 and Subpart L, "Records," of 10 CFR Part 20.)

Contamination Control Program

DG-3024, Section 5.7.6: Describe the proposed occupational radiation survey program to determine that employees (plus their work clothes or coveralls and other items) entering clean areas (e.g., lunchrooms, offices) or leaving the site are not contaminated with radioactive materials. Include proposed housekeeping and cleanup requirements and specifications in process areas to control contamination; frequency of surveys of clean areas; survey methods; and minimum sensitivity, range, and calibration frequency of survey equipment. Provide proposed contamination criteria or action levels for clean areas and for the release of materials, equipment, and work clothes to clean areas or from the site. Procedures for instrument calibration should be included in an appendix. (See 10 CFR 20.1101, "Radiation Protection Programs"; 10 CFR 20.1501; and 10 CFR 20.1702, "Use of Other Controls." See also subsection B.5.7.6 of NUREG-1569, "Standard Review Plan for In Situ Leach Uranium Extraction Applications," issued June 2003 (Ref. 13), for additional guidance on acceptable contamination control programs.)

Airborne Effluent and Environmental Monitoring Programs

DG-3024, Section 5.7.7: Describe in detail the proposed effluent and environmental monitoring programs, including methods and procedures for measuring concentrations and quantities of both radioactive and nonradioactive materials released to the environs. In the description of the proposed monitoring programs, include the technical basis used to determine environmental concentrations to show conformance with 10 CFR 20.1302, "Compliance with Dose Limits for Individual Members of the Public," and 10 CFR 20.1501.

For the frequency of sampling and analysis of both effluent and environmental monitoring, provide the types and sensitivity of analysis, action levels and corrective action requirements, and the minimum number and criteria for locating effluent and environmental monitoring stations. Indicate proposed locations of the monitoring stations on a topographic map of the site and surrounding area. (See Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills" (Ref. 14), in connection with this section.).

Ground Water and Surface Water Monitoring Programs

DG-3024, Section 5.7.8: As required by Criterion 7A of Appendix A to 10 CFR Part 40, describe the detection monitoring program to be used to determine if process effluents are reaching site ground water supplies. In addition, describe the planned monitoring to detect the presence of process effluents in any local surface waters. In this description, provide the technical basis for the monitoring programs, including the number and location of monitoring stations, the criteria used for locating sampling stations and determining sampling frequency, and action levels and corrective action requirements. The procedures for sample collection and analyses for the constituents of concern found in tailings liquor should be provided in an appendix. In addition, another appendix should be included to show a figure of the monitoring locations around the mill and surrounding area.

Control of Windblown Tailings and Ore

> **DG-3024, Section 5.7.9**: Describe the interim stabilization measures (during milling operations) to eliminate the blowing of tailings from the tailings retention system and ore dust from ore piles. Also describe any means (e.g., curbs, drains, sumps) planned to control the spread or seepage of fines from the ore pad and pile to adjacent soils as a result of rainfall or thunderstorm events. Demonstrate that these contamination control and stabilization measures will be adequate under potentially severe wind and weather conditions at the mill site.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 8A-31/01: DAILY INSPECTIONS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 8A: Daily inspections of tailings or waste retention systems must be conducted by a qualified engineer or scientist and documented. The licensee shall retain the documentation for each daily inspection as a record for three years after the documentation is made. The Executive Secretary must be immediately notified of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas, or of any unusual conditions (conditions not contemplated in the design of the retention system) that is not corrected could indicate the potential or lead to failure of the system and result in a release of tailings or waste into unrestricted areas.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 9-32/01: FINANCIAL SURETY ARRANGEMENTS

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 9: Financial surety arrangements must be established by each mill operator prior to the commencement of operations to assure that sufficient funds will be available to carry out the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas. The amount of funds to be ensured by such surety arrangements must be based on Executive Secretary-approved cost estimates in a Executive Secretary-approved plan for (1) decontamination and decommissioning of mill buildings and the milling site to levels which allow unrestricted use of these areas upon decommissioning, and (2) the reclamation of tailings and/or waste areas in accordance with technical criteria delineated in Section I of this Appendix. The licensee shall submit this plan in conjunction with an environmental report that addresses the expected environmental impacts of the milling operation, decommissioning and tailings reclamation, and evaluates alternatives for mitigating these impacts. The surety must also cover the payment of the charge for long-term surveillance and control required by Criterion 10.

In establishing specific surety arrangements, the licensee's cost estimates must take into account total costs that would be incurred if an independent contractor were hired to perform the decommissioning and reclamation work. In order to avoid unnecessary duplication and expense, the Executive Secretary may accept financial sureties that have been consolidated with financial or surety arrangements established to meet requirements of other Federal or state agencies and/or local governing bodies for such decommissioning, decontamination, reclamation, and long-term site surveillance and control, provided such arrangements are considered adequate to satisfy these requirements and that the portion of the surety which covers the decommissioning and reclamation of the mill, mill tailings site and associated areas, and the long-term funding charge is clearly identified and committed for use in accomplishing these activities. The licensee's surety mechanism will be reviewed annually by the Executive Secretary to assure, that sufficient funds would be available for completion of the reclamation plan if the work had to be performed by an independent contractor. The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs. Regardless of whether reclamation is phased through the life of the operation or takes place at the end of operations, an appropriate portion of surety liability must be retained until final compliance with the reclamation plan is determined.

This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance would be provided with a surety instrument which is written for a specified period of time (e.g., 5 years) yet which must be automatically renewed unless the surety notifies the beneficiary (the Executive Secretary) and the principal (the licensee) some reasonable time (e.g., 90 days) prior to the renewal date of their intention not to renew. In such a situation the surety requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief period of time to allow at least 60 days for the regulatory agency to collect.

Proof of forfeiture must not be necessary to collect the surety so that in the event that the licensee could not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The conditions described above would have to be clearly stated on any surety instrument which is not open-ended, and must be agreed to by all parties. Financial surety arrangements generally acceptable to the Executive Secretary are:

(a) Surety bonds;

(b) Cash deposits;

(c) Certificates of deposits;

(d) Deposits of government securities;

(e) Irrevocable letters or lines of credit; and

(f) Combinations of the above or such other types of arrangements as may be approved by the Executive Secretary. However, self insurance, or any arrangement which essentially constitutes self insurance (e.g., a contract with a State or Federal agency), will not satisfy the surety

requirement since this provides no additional assurance other than that which already exists through license requirements.

Relevant NRC Guidance

Financial Assurance

DG-3024, Section 8.3: Criterion 9 of Appendix A to 10 CFR Part 40 specifies that each mill operator must establish financial surety arrangements before the commencement of operations to ensure that sufficient funds will be available to carry out the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas. In the application, give sufficient information to verify that the amount of coverage provided by a financial surety arrangement will permit the completion of all decontamination, decommissioning, and reclamation of sites, structures, and equipment used in the recovery and production of uranium and the concomitant generation of byproduct material. Calculate the cost estimate on the basis of completion of all activities by a third party. The surety must also cover the payment of the charge for long-term surveillance and control of the site as required by Criterion 10 of Appendix A to 10 CFR Part 40. (See Appendix C to NUREG-1620 for additional information on the scope and content of the cost information to be submitted for financial assurance purposes.)

RG 3.8, Chapter 9: Detailed discussions should be provided for the following:

1. Plans for reclaiming and restoring lands disturbed by mining and milling activities. These plans should provide sufficient details for the staff to assess the suitability of these plans when compared to other alternatives (e.g., horizontal-vertical slope, type of cover, sources and thicknesses of cover materials, revegetation species, schedule of events from shutdown through final reclamation).

2. A technical and financial feasibility assessment on methods and costs of mill decommissioning and site reclamation, including tailings area.

3. Financial arrangements to be made (such as bonding arrangements) to ensure that adequate funds will be available for mill decommissioning, site reclamation, and restoration when operations are concluded.

Maintaining Financial Surety

NUREG-1620, Section 4.4.3(10): The licensee must maintain a financial surety, within the specific license, for the cleanup of ground water, with the surety sufficient to recover the anticipated cost and time frame for achieving compliance, before the land is transferred to the long-term custodian. The financial surety must be sufficient to cover the cost of corrective action measures that will have to be implemented if required to restore ground-water quality to the established site-specific standards (including an alternate concentration limit standard) before the site is transferred to the government for long-term custody. Guidance on establishing financial surety is presented in NRC (1988, 1997). Appendix C to this standard review plan provides an outline of the cost elements appropriate for establishing surety amounts for conventional uranium mills. The financial surety review is

acceptable if the applicant's assessment and any staff assessment of the surety amounts are reasonably consistent.

INTERROGATORY WHITE MESA CELL 4B 10CFR40, APPENDIX A, CRITERION 10-33/01: COSTS OF LONG-TERM SURVEILLANCE

REGULATORY BASIS:

UAC R313-24-4 invokes the following requirement from 10CFR40, Appendix A, Criterion 10: A minimum charge of [$855,000 (2008 dollars)] to cover the costs of long-term surveillance must be paid by each mill operator to the general treasury of the United States or to an appropriate State agency prior to the termination of a uranium or thorium mill license.

If site surveillance or control requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in Criterion 12 (e.g., if fencing is determined to be necessary), variance in funding requirements may be specified by the Executive Secretary. In any case, the total charge to cover the costs of long-term surveillance must be such that, with an assumed 1 percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The total charge will be adjusted annually prior to actual payment to recognize inflation. The inflation rate to be used is that indicated by the change in the Consumer Price Index published by the U.S. Department of Labor, Bureau of Labor Statistics.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.3-35/01: GROUND WATER DISCHARGE PERMIT APPLICATION

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6 in lieu of 10CFR40 Appendix A, Criterion 5B(1) thru 5H, Criterion 7A, and Criterion 13. In turn, UAC R317-6-6.3 outlines the content requirements of a State Ground Water Discharge Permit (Permit) application.

Unless otherwise determined by the Executive Secretary, the application for a permit to discharge wastes or pollutants to ground water shall include the following complete information:

A. The name and address of the applicant and the name and address of the owner of the facility if different than the applicant. A corporate application must be signed by an officer of the corporation. The name and address of the contact, if different than above, and telephone numbers for all listed names shall be included.

B. The legal location of the facility by county, quarter-quarter section, township, and range.

C. The name of the facility and the type of facility, including the expected facility life.

D. A plat map showing all water wells, including the status and use of each well, Drinking Water source protection zones, topography, springs, water bodies, drainages, and man-made structures within a one-mile radius of the discharge. The plat map must also show the location and depth of existing or proposed wells to be used for monitoring ground water quality. Identify any applicable Drinking Water source protection ordinances and their impacts on the proposed permit.

E. Geologic, hydrologic, and agricultural description of the geographic area within a one-mile radius of the point of discharge, including soil types, aquifers, ground water flow direction, ground water quality, aquifer material, and well logs.

F. The type, source, and chemical, physical, radiological, and toxic characteristics of the effluent or leachate to be discharged; the average and maximum daily amount of effluent or leachate discharged (gpd), the discharge rate (gpm), and the expected concentrations of any pollutant (mg/l) in each discharge or combination of discharges. If more than one discharge point is used, information for each point must be given separately.

G. Information which shows that the discharge can be controlled and will not migrate into or adversely affect the quality of any other waters of the state, including the applicable surface water quality standards, that the discharge is compatible with the receiving ground water, and that the discharge will comply with the applicable class TDS limits, ground water quality standards, class protection levels or an alternate concentration limit proposed by the facility.

H. For areas where the ground water has not been classified by the Board, information on the quality of the receiving ground water sufficient to determine the applicable protection levels.

I. A proposed sampling and analysis monitoring plan which conforms to EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (EPA/600/R-98/018, February 1998) and includes a description, where appropriate, of the following:

1. ground water monitoring to determine ground water flow direction and gradient, background quality at the site, and the quality of ground water at the compliance monitoring point;

2. installation, use and maintenance of monitoring devices;

3. description of the compliance monitoring area defined by the compliance monitoring points including the dimensions and hydrologic and geologic data used to determine the dimensions;

4. monitoring of the vadose zone;

5. measures to prevent ground water contamination after the cessation of operation, including post-operational monitoring;

6. monitoring well construction and ground water sampling which conform where applicable to the Handbook of Suggested Practices for Design and Installation of Ground-Water Monitoring Wells (EPA/600/4-89/034, March 1991), ASTM

Standards on Ground Water and Vadose Investigations (1996), Practical Guide for Ground Water Sampling EPA/600/2-85/104, (November 1985) and RCRA Ground Water Monitoring Technical Enforcement Guidance Document (1986), unless otherwise specified by the Executive Secretary;

7. description and justification of parameters to be monitored;

8. quality assurance and control provisions for monitoring data.

J. The plans and specifications relating to construction, modification, and operation of discharge systems.

K. The description of the ground water most likely to be affected by the discharge, including water quality information of the receiving ground water prior to discharge, a description of the aquifer in which the ground water occurs, the depth to the ground water, the saturated thickness, flow direction, porosity, hydraulic conductivity, and flow systems characteristics.

L. The compliance sampling plan which in addition to the information specified in the above item I includes, where appropriate, provisions for sampling of effluent and for flow monitoring in order to determine the volume and chemistry of the discharge onto or below the surface of the ground and a plan for sampling compliance monitoring points and appropriate nearby water wells. Sampling and analytical methods proposed in the application must conform with the most appropriate methods specified in the following references unless otherwise specified by the Executive Secretary:

1. Standard Methods for the Examination of Water and Wastewater, twentieth edition, 1998; Library of Congress catalogue number: ISBN: 0-87553-235-7.

2. E.P.A. Methods, Methods for Chemical Analysis of Water and Wastes, 1983; Stock Number EPA-600/4-79-020.

3. Techniques of Water Resource Investigations of the U.S. Geological Survey, (1998); Book 9.

4. Monitoring requirements in 40 CFR parts 141 and 142, 2000 ed., Primary Drinking Water Regulations and 40 CFR parts 264 and 270, 2000 ed.

5. National Handbook of Recommended Methods for Water-Data Acquisition, GSA-GS edition; Book 85 AD-2777, U.S. Government Printing Office Stock Number 024-001-03489-1.

M. A description of the flooding potential of the discharge site, including the 100-year flood plain, and any applicable flood protection measures.

N. Contingency plan for regaining and maintaining compliance with the permit limits and for reestablishing best available technology as defined in the permit.

O. Methods and procedures for inspections of the facility operations and for detecting failure of the system.

P. For any existing facility, a corrective action plan or identification of other response measures to be taken to remedy any violation of applicable ground water quality standards, class TDS limits or permit limit established under R317-6-6.4E. which has resulted from discharges occurring prior to issuance of a ground water discharge permit.

Q. Other information required by the Executive Secretary.

R. All applications for a groundwater discharge permit must be performed under the direction, and bear the seal, of a professional engineer or professional geologist.

S. A closure and post closure management plan demonstrating measures to prevent ground water contamination during the closure and post closure phases of an operation.

Reference can be made to DG-3024 (e.g., Sections 3.1 through 3.3), NUREG-1620 (e.g., Sections 2.6.3 and 2.7.3), and RG 3.8 (e.g., Sections 1, 3.3, and 4.1) as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.4-36/01: ISSUANCE OF DISCHARGE PERMIT

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.4 in lieu of comparable requirements in 10CFR40:

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:

1. the applicant demonstrates that the applicable class TDS limits, ground water quality standards protection levels, and permit limits established under R317-6-6.4E will be met;

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; and

4. there is no impairment of present and future beneficial uses of the ground water.

B. The Board mayapprove an alternate concentration limit for a new facility if:

1. The applicant submits a petition for an alternate concentration limit showing the extent to which the discharge will exceed the applicable class TDS limits, ground water standards or applicable protection levels and demonstrates that:

a. the facility is to be located in an area of Class III ground water;

b. the discharge plan incorporates the use of best available technology;

c. the alternate concentration limit is justified based on substantial overriding social and economic benefits; and,

d. the discharge would pose no threat to human health and the environment.

2. One or more public hearings have been held by the Board in nearby communities to solicit comment.

C. The Executive Secretary may issue a ground water discharge permit for an existing facility provided:

1. the applicant demonstrates that the applicable class TDS limits, ground water quality standards and protection levels will be met;

2. the monitoring plan, sampling and reporting requirements are adequate to determine compliance with applicable requirements;

3. the applicant utilizes treatment and discharge minimization technology commensurate with plant process design capability and similar or equivalent to that utilized by facilities that produce similar products or services with similar production process technology; and,

4. there is no current or anticipated impairment of present and future beneficial uses of the ground water.

D. The Board may approve an alternate concentration limit for a pollutant in ground water at an existing facility or facility permitted by rule under R317-6-6.2 if the applicant for a ground water discharge permit shows the extent the discharge exceeds the applicable class TDS limits, ground water quality standards and applicable protection levels that correspond to the otherwise applicable ground water quality standards and demonstrates that:

1. steps are being taken to correct the source of contamination, including a program and timetable for completion;

2. the pollution poses no threat to human health and the environment; and

3. the alternate concentration limit is justified based on overriding social and economic benefits.

E. An alternate concentration limit, once adopted by the Board under R317-6-6.4B or R317-6-6.4D, shall be the pertinent permit limit.

F. A facility permitted under this provision shall meet applicable class TDS limits, ground water quality standards, protection levels and permit limits.

G. The Board may modify a permit for a new facility to reflect standards adopted as part of corrective action.

Relevant NRC Guidance

Reference can also be made to DG-3024, NUREG-1620 (e.g., Section 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.9-37/01: PERMIT COMPLIANCE MONITORING

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.9 in lieu of comparable requirements in 10CFR40:

A. Ground Water Monitoring

The Executive Secretary may include in a ground water discharge permit requirements for ground water monitoring, and may specify compliance monitoring points where the applicable class TDS limits, ground water quality standards, protection levels or other permit limits are to be met.

The Executive Secretary will determine the location of the compliance monitoring point based upon the hydrology, type of pollutants, and other factors that may affect the ground water quality. The distance to the compliance monitoring points must be as close as practicable to the point of discharge. The compliance monitoring point shall not be beyond the property boundaries of the permitted facility without written agreement of the affected property owners and approval by the Executive Secretary.

B. Performance Monitoring

The Executive Secretary may include in a ground water discharge permit requirements for monitoring performance of best available technology standards.

Relevant NRC Guidance

Examination of the Compliance Monitoring Program

> **NUREG-1620, Section 4.3.3.4**: The compliance monitoring program should monitor all ground-water exposure pathways to assure that any potential exceedances of the proposed alternate concentration limit will be detected before the license is terminated. The compliance monitoring well locations should not be restricted solely to the point of compliance. Some locations between the point of compliance and the points of exposure should be included to assure the identified aquifer attenuation mechanisms are reducing the hazardous constituent concentrations to the predicted levels. The applicable maximum contaminant level, background concentration, or other maximum permissible limit should be used as the compliance monitoring limit for wells at the points of exposure, in those cases where compliance monitoring is conducted at the points of exposure.

Reference can also be made to DG-3024, NUREG-1620 (e.g., Section 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-38/01: BACKGROUND WATER QUALITY DETERMINATION

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.10 in lieu of comparable requirements in 10CFR40:

A. Background water quality contaminant concentrations shall be determined and specified in the ground water discharge permit. The determination of background concentration shall take into account any degradation.

B. Background water quality contaminant concentrations may be determined from existing information or from data collected by the permit applicant. Existing information shall be used, if the permit applicant demonstrates that the quality of the information and its means of collection are adequate to determine background water quality. If existing information is not adequate to determine background water quality, the permit applicant shall submit a plan to determine background water quality to the Executive Secretary for approval prior to data collection. One or more up-gradient, lateral hydraulically equivalent point, or other monitoring wells as approved by the Executive Secretary may be required for each potential discharge site.

C. After a permit has been issued, permittee shall continue to monitor background water quality contaminant concentrations in order to determine natural fluctuations in concentrations. Applicable up-gradient, and on-site ground water monitoring data shall be included in the ground water quality permit monitoring report.

Relevant NRC Guidance

Reference can also be made to DG-3024, NUREG-1620 (e.g., Section 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.12-40/01: SUBMISSION OF DATA

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.12 in lieu of comparable requirements in 10CFR40:

A. Laboratory Analyses

All laboratory analysis of samples collected to determine compliance with these regulations shall be performed in accordance with standard procedures by the Utah Division of Laboratory Services or by a laboratory certified by the Utah Department of Health.

B. Field Analyses

All field analyses to determine compliance with these regulations shall be conducted in accordance with standard procedures specified in R317-6-6.3.L.

C. Periodic Submission of Monitoring Reports

Results obtained pursuant to any monitoring requirements in the discharge permit and the methods used to obtain these results shall be periodically reported to the Executive Secretary according to the schedule specified in the ground water discharge permit.

Relevant NRC Guidance

Reference can be made to DG-3024, NUREG-1620 (e.g., Sections 4.1.3 and 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.13-41/01: REPORTING OF MECHANICAL PROBLEMS OR DISCHARGE SYSTEM FAILURES

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.13 in lieu of comparable requirements in 10CFR40:

The permittee shall notify the Executive Secretary within 24 hours of the discovery of any mechanical or discharge system failures that could affect the chemical characteristics or volume of the discharge. A written statement confirming the oral report shall be submitted to the Executive Secretary within five days of the failure.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-42/01: CORRECTION OF ADVERSE EFFECTS

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.14 in lieu of comparable requirements in 10CFR40:

A. If monitoring or testing indicates that the permit conditions may be or are being violated by ground water discharge operations or the facility is otherwise in an out-of-compliance status, the permittee shall promptly make corrections to the system to correct all violations of the discharge permit.

B. The permittee, operator, or owner may be required to take corrective action as described in

Relevant NRC Guidance:

Corrective Action

NUREG-1620, Section 4.3.3.3: The ground-water corrective action and compliance monitoring plans are acceptable if they meet the following criteria.

(1) Sufficient data are available to adequately define relevant parameters and to support models, assumptions, and boundary conditions necessary for developing detailed and site-scale models of the ground-water cleanup and the estimation of cleanup time. The data are also sufficient to assess the degree to which processes related to the ground-water cleanup that affect compliance with the technical criteria in Appendix A of 10 CFR Part 40 have been characterized. Information required for site-scale reactive transport models can include:

(a) Site description.

(i) Chronology/history of uranium milling operations.

(ii) List of known leaching solutions and other chemicals used in the milling process.

(iii) Summary of known impacts of the site activities on the hydrologic system and background water quality.

(iv) Quantity and chemical/textural characteristics of wastes generated at the mill site.

(v) Information pertaining to surrounding land and water uses.

(vi) Meteorological data for the region including precipitation and other data to support estimates of evapotranspiration.

(b) Description of hydrogeologic units.

(i) Hydrostratigraphic cross sections/maps.

(ii) Hydrogeologic units that constitute the aquifer(s).

(iii) Description of perched aquifers (areal/volumetric extent).

(iv) Description of the unsaturated zone (thickness, extent).

(v) Geologic characteristics (presence of layers, continuity, faults).

(c) Data on the hydraulic and transport properties of each aquifer. Protecting Water Resources

(i) Hydraulic conductivity.

(ii) Thickness of each unit.

(iii) Hydraulic head contour maps (of each aquifer).

(iv) Information on background horizontal and vertical hydraulic gradients and temporal variations to determine flow directions.

(v) Vertical hydraulic gradients and inter-aquifer flow within and between multiple aquifer systems.

(vi) Effective porosity

(vii) Storativity or specific yield (for transient simulations).

(viii) Longitudinal, vertical and horizontal transverse dispersivity.

(ix) Retardation factors.

(c) Data on regional recharge rates and ground-water/surface-water interactions with nearby streams, rivers, or lakes.

(i) Areal recharge rates.

(ii) Information on water fluxes to and from rivers, aquifers, and surface water bodies.

(iii) Data on surface water bodies (e.g., stream flow rates, dimensions of nearby surface water bodies).

(iv) Concentration of hazardous constituents in surface water bodies

(d) Characteristics of the mill tailings.

(i) Identification of contaminant source terms.

(ii) Hydraulic properties of mill tailings material.

(iii) Unsaturated flow and transport parameters of mill tailings material.

(iv) Design and materials for mill tailings cover.

(v) Information on the spatial and temporal distribution of seepage fluxes from the mill tailings to the upper-most aquifer (including the historical variation in rates).

(vi) Information on mill tailings draining mechanisms and drainage volume. Protecting Water Resources 4-44

(vii) Geotechnical properties of the mill tailings and their temporal variation due to drainage of leachates

(viii) Tailings volume.

(ix) Data on the volume, chemical and mineralogical characteristics, and concentration of mill tailings and tailings solution/leachate.

(x) Mass of hazardous constituents placed in the tailings pile and other disposal or storage areas.

(e) Data on geochemical conditions and water quality.

(i) Concentration of hazardous constituents.

(ii) Background (baseline) ground-water quality.

(iii) Delineation of the nature and extent of the hazardous constituent plume.

(iv) Characterization of subsurface geochemical properties.

(v) Identification of attenuation mechanisms and estimation of attenuation rates.

(vi) Mass of hazardous constituents in the aquifer.

(f) Site cleanup data.

(i) Information on grout curtains, slurry walls, drains, interceptor ditches, and other facilities designed to reduce the spreading of the hazardous constituent plume (if used).

(ii) Information on pumping, injection, and sampling wells (coordinates, depths, completion diagrams, flow rates).

(iii) Pumping/injection rates and rate history for each well (if pumping has been ongoing).

(iv) Information on the presence or the absence of liners for the mill tailings pile and evaporation ponds.

(v) Mass of hazardous constituents recovered to date.

Sufficient data are available to justify models used to validate the ground-water corrective action plan. American Standard for Testing and Materials D 5490 provides acceptable guidance for comparing model simulations to site-specific information. Alternatively, in the case of sparse data and/or low confidence in the quality of available data or data interpretations, the licensee demonstrates by sensitivity analyses or other methods that the proposed ground-water corrective action plan is appropriate, and the contingency built into the surety is compatible with the uncertainties. American Standard for Testing and Materials D 5611 provides acceptable guidance for conducting sensitivity analyses on ground-water flow models. Guidance on preparing cost estimates and establishing sureties for uranium mills is provided in the “Technical Position on Financial Assurances and Reclamation, Decommissioning, and Long-Term Surveillance and Control of Uranium Recovery Facilities” (NRC, 1988).

Sufficient information is provided to substantiate that any mathematical flow and transport modeling approach is appropriate for site conditions considering (i) factors pertaining to the specific purpose or intended use of the model(s); (ii) the flow media at the site and along the flow path from the mill tailings to the point of compliance, and downgradient to it, including aquifer properties and transport parameters (e.g., porous media versus fracture flow, aquifer confinement, the number of active layers); (iii) modeling assumptions (e.g., steady-state versus transient flow, assignment of initial and

boundary conditions); and (iv) model-related factors (e.g., underlying flow equations; solution methods; model history; model verification, validation and calibration; expertise and experience of the personnel responsible for model development; and quality of model documentation). American Standard for Testing and Materials D 5718 provides guidance for documenting ground-water flow model applications.

An adequate assessment is provided of the low and high permeability features (heterogeneities), their spatial distributions, and statistical properties; and the available and acquired data are suitable and sufficient for modeling based on observations, independent analyses, or published reports and databases of those features.

Initial and boundary conditions used by the licensee in modeling the ground-water cleanup are justified by the available data, are used consistently throughout the modeling process, and are adequately documented. American Standard for Testing and Materials D 5609 provides acceptable guidance for defining boundary conditions for ground-water flow models.

Where sufficient data do not exist, the definition of parameter values and conceptual models are based on appropriate sources from the literature or are otherwise technically justified.

Adequate site geochemical data are provided. Contaminants are identified sufficiently to support the ground-water corrective action plan and models. In addition to helping set cleanup goals, background water chemical data support assessments of geochemical evolution as ambient ground water is restored in the subsurface.

Generally, a three-dimensional delineation of contaminant distribution and a source term are necessary for defining needed actions and for model development. The important geochemical parameters that should be delineated for both contaminated and background waters are pH, Eh, dissolved oxygen, temperature, major cation and anion concentrations, and concentrations of potential contaminants. Host rock properties affect both the water chemistry and the specific geochemical mechanisms affecting contaminants. Identifying possible attenuation mechanisms ensures that cleanup is based on reasonable models for contaminant transport.

(2) Parameter values, assumed ranges, probability distributions, and/or bounding assumptions used in the modeling of ground-water cleanup are technically defensible and reasonably account for uncertainties and variabilities. The technical bases for each parameter value, ranges of values, or probability distributions used in the modeling of the ground-water cleanup are provided.

Sensitivity analyses are provided that (i) identify aquifer flow and transport parameters that are expected to significantly affect the site model outcome; (ii) test the degree to which the performance of the ground-water cleanup may be affected if a range of parameter values must be used as input to the model due to sparsity of, or uncertainty in, available data; and (iii) test for the need for additional data.

Sufficient bases are provided for parameter values, representative parameter values are taken from the literature, and the bounds and statistical distributions are provided for

hydrologic and transport parameters that are important to the estimation of cleanup time and that are included in the modeling of the ground-water cleanup.

Site data fitted to theoretical models compare reasonably well. American Standard for Testing and Materials D 5490 provides guidance for comparing ground-water flow model simulations to site-specific information. If there is departure of site data from the theoretical model, then an alternate model is considered. The assumptions used in modeling are consistent with site data and observations.

Models used to describe local phenomena, such as the fluxes through the tailings pile, are based on consistently applied conditions.

(3) Important design features, physical phenomena, and consistent and appropriate assumptions are identified and described sufficiently for incorporation into any modeling that supports the ground-water cleanup, including the estimate of cleanup time, and the technical bases are provided. Detailed models and site-scale models used to support the corrective action plan, or other supporting documents, and identify and describe aspects that are important to the cleanup and the estimate of cleanup time.

The licensee delineates the extent of the hazardous constituent plume, contaminant flow paths in the aquifer considering natural site conditions, any effects that can be expected to result from construction of additional facilities and operations (i.e., tailings ponds, evaporation ponds, excavations), and events that may affect the spatial and temporal distribution of the hazardous constituent plume. More specifically, the licensee's models of the ground-water cleanup consider and are consistent with (i) natural climatic, geologic, and hydrologic conditions at the site and in the vicinity of the site; (ii) tailings pile design and construction features and their potential impact on local recharge and consequent flow paths in the aquifer; (iii) geochemical and other processes that can affect the performance of the ground-water cleanup and estimation of cleanup time; and (iv) future events, including additional construction and changes of plans for operations that may occur at the site. The licensee also has determined the range of concentrations of hazardous constituents that can be expected in the aquifer and their changes with time during the ground-water cleanup.

The licensee estimates the total mass of hazardous constituents produced by the leaching process and the quantity of the mass that is in the mill tailings, the aquifer, in surface water bodies (including evaporation ponds, disposal cells, nearby ponds, and rivers) and the portion that has been removed by means of the ground-water cleanup, and accounts for the mass that will be removed for final disposal.

The licensee makes reasonable assumptions, if taking credit for dispersion of hazardous constituents and consequent reduction of concentrations during transport from the mill tailings to the point of compliance, for such processes as mechanical dispersion and mixing with native ground water and surface water. These assumptions are based on available data about the hydraulic and transport properties of the site and the spatial variations of properties of aquifers and ground-water volumetric fluxes along the flow paths.

The licensee provides an adequate basis for considering the effect of any reactive transport and geochemical processes in simulating the ground-water cleanup operation, if taking credit for sorption or any other geochemical reaction of hazardous constituents and consequent reduction or retardation of concentrations during transport from the mill tailings. Predicting the effects of proposed ground-water cleanup actions may include forward, site-specific contaminant transport modeling. Often, such modeling has taken a simple approach employing a retardation factor to describe all geochemical effects on contaminant concentration. This approach may be too simplistic. The use of a constant retardation factor and the neglect of speciation and water-mineral reactions is likely to lead to prediction errors. Reactive transport models using codes such as PHREEQC Version 2 (Parkhurst and Appello, 1999) are acceptable for constructing a geochemical model for the site. Hostetler and Erickson (1993) discuss examples of the effect of extending reactive transport models beyond simply including retardation in advective-dispersive models. In one example involving cadmium transport at a uranium mill tailings site, concentration profiles from the site suggest the importance of otavite (CdCO3) solubility control on aqueous cadmium in the low-pH zones near the tailings pond, and the inadequacy of modeling sorption alone.

Reactive transport models incorporate thermodynamic data on solid phases and aqueous species, allowing the mass action calculations that determine estimated aqueous concentrations and solid phase evolution. Thermodynamic parameters constitute a major source of uncertainty in geochemical modeling [see Murphy and Shock (1999) for a discussion of uranium], with potentially large effects on predicted aqueous ion concentrations. Therefore, geochemical modeling supporting ground-water corrective action plans includes sensitivity analyses that provide assurance that contaminant concentrations will not be underestimated. Likewise, any kinetic models employed are subjected to critical analysis because of the large influence of kinetic effects at low temperatures.

Reactive transport model results are subject to the assumptions and limitations of the conceptual and numerical models employed. For example, Zhu et al.4 list model limitations and briefly discuss how they may affect predictions. Geochemical limitations include:

(a) The assumption of local equilibrium (i.e., kinetic rates were not employed).

(b) Modeled porosity not being affected by reactions affecting the solid phase.

(c) Omitting colloidal transport.

(d) Neglecting density effects due to varying total dissolved solids.

(e) Simplifying the mineralogical suite.

(f) Neglecting surface reactions such as ion exchange.

(g) Relying on bulk mineralogy rather than on mineral surface compositions.

Limitations such as these are typically due to factors such as lack of data, inadequate computational equipment, or insufficient model development. Consideration of model limitations and their effects on uncertainty is an important component of the review by the NRC.

The numerical model of the site constructed by the licensee incorporates site-specific information, is adequately validated and calibrated, and reasonably represents the physical system. American Standard for Testing and Materials Reports D 5490 and D 5981 provide guidance for ground-water flow model validation and calibration. The professional experience and judgment of the reviewer should be applied in assessing these aspects of the analyses.

The licensee identifies and properly integrates factors that are expected to affect, or that are affected by, the ground-water cleanup. These include, but are not limited to, the spatial and temporal variation of the flux of leachates from the mill tailings to the underlying aquifer, drainage mechanisms of leachates from the mill tailings, spatial variability in flow and transport properties of the aquifer underlying the mill tailings, and geochemical processes that may affect the concentrations of hazardous constituents.

The licensee evaluates and documents the degree of conservatism in modeling the ground-water cleanup, and the level of conservatism presumed by the licensee is commensurate with the data and conceptual model uncertainty.

(4) Alternate modeling approaches consistent with available data and current scientific understanding are investigated where necessary, and results and limitations are appropriately factored into the ground-water corrective action plan. The licensee provides sufficient evidence that relevant site features have been considered, that the models are consistent with available data and current scientific understanding, and that the effects on cleanup time have been evaluated. Specifically, the licensee adequately considers alternate modeling approaches where necessary to incorporate uncertainties in site parameters and ensure they are propagated through the modeling.

Uncertainty in data interpretations is considered by analyzing reasonable conceptual models that are supported by site data, or by demonstrating through sensitivity studies that the uncertainties have little impact on the ground-water corrective action plan.

(5) The site-scale model for ground-water cleanup provides results consistent with the output of detailed or site data. Specifically, the site model is consistent with detailed models of geological, hydrological, and geochemical processes for the site. For example, for flow and transport through the aquifer, hydraulic conductivity distributions are reasonably consistent with sensitivity studies of the range of hydraulic conductivities and varying statistical distributions, field observations, and laboratory tests, when applicable.

The licensee documents how the model output is validated in relation to site characteristics.

Where appropriate, in developing the site model for ground-water cleanup, the licensee considers and evaluates alternate models that are reasonably justified by the available

database, with reasonable values assigned to distribution statistics to compensate for limited data availability.

The licensee uses numerical and analytical modeling approaches reflecting varying degrees of complexity consistent with information obtained from site characterization.

The licensee employs the upper and lower bounds of input parameter ranges to examine the robustness of the modeling.

(6) Adequate waste management practices are defined.

The disposition of effluent generated during active remediation is addressed in the corrective action plan. Appendix F to this standard review plan contains NRC staff policy for effluent disposal at licensed uranium recovery facilities for conventional mills. When retention systems such as evaporation ponds are used, design considerations from erosion protection and stability along with construction plans reviewed by a qualified engineer are included. Evaporation and retention ponds should meet the design requirements of 10 CFR Part 40, Appendix A, Criterion 5A. Ideally, the ponds should have leak detection systems capable of reliably detecting a leak from the pond into the ground water and should be located where they will not impede the timely surface reclamation of the tailings impoundment.

If water is to be treated and reinjected, either into an upper aquifer or into a deep disposal well, the injection program is approved by the appropriate State or Federal authority. For release of this waste to surface waters, existing licensees must meet the requirements of 10 CFR 20.1302(b)(2), and should demonstrate that doses are maintained as low as reasonably achievable (ALARA). NRC has no specific requirements for non-radiological constituents, and may adopt the appropriate State limits. Anticipated discharge must be described in enough detail to evaluate environmental impacts. Appropriate State and Federal agency permits should be obtained in accordance with 10 CFR 20.2007.

(7) Appropriate site access control is provided by the licensee.

Site access control should be provided by the licensee until site closure to protect human health and the environment from potential harm. Site access is controlled by limiting access to the site with a fence and by conducting periodic inspections of the site.

(8) Effective corrective action and compliance monitoring programs are provided.

Licensees are required, by Criterion 7 of Appendix A to 10 CFR Part 40, to implement corrective action and compliance monitoring programs. The licensee monitoring programs are adequate to evaluate the effectiveness of ground-water cleanup and control activities, and to monitor compliance with ground-water cleanup standards. The description of the monitoring program includes or references the following information:

(a) Quality assurance procedures used for collecting, handling, and analyzing ground-water samples.

(b) The number of monitor wells and their locations.

(c) A list of constituents that are sampled and the monitoring frequency for each monitored constituent.

(d) Action levels that trigger implementation of enhanced monitoring or revisions to cleanup activities (i.e., timeliness and effectiveness of the corrective action).

For corrective action monitoring:

The same wells used to determine the nature and extent of contamination may be used to monitor the progress of ground-water corrective action activities. However, once the extent of contamination is delineated, it may be possible to adequately monitor compliance with fewer wells. Once selected, major changes to monitored locations are avoided, because it is important to be able to directly compare measurements made at different times.

Licensees choose a monitoring interval that is appropriate for monitoring corrective action progress. Not all hazardous constituents need to be monitored at each interval. It is generally acceptable for licensees to choose a list of more easily measured constituents that serve as good indicators of performance.

These indicators include conservative constituents that are less likely to be attenuated, such as chloride, total dissolved solids, and alkalinity. However, if a hazardous constituent is causing a demonstrated risk to human health or the environment, that constituent must be monitored during the corrective action. Ground water at designated monitor wells is sampled for all hazardous constituents at the end of each major phase of corrective action and again before license termination and transfer of the site to the custodial agency for long-term custody.

For compliance monitoring, after a corrective action program has been terminated, compliance monitoring at the point of compliance will resume for the duration of the compliance period, until license termination, as defined in 10 CFR Part 40, Appendix A, Criterion 7A.

(9) Design of Surface Impoundments.

The reviewer should verify that any impoundment built as part of the corrective action program to contain wastes is acceptably designed, constructed, and installed. The design, installation, and operation of these surface impoundments must meet relevant guidance in Regulatory Guide 3.11, Section 1 (NRC 1977). Materials used to construct the liner should be reviewed to determine that they have acceptable chemical properties and sufficient strength for the design application. The reviewer should confirm that the liner will not be overtopped. The reviewer should also confirm that a proper quality control program is in place.

The review should ensure that the applicable requirements of 10 CFR Part 40, Appendix A, Criterion 5(A) have been met. If the waste water retention impoundments are located below grade, the reviewer should determine that the surface impoundments have an acceptable liner to ensure protection of ground water. The location of a surface impoundment below grade will eliminate the likelihood of embankment failure that could

result in release of waste water. The reviewer should determine that the design of associated dikes is such that they will not experience massive failure.

The design of a clay or synthetic liner and its component parts should be presented. At a minimum, design details, drawings, and pertinent analyses should be provided. Expected construction methods, testing criteria, and quality assurance programs should be presented. Planned modes of operation, inspection, and maintenance should be discussed in the application. Deviations from these plans should be submitted to the staff for approval before implementation.

The liner for a surface impoundment used to manage uranium and thorium byproduct material must be designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the subsurface soil, ground water, or surface water at any time during the active life of the surface impoundment. The liner may be constructed of materials that allow wastes to migrate into the liner provided that the impoundment decommissioning includes removal or decontamination of all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate.

The liner must be constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure caused by pressure gradients, physical contact with the waste or leachate, climatic conditions, and the stresses of installation and daily operation. The subgrade must be sufficient to prevent failure of the liner caused by settlement, compression, or uplift. Liners must be installed to cover all surrounding earth that is likely to be in contact with the wastes or leachate.

Tests should show conclusively that the liner will not deteriorate when subjected to the waste products and expected environmental and temperature conditions at the site. Applicant test data and all available manufacturers test data should be submitted with the application for this purpose. For clay liners, tests, at a minimum, should consist of falling head permeameter tests performed on columns of liner material obtained during and after liner installation. The expected reaction of the impoundment liner to any combination of solutions or environmental conditions should be known before the liner is exposed to them. Field seams of synthetic liners should be tested along the entire length of the seam. Representative sampling may be used for factory seams. The testing should use state-of-the-art test methods recommended by the liner manufacturer. Compatibility tests that document the compatibility of the field seam material with the waste products and expected environmental conditions should be submitted for staff review and approval. If it is necessary to repair the liner, representatives of the liner manufacturer should be called on to supervise the repairs.

Proper preparation of the subgrade and slopes of an impoundment is very important to the success of the surface impoundment. The strength of the liner is heavily dependent on the stability of the slopes of the subgrade. The subgrade should be treated with a soil sterilant. The subgrade surface for a synthetic liner should be graded to a surface tolerance of less than 2.54 cm [1 in.] across a 30.3-cm [1-ft] straightedge. NRC Regulatory Guide 3.11, Section 2 (NRC, 1977) outlines acceptable methods for slope stability and settlement analyses, and should be used for design. If a surface

impoundment with a synthetic liner is located in an area in which the water table could rise above the bottom of the liner, underdrains may be required. The impoundment will be inspected in accordance with Regulatory Guide 3.11.1 (NRC, 1980).

To prevent damage to liners, some form of protection should be provided, such as (a) soil covers, (b) venting systems, (c) diversion ditches, (d) side slope protection, or (e) game-proof fences. A program for maintenance of the liner features should be developed, and repair techniques should be planned in advance. The surface impoundment must have sufficient capacity and must be designed, constructed, maintained, and operated to prevent overtopping resulting from (a) normal or abnormal operations, overfilling, wind and wave actions, rainfall, or run-on; (b) malfunctions of level controllers, alarms, and other equipment; and (c) human error. If dikes are used to form the surface impoundment, they must be designed, constructed, and maintained with sufficient structural integrity to prevent their massive failure. In ensuring structural integrity, the applicant must not assume that the liner system will function without leakage during the active life of the impoundment. Controls should be established over access to the impoundment, including access during routine maintenance. A procedure should be developed that ensures unnecessary traffic is not directed to the impoundment area. A program should be established to ensure that daily inspections of tailings or waste impoundment systems are conducted and recorded and that failures or unusual conditions are reported to the NRC.

In addition, the reviewer should evaluate the proposed surface impoundment to determine if it meets the definition of a dam as given in Regulatory Guide 3.11 (NRC, 1977). If this is the case, the surface impoundment should be included in the NRC dam safety program, and be subject to Section 215, "National Dam Safety Program," of the Water Resources Development Act of 1996. If the reviewer finds that the impoundment conforms to the definition of a dam, the dam ranking (low or high hazard) should be evaluated. If the dam is considered a high hazard, an emergency action plan is needed consistent with Federal Emergency Management Agency requirements. For low hazard dams, no emergency action plan is required. For either ranking of dam, the reviewer should also verify that the licensee has an acceptable inspection program in place to ensure that the dikes are routinely checked, and that performance is properly maintained.

A quality control program should be established for the following factors: (a) clearing, grubbing, and stripping; (b) excavation and backfill; (c) rolling; (d) compaction and moisture control; (e) finishing; (f) subgrade sterilization; and (g) liner subdrainage and gas venting.

(10) Financial Surety Is Provided.

The licensee must maintain a financial surety, within the specific license, for the cleanup of ground water, with the surety sufficient to recover the anticipated cost and time frame for achieving compliance, before the land is transferred to the long-term custodian. The financial surety must be sufficient to cover the cost of corrective action measures that will have to be implemented if required to restore ground-water quality to the established site-specific standards (including an alternate concentration limit standard) before the site is transferred to the government for long-term custody. Guidance on establishing financial surety is presented in NRC (1988, 1997). Appendix C to this standard review plan

provides an outline of the cost elements appropriate for establishing surety amounts for conventional uranium mills. The financial surety review is acceptable if the applicant's assessment and any staff assessment of the surety amounts are reasonably consistent.

Reference can also be made to DG-3024, NUREG-1620 (e.g., Section 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-43/01: OUT-OF-COMPLIANCE STATUS

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.16 in lieu of comparable requirements in 10CFR40:

A. Accelerated Monitoring for Probable Out-of-Compliance Status

If the value of a single analysis of any compliance parameter in any compliance monitoring sample exceeds an applicable permit limit, the facility shall:

1. Notify the Executive Secretary in writing within 30 days of receipt of data;

2. Immediately initiate monthly sampling if the value exceeds both the background concentration of the pollutant by two standard deviations and an applicable permit limit, unless the Executive Secretary determines that other periodic sampling is appropriate, for a period of two months or until the compliance status of the facility can be determined.

B. Violation of Permit Limits

Out-of-compliance status exists when:

1. The value for two consecutive samples from a compliance monitoring point exceeds:

a. one or more permit limits; and

b. the background concentration for that pollutant by two standard deviations (the standard deviation and background (mean) being calculated using values for the ground water pollutant at that compliance monitoring point) unless the existing permit limit was derived from the background pollutant concentration plus two standard deviations; or

2. The concentration value of any pollutant in two or more consecutive samples is statistically significantly higher than the applicable permit limit. The statistical significance shall be determined using the statistical methods described in Statistical Methods for Evaluating Ground Water Monitoring Data from Hazardous Waste Facilities, Vol. 53, No. 196 of the Federal Register, Oct. 11, 1988 and supplemental guidance in Guidance For Data Quality Assessment (EPA/600/R-96/084 January 1998).

C. Failure to Maintain Best Available Technology Required by Permit

1. Permittee to Provide Information

In the event that the permittee fails to maintain best available technology or otherwise fails to meet best available technology standards as required by the permit, the permittee shall submit to the Executive Secretary a notification and description of the failure according to R317-6-6.13. Notification shall be given orally within 24 hours of the permittee's discovery of the failure of best available technology, and shall be followed up by written notification, including the information necessary to make a determination under R317-6-6.16.C.2, within five days of the permittee's discovery of the failure of best available technology.

Relevant NRC Guidance

Reference can also be made to DG-3024, NUREG-1620 (e.g., Section 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.

INTERROGATORY WHITE MESA CELL 4B UAC R317-6-6.10-44/01: PROCEDURE WHEN A FACILITY IS OUT-OF-COMPLIANCE

REGULATORY BASIS:

UAC R313-24-4 invokes UAC R317-6-6.17 in lieu of comparable requirements in 10CFR40:

A. If a facility is out of compliance the following is required:

1. The permittee shall notify the Executive Secretary of the out of compliance status within 24 hours after detection of that status, followed by a written notice within 5 days of the detection.

2. The permittee shall initiate monthly sampling, unless the Executive Secretary determines that other periodic sampling is appropriate, until the facility is brought into compliance.

3. The permittee shall prepare and submit within 30 days to the Executive Secretary a plan and time schedule for assessment of the source, extent and potential dispersion of the contamination, and an evaluation of potential remedial action to restore and maintain ground water quality and insure that permit limits will not be exceeded at the compliance monitoring point and best available technology will be reestablished.

4. The Executive Secretary may require immediate implementation of the contingency plan submitted with the original ground water discharge permit in order to regain and maintain compliance with the permit limit standards at the compliance monitoring point or to reestablish best available technology as defined in the permit.

5. Where it is infeasible to re-establish BAT as defined in the permit, the permittee may propose an alternative BAT for approval by the Executive Secretary.

Relevant NRC Guidance

Reference can also be made to DG-3024, NUREG-1620 (e.g., Section 4.4.3), and RG 3.8 as appropriate for additional guidance on topics listed above.