

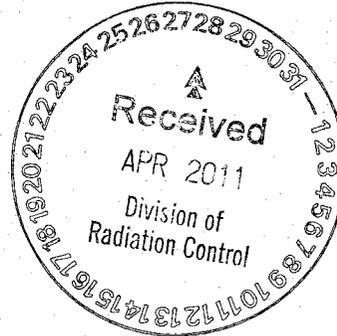
DRC-2011-004669



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April 27, 2011

**VIA FEDERAL EXPRESS**

Mr. Rusty Lundberg  
Executive Secretary  
Utah Division of Radiation Control  
Utah Department of Environmental Quality  
195 North 1950 West  
Salt Lake City, UT 84116-3097

Dear Mr. Lundberg:

**Re: Amendment Request to Process an Alternate Feed Material (the "Uranium Material") at White Mesa Mill (the "Mill") from Dawn Mining Corporation ("DMC") Midnite Mine  
State of Utah Radioactive Material License No. UT1900479**

We are pleased to enclose with this letter two copies of an application to amend the Mill's Radioactive Materials License No. 1900479 to authorize receipt and processing of the Uranium Material as an alternate feed material primarily for the recovery of uranium and disposal of the resulting tailings in the Mill's tailings impoundments as 11e.(2) byproduct material.

As we have discussed with Loren Morton of the Division of Radiation Control, Dawn Mining Corporation is currently reclaiming the Midnite Mine Site under deadlines driven by their schedule under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). The Uranium Material was and is currently accepted at the Dawn Mill tailings disposal facility for direct disposal as source material in accordance with the United States Nuclear Regulatory Commission (NRC) Guidance on Disposal of Atomic Energy Act Non-Section 11e.(2) Byproduct Material in Tailings Impoundments (November 2000). Based on the CERCLA schedule, following the 2010 operational season, direct disposal in the tailings impoundment is no longer an option.

Therefore, DMC requires that this application be approved in time for deliveries of Uranium Material to the White Mesa Mill beginning in 2011. Denison is prepared to sign a Memorandum of Understanding with the Division of Radiation Control to fund the use of URS Corporation to perform an expedited review of the application documents.

If you have any questions regarding this application or on development of the Memorandum of understanding, please contact me at (303) 389-4132.

Yours very truly,



**DENISON MINES (USA) CORP.**  
Jo Ann Tischler  
Director, Compliance and Permitting

cc Ron F. Hochstein  
Harold R. Roberts  
David C. Frydenlund  
David E. Turk  
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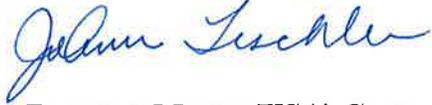
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**REQUEST TO AMEND  
RADIOACTIVE MATERIALS LICENSE  
DENISON MINES (USA) CORP.  
WHITE MESA URANIUM MILL  
SAN JUAN COUNTY, UTAH  
AND  
ENVIRONMENTAL REPORT**

Prepared for:

**Utah Department of Environmental Quality**  
Division of Radiation Control  
P.O. Box 144850  
Salt Lake City, UT 84114-4850

Prepared by:

**Denison Mines (USA) Corp.**  
1050 17th Street, Suite 950,  
Denver, CO 80265

**April 2011**

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**ATTACHMENTS**

- Attachment 1 Midnite Mine Site Location
- Attachment 2 Radioactive Material Profile Record and Affidavit
- Attachment 3 Denison/UDEQ Protocol for Determining Whether Alternate Feed Materials are RCRA Listed Hazardous Wastes
- Attachment 4 Review of Chemical Contaminants in Dawn Mining Company (DMC) Midnite Mine Uranium Material to Determine the Potential Presence of RCRA Characteristic or RCRA Listed Hazardous Waste
- Attachment 5 Review of Chemical Contaminants in Dawn Mining Company Midnite Mine (DMC) Uranium Material to Determine Worker Safety and Environmental Issues and Chemical Compatibility at the Denison Mines White Mesa Mill

## **1.0 INTRODUCTION**

### **1.1 White Mesa Mill**

Denison Mines (USA) Corp. ("Denison") operates the White Mesa Uranium Mill (the "Mill") located approximately six miles south of Blanding, Utah. The Mill processes natural (native, raw) uranium ores and alternate feed materials. Alternate feed materials are uranium-bearing materials other than natural ores that meet the criteria specified in the United States Nuclear Regulatory Commission's ("NRC's") *Interim Position and Guidance on the Use of Uranium Mill feed Material Other Than Natural Ores* (November 30, 2000) (the "Alternate Feed Guidance"). Alternate feed materials are processed as "ore" at the Mill primarily for their source material content. As a result, all waste associated with this processing is 11e.(2) byproduct material.

### **1.2 Proposed Action**

This is a request for an amendment to State of Utah Radioactive Materials License No. UT 1900479 to authorize receipt and processing of certain uranium containing materials. These materials are Water Treatment Plant ("WTP") solids resulting from treatment of natural uranium mine storm water and ground water collected from Pit 3 and Pit 4 at the Midnite Mine in Wellpinit, WA, an inactive uranium mine owned by the Dawn Mining Company ("DMC"). For ease of reference, the uranium bearing material that results from this water treatment process described further in Section 2, is referred to herein as "Uranium Material".

### **1.3 Purpose of Action**

The Uranium Material contains greater than 0.05% uranium on both a wet and dry basis. A radioactive materials license issued by the Washington State Department of Health (WN-I0390-1) was held for the Midnite Mine WTP through December 31, 2008. After December 31, 2008, the license was terminated and the regulatory authority for the Midnite Mine WTP facility and the Uranium Material was transferred to the U.S. Environmental Protection Agency ("EPA") as part of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), also known as Superfund. Through December 31, 2008, the Uranium Materials were processed offsite as an alternate feed material at DMC's Uranium Mill near Ford Washington for its source material content. The processing facility at the Dawn Mill has been decommissioned and processing of the Uranium Material is no longer possible at that location. After December 31, 2008 the uranium material was and is currently accepted at the Dawn Mill tailings disposal facility for direct disposal as source material in accordance with the United States Nuclear Regulatory Commission (NRC) Guidance on Disposal of Atomic Energy Act Non-Section 11e.(2) Byproduct Material in Tailings Impoundments (November 2000). Following the 2010 operational season, direct disposal in the tailings impoundment is no longer an option.

Denison has been requested by DMC to make this application to process the Uranium Material as an alternate feed material at the Mill and to dispose of the resulting tailings in the Mill's tailings impoundments as 11e.(2) byproduct material. Approval of this application will allow the recovery of valuable uranium, a resource that would otherwise be lost to direct disposal and will afford DMC a cost effective and productive mechanism for managing the material generated as part of the Midnite Mine reclamation.

### **1.4 Amendment Application and Environmental Report**

This application is intended to fulfill the requirements of an application for an amendment to the Mill's Radioactive Materials License set out in Utah Administrative Code ("UAC") R313-22-38 and includes the Environmental Report required by UAC R313-24-3 to be contained in such an application.

## 2.0 MATERIAL COMPOSITION AND VOLUME

### 2.1 General

The Midnite Mine Superfund Site ("Site") is an inactive open-pit uranium mine that is currently administrated by EPA Region 10 under CERCLA, also known as Superfund. The Site EPA Identification Number is WA980978753. The Site is located on the Spokane Indian Reservation in eastern Washington State, approximately 48 air miles northwest of Spokane (Attachment 1). These lands are owned by the federal government and held in trust for the Spokane Tribe of Indians ("Tribe") and individual tribal members.

Uranium was discovered on the site in 1954. The prospectors and several tribal members subsequently formed Midnite Mines, Inc. and acquired the mining leases at the Site. Midnite Mines, Inc. subsequently joined with Newmont Mining Company ("Newmont") to create DMC, with Newmont Mining Company as the 51 percent shareholder and Midnite Mines, Inc. owning 49 percent. Newmont USA Limited is the corporate successor of Newmont Mining Company and continues to be the majority shareholder of DMC.

The mine operated from 1954 until 1965, providing uranium under contracts with the United States Atomic Energy Commission ("AEC"). The mine went into standby from 1965 and resumed mining in 1969. The ores were milled at the Dawn Mill site, located near Ford, Washington. Mining was suspended in 1981 due to decreases in uranium prices and never resumed. The Mine was regulated by several United States Department of the Interior ("USDO") agencies, including the U.S. Geological Survey, U.S. Bureau of Mines, and U.S. Bureau of Land Management ("BLM") Minerals Management Service. The Bureau of Indian Affairs ("BIA") represented the Tribe and individual tribal allotment owners in matters related to leases and royalties.

An estimated 5.3 million tons of ore and proto-ore (i.e. low-grade mineralized rock) and 33 million tons of waste rock were removed from nine pits between 1955 and 1981. All but two of the mine pits have been backfilled. The last two pits to be mined consisted of Pit 3 and Pit 4, these pits were not backfilled and remain open. Several reclaimed waste rock piles remain on the mine property and an estimated 2.4 million tons of ore and proto-ore were stockpiled and currently remain on the Site.

In the late 1970s, seeps with dissolved ore-derived constituents were observed at the toe of the largest waste rock piles at the Midnite Mine. The BLM ordered DMC to construct a control pond (the Pollution Control Pond, or "PCP") in 1979 to capture the seeps for evaporation. Following the suspension of mining in 1981, DMC began pumping water from the PCP to the now inactive Pit 3 in response to growing quantities of water in the PCP and newly identified seeps at the base of the largest waste rock pile. Since cessation of mining operations, mine site surface runoff water has been collected in engineered channels and diverted to the inactive open mining pit, Pit 3. In addition, natural ground water from the ore zones of the pits has flowed into and accumulated in the two open mining pits, Pit 3 and Pit 4, at the site. In February of 1985, DMC applied to the EPA for a National Pollution Discharge Elimination System ("NPDES") permit to allow for the discharge of treated water from those pits and other waters collected on the site. In September of 1986, the EPA issued DMC an NPDES permit.

In 1987 a Compliance Order was issued by EPA under the Clean Water Act ("CWA") NPDES program requiring DMC to eliminate discharges of pollutants to waters of the United States in excess of the limits in the existing NPDES Permit. Subsequently, DMC developed a seep collection and pumpback program that collected water from Site drainages and returned them to the PCP and Pit 3. Existing seep and surface water collection occurs at six specific locations throughout the Midnite Mine Site as part of this seep collection and pumpback program including the PCP. Pit 3 water consists of mine site waters collected and pumped from the seep collection and pumpback program, direct precipitation and local mine surface runoff in the immediate area of Pit 3, and natural ground water inflow from the Pit 3 ore zones. The water that accumulates in Pit 4 consists of direct precipitation, groundwater inflow, and surface runoff in the immediate area of Pit 4. All waters collected in the seep collection and pumpback system are derived from seeps from waste rock piles or surface runoff at the Site. The seep collection and pumpback system

does not collect water from any areas that have ever been known to contain or currently contain any listed hazardous wastes or from any operations other than the mining of natural uranium ores.

In 1988, a water treatment plant ("WTP") was constructed to treat the accumulating water in the open pits. The WTP began treating water in 1992. The Washington Department of Health ("WDOH"), under the authority of the Nuclear Regulatory Commission ("NRC") Agreement State Program, issued a Radioactive Materials License (WN-10390-1) in 1992 for the Uranium Material, which contains greater than 0.05% uranium. This License was terminated by the State of Washington in December 31, 2008. Operation of the WTP since that time has been administrated by the EPA under CERCLA.

There are no shop areas, petroleum tanks, or other sources of hydrocarbons at the mine site, with the exception of a 300 gallon diesel fuel tank for the Pit 4 pump, and a 300 gallon tank of gasoline for WTP equipment. The diesel fuel tank and pump are located in secondary containment near Pit 4 with a maximum volume stored of 300 gallons and the 300 gallon gasoline tank is located next to the WTP. These fuels are stored and managed separately from the Uranium Material and have not impacted the Uranium Material in the past nor do they have a reasonable potential to do so in the future. The constituents precipitated from the WTP influent are derived from flow of natural precipitation through uranium mine waste rock and natural ore, collected surface runoff from natural materials, and natural ground water inflow from the ore zones into one of the two remaining open pits, Pit 3 and Pit 4 as discussed above.

In 1998, EPA performed an Expanded Site Investigation ("ESI") and scored the Site using the Hazard Ranking System ("HRS") to determine the eligibility of the Site for inclusion on the National Priorities List (NPL). A Record of Decision ("ROD") was signed on September 29, 2006, which established the Selected Remedy for the Site. Part of the Selected Remedy for Operable Unit 1 (Mined Area and the Mining Affected Area, which includes Pit 3 and Pit 4) included long-term treatment of contaminated seeps and pit water, with on-site discharge of treated water in compliance with interim discharge limits. The Dawn Mill tailings facility is scheduled for reclamation in the near future, and continued direct disposal of the Uranium Material at the Dawn Mill will not be allowed or possible beyond the 2010 operating season. DMC desires to recycle the Uranium Material at the Mill in lieu of direct disposal as a means to disposition of the material.

## **2.2 Historical Summary of Sources**

The WTP is a conventional lime treatment high-density solids process in which the metals and uranium are precipitated out in the treatment process, and includes addition of barium chloride for radium removal. A polymer coagulant is added and the resultant slurry is settled and filtered to produce a solution free of solids for surface discharge under the CWA NPDES program and EPA CERCLA program. The precipitate is currently centrifuged, and the final solids contain on average 0.18 wet weight percent uranium (0.21 wet weight percent  $U_3O_8$ ) at an average historical solids content of 15 percent. However, the centrifuges are to be replaced with a hydraulic filter press in 2011, increasing the percent solids of the final Uranium Material to between 25% and 45%, resulting in a proportional increase in weight percent uranium estimated to be between 0.3 and 0.55 wet weight percent uranium (0.35 and 0.63 wet weight percent  $U_3O_8$ ). As uranium ores and alternate feed materials are typically evaluated on a dry percent  $U_3O_8$  basis, the actual (dry) percent  $U_3O_8$  of the Uranium Material is estimated to be approximately 1.4 percent  $U_3O_8$ .

The WTP is typically operational from early May through the end of October and operates 24 hours per day, four days per week. WTP influent is derived from approximately 400 gallons per minute ("gpm") influent from Pit 3 and approximately 50 gpm influent from Pit 4. The pit waters are pumped to the WTP using positive displacement pumps which are piped separately to the WTP through polyethylene piping. The WTP reagents are pre-mixed in individual mixing tanks prior to addition to the treatment stream. The hydrated lime and flocculent are pre-mixed using makeup water from Pit 4, while the barium chloride is mixed with potable water.

Barium chloride is added to the influent water stream, which is then mixed with approximately 90 gpm from the clarifier bottoms (clarifier underflow) to increase the overall final WTP solids density. Then hydrated lime is added for

the precipitation of uranium and metals. Waters recovered from the dewatering process are also added back to the process stream at this point. An anionic water soluble polymer (Neo Solutions, NS-6852) is subsequently added as a coagulant to facilitate clarification.

This process stream is then sent to one of two clarifiers. The precipitated solids are drawn from the clarifier bottom and, as mentioned previously, approximately 20% of the clarifier underflow (approximately 90 gpm) is pumped back to the beginning of the process to increase overall WTP solids density. The liquid fraction of the remaining process stream (approximately 360 gpm) is decanted from the top of the clarifier for further treatment and discharge separately from the solids, while the remaining solids fraction from the clarifier underflow is sent to the centrifuge for dewatering. The centrifuge will be replaced for the 2011 operating season with a hydraulic filter press as discussed in more detail below. A more detailed description of this process is provided in the Technical Memoranda included in Attachment 4.

The dewatered solids are currently transferred from the centrifuge to the transport truck via a discharge conveyor. The transport truck is housed within the WTP building and remains in that location until it is hauled for final disposal, thereby eliminating any opportunity for other waste materials to be introduced into the Uranium Material.

The time period from 2001-2008 is the most representative of treatment volumes processed in the WTP. Before this time period, pit dewatering and other site activities increased the volumes treated. Therefore these are the years used for this analysis.

From 2001 through 2008 the WTP process produced between 164,000 dry lbs and 393,500 dry lbs per year (or 82 to 194 dry tons per year) of treatment solids (average 294,700 dry lbs or 147 dry tons). The maximum annual total volume of Pit water treated was approximately 76.5 million gallons for the period of 2001 through 2008. Volumes vary depending on how much precipitation the site receives in a given year.

The plant will be modified for the 2011 operational season, and the centrifuges currently used for Uranium Material dewatering will be replaced by a hydraulic filter press. It is expected that the same water soluble polymer will be used for coagulation; however the polymer application rate may be increased from the current rate to improve the dewatering characteristics of the solids. The Uranium Material solids percent is expected to increase from an average of 15 weight percent solids to between 25 and 45 percent. The total wet concentrations of the constituents present in the Uranium Material are expected to increase by 67 to 300 percent from the analytical values reported for the current Uranium Material as a result of decreased water content due to dewatering with the filter press.

In addition, a Remedial Investigation/Feasibility Study (RI/FS) was completed on 9/30/05 for the Midnite Mine. The Selected Remedy for the Site is Alternative 5a (Complete Pit Backfill with Passive Drains and Ex-Situ Water Treatment) of the FS. Based on the FS and issued in the Record of Decision (ROD) as the Selected Remedy ("Remedy"), Pits 3 and 4 will be backfilled, waste rock and proto-ore will be moved and capped, and a new passive water collection system will be installed to capture groundwater from these and other backfilled pit areas. The surface water management will be designed to divert surface flows around sources of contamination and therefore minimize the volume of water to be treated after the Remedy is implemented. The existing WTP is located on a waste rock pile that must be removed for the Remedy. Therefore, a new water treatment plant will be built before construction of the Remedy begins. It is estimated that the construction will begin in the beginning of 2013 and will require approximately 2 years ending at the end of 2014, and the new WTP must be capable of treating water at a rate of 1,000 gpm year round for the construction phase. It is likely that the new WTP will be comparable to the current treatment employed using lime and barium addition for removal of constituents from the feed water. This higher design flow will allow for rapid dewatering of the pits during backfilling, as well as groundwater collection and surface water collection treatment. After construction, it is expected that the flows will be reduced to an ultimate annual value of 65 million gallons and will take an estimated 6 to 7 years to reach these reduced flows.

The water quality during construction is assumed to be the same composition as currently is captured and treated, and it is expected that the water quality after implementation of the Remedy will be improved from current water quality.

### 2.3 Quantity of Uranium Material

As discussed above, the WTP is expected to generate approximately 190 dry tons of Uranium Material per year. This is based on a total flow rate of 450 gpm, four days per week for 6 months of the year into the WTP, with an average dry concentration of 1.4 percent  $U_3O_8$ . On an annualized basis, this equates to approximately a 180 gpm continuous inflow rate into the WTP throughout the year. As part of the Remedy, a new water treatment plant will be constructed over the two-year period commencing in 2013<sup>1</sup>. During the two-year construction period, the new plant will treat water at a rate of 1,000 gpm continuously throughout each of the two years. This represents an increase in water flow from 180 gpm, on an annualized basis, to 1,000 gpm. Accordingly, during the two years of construction the amount of Uranium Material to be produced will increase proportionately from approximately 190 dry tons per year to approximately 1,000 dry tons per year, to accommodate drainage of Pits 3 and 4.

After the new plant has been constructed, the influent rates into the new plant are expected to revert to the pre-construction rates resulting in the generation of approximately 190 dry tons of Uranium Material per year. This annual amount is expected to be reduced annually over the next 6 to 7 years, ending in a steady state rate of generation of approximately 18.3 dry tons of Uranium Material per year, indefinitely. The following table summarizes the anticipated amounts of Uranium Material to be generated over the first ten year period.

Year	Anticipated Quantity of Uranium Material (tons)
1	190
2	190
3	996
4	996
5	190
6	155
7	121
8	87
9	52
10	18
10-year interim total	2995

Although the foregoing estimates are based on reasonable engineering calculations assumptions, experience has demonstrated that for excavation remediation projects, such estimates typically underestimate the amounts of materials ultimately produced. Denison, therefore, considers it to be appropriate to increase the foregoing estimate by 50 percent, as was done for other alternate feed materials of this type.

Accordingly, this is a request for a license amendment to authorize the Mill to receive and process up to 4,500 dry tons of Uranium Material, and to dispose of the resulting tailings as 11e.(2) byproduct materials in the Mill's tailings impoundments.

<sup>1</sup> This is not to be confused with the modifications being made to the existing WTP in 2011, when the current centrifuges will be replaced with a hydraulic filter press that is intended to reduce the water content of the Uranium Material.

## 2.4 Radiochemical Data

As noted, the process history demonstrates that the Uranium Material results from treatment of natural mine water that is accumulated in inactive mine pits created during uranium mining. DMC has estimated that the current Uranium Material has a uranium content of approximately 0.18 wet weight percent natural uranium (0.21 wet weight percent  $U_3O_8$ ). The modifications to the WTP anticipated to occur in 2011 are estimated to increase the uranium content to between 0.3 and 0.55 percent natural uranium (wet weight basis) or 0.35 and 0.65 wet weight percent  $U_3O_8$ . As uranium ores and alternate feeds are typically evaluated on a dry percent  $U_3O_8$  basis, the actual (dry) percent  $U_3O_8$  of the Uranium Material is estimated to be approximately 1.4 percent  $U_3O_8$ . These modifications to the WTP are expected to increase the constituent concentrations by 67 to 300 percent. Thorium 232 content will likely range from 0.0013 to 0.002 percent on a dry basis. A more detailed radiological characterization of the Uranium Materials is contained in the Radioactive Materials Profile Record ("RMPR") (Attachment 2). The radionuclide activity concentrations of the Uranium Material (on a dry basis) are consistent with higher-grade Arizona Strip breccia pipe ores and a number of alternate feed materials which the Mill is currently licensed to receive as previously approved by the NRC and Utah Division of Radiation Control ("DRC").

## 2.5 Physical and Chemical Data

Physically, the Uranium Materials are WTP solids with no free liquid, consisting of finely graded solids containing residual amounts of uranium and other metals. The Uranium Material will be relatively moist, with an average moisture content of approximately 55-75%. However, this moisture consists of chemically bound water of hydration, and a minor amount of moisture held in capillary tension. That is, the Uranium Material contains little or no moisture as free water or pore water. The water of hydration will remain chemically bound regardless of applied mechanical forces. Just as the proposed filter press will not release the bound water in the WTP, forces from subsequent handling, such as the pressure from vibration in transit or stacking on the ore pad, will not release the bound water in those settings. The generator's information in the RMPR in Attachment 2 also attests that there is no free water associated with these solids. Photo Number 1, attached to the RMPR, demonstrates the Uranium Material's ability to maintain integrity of form with no seepage of free water, at the moisture contents described above.

The chemical characterization data for the Uranium Materials is also set out in the RMPR (Attachment 2). As with the radionuclides and as discussed in more detail in Section 4.4 below, all the chemical constituents in the Uranium Material have either been reported to be, or can be assumed to be, already present in the Mill's tailings system or were reported in other licensed alternate feeds, at levels generally comparable to or higher than those reported in the Uranium Materials.

## 2.6 Comparison to Other Ores and Alternate Feed Materials Licensed for Processing at the Mill

### 2.6.1 Ores and Alternate Feed Materials With Similar Radiological Characteristics

With an average uranium content of approximately 1.4%  $U_3O_8$ , on a dry weight basis the uranium content of the Uranium Material is comparable to a relatively high-grade Arizona Strip breccia pipe uranium ore, which typically range from approximately 0.4% to 2% or higher  $U_3O_8$ . However the uranium daughter products in the Uranium Material are generally lower than for comparable Arizona Strip ores, resulting in the Uranium Material generally having a lower radiological hazard.

The concentrations of Ra-226, Th-230 and Pb-210 are lower in the feed as a result of the lower concentrations in the feed water to the treatment plant. The concentrations of these daughter products are lower in the feed water than the concentrations typically found in ore due to the limited solubility in groundwater.

The estimated average content of Thorium 232 ("Th-232") is approximately 0.005% on a dry basis. This is well below the levels of Th-232 that the Mill has been licensed to process in the past. For example the average concentrations of

Th-232 in the W.R. Grace, Heritage and Maywood alternate feed materials are approximately 7.27%, 1.08% and 0.88% respectively.

The activities of Ra-226, Th-230 and Pb-210 of approximately 24.1 pCi/L, 20.7 pCi/L and 33.3 pCi /L (on a dry basis) are all well below the corresponding activities of 825 pCi/L, for each of those radionuclides, typically associated with Colorado Plateau Ore of 0.25% U<sub>3</sub>O<sub>8</sub>.

### **2.6.2 Ores and Alternate Feed Materials With Similar Chemical/Metal Characteristics**

The Uranium Material is simple and more benign in chemical composition than many previously approved alternate feed materials that the Mill has processed. As discussed in more detail in Section 4.5 below, all the constituents in the Uranium Material have either been reported to be, or can be assumed to be, already present in the Mill's tailings system or were reported in other licensed alternate feeds, at levels generally comparable to or higher than those reported in the Uranium Material.

## **3.0 REGULATORY CONSIDERATIONS**

### **3.1 Alternate Feed Guidance**

The Alternate Feed Guidance provides that if it can be determined, using the criteria specified in the Alternate Feed Guidance, that a proposed feed material meets the definition of "ore", that it will not introduce a hazardous waste not otherwise exempted (unless specifically approved by the EPA (or State) and the long term custodian), and that the primary purpose of its processing is for its source material content, the request can be approved.

### **3.2 Uranium Material Qualifies as "Ore"**

According to the Alternate Feed Guidance, for the tailings and wastes from the proposed processing to qualify as 11e.(2) byproduct material, the feed material must qualify as "ore". NRC has established the following definition of ore: "Ore is a natural or native matter that may be mined and treated for the extraction of any of its constituents or any other matter from which source material is extracted in a licensed uranium or thorium mill." The Uranium Material is an "other matter" which will be processed primarily for its source material content in a licensed uranium mill, and therefore qualifies as "ore" under this definition. Further, the uranium concentration of the Uranium Material is greater than 0.05 percent on both a wet and dry basis, thereby causing the Uranium Material to also meet the definition of source material.

### **3.3 Uranium Material Not Subject to RCRA**

#### **3.3.1 General**

The Alternate Feed Guidance currently provides that if a proposed feed material contains hazardous waste, listed under Section 261.30-33, Subpart D, of 40 CFR (or comparable Resource Conservation and Recovery Act ("RCRA") authorized State regulations), it would be subject to EPA (or State) regulation under RCRA. However, the Guidance provides that if the licensee can show that the proposed feed material does not consist of a listed hazardous waste, this issue is resolved. NRC guidance further states that feed material exhibiting only a characteristic of hazardous waste (ignitable, corrosive, reactive, toxic) that is being recycled, would not be regulated as hazardous waste and could therefore be approved for extraction of source material, unless it is a residue from water treatment. The Alternate Feed Guidance concludes that if the feed material contains a listed hazardous waste or in the case of a water treatment residual, a characteristic hazardous waste, the licensee, can process it only if it obtains EPA (or State) approval and provides the necessary documentation to that effect. The Alternate Feed Guidance also states that NRC staff may consult with EPA (or the State) before making a determination on whether the feed material contains hazardous waste.

Subsequent to the date of publication of the Alternate Feed Guidance, NRC recognized that, because alternate feed materials that meet the requirements specified in the Alternate Feed Guidance must be ores, any alternate feed materials that contain greater than 0.05% source material are considered source material under the definition of source material in 10 CFR 40.4 and hence exempt from the requirements of RCRA under 40CFR 261.4(a)(4). See *Technical Evaluation Report Request to Receive and Process Molycorp Site Material* issued by the NRC on December 3, 2001 (the "Molycorp TER"). As a result, any such alternate feed ores are exempt from RCRA, regardless of whether they would otherwise have been considered to contain listed or characteristic hazardous wastes. Since the Uranium Material contains greater than 0.05% source material, it is exempt from RCRA, regardless of its process history or constituents, and no further RCRA analysis is required. Nevertheless, because the Alternate Feed Guidance has not yet been revised to reflect this position recognized by NRC in the Molycorp TER, Denison will demonstrate below that, even if the Uranium Material were not considered source material and as such exempt from RCRA, the Uranium Material would not, in any event, contain any RCRA listed or characteristic hazardous wastes, as required under the Alternate Feed Guidance as currently worded.

### **3.3.2 DENISON/UDEQ Listed Hazardous Waste Protocol**

In a February, 1999 decision regarding the Mill, the Atomic Safety and Licensing Board Presiding Officer suggested there was a general need for more specific protocols for determining if alternate feed materials contain hazardous components. In a Memorandum and Order of February 14, 2000, the full Commission of the NRC also concluded that this issue warranted further staff refinement and standardization. Cognizant at that time of the need for specific protocols to be used in making determinations as to whether or not any alternate feeds considered for processing at the Mill contained listed hazardous wastes, Denison took a proactive role in the development of such a protocol. Accordingly, Denison established a "Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes" (November 22, 1999). This Protocol was developed in conjunction with, and accepted by, the State of Utah Department of Environmental Quality ("UDEQ") (Letter of December 7, 1999). Copies of the Protocol and UDEQ letter are provided in Attachment 3. The provisions of the protocol can be summarized as follows:

- a) In all cases, the protocol requires that Denison perform a source investigation to collect information regarding the composition and history of the material, and any existing generator or agency determinations regarding its regulatory status;
- b) The protocol states that if the material is known -- by means of chemical data or site history -- to contain no listed hazardous waste, Denison and UDEQ will agree that the material is not a listed hazardous waste;
- c) If such a direct confirmation is not available, the protocol describes the additional chemical process and material handling history information that Denison will collect and evaluate to assess whether the chemical contaminants in the material resulted from listed or non-listed sources;
- d) The protocol also specifies the situations in which ongoing confirmation/acceptance sampling will be used, in addition to the chemical process and handling history, to make a listed waste evaluation;
- e) If the results from any of the decision steps indicate that the material or a constituent of the material did result from a RCRA listed hazardous waste or RCRA listed process, the material will be considered to have contained RCRA listed hazardous waste; and
- f) The protocol identifies the types of documentation that Denison will obtain and maintain on file, to support the assessment for each different decision scenario.

The above components and conditions of the Protocol are summarized in a decision tree diagram, or logic flow diagram, included in Attachment 3, and hereinafter referred to as the "Protocol Diagram".

### **3.3.3 Application of the Listed Hazardous Waste Protocol**

In independent chemical engineer from TetraTech, Inc. ("TetraTech") has conducted a RCRA evaluation of the Uranium Material and, specifically, applied the Listed Hazardous Waste Protocol to the Uranium Material. A copy of TetraTech's analysis is included as Attachment 4.

It was concluded that, based on the information that is available,

1. The Uranium Material is not a RCRA listed hazardous waste because it is an ore that has a natural uranium content of greater than 0.05 weight percent, is therefore source material under 10 CFR 40.4 and, as a result, is exempt from regulation under RCRA (40 CFR 261.4(a)(4)).
2. Even if the Uranium Material were not source material, it would not be a RCRA listed hazardous waste for the following additional reasons:

- a) It was generated from a known process under the control of the generator, who has provided the Affidavit, included in Attachment 2, declaring that the Uranium Material is not and does not contain RCRA listed hazardous waste. This determination is consistent with Boxes 1 and 2 and Decision Diamonds 1 and 2 in the Denison/UDEQ Protocol Diagram;
- b) The five volatile organic compounds detected at very low concentrations in the Uranium Material have been attributed to laboratory contamination and are not actual contaminants in the Uranium Material; and
- c) None of the metals in the Uranium Material samples came from RCRA listed hazardous waste sources. This determination is consistent with Box 8 and Decision Diamonds 9 through 11 in the Denison/UDEQ Protocol Diagram.

### **3.3.4 Analysis for RCRA Characteristic Waste**

3. The Uranium Material does not exhibit any of the RCRA characteristics of ignitability, corrosivity, reactivity, or toxicity for any constituent, based on the Toxicity Characteristic Leaching Procedure ("TCLP") analysis summarized in Attachment 2.

### **3.3.5 Radioactive Material Profile Record**

Furthermore, in order for Denison to characterize the Uranium Material, DMC has completed Denison's RMPR form, stating that the material is not RCRA listed waste. The certification section of the RMPR includes the following text:

I certify that the material described in this profile has been fully characterized and that hazardous constituents listed in 10 CFR 40 Appendix A Criterion 13 which are applicable to this material have been indicated on this form. I further certify and warrant to Denison that the material represented on this form is not a hazardous waste as identified by 40 CFR 261 and/or that this material is exempt from RCRA regulation under 40 CFR 261.4(a)(4).

### **3.3.6 Conclusion**

Because the Uranium Material is an ore that contains greater than 0.05% source material, the Uranium Material is exempt from RCRA under 40 CFR 261.4(a)(4). In addition, based on the site history, the determinations by DMC, and the analysis of the independent chemical engineer from Tetra Tech, Denison has also concluded that, even if not exempted from RCRA under 40 CFR 261.4(a)(4), based on the application of the Listed Hazardous Waste Protocol, the Uranium Material would not be listed hazardous waste subject to RCRA. Further, the Uranium material does not possess any of the RCRA characteristics of ignitability, reactivity, corrosivity, or toxicity for any constituent and therefore, were it not source material, it would not be a RCRA hazardous waste.

## **3.4 Uranium Material is Processed Primarily for its Source Material Content**

In its Memorandum and Order, February 14, 2000, In the Matter of International Uranium (USA) Corp. (Request for Materials License Amendment), Docket No. 40-8681-MLA-4, the NRC Commission concluded that an alternate feed material will be considered to be processed primarily for its source material content if it is reasonable to conclude that uranium can be recovered from the Uranium Material and that the processing will indeed occur. The Uranium Material will be processed for the recovery of uranium at the Mill. Based on the uranium content of the Uranium Material, its physical and chemical characteristics, and Denison's success in recovering uranium from a variety of different types of materials, including materials that were similar to the Uranium Materials, at the Mill, it is reasonable to expect that uranium can be recovered from the Uranium Material. As a result, the Uranium Material is an ore that will be processed primarily for the recovery of source material, and the tailings resulting from processing the Uranium Material will therefore be 11e.(2) byproduct material under the definition set out in 10 CFR 40.4.

## 4.0 ENVIRONMENT AFFECTED

### 4.1 General

The Mill is a licensed uranium processing facility that has processed to date approximately 4,000,000 tons of uranium-bearing conventionally mined ores and alternate feed materials primarily for the recovery of uranium, with the resulting tailings being permanently disposed of as 11e.(2) byproduct material in the Mill's tailings impoundments. Environmental impacts associated with such previously licensed Mill operations have been thoroughly evaluated and documented in the past (see, for example, the original 1979 Final Environmental Statement ("FES") for the Mill, Environmental Assessments ("EAs") for Mill license renewals dated 1985 and 1997, an EA for the Mill's reclamation plan dated 2000, EAs for alternate feed materials dated 2001 and 2002, in each case prepared by the NRC) and a Safety Evaluation Report prepared by UDEQ in connection with another alternate feed material. The Uranium Material will also be processed as an alternate feed material at the Mill for the recovery of uranium and the resulting tailings will be permanently disposed of in the Mill's tailings impoundments as 11e.(2) byproduct material, in a similar fashion to other conventionally mined ores and alternate feed materials that have been processed or licensed for processing at the Mill.

Accordingly, this Environmental Report will focus on the various pathways for potential radiological and non-radiological impacts on public health, safety and the environment and determine if the receipt and processing of the Uranium Material would result in any potential significant *incremental* impacts over and above previously licensed activities.

The pathways that are analyzed are the following:

- a) potential impacts from transportation of the Uranium Material to the Mill;
- b) potential impacts from radiation released from the Uranium Material while in storage at the Mill;
- c) any chemical reactions that may occur in the Mill's process;
- d) any potential reactions or inconsistencies with the existing tailings or tailings facilities;
- e) potential impacts on groundwater;
- f) potential impacts on surface water;
- g) potential airborne radiologic impacts;
- h) potential radon and gamma impacts; and
- i) worker health and safety issues.

These potential pathways will be discussed in the following sections of this document. The findings below will demonstrate that, because all the constituents in the Uranium Material have either been reported to be, or can be assumed to be, already present in the Mill's tailings system or were reported in other licensed alternate feeds, at levels generally comparable to or higher than those reported in the Uranium Material, the resulting tailings will not be significantly different from existing tailings at the facility. As a result, there will be no incremental public health, safety or environmental impacts over and above previously licensed activities.

### 4.2 Transportation Considerations

#### 4.2.1 Packaging and Mode of Transportation

The Uranium Material will be shipped in covered end- or side-dump haul trucks. The Uranium Material will be shipped as Radioactive LSA 1 (low specific activity) Hazardous Material as defined by DOT regulations. DMC will arrange with a materials handling contractor for the proper marking, labeling, placarding, manifesting and transport of each shipment of the Uranium Material. Shipments will be tracked by the shipping company from the Midnite Mine until they reach the Mill. DMC will ship approximately 25 trucks per year, or an average of one truck per week for the six month annual operating period. The number of trucks per year could vary depending on the Uranium Material

production. The estimated range would be from 2 to 73 trucks per year, with the highest number of trucks expected in the two years of construction of the Remedy.

The trucks involved in transporting the Uranium Material to the Mill site will be surveyed and decontaminated, as necessary, prior to leaving the Midnite Mine for the Mill and again prior to leaving the Mill site.

#### **4.2.2 Transportation Impacts**

For the following reasons, it is not expected that transportation impacts associated with the movement of the Uranium Material by truck from the Midnite Mine WTP facility to the Mill will be significant:

##### *a) Radiological Matters*

The transport of radioactive materials is subject to limits on radiation dose rate measured at the transport vehicle as specified in the US Code of Federal Regulations. The external radiation standards for these shipments are specified in 10 CFR 71.47 sections (2) and (3) as less than 200 millirems per hour ("mrem/h") at any point on the outer surface of the vehicle, and less than 10 mrem/h at any point two meters from the outer lateral surfaces of the vehicle. All exclusive use trailer trucks will be scanned by DMC prior to departure from the Midnite Mine to ensure that these limits are satisfied. All conveyances will be covered by tarpaulins or similar cover to prevent any migration of ore dust while in transit. From a radiologic standpoint, the Uranium Material is within the bounds of other ores and alternate feed materials licensed for processing at the Mill. The Uranium Material will be transported in covered end or side dump haul trucks, in a similar fashion to other conventional ores, and as a result there will be no significant incremental radiological impacts associated with transportation of Uranium Material to the Mill, over and above other previously licensed ores and alternate feed materials at the Mill or from licensed activities at other facilities in the State of Utah. All applicable requirements of 49 CFR Part 172 and Part 173 will be met, and the selected transport company will have all the required training and emergency response programs and certifications in place.

##### *b) Traffic Volume Matters*

###### *(i) Comparison to Licensed Mill Operations*

Section 4.8.5 of the 1979 FES for the Mill noted that when area mining was at expected full operational levels, approximately 68 round trips on local highways would be made by 30-ton ore trucks to the Mill per day (see the 1978 Dames and Moore Environmental Report for the Mill, p. 5-34). In addition, based on a licensed yellowcake capacity of 4,380 tons per year (Mill license condition 10.1) a maximum of 8,760,000 pounds of yellowcake would require shipment from the Mill to conversion facilities. This would require approximately 183-275 truck shipments from the Mill per year (based on 40-60 drums per truck, 800 lbs per drum), or one truck every one to two days based on a seven day work week (one truck every day or so, based on a five-day work week). In contrast, on average, 25 truck loads will be transported yearly from the Midnite Mine to the Mill during the period when the Water Treatment Plant is operating (May to October), or at an approximate frequency of one truck per week from May to October. In addition, the amount of yellowcake to be produced from processing the Uranium Material is expected to be transported in approximately one truck load per year. This frequency is well within the estimated yellowcake transport frequency at licensed capacity. During the period of transportation of the Uranium Material to the Mill, Denison does not expect that ore deliveries from all other sources would, in total, exceed a small fraction of the truck transportation associated with licensed capacity.

###### *(ii) Comparison to Existing Truck Traffic on Interstate Highways 15 and 70*

Based on information provided by the State of Utah Department of Transportation ("UDOT") on July 14, 2010, on average during 2009, 2350 multi-unit trucks traveled south daily on Interstate 15 from Idaho into Utah. On average between 740 and 6,518 multi-unit trucks traveled south daily on Interstate 15, across Interstate 50 to Interstate 70. Based on the 2009 UDOT truck traffic information, an average of five additional trucks per month traveling this route to the Mill from May to October represents an increased traffic load of less than 1/100 of one percent. For the foregoing reasons, the truck traffic to the Mill from this project is expected to be an insignificant portion of existing truck traffic through the state, and well within the level of truck traffic expected from normal Mill operations.

(iii) *Comparison to Existing Truck Traffic on Highway 191*

Based on information provided by the State of Utah Department of Transportation ("UDOT") on July 14, 2010, on average during 2009, 1,628 multi-unit trucks traveled south on State Road 191 from Moab across the Grand County line each day. On average between 285 and 610 multi-unit trucks per day traveled the stretch of State Road 191 south of Monticello, UT toward Blanding, UT. Based on the 2009 UDOT truck traffic information, an average of five additional trucks per month traveling this route to the Mill from May to October represents an increased traffic load of less than one quarter of one percent. For the foregoing reasons, the truck traffic to the Mill from this project is expected to be an insignificant portion of existing truck traffic in the area, and well within the level of truck traffic expected from normal Mill operations.

### **4.3 Storage**

#### **4.3.1 Manner of Storage**

Trucks arriving at the Mill site will be received according to existing Mill procedures. The trucks will be unloaded onto the ore pad for temporary storage of the Uranium Material pending processing. The Uranium Material will be stored in a manner similar to conventional ore. Tarped haul trucks will enter the site, roll back the tarp covering and dump their loads onto the ore pads as with conventional ore deliveries. The haul truck will then be cleaned and scanned for free release as per approved Mill standard operating procedures.

#### **4.3.2 Environmental Impacts Associated With Storage**

Because the Uranium Material will be temporarily stored on the ore pad awaiting processing and because the Uranium Material does not significantly differ in radiological activity from other ores and alternate feed materials, gamma radiation and radon emanation from the Uranium Material will be minimal and within the levels associated with other ores and alternate feed materials handled at the Mill on a routine basis. Experience at the Dawn Mill Site has determined that the Uranium Material is stable under ambient environmental conditions and does not require any special handling (item 10 of the Affidavit (Attachment 2)). The TCLP data evidences that the material does not readily leach and does not exhibit hazardous waste characteristics when exposed to more severe conditions than would be anticipated on the ore storage pad.

### **4.4 Process**

The Uranium Material will be introduced to the process circuit either in the main circuit mixed with conventional ore, or in the Mill's alternate feed circuit alone. If processed in the main circuit, the material will be processed through the Mill's existing conventional ore acid leach, counter-current decantation and solvent extraction circuits for the recovery of uranium values. The leaching process will begin in Pulp Storage with the addition of sulfuric acid. The solution will be advanced through the remainder of the Mill circuits with no significant modifications to either the circuits or the recovery process anticipated. If processed through the Mill's alternate feed circuit, no significant changes to that circuit would be required. Since no significant physical changes to the Mill circuits will be necessary to process this Uranium Material, no significant construction impacts beyond those previously assessed will be involved. Recovery of additional contained metals is not anticipated at this time.

The effects of introducing the Uranium Material into the Mill's process and tailings were reviewed by the independent chemical process engineer from Tetra Tech. Tetra Tech's Technical Memorandum is included as Attachment 5. Table 5 in the Technical Memorandum provides comparisons of the concentrations of all known constituents of the Uranium Material to the tailings and other previously processed ores and alternate feeds.

## 4.5 Compatibility with Denison Mill Tailings

### 4.5.1 Physical Compatibility

The Uranium Material will be received as a precipitated solid from lime treatment of the WTP influent water. A portion of this material may be insoluble in the acid leach process at the Mill and therefore, the discharge sent to tailings may contain some solid material ("sand"). The remainder of the Uranium Material will be soluble and therefore be contained in the liquid phase after processing in the acid leach system. The solids will be sent to an active tailings cell at the Mill, e.g., Cell 4A, or Cell 4B. The solutions from the Uranium Material tailings will be recirculated through the mill process for reuse of the acidic properties in the solution. The sands will be only a portion of the total mass of Uranium Material sent to the Mill from the Midnite Mine site. However, assuming a worst case scenario that all of the solid material ends up as sand in the tailings, it is estimated that for the main processing circuit, the additional load to the tailings is minimal (Attachment 5, Table 5). It is expected that the percent increase to the system is less than one percent for all components.

For the analysis presented in Attachment 5, it is assumed that the chemical composition of each active cell, Cell 4A or Cell 4B, is represented by the composition of Cell 3 from the Statement of Basis for the Utah Groundwater Discharge Permit for the Mill (November 29, 2004).

Cell 4A has a High-Density Polyethylene ("HDPE") liner. Cell 4A went into service in October of 2008 and contains conventional ore tailings sands. Solutions from the Mill, starting in July 2009, have also been sent to Cell 4A. Cell 4B was recently constructed, with an HDPE liner system similar to Cell 4A and is expected to ultimately receive the same materials as Cell 4A. It is currently expected that future tailings cells will have similar construction.

The constituents in the sands and liquids resulting from processing the Uranium Material are not expected to be significantly different from those in the conventional ores either in composition or in concentration of constituents. Attachment 5, Table 5 indicates that based on a comparison of the Uranium Material to the tailings, all of the metal constituents found in the Uranium Material are currently processed in the Mill's main circuit and are all natural components of uranium ore with the exception of barium.

The constituents that would be added to the Mill process from processing the Uranium Material are similar to conventional ores, absent of organic materials, and also contain additional calcium, barium, and polymer due to the addition of these constituents in the WTP process. Tetra Tech identified that these components are not expected to have any adverse effect on the Mill processing system or to the tailings Cells. As described in Attachment 5, it is expected that most of the metal and non-metal constituents entering the leach system with the Uranium Material will be converted to sulfate salts, precipitated, and eventually discharged to the tailings system.

Every metal and non-metal cation and anion component in the Uranium Material already exists in the Mill's tailings system. A summary of the tailings composition before and after the Uranium Material is processed is presented in Attachment 5, Table 6.

Every component in the Uranium Material has been:

1. detected in analyses of the tailings cells liquids;
2. detected in analyses of tailings cells solids;
3. detected in analyses of alternate feed materials licensed for processing at the Mill; or
4. detected in process streams or intermediate products when previous alternate feeds were processed at the Mill;

at concentrations that are generally comparable to the concentrations in the Uranium Material. Due to the small annual quantities of the Uranium Material, an increase in the concentration of any analyte in the Mill's tailings is not expected to be significant.

The constituents in the Uranium Material, are expected to produce no incremental additional environmental, health, or safety impacts in the Mill's tailings system beyond those produced by the Mill's processing of natural ores or previously approved alternate feeds.

#### **4.5.2 Capacity and Throughput**

The amount of tailings that would potentially be generated is substantially smaller than the volume that would be generated from processing an equivalent volume of conventional ore, as the Uranium Material consists of soluble salts and minimal insoluble solids. Midnite Mine, as described above, may be expected to ship on average approximately 300 dry tons per year of Uranium Material to the Mill. As the Mill's design capacity is approximately 2,000 dry tons per day, the total *annual* throughput of Uranium Material is a small fraction of one day's Mill capacity. This volume is well within the maximum annual throughput rate and tailings generation rate for the Mill of 680,000 dry tons per year. Additionally, the expected annual amount of uranium in the Material of approximately 84,000 lbs (4,2 tons) of  $U_3O_8$  is well within the Mill's licensed yellowcake capacity of 4,380 tons per year of  $U_3O_8$ .

Denison proposes that, as has been the case for recent alternate feed license amendments approved by the NRC and DRC, a condition should be added to the license amendment to the effect that the Mill shall not accept any Uranium Material at the site unless and until the Mill's Safety and Environmental Review Panel ("SERP") has determined that the Mill has sufficient licensed tailings capacity to permanently store:

- a) all 11 e.(2) byproduct material that would result from processing all the Uranium Material,
- b) all other ores and alternate feed materials on site; and
- c) all other materials required to be disposed of in the Mill's tailings impoundments pursuant to the Mill's reclamation plan.

#### **4.6 Groundwater**

In the 1997 EA, NRC staff concluded that, for a number of reasons, groundwater beneath or in the vicinity of the Mill site will not be adversely impacted by continued operation of the Mill. Additionally, the design of the existing impoundments has previously been approved by Utah DRC (Cells 4A and 4B), and Denison is required to conduct regular monitoring of the impoundment leak detection systems and of the groundwater in the vicinity of the impoundments to detect leakage should it occur.

Because the Mill's tailings cells are not impacting groundwater, the receipt and processing of Uranium Material at the Mill will not have any incremental impacts on groundwater.

In any event, Denison has a groundwater monitoring program for the Mill. With the exception of barium, all constituents identified in the Uranium Material are included in the groundwater monitoring program.

Barium will be introduced to the Mill's tailings cells with disposal of the tailings from the processing of the Uranium Material. The chemistry of the tailings cells would limit the mobility of barium due to the abundance of sulfate in the tailings cells. The insolubility of barium in the presence of sulfate is generally consistent regardless of the liquid medium. That is, the solubility of barium sulfate in cold water is 0.022 mg/L and in concentrated sulfuric acid is 0.025 mg/L (Handbook of Chemistry and Physics, 68<sup>th</sup> Edition). At the listed concentrations of sulfate in the tailings solutions (67,600 mg/L to 87,100 mg/L in Cell 4A), a change in the ambient barium concentration in the tailings solutions (0.02 mg/L) would be negligible. Therefore, given the strong tendency of barium to partition to solids, especially in the presence of sulfate, there is no reasonable potential for barium to migrate to ground water from the tailings cells at the Mill in the unlikely event of a leak in the tailings cells. Calcium  $K_d$  value in UDEQ Statement of Basis for the permit (December 1, 2004) contains published  $K_d$  values for calcium of 5 to 100 L/kg for sandy to clayey soils. The  $K_d$  for barium is 100 to 150,000 L/kg for the same soil types indicating less mobility in groundwater and Tetra Tech has therefore concluded that barium is sufficiently represented by monitoring for calcium and has

identified no technical reason to add barium to the list of constituents monitored in ground water in the vicinity of the tailings cells.

Excluding barium, chemical and radiological make-up of the Uranium Material is similar to other ores and alternate feed materials processed at the Mill, and their resulting tailings will have the chemical composition of typical uranium process tailings, for which the Mill's tailings system was designed. As a result, the existing groundwater monitoring program at the Mill will be adequate to detect any potential future impacts to groundwater.

As a result, there will be no incremental impacts over and above previously licensed activities.

#### **4.7 Surface Water**

There will be no discharge of Mill effluents to local surface waters. All Mill process effluents, laundry, and analytical laboratory liquid wastes will be discharged to the Mill's tailings impoundments for disposal by evaporation. Runoff from the Mill and facilities is directed to the tailings impoundments. Sanitary wastes are discharged to State-approved leach fields. As a result, there is no plausible pathway for Uranium Material to impact surface water. Further, as indicated in Semi-Annual Effluent Reports filed by the Mill to date, there is no indication of the Mill impacting surface waters. There will therefore be no incremental impact to surface waters from any airborne particulates associated with processing the Uranium Material.

Uranium Material will be transported to the Mill in covered exclusive-use trucks. Upon introduction into the Mill circuit, the Uranium Material will be processed in a similar fashion as other ores and alternate feed materials. The Uranium Material will be relatively moist, with an average moisture content of approximately 55-75%. This moisture is bound water of hydration, and a minor amount of moisture held in capillary tension, that is not driven off by the high pressure filter press. As attested to by the generator (Attachment 1), there is no free water associated with these solids. This will minimize any potential for dusting while the Uranium Material is introduced into the Mill process. In addition, standard procedures at the Mill for dust suppression will be employed if necessary. There will therefore be no new or incremental risk of discharge to surface waters resulting from the receipt and processing of Uranium Material at the Mill or the disposition of the resulting tailings.

Finally, as the chemical and radiological make-up of the Uranium Material are sufficiently similar to natural ores and the tailings resulting therefrom, the existing surface water monitoring program at the Mill will be adequate to detect any potential impacts to surface water. As a result, there will be no incremental impacts over and above previously licensed activities.

#### **4.8 Airborne Radiological Impacts**

The chemical and radiological make-up of the Uranium Material will not be significantly different from natural ores that have been processed at the Mill in the past. The existing air particulate monitoring program is equipped to handle all such ores.

#### **4.9 Radon and Gamma Impacts**

As discussed in Section 2.5.1 above, the concentration of uranium in the Uranium Material is comparable to the concentration of uranium in conventionally mined Arizona Strip breccias pipe ores. However, the Radon-222 activity is much lower, being less than that associated with low-grade Colorado Plateau ores. In addition, the concentration of Th-232 in the Uranium Material is low, and is lower than the concentration of Th-232 in a number of other alternate feed materials that have been licensed for processing at the Mill. As a result, the Uranium Material contains comparable concentrations of radium and other gamma-emitting radionuclides as natural ores and other alternate feed materials licensed for processing at the Mill. The Uranium Material will therefore pose less of a gamma and

radon hazard than other ores and alternate feed materials that have been processed or licensed for processing at the Mill.

#### **4.10 Safety Measures**

##### **4.10.1 General**

During unloading of the Uranium Material onto the ore pad, while the Uranium Material is being stored on the ore pad pending processing, while feeding Uranium Material into the Mill process and while processing the Uranium Material and disposing of and managing the resulting tailings, the Mill will follow its standard operating procedures for occupational and radiological safety.

##### **4.10.2 Radiation Safety**

###### *a) Existing Radiation Protection Program at the Mill*

The radiation safety program which exists at the Mill, pursuant to the conditions and provisions of the Mill's Radioactive Materials License, and applicable State Regulations, is adequate to ensure the maximum protection of the worker and environment, and is consistent with the principle of maintaining exposures of radiation to individual workers and to the general public to levels As Low As Reasonably Achievable ("ALARA"). Employees will be provided with personal protective equipment including full-face respirators, if required. In addition, all workers at the Mill are required to wear personal TLD badges or the equivalent to monitor their exposure to gamma radiation.

###### *b) Gamma Radiation*

Gamma radiation levels associated with the Uranium Material are expected to be within levels of gamma radiation associated with other ores and alternate feed materials processed or licensed for processing at the Mill in the past. Gamma exposure to workers will be managed in accordance with existing Mill standard operating procedures.

###### *c) Radon*

Radon levels associated with the Uranium Material are within levels of radon associated with other ores and alternate feed materials processed or licensed for processing at the Mill in the past. Radon exposures to workers will be managed in accordance with existing Mill standard operating procedures.

###### *d) Control of Airborne Contamination*

The Uranium Material is a fine-grained solid currently containing an average moisture content of approximately 85%. After modification of the hydraulic filter press at the Midnite Mine Water Treatment Plant in 2011, the moisture content will decrease to 55% to 75%. Dust suppression techniques will be implemented, if required, while the Uranium Material is being introduced into the Mill process, although this may be unnecessary due to the relatively high moisture content of the Uranium Material. Once in the Mill process, the Uranium Material will be in a dissolved form, and no special dust suppression procedures will be required. As is the practice at the Mill for other alternate feed materials, the Derived Air Concentration ("DAC") to be used in any analysis of airborne particulate exposure to workers will be developed specifically for the Uranium Material, based on applicable regulations and Mill procedures, in order to take into account the specific radionuclide make-up of the Uranium Material. The Mill has safely received and processed alternate feed materials with higher concentrations of each of the radionuclides contained in the Uranium Material, under previous license amendments, and can safely handle the Uranium Material in accordance with existing Mill standard operating procedures.

##### **4.10.3 Occupational Safety**

The primary focus of safety and environmental control measures will be to manage potential exposures from radionuclide particulates. Response actions and control measures designed to manage particulate radionuclide hazards will be more than sufficient to manage chemical hazards from the metal oxides (see the conclusions of Tetra Tech in Attachment 5).

#### **4.10.4 Vehicle Scan**

As stated in Section 4.2.1 above, the shipments of Uranium Material to and from the Mill will be dedicated, exclusive loads. Radiation surveys and radiation levels consistent with applicable DOT regulations will be applied to the exclusive use vehicles. For unrestricted use, radiation levels will be in accordance with applicable values contained in the NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, U.S. NRC, May, 1987. If radiation levels indicate values in excess of the above limits, appropriate decontamination procedures will be implemented.

#### **4.11 Long Term Impacts**

The Uranium Material is comprised of similar chemical and radiological components as already exist in the Mill's tailings cells. Existing monitoring programs are therefore adequate, and no new monitoring procedures are required. As a result, there will be no decommissioning, decontamination or reclamation impacts associated with processing the Uranium Material, over and above previously licensed Mill operations.

#### **4.12 Other Information**

#### **4.13 Added Advantage of Recycling**

DMC has expressed its preference for use of recycling and mineral recovery technologies for the Uranium Material for three reasons: 1) for the environmental benefit of reclaiming valuable minerals; 2) for the added benefit of reducing radioactive material disposal costs; and 3) for the added benefit of minimizing or eliminating any long term contingent liability for the waste materials generated during processing.

DMC has noted that the Mill has the technology necessary to process materials for the extraction of uranium and to provide for disposal of the 11e,(2) byproduct material, resulting from processing the Uranium Material primarily for the recovery of uranium, in the Mill's existing tailings impoundments. As a result, DMC will contractually require Denison to recycle the Uranium Material at the Mill primarily for the recovery of uranium.

#### **4.14 Consideration of Alternatives**

This application is in response to a request by DMC for disposal/processing options in connection with the clean up of the Midnite Mine. The Mill is a facility that has been requested to provide these services, because it is licensed to process materials that are similar to the Uranium Materials for the recovery of uranium and is licensed to create, possess and dispose of the resulting byproduct materials. Given that a decision to dispose of the Uranium Material at an offsite facility is required, the only options are as to which offsite facility the Uranium Materials will ultimately be sent for disposal. There are a limited number of facilities that are licensed to receive, store, process or dispose of the Uranium Material. Alternatives to processing/disposal at the Mill would be direct disposal or processing at one of these other facilities. If direct disposal is utilized, the value of the recoverable uranium in the Uranium Material would not be realized.

## 5.0 SIGNATURE

This document was prepared by Denison Mines (USA) Corp. on April 27, 2011.

DENISON MINES (USA) CORP.

By:

A handwritten signature in cursive script that reads "Jo Ann S. Tischler".

Jo Ann S. Tischler  
Director, Compliance and Permitting

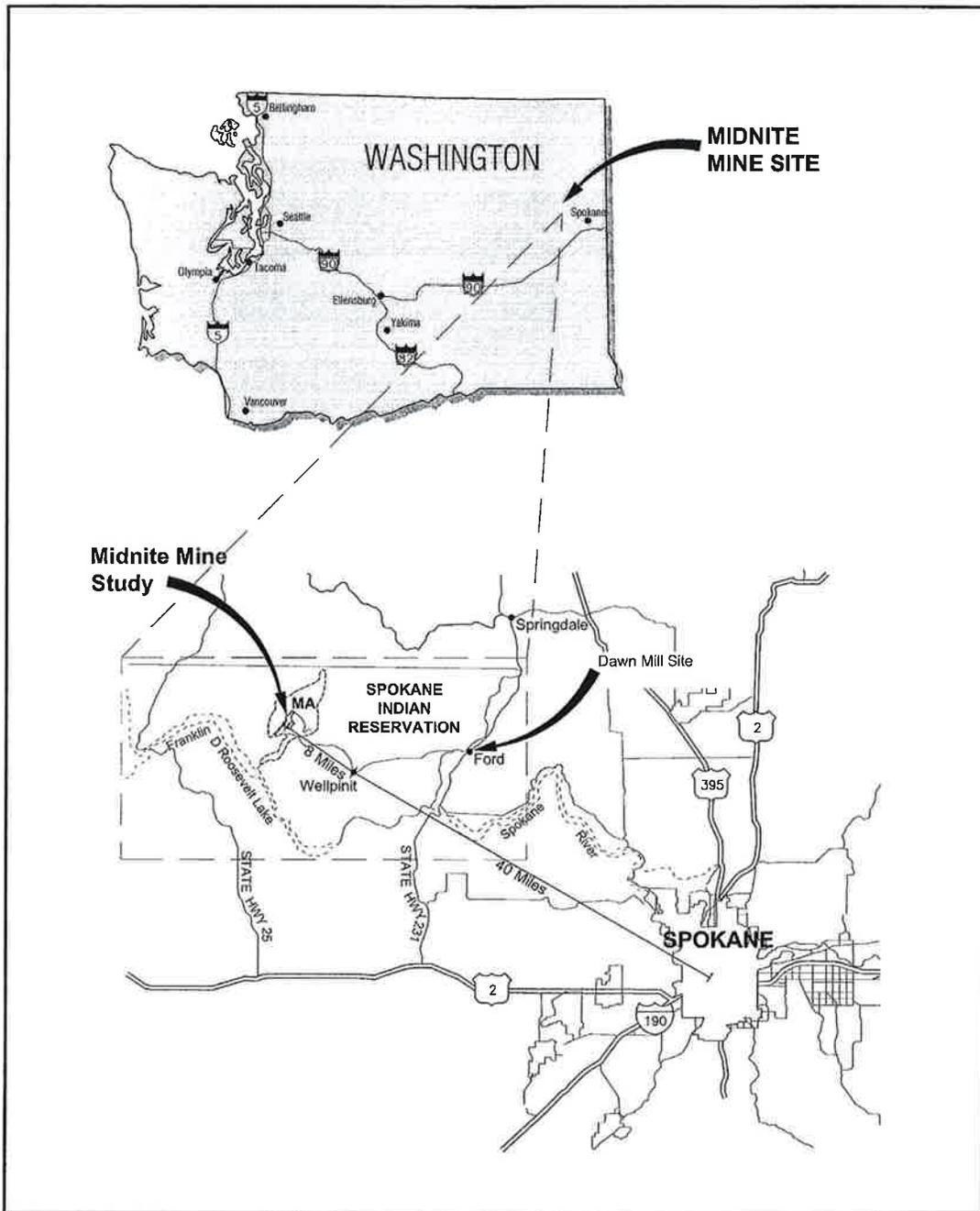
## **6.0 REFERENCES**

United States Nuclear Regulatory Commission; Interim Guidance on Disposal of Non-Atomic Energy Act of 1954, Section 11e.(2) Byproduct Material in Tailings Impoundments, November 2000.

Utah Division of Radiation Control Ground Water Quality Discharge Permit Statement of Basis for a Uranium Mining Facility at White Mesa, South of Blanding, Utah, November 29, 2004.

**ATTACHMENT 1**





**Midnite Mine Site Location**



**ATTACHMENT 2**

# RADIOACTIVE MATERIAL PROFILE RECORD

Generator Name: Dawn Mining Company Generator/Feed Stream #: MMWTP Mass of Feed Material (Dry Weight) 160 tons/year  
 Contractor Name: \_\_\_\_\_, Feed Stream Name: \_\_\_\_\_, Delivery Date: April 1, 2011  
 Check appropriate boxes: Licensed Y \_\_\_ N  NORM/NARM \_\_\_; LLRW \_\_\_; MW \_\_\_; MW Treated \_\_\_; MW Needing Trtmt \_\_\_; DOE \_\_\_; 11e.(2) \_\_\_;  
 Original Submission: Y  N \_\_\_; Revision # \_\_\_; Date of Revision: \_\_\_\_\_  
 Name and Title of Person Completing Form: Robert Nelson - Midnite Mine Site Manager Phone: (509) 258-4511

**A. CUSTOMER INFORMATION:**

GENERAL: Please read carefully and complete this form for one feed stream. This information will be used to determine how to properly manage the material. Should there be any questions while completing this form, contact Denison Mines (USA) Corp. ("Denison") Environmental Management at 303.628.7798. MATERIALS CANNOT BE ACCEPTED AT DENISON'S WHITE MESA MILL UNLESS THIS FORM IS COMPLETED. If a category does not apply, please indicate. This form must be updated annually.

**1. GENERATOR INFORMATION**

EPA ID# WAD980978753 EPA Hazardous Waste Number(s) (if applicable) \_\_\_\_\_  
 Mailing Address: P.O. Box 250, Ford, WA 99013  
 Phone: (509) 258-4511 Fax: (509)-258-4512  
 Location of Material (City, ST): ~8 miles west of Wellpinit, WA  
 Generator Contact: Robert Nelson Title: Site Manager  
 Mailing Address (if different from above): Same as above  
 Phone: Same as above Fax: Same as above

**B. MATERIAL PHYSICAL PROPERTIES** (Should you have any questions while completing this section, contact Denison Environmental Management at 303.628.7798.

- |   |  |
|---|--|
| <p>1. PHYSICAL DATA (Indicate percentage of material that will pass through the following grid sizes, e.g. 12" 100%, 4" 96%, 1" 74%, 1/4" 50%, 1/40" 30%, 1/200" .5%)<br/> <u>See Attached</u></p> <p>2. DESCRIPTION: Color ___ Brown/Multi <input checked="" type="checkbox"/> Odor ___ Odorless <input checked="" type="checkbox"/><br/>                 Liquid ___ Solid <input checked="" type="checkbox"/> Sludge ___ Powder/Dust ___</p> <p>3. DENSITY RANGE: (Indicate dimensions) <u>56.2 - 74.9</u> S.G. <u>lb./ft<sup>3</sup></u> <u>lb./yd<sup>3</sup></u></p> <p>4. GENERAL CHARACTERISTICS (% OF EACH)<br/>                 Soil ___ Building Debris ___ Rubble ___ Pipe Scale ___ Tailings ___ Process Residue <input checked="" type="checkbox"/> Concrete ___ Plastic/Resin ___<br/>                 Other constituents and approximate % contribution of each: <u>WTP Solids 100%</u></p> <p>5. MOISTURE CONTENT: (For soil or soil-like materials).<br/>                 (Use Std Proctor Method ASTM D-698)<br/> <u>See Attached</u></p> | <p>GRADATION OF MATERIAL:</p> <p>12" ___ 100%<br/>                 4" ___ 95%<br/>                 1" ___ 90%<br/>                 1/4" ___ 84%<br/>                 1/40" ___ 65%<br/>                 1/200" ___ 57%</p> |
|---|--|
6. DESCRIPTION OF MATERIAL (Please attach a description of the material with respect to its physical composition and characteristics. This description can be attached separately or included with the attachment for Item D.1.) See Attached

Generator or Contractor Initials: 

# Radioactive Material Profile Record

## C. RADIOLOGICAL EVALUATION

1. MATERIAL INFORMATION. For each radioactive isotope associated with the material, please list the following information. Denison's license assumes daughter products to be present in equilibrium, these are not required to be listed below and do not require manifesting. (Use additional copies of this form if necessary).

See Attached

Isotopes	Concentration Range (pCi/g dry)	Weighted Average (pCi/g dry)	Isotopes	Concentration Range (pCi/g)	Weighted Average (pCi/g)
a. <u>Th-228</u>	<u>0.93</u> to <u>1.50</u>	<u>1.22</u>	b. <u>Th-230</u>	<u>20.4</u> to <u>21.4</u>	<u>20.7</u>
c. <u>Pb-210</u>	<u>32.0</u> to <u>34.7</u>	<u>33.3</u>	d. <u>Th-232</u>	<u>0.66</u> to <u>1.14</u>	<u>0.84</u>
e. <u>Ra-Total</u>	<u>36.6</u> to <u>41.0</u>	<u>39.1</u>	f. <u>Ra-226</u>	<u>22.8</u> to <u>25.7</u>	<u>24.1</u>

ND - Analyte not detected.

2. Y  Is the radioactivity contained in the feed material Low-Level Radioactive Waste as defined in the Low-Level Radioactive Waste Policy Amendments Act of 1985 or in DOE Order 5820.2A, Chapter III? (Please Circle) If yes, check "LLRW" block on line 3 of page 1.
3. Y  LICENSED MATERIAL: Is the feed material listed or included on an active Nuclear Regulatory Commission or Agreement State license? (Please Circle)
- (If Yes) TYPE OF LICENSE: Source \_\_\_\_\_; Special Nuclear Material \_\_\_\_\_; By-Product \_\_\_\_\_; Norm \_\_\_\_\_; NARM \_\_\_\_\_;
- LICENSING AGENCY: \_\_\_\_\_

## D. CHEMICAL AND HAZARDOUS CHARACTERISTICS

### 1. DESCRIPTION AND HISTORY OF MATERIAL

See attached

Please attach a description of the material to this profile. Include the following as applicable: The process by which the material was generated. Available process knowledge of the material. The basis of hazardous material or waste determinations. A list of the chemicals and materials used in or commingled with the material; a list of any and all applicable EPA Hazardous Waste Numbers, current or former; and a list of any and all applicable land-disposal prohibition or hazardous-waste exclusions, extensions, exemptions, effective dates, variances or delistings. Attach the most recent or applicable analytical results of the material's hazardous-waste characteristics or constituents. Attach any applicable analytical results involving the composition of the material. Attach any product information or Material Safety Data Sheets associated with the material. If a category on this Material Profile Record does not apply, describe why it does not.

Please describe the history, and include the following:

- Y  Was this material mixed, treated, neutralized, solidified, commingled, dried, or otherwise processed at any time after generation?
- Y  Has this material been transported or otherwise removed from the location or site where it was originally generated?
- Y  Was this material derived from (or is the material a residue of) the treatment, storage, and/or disposal of hazardous waste defined by 40 CFR 261?
- Y  Has this material been treated at any time to meet any applicable treatment standards?

### 2. LIST ALL KNOWN AND POSSIBLE CHEMICAL COMPONENTS OR HAZARDOUS WASTE CHARACTERISTICS

	(Y)	(N)		(Y)	(N)		(Y)	(N)
a. Listed HW		<input checked="" type="checkbox"/>	b. "Derived-From" HW		<input checked="" type="checkbox"/>	c. Toxic		<input checked="" type="checkbox"/>
d. Cyanides		<input checked="" type="checkbox"/>	e. Sulfides		<input checked="" type="checkbox"/>	f. Dioxins		<input checked="" type="checkbox"/>
g. Pesticides		<input checked="" type="checkbox"/>	h. Herbicides		<input checked="" type="checkbox"/>	i. PCBs		<input checked="" type="checkbox"/>
j. Explosives		<input checked="" type="checkbox"/>	k. Pyrophorics		<input checked="" type="checkbox"/>	l. Solvents		<input checked="" type="checkbox"/>
m. Organics		<input checked="" type="checkbox"/>	n. Phenolics		<input checked="" type="checkbox"/>	o. Infectious		<input checked="" type="checkbox"/>
p. Ignitable		<input checked="" type="checkbox"/>	q. Corrosive		<input checked="" type="checkbox"/>	r. Reactive		<input checked="" type="checkbox"/>
s. Antimony		<input checked="" type="checkbox"/>	t. Beryllium	<input checked="" type="checkbox"/>		u. Copper	<input checked="" type="checkbox"/>	
v. Nickel	<input checked="" type="checkbox"/>		w. Thallium		<input checked="" type="checkbox"/>	x. Vanadium		<input checked="" type="checkbox"/>
y. Alcohols		<input checked="" type="checkbox"/>	z. Arsenic		<input checked="" type="checkbox"/>	aa. Barium	<input checked="" type="checkbox"/>	
bb. Cadmium	<input checked="" type="checkbox"/>		cc. Chromium	<input checked="" type="checkbox"/>		dd. Lead	<input checked="" type="checkbox"/>	
ee. Mercury		<input checked="" type="checkbox"/>	ff. Selenium	<input checked="" type="checkbox"/>		gg. Silver	<input checked="" type="checkbox"/>	
hh. Benzene		<input checked="" type="checkbox"/>	ii. Nitrate	<input checked="" type="checkbox"/>		jj. Nitrite	<input checked="" type="checkbox"/>	
kk. Fluoride	<input checked="" type="checkbox"/>		ll. Oil		<input checked="" type="checkbox"/>	mm. Fuel		<input checked="" type="checkbox"/>
nn. Chelating Agents		<input checked="" type="checkbox"/>	oo. Residue from water treatment	<input checked="" type="checkbox"/>				
pp. Other Known or Possible Materials or Chemicals	_____							

The chemical component identified above with an X\* indicates that the WTP solids were not tested for this component but process knowledge indicates that these components would not be present in the WTP solids.

Generator or Contractor Initials: 

Radioactive Material Profile Record

3. ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTICS. (Please transcribe results on the blank spaces provided. Attach additional sheets if needed, indicate range or worst-case results). See attached

Metals (circle one): Total (mg/kg) or TCLP (mg/l) Organics (circle one): Total (mg/kg) or TCLP (mg/l)

4. Lead ND See attached  
 Barium ND \_\_\_\_\_  
 Mercury ND \_\_\_\_\_  
 Cadmium ND \_\_\_\_\_  
 Zinc ND \_\_\_\_\_  
 Chromium ND \_\_\_\_\_  
 Copper ND \_\_\_\_\_

ND – Analyte not detected

5. ANALYTICAL RESULTS FOR REQUIRED PARAMETERS: (Please transcribe results on the blank spaces provided. Attached additional sheets if needed).

Soil pH 9.09 -9.26 SU Paint Filter No Free Liquid P Cyanide NO Not detected ND Sulfide NO Not detected ND  
 Liquids Test (Pass/Fail) Released mg/kg Released mg/kg

6. IGNITABILITY (40 CFR 261.21[a][2],[4].)

Flash Point >95 °F  C Is the material a RCRA oxidizer? Y  N

7. CHEMICAL COMPOSITION (List all known chemical components and circle the applicable concentration dimensions. Use attachments to complete, if necessary.) See attached

Chemical Component	Concentration	Chemical Component	Concentration
_____	_____ % mg/kg	_____	_____ % mg/kg
_____	_____ % mg/kg	_____	_____ % mg/kg
_____	_____ % mg/kg	_____	_____ % mg/kg

Halogenated Organic Compounds (HOC) (Sum of the list of HOCs) mg/kg

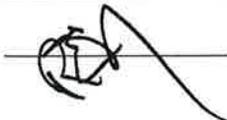
E. REQUIRED CHEMICAL LABORATORY ANALYSIS. Generator must submit results of analyses of samples of the material. Results are required from a qualified laboratory for the following analytical parameters unless nonapplicability of the analysis for the material can be stated and justified in attached statements. Attach all analytical results and QA/QC documentation available. (CAUTION: PRIOR TO ARRANGING FOR LABORATORY ANALYSIS, CHECK WITH DENISON AND LABORATORY REGARDING UTAH LABORATORY CERTIFICATIONS.)

FOR ALL MATERIAL TYPES: CHEMICAL ANALYSIS: Soil pH (9045), Paint Filter Liquids Test (9095): Reactivity (cyanide and sulfide).

1. MINIMUM ADDITIONAL ANALYTICAL REQUIRED FOR:

a. Non-RCRA Waste (Non Mixed Waste e.g., LLRW, NORM): TCLP including the 32 organics, 8 metals, and copper (Cu) and zinc (Zn).

2. REQUIRED RADIOLOGICAL ANALYSES. Please obtain sufficient samples to adequately determine a range and weighted average of activity in the material. Have a sufficient number of samples analyzed by gamma spectral analysis for all natural isotopes such that they support the range and weighted average information for the material that will be recorded in item D.1. If Uranium, Thorium, or other non-gamma emitting nuclides are present in the material, have at least (1) sample evaluated by radiochemistry to determine the concentration of these additional contaminants in the material.

Generator or Contractor Initials: 

# Radioactive Material Profile Record

## 3. PRE-SHIPMENT SAMPLES OF MATERIAL TO DENISON

Once permission has been obtained from Denison, and unless amenability samples have previously been sent to Denison, please send 5 representative samples of the material to Denison. A completed chain of custody form must be included with the sampling containers. These samples will be used to establish the material's incoming shipment acceptance parameter tolerances and may be analyzed for additional parameters. Send about two pounds (one liter) for each sample in an air-tight clean glass container via United Parcel Post (UPS) or Federal Express to:

Denison Mines (USA) Corp., Attn: Sample Control, 6425 S. Highway 191, P.O. Box 809, Blanding, UT 84511  
Phone: (435) 678-2221

## 4. LABORATORY CERTIFICATION INFORMATION. Please indicate below which of the following categories applies to your laboratory data.

a. All radiologic data used to support the data in item C.1. must be from a certified laboratory.

UTAH CERTIFIED (ALS Laboratory Group, Fort Collins, CO). The laboratory holds a current certification for the applicable chemical or radiological parameters from the Utah Department of Health insofar as such official certifications are given.

GENERATOR'S STATE CERTIFICATION. The laboratory holds a current certification for the applicable chemical parameters from the generator's State insofar as such official certifications are given, or

GENERATOR'S STATE LABORATORY REQUIREMENTS. The laboratory meets the requirements of the generator's State or cognizant agency for chemical laboratories, or:

If using a non-Utah certified laboratory, briefly describe the generator state's requirements for chemical analytical laboratories to defend the determination that the laboratory used meets those requirements, especially in terms of whether the requirements are parameter specific, method specific, or involve CLP or other QA data packages. Note: When process or project knowledge of this feed material is applied, additional analytical results may not be necessary to complete Section B. D.2. D.5. or D.6. of this form.

b. For analytical work done by Utah-certified laboratories, please provide a copy of the laboratory's current certification letter for each parameter analyzed and each method used for analyses required by this form.

c. For analytical work done by laboratories which are not Utah-Certified, please provide the following information:

\_\_\_\_\_  
State or Other Agency Contact Person

\_\_\_\_\_  
Generator's State

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
Lab Contact Person

\_\_\_\_\_  
Laboratory's State

\_\_\_\_\_  
Telephone Number

## F. CERTIFICATION

GENERATOR'S CERTIFICATION: I also certify that where necessary those representative samples were or shall be provided to Denison and to qualified laboratories for the analytical results reported herein. I also certify that the information provided on this form is complete, true and correct and is accurately supported and documented by any laboratory testing as required by Denison. I certify that the results of any said testing have been submitted to Denison. I certify that the material described in this profile has been fully characterized and that hazardous constituents listed in 10 CFR 40 Appendix A Criterion 13 which are applicable to this material have been indicated on this form. I further certify and warrant to Denison that the material represented on this form is not a hazardous waste as defined by 40 CFR 261 and/or that this material is exempt from RCRA regulation under 40 CFR 261.4(a)(4).

The Generator's responsibilities with respect to the material described in this form are for policy, programmatic, funding and scheduling decisions, as well as general oversight. The Contractor's responsibilities with respect to this material are for the day-to-day operations (in accordance with general directions given by the Generator as part of its general oversight responsibility), including but not limited to the following responsibilities: material characterization, analysis and handling; sampling; monitoring; record keeping; reporting and contingency planning. Accordingly, the Contractor has the requisite knowledge and authority to sign this certification on behalf of itself, and as agent for the Generator, on behalf of the Generator. By signing this certification, the Contractor is signing on its own behalf and on behalf of the Generator.

Generator's or Contractor's Signature

Title

VP + GM Date 2/23/2011

(Sign for the above certifications).

Print Name of Individual Signing above: ROBERT E. NELSON

## Radioactive Material Profile Record

### RADIOACTIVE MATERIAL PROFILE RECORD ATTACHMENTS

- B.1. PHYSICAL DATA: Soluble salts will not have solids characteristics in the mill process or in the tailings. As shipped, these materials will be dry, coarse, granular solids (see attached photos). No grain size data is available.
- B.5. MOISTURE CONTENT: 25% to 45% solids by weight, will pass paint filter test (ASTM 9095, Paint Filter Test, found in EPA document EPA SW-846, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods; Third Edition, September, 1986, as revised, December, 1987.) Solids are soluble under acidic conditions and will not have solid density\moisture content characteristic properties as a component of the tailings.
- B.6. DESCRIPTION OF MATERIAL: The Uranium Material is light grey to light brown in color and odorless. The material is consolidated chemical precipitates, no grain sized distribution data are available. The material is a relatively dense pressed filter cake and does not exhibit free moisture or drainage of retained liquid. Photo 1 at the bottom of these attachments depicts a sample of the Uranium Material developed from pilot filter press tests on the WTP solids.

#### C.1 RADIOLOGICAL EVALUATION

Uranium is present in the thousands of pCi/g and Thorium is present in the range of 10's of pCi/g, based on eight years of historical analyses (2002-2009) of the WTP solids for uranium and the testing of three samples collected in 2010 (WTPS-1, -2, -3) for the other radionuclides (Gross Alpha, Gross Beta, Pb-210, Ra-226, Th-228, Th-230, Th-232). The measured radionuclide activity concentrations for the dry uranium material has been used to describe the range of concentrations and weighted average expected for the uranium materials. Uranium values present representative values from the last 8 years of testing. See analytical data presented in response to Item D.1, below.

#### D. CHEMICAL AND HAZARDOUS CHARACTERISTICS

##### D.1 DESCRIPTION AND HISTORY OF MATERIAL

The plant feed is a combination of water pumped from two uranium mine pit lakes from the inactive Midnite Mine. Water from the pit lakes, which contain primarily metals, sulfate, and uranium, are pumped into the WTP at a rate of approximately 450 gallons per minute. The WTP is a conventional lime treatment high-density sludge process in which the metals and uranium are precipitated out in the lime treatment process. Historically, the final WTP solids have contained on average 0.18 wet weight percent uranium (0.21 wet weight percent  $U_3O_8$ ) at an average historical solids content of 15 percent when produced using centrifuges for dewatering. However, the centrifuges are to be replaced with a hydraulic filter press in 2011, increasing the percent solids of the final Uranium Material to between 25% and 45% resulting in a proportional increase in weight percent uranium estimated to be between 0.3 and 0.55 wet weight percent uranium (0.35 and 0.65 wet weight percent  $U_3O_8$ ).

The plant is typically operational from early May through the end of October and operates 24 hours per day, four days per week. Barium chloride is added to the influent water upstream of the neutralization tanks for removal of radium. The lime slurry is added to the second of three neutralization tanks for metals precipitation. At the discharge of the third neutralization tank, an anionic water soluble polymer (Neo Solutions NS-6852) is added as a coagulant during clarification. The stream is sent to one of two clarifiers and the sludge drawn from

## Radioactive Material Profile Record

the bottom and currently sent to a centrifuge for dewatering. As mentioned above, the centrifuge will be replaced in 2011 with a plate filter press, and solids content is expected to increase to 25 to 45 percent. The WTP solids decant is sent to the clarifier overflow tank, where it is pH adjusted to between 6.5 and 9.0 using sulfuric acid, and a polyacrylic scale inhibitor is added prior to discharge. No other chemical addition to the sludge generation process occurs in the WTP.

Once dewatered, the pressed WTP solids will fall directly from the filter press into the bed of the transport vehicle when the dewatering is complete. The transport truck is housed within the WTP building and remains on site until it is covered with a dedicated tight tarp and the material hauled to the off site for disposal or processing. From 2001 through 2008, the WTP produced between approximately 164,000 dry lbs and 393,500 dry lbs per year of treatment solids.

The WTP solids, also referred to as the Uranium Material, has been tested for natural uranium for the past eight years (2002-2009). In addition, three samples were collected in 2010 from this year's production of WTP solids (WTPS-1, -2, -3). The 2010 samples were analyzed for the following RCRA characteristic and listed hazardous waste properties: total uranium, total mercury, total metals, TCLP metals and mercury, Lead-210, isotopic thorium, total alpha emitting radium, volatile organic compounds ("VOCs"), semi-volatile organic compounds ("SVOCs"), diesel range organics ("DRO"), gas range organics ("GRO"), pesticides, herbicides, inorganics (reactive cyanides and reactive sulfides), and ignitibility. These data are summarized in the tables below.

The Uranium Material is an ore, which contains more than 0.05% uranium, is definitional source material as per 10 CFR 40.4 and 40 CFR Part 261.4(a)(4) and is explicitly exempt from regulation under RCRA. However, for the sake of completeness, the "Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes" (November 22, 1999), developed by Denson Mines in conjunction with, and accepted by, the State of Utah Department of Environmental Quality ("UDEQ") (Letter of December 7, 1999) was applied to these data. Based on this evaluation, the Uranium Material does not contain any listed or characteristic hazardous wastes. See *Review of Chemical Contaminants in Dawn Mining Company (DMC) Midnite Mine Uranium Material to Determine the Potential Presence of RCRA Characteristic or RCRA Listed Hazardous Waste*, Tetra Tech. November 2010.

### D.3 & D.4 ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTICS

See Summary Tables Below.

### D.7 CHEMICAL COMPOSITION

See Summary Tables Below.

**Uranium Material Metals Analysis for RCRA Toxicity Characteristics (TCLP)**

Sample ID	Sample Date	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	2002	<0.05	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2003	<0.5	<10	0.2	<0.5	<0.5	<0.02	<0.1	<0.5
	2004	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2005	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2006	<0.5	<10	0.25	<0.5	<0.5	<0.02	<0.1	<0.5
	2007	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2008	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	5/20/2009	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	9/17/2009	<0.06	0.083	<0.005	<0.01	<0.04	<0.0002	<0.06	<0.01
	9/19/2009	<0.04	0.16	0.019	<0.01	<0.04	<0.0002	<0.04	<0.01
	9/23/2009	<0.04	0.12	0.011	<0.01	<0.04	<0.0002	<0.04	<0.01
	10/6/2009	<0.1	0.066	0.03	0.03	<0.08	<0.0002	0.2	<0.02
WTPS-1	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.051	<0.1
WTPS-2	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.054	<0.1
WTPS-3	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.054	<0.1
	<b>Count</b>	15	15	15	15	15	15	15	15
	<b>Min</b>	<0.04	0.066	<0.005	<0.01	<0.03	<0.0002	<0.04	<0.01
	<b>Max</b>	<0.1	<10	<0.05	<0.5	<0.5	<0.02	0.2	<0.5
	<b>40 CFR Part 261.24</b>	5	100	1	5	5	0.2	1	5
	<b>PASS?</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yrs	Yes

### Uranium Material Organics and Pesticides Analyses for RCRA Toxicity Characteristics (TCLP)

Target Analyte	Units	Results		
		WTPS-1	WTPS-2	WTPS-3
<b>Organochlorine Pesticides - Method SW8081A - TCLP Leachate</b>				
Gamma-BHC (Lindane)	mg/L	<0.0001	<0.0001	<0.0001
Heptachlor	mg/L	<0.00015	<0.00015	<0.00015
Heptachlor Epoxide	mg/L	<0.000079	<0.000079	<0.000079
Gamma-Chlordane	mg/L	<0.000078	<0.000078	<0.000078
Alpha-Chlordane	mg/L	<0.00009	<0.00009	<0.00009
Endrin	mg/L	<0.000096	<0.000096	<0.000096
Methoxychlor	mg/L	<0.00039	<0.00039	<0.00039
Toxaphene	mg/L	<0.0051	<0.0051	<0.0051
Chlordane	mg/L	<0.0011	<0.0011	<0.0011
<b>Chlorinated Herbicides - Method SW8151A - TCLP Leachate</b>				
2,4-D	µg/L	<1.6	<1.6	<1.6
Silvex	µg/L	<0.12	<0.12	<0.12
<b>GC/MS Semivolatiles - Method SW8270D - TCLP Leachate</b>				
Pyridine	mg/L	<0.02	<0.02	<0.02
1,4-Dichlorobenzene	mg/L	<0.02	<0.02	<0.02
2-Methylphenol (o Cresol)	mg/L	<0.02	<0.02	<0.02
3+4-Methylphenol (m+p Cresol)	mg/L	<0.02	<0.02	<0.02
Hexachloroethane	mg/L	<0.02	<0.02	<0.02
Nitrobenzene	mg/L	<0.02	<0.02	<0.02
Hexachlorobutadiene	mg/L	<0.02	<0.02	<0.02
2,4,6-Trichlorophenol	mg/L	<0.02	<0.02	<0.02
2,4,5-Trichlorophenol	mg/L	<0.02	<0.02	<0.02
2,4-Dinitrotoluene	mg/L	<0.02	<0.02	<0.02
Hexachlorobenzene	mg/L	<0.02	<0.02	<0.02
Pentachlorophenol	mg/L	<0.043	<0.043	<0.043
<b>GC/MS Volatiles - Method SW8260_25B - Leachate</b>				
Vinyl Chloride	µg/L	<0.83	<0.83	<0.83
1,1-Dichloroethene*	µg/L	<0.83	<0.83	<0.83
2-Butanone (Methyl Ethyl Keytone)	µg/L	<8.3	<8.3	<8.3
Chloroform	µg/L	<0.83	<0.83	<0.83
Carbon Tetrachloride	µg/L	<0.83	<0.83	<0.83
1,2-Dichloroethane	µg/L	<0.83	<0.83	<0.83
Benzene	µg/L	<0.83	<0.83	<0.83
Trichloroethene*	µg/L	2.7 B,J	1.5 B,J	<0.83
Tetrachloroethene*	µg/L	<0.83	<0.83	<0.83
Chlorobenzene	µg/L	<0.83	<0.83	<0.83
<b>Inorganics - Method SW 846 7.3.1 (Cyanide) &amp; 7.3.2 (Sulfide), SW9045C (pH)</b>				
Reactive Cyanide	mg/kg	<0.1	<0.1	<0.1
Reactive Sulfide	mg/kg	<50	<50	<50
Solid pH in Water @ 25°C	pH	9.09	9.19	9.26
<b>Ignitability - Method SW1010A</b>				
Ignitability - 95°C	°C	U	U	U
B=This flag is used when the analyte is detected in the associated method blank as well as in the sample. It indicates probable blank contamination and warns the data user. This flag shall be used for a tentatively identified compound (TIC) as well as for a positively identified target compound.				
J=This flag indicates an estimated value. This flag is used as follows: (1) when estimating a concentration for tentatively identified compounds (TICs) where a 1:1 response is assumed; (2) when the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semi-volatile GC/MS identification criteria, and the result is less than the reporting limit (RL) but greater than the method detection limit (MDL); (3) when the data indicate the presence of a compound that meets the identification criteria, and the result is less than the RL but greater than the MDL; and (4) the reported value is estimated.				
*IUPAC compounds ending in "ethene" are equivalent to "ethylene".				

Radioactive Material Profile Record

**Uranium Material Analyses for RCRA Listed Hazardous Waste (Total Analyses)**

Target Analyte <sup>(1)</sup>	Units	Laboratory Results			Calculated Average
		WTPS-1	WTPS-2	WTPS-3	
<b>Total Uranium - Method SW6020A</b>					
Total Uranium	mg/kg	15,000	16,000	15,000	15,333
<b>Total ICP Metals - Method SW6010B</b>					
Arsenic	mg/kg	<5.9	<5.9	<5.7	<5.8
Barium	mg/kg	8,100	7,900	7,200	7,733
Beryllium	mg/kg	33	36	36	35
Cadmium	mg/kg	40	44	43	42
Calcium	mg/kg	15,000	16,000	16,000	15,667
Chromium	mg/kg	19	20	19	19
Cobalt	mg/kg	1,200	1,200	1,100	1,167
Copper	mg/kg	160	180	170	170
Iron	mg/kg	690	740	740	723
Lead	mg/kg	18	19	17	18
Manganese	mg/kg	110,000	110,000	96,000	105,333
Molybdenum	mg/kg	<5.8	<6.0	<5.7	<5.8
Nickel	mg/kg	1,700	1,800	1,800	1,767
Selenium	mg/kg	25	26	26	26
Silver	mg/kg	11	12	11	11
Thallium	mg/kg	<580	<600	<570	<583
Tin	mg/kg	<29	<30	<29	<29
Vanadium	mg/kg	<5.8	<6.0	<5.7	<5.8
Zinc	mg/kg	3,400	3,600	3,600	3,533
<b>Total Mercury - Method SW7471A</b>					
Total Mercury	mg/kg	<0.19	<0.2	<0.19	<0.19
<b>GC/MS Total Volatile Organics - Method SW8260</b>					
Chloromethane	µg/kg	<1.1	<1.2	<1.1	<1.1
Acetone	µg/kg	22 B	29 B	33 B	28
Methylene Chloride	µg/kg	3.8 J,B	3.7 J,B	5.8 J,B	4.4
2-Butanone	µg/kg	<5.7	<5.9	<5.7	<5.8
Tetrahydrofuran	µg/kg	<7.2	<7.4	<7.2	<7.3
Chloroform	µg/kg	1.7 J	2 J	1.2 J	1.6
Carbon Tetrachloride	µg/kg	<1.3	<1.4	<1.3	<1.3
Benzene	µg/kg	<0.94	<0.96	<0.93	<0.94
Toluene	µg/kg	2.2 J,B	1.9 J,B	1.3 J,B	1.8
m,p-Xylene	µg/kg	<1.9	<1.9	<1.9	<1.9
o-Xylene	µg/kg	<0.95	<0.97	<0.94	<0.95
Naphthalene	µg/kg	<1.4	<1.4	<1.4	<1.4

<sup>(1)</sup> All values as reported by ALS Laboratory as dry weight values

Radioactive Material Profile Record

Uranium Material Analyses for RCRA Listed Hazardous Waste (Total Analyses) Cont'd

Target Analyte	Units <sup>(1)</sup>	Laboratory Results			Calculated Average
		WTPS-1	WTPS-2	WTPS-3	
<b>GC/MS Total Semi-Volatile Organics - Method SW8270D</b>					
Pyridine	µg/kg	<310	<320	<320	<317
1,4-dichlorobenzene	µg/kg	<310	<320	<320	<317
2-methylphenol	µg/kg	<310	<320	<320	<317
3+4-methylphenol	µg/kg	<310	<320	<320	<317
Hexachloroethane	µg/kg	<310	<320	<320	<317
Nitrobenzene	µg/kg	<310	<320	<320	<317
Hexachlorobutadiene	µg/kg	<310	<320	<320	<317
2,4,6-trichlorophenol	µg/kg	<310	<320	<320	<317
2,4,5-trichlorophenol	µg/kg	<310	<320	<320	<317
2,4-dinitrotoluene	µg/kg	<310	<320	<320	<317
Hexachlorobenzene	µg/kg	<310	<320	<320	<317
Pentachlorophenol	µg/kg	<490	<500	<500	<497
<b>Gasoline Range Organics - Method SW8015B</b>					
Gasoline Range Organics	mg/kg	<0.38	<0.35	<0.39	<0.37
<b>Diesel Range Organics - Method SW8015MB</b>					
Diesel Range Organics	mg/kg	<6.5	<6.6	<6.8	<6.6
<b>Oil &amp; Grease</b>					
Oil & Grease	mg/kg	<120	<120	<120	<120
<b>Inorganics</b>					
Ammonia as N - Method EPA350.1	mg/kg	7.9	7.9	8.3	8.0
Nitrate/Nitrite as N - Method EPA353.2 Revision 2	mg/kg	3.1	3.2	3.1	3.1
Total Dissolved Solids - EPA160.1	mg/kg	26,000	26,000	27,000	26333.3
Fluoride - Method EPA300.0 Revision 2.1	mg/kg	38	38	40	38.7
Chloride - Method EPA300.0 Revision 2.1	mg/kg	40	39	41	40
Sulfate - Method EPA300.0 Revision 2.1	mg/kg	17,000	17,000	17,000	17,000
<b>Gross Alpha/Beta - GFPC</b>					
Gross Alpha	pCi/g	4,310±690	4,830±770	5,440±870	4,860
Gross Beta	pCi/g	4,870±780	4,780±760	4,860±780	4,867
<b>Lead-210 - Liquid Scintillation</b>					
Lead-210	pCi/g	33.1±8.0	34.7±8.4	32.0±7.8	33.3
<b>Radium-226 - GFPC</b>					
Radium-226	pCi/g	22.8±5.8	25.7±6.6	23.8±6.1	24.1
<b>Total Alpha Emitting Radium - GFPC</b>					
Total Radium	pCi/g	39.7±10	41±11	36.6±9.4	39.1
Total Radium (duplicate sample)	pCi/g	35.8±9.2			
<b>Isotopic Thorium - Alpha Spectroscopy</b>					
Th-228	pCi/g	1.24±0.99	1.50±0.74	0.93±0.67	1.22
Th-230	pCi/g	20.4±3.8	21.4±3.9	20.4±3.7	20.7
Th-232	pCi/g	1.14±0.48	0.66±0.34	0.71±0.32	0.84

<sup>(1)</sup> All values as reported by ALS Laboratory as dry weight values

Radioactive Material Profile Record

Photo Number 1. Fresh filter cake from filter press tests.



## AFFIDAVIT OF ROBERT NELSON

I, Robert Nelson, being duly sworn according to law, depose and state as follows:

1. I am presently employed as the Site Manager for Dawn Mining, Corporation (“Dawn Mining”) at the company’s Midnite Mine Water Treatment Plant, Wellpinit, Washington facility. (“the Water Treatment Plant facility”). In that capacity, I am responsible for management of the Midnite Mine Water Treatment Plant. My experience with the Water Treatment Plant facility dates back to 1989 when the water treatment plant was first constructed. I have personal knowledge of the raw materials used, the production processes employed, and the waste handling procedures followed at the Water Treatment Plant facility. I am also familiar with the hazardous waste regulations set out in U.S. Code of Federal Regulations, Title 40261, Subpart D, as amended by the U.S. Federal Register August 6, 1998.

2. Dawn Mining proposes to ship to Denison Mines (USA) Corp.’s’ (Denison’s) White Mesa Mill near Blanding Utah, uranium-bearing materials for processing as alternate feed materials. All of the proposed alternate feed materials are secondary products or waste streams produced from treatment of mine waters at the Water Treatment Plant facility, and contain no materials or wastes from any other source.

3. The uranium-bearing materials consist of flocculated solids from the treatment of mine waters. The treatment process consists of a pH adjustment using hydrated lime (calcium hydroxide;  $\text{Ca}(\text{OH})_2$ ), precipitation of radium-226 by the addition of barium chloride dihydrate ( $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ ) and flocculation of the solids using Neo Solutions Inc. flocculent NS- 6852 (anionic water-soluble polymer).

4. Based on the processing steps employed in the water treatment operation that generated the proposed alternate feed materials, the materials do not contain any of

the listed wastes enumerated in U.S. Code of Federal Regulations, Title 40 261, Subpart D as amended by the U.S. Federal Register August 6, 1998.

5. Based on my knowledge of waste management at the Water Treatment Plant facility, the proposed alternate feed materials have not been mixed with wastes from any other source, which may have been defined as or which may have contained listed wastes enumerated in U.S. Code of Federal Regulations, Title 40 Section 261, Subpart D as amended by the U.S. Federal Register August 6, 1998.

6. Specifically, the proposed alternate feed materials do not contain hazardous wastes from non-specific sources (U.S. RCRA F type wastes) because (a) Dawn Mining does not operate any processes at the Water Treatment Plant facility which produce the types of wastes listed in Section 261.31 of Title 40 of the U.S. Code of Federal Regulations, and (b) Dawn Mining has never accepted at the Water Treatment Plant facility, nor have the proposed alternate feed materials ever been combined with, wastes from any other source which contain U.S. RCRA F type wastes as defined therein.

7. Specifically, the proposed alternate feed materials do not contain hazardous wastes from specific sources (U.S. RCRA K type wastes) because Dawn Mining does not operate any of the processes which produce the types of wastes listed in Section 262.31 of Title 40 of the U.S. Code of Federal Regulations, and (b) Dawn Mining has never accepted at the Water Treatment Plant facility, nor have the proposed alternate feed materials ever been combined with, wastes from any other source which contain U.S. RCRA K type wastes as defined therein.

8. Specifically, the proposed alternate feed materials are not U.S. RCRA P or U type wastes as defined in Section 261.33 of Title 40 of the U.S. Code of Federal Regulations because they (a) are not manufactured or formulated commercially pure grade chemicals, off spec commercial chemical products or manufacturing chemical intermediates, residues from containers that held commercial chemical products or manufacturing chemical intermediates, or any residue or contaminated soil, water or other

debris resulting from a spill cleanup, and (b) Dawn Mining has never accepted, nor have the proposed alternate feed materials ever been combined with, wastes from any other source which contain U.S. RCRA P or U type wastes as defined therein.

9. The proposed alternate feed materials were regulated by the U.S. Nuclear Regulatory Commission through the Washington Department of Health, as source material under Radioactive Materials License No. WN-I0390-1, though this license has since been terminated. However, the treatment process and the resulting treatment solids have not materially changed since the license was in effect. As such, the proposed alternate feed materials are excluded from the definition of hazardous waste under 40 CFR Part 261.4(4).

10. Based on my knowledge of past management practices at the Water Treatment Plant facility and experience with the treatment solids generated from this process, the proposed alternate feed materials will not yield water during shipping or during dry open air storage nor will the proposed alternate feed material flow when exposed to precipitation events or standard dust control measures by applying water through spray application, and is not prone degrading to fine dust sized particles.

*Robert E. Al*

Sworn to and subscribed before me

this 13<sup>th</sup> day of October, 2010

*Linda Sue Milliken*  
Notary Public *Linda Sue Milliken*



My Commission Expires: 6/27/11

**ATTACHMENT 3**





# State of Utah

DEPARTMENT OF ENVIRONMENTAL QUALITY  
DIVISION OF SOLID AND HAZARDOUS WASTE

Michael O. Leavitt  
Governor  
Dianne R. Nielson, Ph.D.  
Executive Director  
Dennis R. Downs  
Director

288 North 1460 West  
P.O. Box 144880  
Salt Lake City, Utah 84114-4880  
(801) 538-6170  
(801) 538-6715 Fax  
(801) 536-4414 TDD  
[www.deq.state.ut.us](http://www.deq.state.ut.us) Web

December 7, 1999

M. Lindsay Ford  
Parsons, Behle and Latimer  
One Utah Center  
201 South Main Street  
Suite 1800  
Post Office Box 45898  
Salt Lake City, Utah 84145-0898

**RE: Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes**

Dear Mr. Ford:

On November 22, 1999, we received the final protocol to be used by International Uranium Corporation (IUSA) in determining whether alternate feed materials proposed for processing at the White Mesa Mill are listed hazardous wastes. We appreciate the effort that went into preparing this procedure and feel that it will be a useful guide for IUSA in its alternate feed determinations.

As was discussed, please be advised that it is IUSA's responsibility to ensure that the alternate feed materials used are not listed hazardous wastes and that the use of this protocol cannot be used as a defense if listed hazardous waste is somehow processed at the White Mesa Mill.

Thank you again for your corporation. If you have any questions, please contact Don Verbica at 538-6170.

Sincerely,

Dennis R. Downs, Executive Secretary  
Utah Solid and Hazardous Waste Control Board

c: Bill Sinclair, Utah Division of Radiation Control



A PROFESSIONAL  
LAW CORPORATION

One Utah Center  
251 South Main Street  
Suite 1800  
Post Office Box 45898  
Salt Lake City, Utah  
94145-0898  
Telephone 801 532-234  
Facsimile 801 536-6111

November 22, 1999

Don Verbica  
Utah Division of Solid & Hazardous Waste  
288 North 1460 West  
Salt Lake City, Utah

**Re: Protocol for Determining Whether Alternate Feed Materials are  
Listed Hazardous Wastes**

Dear Don:

I am pleased to present the final protocol to be used by International Uranium (USA) Corporation ("IUSA") in determining whether alternate feed materials proposed for processing at the White Mesa Mill are listed hazardous wastes. Also attached is a red-lined version of the protocol reflecting final changes made to the document based on our last discussion with you as well as some minor editorial changes from our final read-through of the document. We appreciate the thoughtful input of you and Scott Anderson in developing this protocol. We understand the Division concurs that materials determined not to be listed wastes pursuant to this protocol are not listed hazardous wastes.

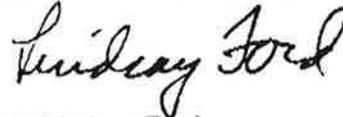
We also recognize the protocol does not address the situation where, after a material has been determined not to be a listed hazardous waste under the protocol, new unrefutable information comes to light that indicates the material is a listed hazardous waste. Should such an eventuality arise, we understand an appropriate response, if any, would need to be worked out on a case-by-case basis.

Don Verbica  
Utah Division of Solid & Hazardous Waste  
November 22, 1999  
Page Two

Thank you again for your cooperation on this matter. Please call me if you have any questions.

Very truly yours,

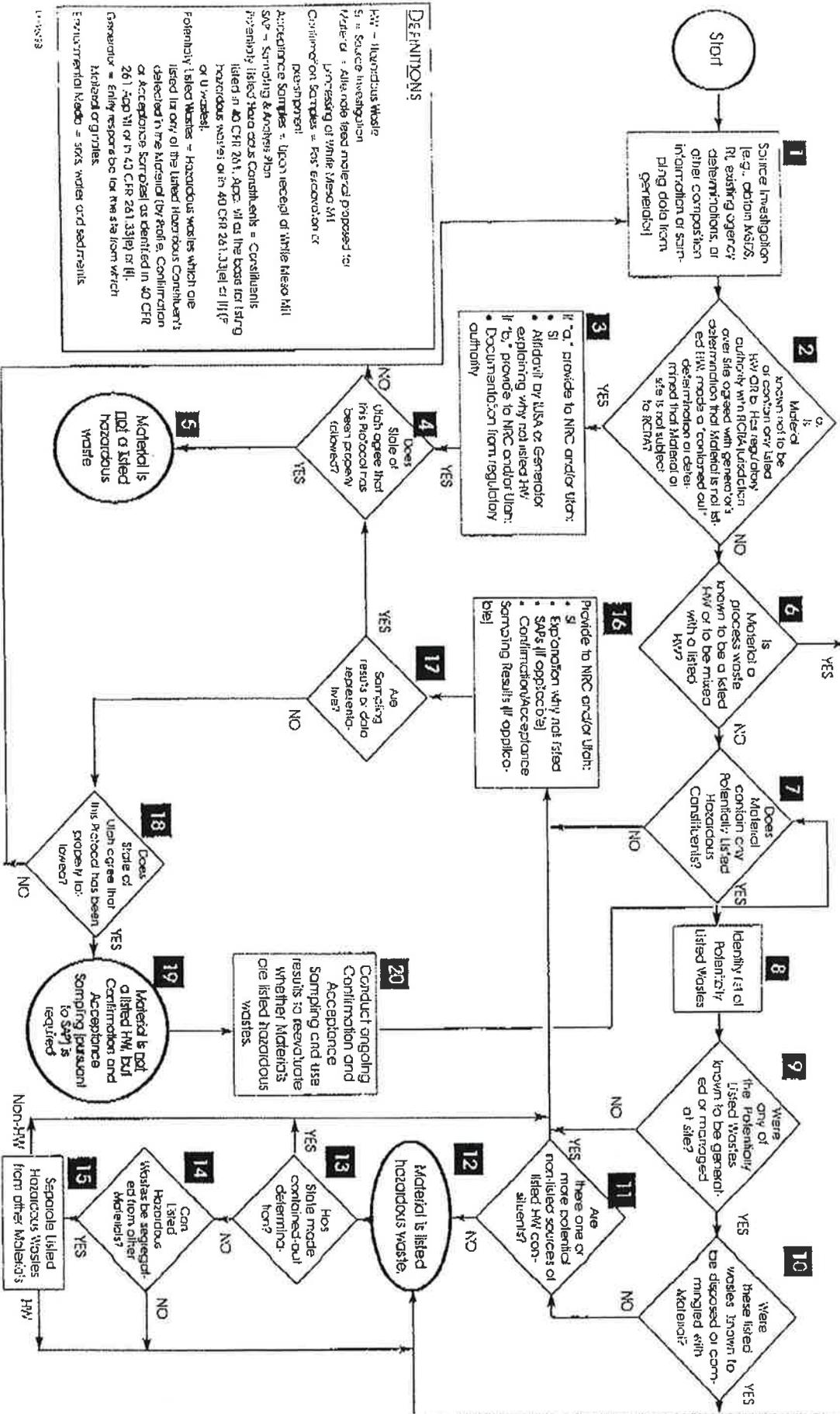
Parsons Behle & Latimer

A handwritten signature in cursive script that reads "Lindsay Ford".

M. Lindsay Ford

cc: (with copy of final protocol only)  
Dianne Nielson  
Fred Nelson  
Brent Bradford  
Don Ostler  
Loren Morton  
Bill Sinclair  
David Frydenlund  
David Bird  
Tony Thompson

# Protocol for Determining if Alternate Feed Material is a Listed Hazardous Waste



PROTOCOL FOR DETERMINING WHETHER  
ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES<sup>1</sup>

NOVEMBER 16, 1999

**1. SOURCE INVESTIGATION.**

Perform a good faith investigation (a "Source Investigation" or "SI")<sup>2</sup> regarding whether any listed hazardous wastes<sup>3</sup> are located at the site from which alternate feed material<sup>4</sup> ("Material") originates (the "Site"). This investigation will be conducted in conformance with EPA guidance<sup>5</sup> and the extent of information required will vary with the circumstances of each case. Following are examples of investigations that would be considered satisfactory under EPA guidance and this Protocol for some selected situations:

- Where the Material is or has been generated from a known process under the control of the generator: (a) an affidavit, certificate, profile record or similar document from the Generator or Site Manager, to that effect, together with (b) a Material Safety Data Sheet ("MSDS") for the Material, limited profile sampling, or a material composition determined by the generator/operator based on a process material balance.

---

<sup>1</sup> This Protocol reflects the procedures that will be followed by International Uranium (USA) Corporation ("IUSA") for determining whether alternate feed materials proposed for processing at the White Mesa Mill are (or contain) listed hazardous wastes. It is based on current Utah and EPA rules and EPA guidance under the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 et seq. This Protocol will be changed as necessary to reflect any pertinent changes to RCRA rules or EPA guidance.

<sup>2</sup> This investigation will be performed by IUSA, by the entity responsible for the site from which the Material originates (the "Generator"), or by a combination of the two.

<sup>3</sup> Attachment 1 to this Protocol provides a summary of the different classifications of RCRA listed hazardous wastes.

<sup>4</sup> Alternate feed materials that are primary or intermediate products of the generator of the material (e.g. "green" or "black" salts) are not RCRA "secondary materials" or "solid wastes," as defined in 40 CFR 261, and are not covered by this Protocol.

<sup>5</sup> EPA guidance identifies the following sources of site- and waste-specific information that may, depending on the circumstances, be considered in such an investigation: hazardous waste manifests, vouchers, bills of lading, sales and inventory records, material safety data sheets, storage records, sampling and analysis reports, accident reports, site investigation reports, interviews with employees/former employees and former owners/operators, spill reports, inspection reports and logs, permits, and enforcement orders. See e.g., 61 Fed. Reg. 18805 (April 29, 1996).

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

- Where specific information exists about the generation process and management of the Material: (a) an affidavit, certificate, profile record or similar document from the Generator or Site Manager, to that effect, together with (b) an MSDS for the Material, limited profile sampling data or a preexisting investigation performed at the Site pursuant to CERCLA, RCRA or other state or federal environmental laws or programs.
- Where potentially listed processes are known to have been conducted at a Site, an investigation considering the following sources of information: site investigation reports prepared under CERCLA, RCRA or other state or federal environmental laws or programs (e.g., an RI/FS, ROD, RFI/CMS, hazardous waste inspection report); interviews with persons possessing knowledge about the Material and/or Site; and review of publicly available documents concerning process activities or the history of waste generation and management at the Site.
- If material from the same source is being or has been accepted for direct disposal as 11e.(2) byproduct material in an NRC-regulated facility in the State of Utah with the consent or acquiescence of the State of Utah, the Source Investigation performed by such facility.

*Proceed to Step 2.*

**2. SPECIFIC INFORMATION OR AGREEMENT/DETERMINATION BY RCRA REGULATORY AUTHORITY THAT MATERIAL IS NOT A LISTED HAZARDOUS WASTE?**

a. Determine whether specific information from the Source Investigation exists about the generation and management of the Material to support a conclusion that the Material is not (and does not contain) any listed hazardous waste. For example, if specific information exists that the Material was not generated by a listed waste source and that the Material has not been mixed with any listed wastes, the Material would not be a listed hazardous waste.

b. Alternatively, determine whether the appropriate state or federal authority with RCRA jurisdiction over the Site agrees in writing with the generator's determination that the Material is not a listed hazardous waste, has made a "contained-out" determination<sup>6</sup> with respect to the Material or has concluded the Material or Site is not subject to RCRA.

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<sup>6</sup> EPA explains the "contained-out" (also referred to as "contained-in") principle as follows:

In practice, EPA has applied the contained-in principle to refer to a process where a site-specific determination is made that concentrations of hazardous constituents in any given  
(footnote continued on next page)

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

*If yes to either question, proceed to Step 3.*

*If no to both questions, proceed to Step 6.*

**3. PROVIDE INFORMATION TO NRC AND UTAH.**

a. If specific information exists to support a conclusion that the Material is not, and does not contain, any listed hazardous waste, IUSA will provide a description of the Source Investigation to NRC and/or the State of Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (the "State"), together with an affidavit explaining why the Material is not a listed hazardous waste.

b. Alternatively, if the appropriate regulatory authority with RCRA jurisdiction over the Site agrees in writing with the generator's determination that the Material is not a listed hazardous waste, makes a contained-out determination or determines the Material or Site is not subject to RCRA, IUSA will provide documentation of the regulatory authority's determination to NRC and the State. IUSA may rely on such determination provided that the State agrees the conclusions of the regulatory authority were reasonable and made in good faith.

*Proceed to Step 4.*

**4. DOES STATE OF UTAH AGREE THAT ALL PREVIOUS STEPS HAVE BEEN PERFORMED IN ACCORDANCE WITH THIS PROTOCOL?**

Determine whether the State agrees that this Protocol has been properly followed (including that proper decisions were made at each decision point). The State shall review the information provided by IUSA in Step 3 or 16 with reasonable speed and advise IUSA if it believes IUSA has not properly followed this Protocol in determining

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(footnote continued from previous page)

volume of environmental media are low enough to determine that the media does not "contain" hazardous waste. Typically, these so-called "contained-in" [or "contained-out"] determinations do not mean that no hazardous constituents are present in environmental media but simply that the concentrations of hazardous constituents present do not warrant management of the media as hazardous waste. ...

EPA has not, to date, issued definitive guidance to establish the concentrations at which contained-in determinations may be made. As noted above, decisions that media do not or no longer contain hazardous waste are typically made on a case-by-case basis considering the risks posed by the contaminated media.

63 Fed. Reg. 28619, 28621-22 (May 26, 1998) (Phase IV LDR preamble).

that the Material is not listed hazardous waste, specifying the particular areas of deficiency.

If this Protocol has not been properly followed by IUSA in making its determination that the Material is not a listed hazardous waste, then IUSA shall redo its analysis in accordance with this Protocol and, if justified, resubmit the information described in Step 3 or 16 explaining why the Material is not a listed hazardous waste. The State shall notify IUSA with reasonable speed if the State still believes this Protocol has not been followed.

*If yes, proceed to Step 5.*

*If no, proceed to Step 1.*

**5. MATERIAL IS NOT A LISTED HAZARDOUS WASTE.**

The Material is not a listed hazardous waste and no further sampling or evaluation is necessary in the following circumstances:

- ◆ Where the Material is determined not to be a listed hazardous waste based on specific information about the generation/management of the Material OR the appropriate RCRA regulatory authority with jurisdiction over the Site agrees with the generator's determination that the Material is not a listed HW, makes a contained-out determination, or concludes the Material or Site is not subject to RCRA (and the State agrees the conclusions of the regulatory authority were reasonable and made in good faith) (Step 2); or
- ◆ Where the Material is determined not to be a listed hazardous waste (in Steps 6 through 11, 13 or 15) and Confirmation/Acceptance Sampling are determined not to be necessary (under Step 17).

**6. IS MATERIAL A PROCESS WASTE KNOWN TO BE A LISTED HAZARDOUS WASTE OR TO BE MIXED WITH A LISTED HAZARDOUS WASTE?**

Based on the Source Investigation, determine whether the Material is a process waste known to be a listed hazardous waste or to be mixed with a listed hazardous waste. If the Material is a process waste and is from a listed hazardous waste source, it is a listed hazardous waste. Similarly, if the Material is a process waste and has been mixed with a listed hazardous waste, it is a listed hazardous waste under the RCRA "mixture rule." If

the Material is an Environmental Medium,<sup>7</sup> it cannot be a listed hazardous waste by direct listing or under the RCRA "mixture rule."<sup>8</sup> If the Material is a process waste but is not known to be from a listed source or to be mixed with a listed waste, or if the Material is an Environmental Medium, proceed to Steps 7 through 11 to determine whether it is a listed hazardous waste.

*If yes, proceed to Step 12.*

*If no, proceed to Step 7.*

**7. DOES MATERIAL CONTAIN ANY POTENTIALLY LISTED HAZARDOUS CONSTITUENTS?**

Based on the Source Investigation (and, if applicable, Confirmation and Acceptance Sampling), determine whether the Material contains any hazardous constituents listed in the then most recent version of 40 CFR 261, Appendix VII (which identifies hazardous constituents for which F- and K-listed wastes were listed) or 40 CFR 261.33(e) or (f) (the P and U listed wastes) (collectively "Potentially Listed Hazardous Constituents"). If the Material contains such constituents, a source evaluation is necessary (pursuant to Steps 8 through 11). If the Material does not contain any Potentially Listed Hazardous Constituents, it is not a listed hazardous waste. The Material also is not a listed hazardous waste if, where applicable, Confirmation and Acceptance Sampling results do not reveal the presence of any "new" Potentially Listed Hazardous Constituents (*i.e.*, constituents other than those that have already been identified by the Source Investigation (or previous Confirmation/Acceptance Sampling) and determined not to originate from a listed source).

*If yes, proceed to Step 8.*

*If no, proceed to Step 16.*

**8. IDENTIFY POTENTIALLY LISTED WASTES.**

Identify potentially listed hazardous wastes ("Potentially Listed Wastes") based on Potentially Listed Hazardous Constituents detected in the Material, *i.e.*, wastes which are listed for any of the Potentially Listed Hazardous Constituents detected in the Material, as

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<sup>7</sup> The term "Environmental Media" means soils, ground or surface water and sediments.

<sup>8</sup> The "mixture rule" applies only to mixtures of listed hazardous wastes and other "solid wastes." See 40 CFR § 261.3(a)(2)(iv). The mixture rule does not apply to mixtures of listed wastes and Environmental Media, because Environmental Media are not "solid wastes" under RCRA. See 63 Fed. Reg. 28556, 28621 (May 26, 1998).

identified in the then most current version of 40 CFR 261 Appendix VII or 40 CFR 261.33(c) or (f).<sup>9</sup> With respect to Potentially Listed Hazardous Constituents identified through Confirmation and/or Acceptance Sampling, a source evaluation (pursuant to Steps 8 through 11) is necessary only for "new" Potentially Listed Hazardous Constituents (*i.e.*, constituents other than those that have already been identified by the Source Investigation (or previous Confirmation/Acceptance Sampling) and determined not to originate from a listed source).

*Proceed to Step 9.*

**9. WERE ANY OF THE POTENTIALLY LISTED WASTES KNOWN TO BE GENERATED OR MANAGED AT SITE?**

Based on information from the Source Investigation, determine whether any of the Potentially Listed Wastes identified in Step 8 are known to have been generated or managed at the Site. This determination involves identifying whether any of the specific or non-specific sources identified in the K- or F-lists has ever been conducted or located at the Site, whether any waste from such processes has been managed at the Site, and whether any of the P- or U-listed commercial chemical products has ever been used, spilled or managed there. In particular, this determination should be based on the following EPA criteria:

**Solvent Listings (F001-F005)**

Under EPA guidance, "to determine if solvent constituents contaminating a waste are RCRA spent solvent F001-F005 wastes, the [site manager] must know if:

- ◆ The solvents are *spent* and *cannot be reused without reclamation or cleaning*.
- ◆ The solvents were *used exclusively for their solvent properties*.
- ◆ The solvents are *spent mixtures and blends that contained, before use, a total of 10 percent or more (by volume) of the solvents listed in F001, F002, F004, and F005*.

If the solvents contained in the [wastes] are RCRA listed wastes, the [wastes] are RCRA hazardous waste. When the [site manager] does not have guidance information on the use of the solvents and their characteristics before use, the [wastes] cannot be classified as containing a

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<sup>9</sup> For example, if the Material contains tetrachloroethylene, the following would be Potentially Listed Wastes: F001, F002, F024, K019, K020, K150, K151 or U210. See 40 CFR 261 App. VII.

listed spent solvent."<sup>10</sup> The person performing the Source Investigation will make a good faith effort to obtain information on any solvent use at the Site. If solvents were used at the Site, general industry standards for solvent use in effect at the time of use will be considered in determining whether those solvents contained 10 percent or more of the solvents listed in F001, F002, F004 or F005.

#### **K-Listed Wastes and F-Listed Wastes Other Than F001-F005**

Under EPA guidance, to determine whether K wastes and F wastes other than F001-F005 are RCRA listed wastes, the generator "must know the *generation process information* (about each waste contained in the RCRA waste) described in the listing. For example, for [wastes] to be identified as containing K001 wastes that are described as 'bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol,' the [site manager] must know the manufacturing process that generated the wastes (treatment of wastewaters from wood preserving process), feedstocks used in the process (creosote and pentachlorophenol), and the process identification of the wastes (bottom sediment sludge)."<sup>11</sup>

#### **P- and U-Listed Wastes**

EPA guidance provides that "P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-spec products. Not every waste containing a P or U chemical is a hazardous waste. To determine whether a [waste] contains a P or U waste, the [site manager] must have direct evidence of product use. In particular, the [site manager] should ascertain, if possible, whether the chemicals are:

- ◆ Discarded (as described in 40 CFR 261.2(a)(2)).
- ◆ Either off-spec commercial products or a commercially sold grade.
- ◆ Not used (soil contaminated with spilled unused wastes is a P or U waste).

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<sup>10</sup> Management of Investigation-Derived Wastes During Site Inspections, EPA/540/G-91/009, May 1991 (emphasis added).

<sup>11</sup> Management of Investigation-Derived Wastes During Site Inspections, EPA/540/G-91/009, May 1991 (emphasis added).

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

- ◆ The sole active ingredient in a formulation.<sup>12,13</sup>

If Potentially Listed Wastes were known to be generated or managed at the Site, further evaluation is necessary to determine whether these wastes were disposed of or commingled with the Material (Steps 10 and possibly 11). If Potentially Listed Wastes were not known to be generated or managed at the Site, then information concerning the source of Potentially Listed Hazardous Constituents in the Material will be considered "unavailable or inconclusive" and, under EPA guidance,<sup>13</sup> the Material will be assumed not to be a listed hazardous waste.

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12 Management of Investigation-Derived Wastes During Site Inspections, EPA/540/G-91/009, May 1991.

13 EPA guidance consistently provides that, where information concerning the origin of a waste is unavailable or inconclusive, the waste may be assumed not to be a listed hazardous waste. See e.g., Memorandum from Timothy Fields (Acting Assistant Administrator for Solid Waste & Emergency Response) to RCRA/CERCLA Senior Policy Managers regarding "Management of Remediation Waste Under RCRA," dated October 14, 1998 ("Where a facility owner/operator makes a good faith effort to determine if a material is a listed hazardous waste but cannot make such a determination because documentation regarding a source of contamination, contaminant, or waste is *unavailable or inconclusive*, EPA has stated that one may assume the source, contaminant, or waste is not listed hazardous waste"); NCP Preamble, 55 Fed. Reg. 8758 (March 8, 1990) (Noting that "it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, *if such documentation is lacking, the lead agency may assume it is not a listed waste*"); Preamble to proposed Hazardous Waste Identification Rule, 61 Fed. Reg. 18805 (April 29, 1996) ("Facility owner/operators should make a good faith effort to determine whether media were contaminated by hazardous wastes and ascertain the dates of placement. The Agency believes that by using available site- and waste-specific information ... facility owner/operators would typically be able to make these determinations. However, as discussed earlier in the preamble of today's proposal, *if information is not available or inconclusive, facility owner/operators may generally assume that the material contaminating the media were not hazardous wastes.*"); Preamble to LDR Phase IV Rule, 63 Fed. Reg. 28619 (May 26, 1998) ("As discussed in the April 29, 1996 proposal, the Agency continues to believe that, *if information is not available or inconclusive, it is generally reasonable to assume that contaminated soils do not contain untreated hazardous wastes ...*"); and Memorandum from John H. Skinner (Director, EPA Office of Solid Waste) to David Wagoner (Director, EPA Air and Waste Management Division, Region VII) regarding "Soils from Missouri Dioxin Sites," dated January 6, 1984 ("The analyses indicate the presence of a number of toxic compounds in many of the soil samples taken from various sites. However, the presence of these toxicants in the soil does not automatically make the soil a RCRA hazardous waste. The origin of the toxicants must be known in order to determine that they are derived from a listed hazardous waste(s). *If the exact origin of the toxicants is not known, the soils cannot be* (footnote continued on next page)

*If yes, proceed to Step 10.*

*If no, proceed to Step 16.*

**10. WERE LISTED WASTES KNOWN TO BE DISPOSED OF OR COMMINGLED WITH MATERIAL?**

If listed wastes identified in Step 9 were known to be generated at the Site, determine whether they were known to be disposed of or commingled with the Material?

*If yes, proceed to Step 12.*

*If no, proceed to Step 11.*

**11. ARE THERE ONE OR MORE POTENTIAL NON-LISTED SOURCES OF LISTED HAZARDOUS WASTE CONSTITUENTS?**

In a situation where Potentially Listed Wastes were known to have been generated/managed at the Site, but the wastes were not known to have been disposed of or commingled with the Material, determine whether there are potential non-listed sources of Potentially Listed Hazardous Constituents in the Material. If not, unless the State agrees otherwise, the constituents will be assumed to be from listed sources (proceed to Step 12). If so, the Material will be assumed not to be a listed hazardous waste (proceed to Step 16). Notwithstanding the existence of potential non-listed sources at a Site, the Potentially Listed Hazardous Constituents in the Material will be considered to be from the listed source(s) if, based on the relative proximity of the Material to the listed and non-listed source(s) and/or information concerning waste management at the Site, the evidence is compelling that the listed source(s) is the source of Potentially Listed Hazardous Constituents in the Material.

*If yes, proceed to Step 16.*

*If no, proceed to Step 12.*

**12. MATERIAL IS A LISTED HAZARDOUS WASTE.**

The Material is a listed hazardous waste under the following circumstances:

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(footnote continued from previous page)

considered RCRA hazardous wastes unless they exhibit one or more of the characteristics of hazardous waste ...").

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

- ◆ If the Material is a process waste and is known to be a listed hazardous waste or to be mixed with a listed hazardous waste (Step 6),
- ◆ If Potentially Listed Wastes were known to be generated/managed at the Site and to be disposed of/commingled with the Material (Step 10) (subject to a "contained-out" determination in Step 13), or
- ◆ If Potentially Listed Wastes were known to be generated/managed at the Site, were not known to be disposed of/commingled with the Material but there are not any potential non-listed sources of the Potentially Listed Hazardous Constituents detected in the Material (Step 11) (subject to a "contained-out" determination in Step 13).

*Proceed to Step 13.*

**13. HAS STATE OF UTAH MADE A CONTAINED-OUT DETERMINATION.**

If the Material is an Environmental Medium, and:

- the level of any listed waste constituents in the Material is "de minimis"; or
- all of the listed waste constituents or classes thereof are already present in the White Mesa Mill's tailings ponds as a result of processing conventional ores or other alternate feed materials in concentrations at least as high as found in the Materials

the State of Utah will consider whether it is appropriate to make a contained-out determination with respect to the Material.

*If the State makes a contained-out determination, proceed to Step 16.*

*If the State does not make a contained-out determination, proceed to Step 14.*

**14. IS IT POSSIBLE TO SEGREGATE LISTED HAZARDOUS WASTES FROM OTHER MATERIALS?**

Determine whether there is a reasonable way to segregate material that is a listed hazardous waste from alternate feed materials that are not listed hazardous wastes that will be sent to IUSA's White Mesa Mill. For example, it may be possible to isolate material from a certain area of a remediation site and exclude that material from Materials that will be sent to the White Mesa Mill. Alternatively, it may be possible to increase

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

sampling frequency and exclude materials with respect to which the increased sampling identifies constituents which have been attributed to listed hazardous waste.

*If yes, proceed to Step 15.*

*If no, proceed to Step 12.*

**15. SEPARATE LISTED HAZARDOUS WASTES FROM MATERIALS.**

Based on the method of segregation determined under Step 14, materials that are listed hazardous wastes are separated from Materials that will be sent to the White Mesa Mill.

*For materials that are listed hazardous wastes, proceed to Step 12.*

*For Materials to be sent to the White Mesa Mill, proceed to Step 16.*

**16. PROVIDE INFORMATION TO NRC AND UTAH.**

If the Material does not contain any Potentially Listed Hazardous Constituents (as determined in Step 7), where information concerning the source of Potentially Listed Hazardous Constituents in the Material is "unavailable or inconclusive" (as determined in Steps 8 through 11), or where the State of Utah has made a contained-out determination with respect to the Material (Step 13), the Material will be assumed not to be (or contain) a listed hazardous waste. In such circumstances, IUSA will submit the following documentation to NRC and the State:

- ◆ A description of the Source Investigation;
- ◆ An explanation of why the Material is not a listed hazardous waste.
- ◆ Where applicable, an explanation of why Confirmation/Acceptance Sampling has been determined not to be necessary in Step 17.
- ◆ If Confirmation/Acceptance Sampling has been determined necessary in Step 17, a copy of IUSA's and the Generator's Sampling and Analysis Plans.
- ◆ A copy of Confirmation and Acceptance Sampling results, if applicable. IUSA will submit these results only if they identify the presence of "new" Potentially Listed Hazardous Constituents (as defined in Steps 7 and 8).

*Proceed to Step 17.*

**17. ARE SAMPLING RESULTS OR DATA REPRESENTATIVE?**

Determine whether the sampling results or data from the Source Investigation (or, where applicable, Confirmation/Acceptance Sampling results) are representative. The purpose of this step ) is to determine whether Confirmation and Acceptance Sampling (or

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

continued Confirmation and Acceptance Sampling) are necessary. If the sampling results or data are representative of all Material destined for the White Mesa Mill, based on the extent of sampling conducted, the nature of the Material and/or the nature of the Site (e.g., whether chemical operations or waste disposal were known to be conducted at the Site), future Confirmation/Acceptance Sampling will not be necessary. If the sampling results are not representative of all Material destined for the White Mesa Mill, then additional Confirmation/Acceptance sampling may be appropriate. Confirmation and Acceptance Sampling will be required only where it is reasonable to expect that additional sampling will detect additional contaminants not already detected. For example:

- Where the Material is segregated from Environmental Media, e.g., the Material is containerized, there is a high probability the sampling results or data from the Source Investigation are representative of the Material and Confirmation/Acceptance Sampling would not be required.
- Where IUSA will be accepting Material from a discrete portion of a Site, e.g., a storage pile or other defined area, and adequate sampling characterized the area of concern for radioactive and chemical contaminants, the sampling for that area would be considered representative and Confirmation/Acceptance sampling would not be required.
- Where Material will be received from a wide area of a Site and the Site has been carefully characterized for radioactive contaminants, but not chemical contaminants, Confirmation/Acceptance sampling would be required.
- Where the Site was not used for industrial activity or disposal before or after uranium material disposal, and the Site has been adequately characterized for radioactive and chemical contaminants, the existing sampling would be considered sufficient and Confirmation/Acceptance sampling would not be required.
- Where listed wastes were known to be disposed of on the Site and the limits of the area where listed wastes were managed is not known, Confirmation/Acceptance sampling would be required to ensure that listed wastes are not shipped to IUSA (see Step 14).

*If yes, proceed to Step 4.*

*If no, proceed to Step 18.*

**18. DOES STATE OF UTAH AGREE THAT ALL PREVIOUS STEPS HAVE BEEN PERFORMED IN ACCORDANCE WITH THIS PROTOCOL?**

Determine whether the State agrees that this Protocol has been properly followed (including that proper decisions were made at each decision point). The State shall

PROTOCOL FOR DETERMINING WHETHER ALTERNATE FEED MATERIALS ARE LISTED HAZARDOUS WASTES

review the information provided by IUSA in Step 16 with reasonable speed and advise IUSA if it believes IUSA has not properly followed this Protocol in determining that the Material is not listed hazardous waste, specifying the particular areas of deficiency.

If this Protocol has not been properly followed by IUSA in making its determination that the Material is not a listed hazardous waste, then IUSA shall redo its analysis in accordance with this Protocol and, if justified, resubmit the information described in Step 16 explaining why the Material is not a listed hazardous waste. The State shall notify IUSA with reasonable speed if the State still believes this Protocol has not been followed.

*If yes, proceed to Step 19.*

*If no, proceed to Step 1.*

**19. MATERIAL IS NOT A LISTED HAZARDOUS WASTE, BUT CONFIRMATION AND ACCEPTANCE SAMPLING ARE REQUIRED.**

The Material is not a listed hazardous waste, but Confirmation and Acceptance Sampling are required, as determined necessary under Step 17.

*Proceed to Step 20.*

**20. CONDUCT ONGOING CONFIRMATION AND ACCEPTANCE SAMPLING.**

Confirmation and Acceptance Sampling will continue until determined no longer necessary under Step 17. Such sampling will be conducted pursuant to a Sampling and Analysis Plan ("SAP") that specifies the frequency and type of sampling required. If such sampling does not reveal any "new" Potentially Listed Hazardous Constituents (as defined in Steps 7 and 8), further evaluation is not necessary (as indicated in Step 7). If such sampling reveals the presence of "new" constituents, Potentially Listed Wastes must be identified (Step 8) and evaluated (Steps 9 through 11) to determine whether the new constituent is from a listed hazardous waste source. Generally, in each case, the SAP will specify sampling comparable to the level and frequency of sampling performed by other facilities in the State of Utah that dispose of 11e.(2) byproduct material, either directly or that results from processing alternate feed materials.

*Proceed to Step 7.*

## Attachment 1

### Summary of RCRA Listed Hazardous Wastes

There are three different categories of listed hazardous waste under RCRA:

- *F-listed wastes from non-specific sources (40 CFR § 261.31(a))*: These wastes include spent solvents (F001-F005), specified wastes from electroplating operations (F006-F009), specified wastes from metal heat treating operations (F010-F012), specified wastes from chemical conversion coating of aluminum (F019), wastes from the production/manufacturing of specified chlorophenols, chlorobenzenes, and chlorinated aliphatic hydrocarbons (F019-F028), specified wastes from wood preserving processes (F032-F035), specified wastes from petroleum refinery primary and secondary oil/water/solids separation sludge (F037-F038), and leachate resulting from the disposal of more than one listed hazardous waste (F039).
- *K-listed wastes from specific sources (40 CFR § 261.32)*: These include specified wastes from wood preservation, inorganic pigment production, organic chemical production, chlorine production, pesticide production, petroleum refining, iron and steel production, copper production, primary and secondary lead smelting, primary zinc production, primary aluminum reduction, ferroalloy production, veterinary pharmaceutical production, ink formulation and coking.
- *P- and U-listed commercial chemical products (40 CFR § 261.33)*: These include commercial chemical products, or manufacturing chemical intermediates having the generic name listed in the "P" or "U" list of wastes, container residues, and residues in soil or debris resulting from a spill of these materials.<sup>1</sup> "The phrase 'commercial chemical product or manufacturing chemical intermediate ...' refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a material, such as a manufacturing process waste, that contains any of the [P- or U-listed substances]."<sup>2</sup>

Appendix VII to 40 CFR part 261 identifies the hazardous constituents for which the F- and K-listed wastes were listed.

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<sup>1</sup> P-listed wastes are identified as "acutely hazardous wastes" and are subject to additional management controls under RCRA. 40 CFR § 261.33(e) (1997). U-listed wastes are identified as "toxic wastes." *Id.* § 261.33(f).

<sup>2</sup> 40 CFR § 261.33(d) note (1997).

**ATTACHMENT 4**





## Technical Memorandum

**To:** Jo Ann Tischler **From:** Jen Hudson  
**Company:** Denison Mines (USA) Corp. **Date:** April 27, 2011  
**Re:** Review of Chemical Contaminants in Dawn Mining Company (DMC) Midnite Mine Uranium Material to Determine the Potential Presence of RCRA Characteristic or RCRA Listed Hazardous Waste **Project #:** 114-181850/300

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This report summarizes the characterization of the Dawn Mining Company ("DMC") Uranium Material (the "Uranium Material"), also referred to as the Water Treatment Plant ("WTP") solids to be transported from the DMC Midnite Mine, Wellpinit, Washington, to determine whether or not the Uranium Material is or contains any listed or characteristic hazardous waste as defined by the Resource Conservation and Recovery Act ("RCRA"). The results of this characterization will provide information to Denison Mines (USA) Corp. ("Denison") to determine the requirements necessary for an amendment to its White Mesa Uranium Mill ("Mill") State of Utah Radioactive Materials License No. UT1900479 (the "License"), to permit the processing of the Uranium Material as an alternate feed material at the Mill.

In accordance with the definitions in the Atomic Energy Act, as amended, and 10 Code of Federal Regulations ("CFR") 40.4, ores with natural uranium content of 0.05 weight percent or higher are classified as source material and, as per 40 CFR Part 261.4, are exempt from regulation under RCRA. As summarized in the Radioactive Material Profile Record, the Uranium Material has historically had an average uranium content of approximately 0.18 wet weight percent uranium (0.21 wet weight percent  $U_3O_8$ ), 1.2 dry weight percent natural uranium (1.4 dry weight percent  $U_3O_8$ ). This Uranium Material is therefore source material, and is categorically exempt from RCRA.

Although the Uranium Material is exempt from regulation under RCRA, Denison nonetheless requires a due diligence evaluation of potential materials to be processed, to assess:

1. Whether the material is, or contains, any hazardous constituents that would be regulated as RCRA listed hazardous waste, if the Uranium Material were not categorically exempt from RCRA as a uranium ore or a categorically exempt solid waste.
2. Whether the material contains any constituents that could generate a worker safety or environmental hazard under the conditions under which it will be processed at the Mill.
3. Whether the material contains any constituents that would be incompatible with the Mill's tailings system.

This memorandum provides the evaluation of the regulatory status of the Uranium Material relative to RCRA. Evaluation of potential safety and environmental hazards, and compatibility with the Mill's tailings system are provided in a separate memorandum.



## **1. Site History and Background**

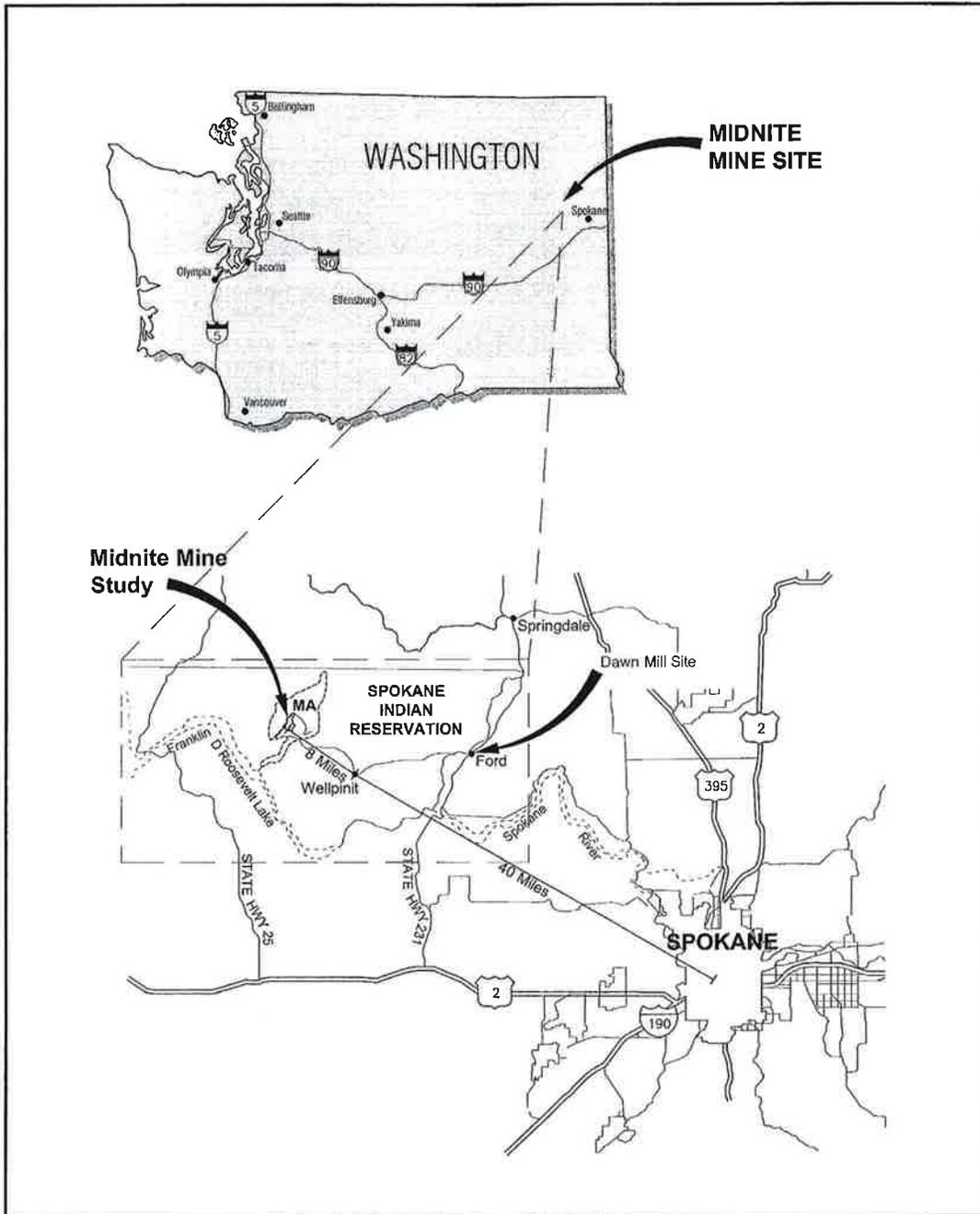
The Midnite Mine Superfund Site ("Site") is an inactive open-pit uranium mine that is currently administrated by the U.S. Environmental Protection Agency ("EPA") Region 10 under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), also known as Superfund. The Site EPA Identification Number is WA980978753.

The Site is located on the Spokane Indian Reservation in eastern Washington State, approximately 48 air miles northwest of Spokane (Figure 1). These lands are owned by the federal government and held in trust for the Spokane Tribe of Indians ("Tribe") and individual tribal members.

Uranium was discovered on the site in 1954. The prospectors and several tribal members subsequently formed Midnite Mines, Inc. and acquired the mining leases at the Site. Midnite Mines, Inc. then joined with Newmont Mining Company ("Newmont") to create the DMC, with Newmont Mining Company as the 51 percent shareholder and Midnite Mines, Inc. owning 49 percent. Newmont USA Limited is the corporate successor of Newmont Mining Company and continues to be the majority shareholder of DMC (EPA, 2006).

The mine operated from 1954 until 1965, providing uranium under contracts with the United States Atomic Energy Commission ("AEC"). The mine went into standby from 1965 and resumed mining in 1969. The ores were milled at the Mill site, located near Ford, Washington. Mining was suspended in 1981 due to decreases in uranium prices and never resumed. The Mine was regulated by several United States Department of the Interior ("USDOI") agencies, including U.S. Geological Survey, U.S. Bureau of Mines, and U.S. Bureau of Land Management ("BLM") Minerals Management Service. The Bureau of Indian Affairs ("BIA") represented the Tribe and individual tribal allotment owners in matters related to leases and royalties.

An estimated 5.3 million tons of ore and proto-ore and 33 million tons of waste rock were removed from nine pits between 1955 and 1981. All but two of the mine pits have been backfilled using waste rock. The last two pits to be mined consisted of Pit 3 and Pit 4, these pits were not backfilled and remain open (EPA, 2006). Several reclaimed waste rock piles remain on the mine property and an estimated 2.4 million tons of ore and proto-ore were stockpiled on Site during active mining operations.



DATE: Sep 27, 2006 FILE: PMXRegional Map



**Figure 1. Midnite Mine Site Location**



## 1.1 Seep and Surface Water Collection System

In the late 1970s, seeps with dissolved ore-derived constituents were observed at the toe of the largest waste rock piles at Midnite Mine. The BLM ordered DMC to construct a control pond (the Pollution Control Pond, or "PCP") in 1979 to capture the seeps for evaporation. Following the suspension of mining in 1981, DMC began pumping water from the PCP to the now inactive Pit 3 in response to growing quantities of water in the PCP and newly identified seeps at the base of the largest waste rock pile. Since cessation of mining operations, mine site surface runoff water has been collected in engineered channels and diverted to the inactive open mining pit, Pit 3. In addition, natural ground water from the ore zones of the pits has flowed into and accumulated in the two open mining pits, Pit 3 and Pit 4, at the site. In February of 1985, DMC applied to the EPA for a National Pollution Discharge Elimination System ("NPDES") permit to allow for the discharge of treated water from those pits and other waters collected on the site. In September of 1986 DMC was issued a NPDES permit.

In 1987 a Compliance Order was issued by EPA under the Clean Water Act ("CWA") and in conjunction with the NPDES permit requiring DMC to eliminate discharges of pollutants to waters of the United States. Subsequently, DMC developed a seep collection and pumpback program that collected water from Site drainages and returned them to the PCP and Pit 3 and mixed with the accumulating water from surface water runoff as described previously. Seep and surface water collection occurs at six specific locations throughout the Midnite Mine Site as part of this seep collection and pumpback program including the PCP. Pit 3 waters consist of mine site waters collected and pumped from the seep collection and pumpback program, direct precipitation and local mine surface runoff in the immediate area of Pit 3, and natural ground water inflow from the Pit 3 ore zones. The water that accumulates in Pit 4 consists of direct precipitation, groundwater inflow, and surface runoff in the immediate area of Pit 4. All waters collected in the seep collection and pumpback system are derived from seeps from waste rock piles or surface runoff at the Site. The seep collection and pumpback system does not collect water from any areas that have ever been known to contain or currently contain any listed hazardous wastes.

In 1988, DMC built a water treatment plant at the Site to treat the accumulating water in the open pits. In 1991 the BLM issued an order requiring DMC to dewater the open pits and treat for metals, uranium and sulfate removal in the water treatment plant for compliance with the NPDES permit and in 1992 the WTP began treating pit water.

There are no shop areas, petroleum tanks, or other sources of hydrocarbons at the mine site with the exception of a 300 gallon diesel fuel tank for the Pit 4 pump, and a 300 gallon tank of gasoline for WTP equipment. The diesel fuel tank and pump are located in secondary containment near Pit 4 with a maximum volume stored of 300 gallons, and the 300 gallon gasoline tank is located next to the WTP. These fuels are stored and managed separately from the Uranium Material and have not impacted the Uranium Material in the past nor do they have a reasonable potential to do so in the future. The constituents precipitated from the WTP influent are derived from flow of natural precipitation through uranium mine waste rock and natural ore, collected surface runoff from natural materials, and natural ground water inflow from the ore zones into one of the two remaining open pits, Pit 3 and Pit 4 as discussed above.

A Remedial Investigation/Feasibility Study (RI/FS) was completed on 9/30/05 for the Midnite Mine. The Selected Remedy for the Site is Alternative 5a (Complete Pit Backfill with Passive Drains and Ex-Situ Water Treatment) of the FS. Based on the FS and issued in the Record of



Decision (ROD) as the Selected Remedy ("Remedy), Pits 3 and 4 will be backfilled, waste rock and proto-ore will be moved and capped, and a new passive water collection system will be installed to capture groundwater from these and other backfilled pit areas. The surface water management will be designed to divert surface flows around sources of contamination and therefore minimize the volume of water to be treated after the Remedy is implemented. The existing WTP is located on a waste rock pile that must be removed for the Remedy. Therefore, a new water treatment plant will be built before construction of the Remedy begins. It is estimated that the construction will require approximately 2 years and the new WTP must be capable of treating water at a rate of 1,000 gpm year round for the construction phase. It is likely that the new WTP will be comparable to the current treatment employed using lime and barium addition for removal of constituents from the feed water. This higher design flow will allow for rapid dewatering of the pits during backfilling, as well as groundwater collection and surface water collection treatment. After construction, it is expected that the flows will be reduced to an ultimate annual value of 65 million gpm and will take an estimated 6 to 7 years to reach these reduced flows.

The water quality during construction is assumed to be the same composition as currently is captured and treated, and it is expected that the water quality after implementation of the Remedy will be improved from current water quality.

## **1.2 Water Treatment Plant Process Description**

The WTP is a conventional lime treatment high-density solids process in which the metals and uranium are precipitated out in the treatment process, and includes addition of barium chloride for radium removal. A polymer coagulant is added, and the resultant slurry is settled and filtered to produce a solution free of solids for surface discharge under the EPA CERCLA program and NPDES permit issued to DMC. The precipitate is currently centrifuged and the final solids contain on average 0.18 wet weight percent uranium (0.21 wet weight percent  $U_3O_8$ ) at an average historical solids content of 15 percent. However, the centrifuges are to be replaced with a hydraulic filter press in 2011, increasing the percent solids of the final Uranium Material to between 25% and 45% resulting in a proportional increase in weight percent uranium estimated to be between 0.3 and 0.55 wet weight percent uranium (0.35 and 0.65 wet weight percent  $U_3O_8$ ). The wet weight concentrations of the constituents present in the Uranium Material are expected to increase by 67 to 300 percent from current values as a result of dewatering with the filter press. The total constituent mass will remain equal to or less than the amount currently produced as discussed herein. No other material changes to the physical or chemical processes of the WTP are planned. Therefore, no other significant changes to the chemical composition of the Uranium Material are expected to occur.

The WTP is typically operational from early May through the end of October and operates 24 hours per day, four days per week. WTP influent is derived from approximately 400 gpm influent from Pit 3 and approximately 50 gpm influent from Pit 4. The pit waters are pumped to the WTP using positive displacement pumps which are piped separately to the WTP through polyethylene piping. The WTP reagents are pre-mixed in individual mixing tanks prior to addition to the treatment stream. The hydrated lime and flocculent are pre-mixed using makeup water from Pit 4 while the barium chloride is mixed with potable water.

The powdered barium chloride is pre-mixed at a ratio of 500 pounds (lbs) of barium chloride to 1,200 gallons of potable water. This barium chloride solution is then injected directly into the Pit



3 influent line in the WTP at rates from 170 milliliters per minute (“ml/min”) to 180 ml/min for the 400 gpm inflow for precipitation of radium. The Pit 3 influent then discharges into the first of three agitation tanks for mixing. Added to this agitation tank is approximately 90 gpm, or roughly 20% of the total process stream, from the clarifier bottoms (clarifier underflow) to increase the overall final Uranium Material density.

This first agitation tank then gravity feeds into a second agitation tank where hydrated lime is added for the precipitation of uranium and metals. The hydrated lime solution is added to the second agitation tank as needed to achieve a target pH of 9.8 to 9.9 standard pH units prior to clarification. The second agitation tank gravity feeds to a third agitation tank for additional mixing, which in turn gravity feeds to the neutralization surge tank.

The neutralization surge tank receives two influent streams. The primary influent stream is the flow from the third agitation tank, described above. The secondary influent stream is the liquid collected from the dewatering process (currently centrifuge, which will be replaced by a hydraulic filter press system in 2011). Waters removed by the dewatering process are collected in the concentrate surge tank and pumped to the neutralization surge tank. At the discharge of the neutralization surge tank, an anionic water soluble polymer (Neo Solutions, NS-6852) is added as a coagulant to facilitate clarification.

The neutralization surge tank discharge is currently sent to one of two clarifiers. Pit 4 water is higher in pH and significantly lower in metals and radionuclide concentrations than the Pit 3 water (See Table 1) and therefore requires less initial treatment. As a result, the remaining portion of the Pit 4 influent stream not used for reagent make up is pumped directly to the clarifiers. The precipitated solids are drawn from the clarifier bottom and, as mentioned previously, approximately 20% of the clarifier underflow (approximately 90 gpm) is pumped back to the first agitation tank to increase overall Uranium Material density. The liquid fraction of the remaining 80% of the process stream (approximately 360 gpm) is decanted from the top of the clarifier (clarifier decant) for final pH adjustment and addition of scale inhibitor for direct surface discharge, while the remaining solids fraction from the clarifier underflow is sent to the centrifuge for dewatering. The centrifuge will be replaced for the 2011 operating season with a hydraulic filter press as discussed in more detail below.

The clarifier decant is sent to the clarifier overflow tank, where it is pH adjusted to between 6.5 and 9.0 using sulfuric acid, and a polyacrylic scale inhibitor (“anti-scalant”) is added prior to discharge. Neither the sulfuric acid nor anti-scalant added to the final plant discharge water are introduced to the solids generation process and therefore do not become components of the Uranium Material.

The dewatered solids are currently transferred from the centrifuge to the hauling truck via a discharge conveyor. The transport truck is housed within the WTP building and remains in that location until it is hauled for final disposal, thereby eliminating any opportunity for other waste materials to be introduced into the Uranium Material.

From 2001 through 2008 the WTP processed produced between 1.05 million (“M”) lbs and 2.5 M lbs per year of Uranium Material at 15% solids (average 1.9 M lbs at 15% solids). This is equivalent to 164,000 to 393,500 dry tons of annual solids produced. The average annual total volume of Pit water treated is approximately 55.5 million gallons for the period of 2001 through 2008. Volumes vary depending on how much precipitation the site receives in a given year.



The plant will be modified for the 2011 operational season and the centrifuges currently used for Uranium Material dewatering will be replaced by a hydraulic filter press. It is expected that the same water soluble polymer will be used for coagulation; however the polymer application rate may be increased from the current rate to improve the dewatering characteristics of the solids. The Uranium Material solids percent is expected to increase from an average of 15 weight percent solids to between 25 and 45 percent, resulting in an estimated lower average volume of sludge production while the total dry weight production will remain in the range of 82 tons to 197 tons annually. No material changes to the physical or chemical processes of the WTP are planned aside from the increased flows to the new plant as discussed above. Therefore, no other significant changes to the chemical composition of the Uranium Material are expected to occur.

## **2. Basis and Limitations of this Evaluation**

The Uranium Material to be processed at the Denison White Mesa Mill consists solely of the solids to be produced from the existing DMC WTP. The characterization of the Uranium Material is based on assessment of the mine site historical operations, the origins and handling of the waters treated in the WTP, assessment of the WTP influent water quality, assessment of the treatment process and process chemicals, analysis of representative Uranium Material samples in 2010 as well as assessment of historical Uranium Material analysis for a limited suite of parameters.

Three Uranium Material samples collected in 2010 were tested for radionuclides, recoverable metal values, RCRA regulated organic and inorganic contaminants, diesel and gas range organics (DRO and GRO) as well as for RCRA hazardous waste characteristics. Radionuclide analyses included Lead-210, isotopic thorium, gross alpha and beta, and total alpha emitting radium. Additional parameters including nutrients (ammonia and nitrate/nitrite), and other non-metals were included in the analysis to assess compatibility with existing tailings and process chemicals at the White Mesa Mill and presented in *Technical Memorandum: Review of Chemical Contaminants in Dawn Mining Company (DMC) Midnite Mine Uranium Material to Determine the Potential Worker Safety and Environmental Issues and Chemical Compatibility at the Denison Mines White Mesa Mill*. The historical water quality data indicates that influent water parameters are relatively consistent over the WTP operational history (Table 1). The total uranium values from the 2010 sampling results indicate average uranium concentration in the sludge to be 15,333 mg/kg (1.5 percent) corresponding with the historical values for uranium.

Organic constituents have not historically been analyzed in the WTP influent, or the final Uranium Material; however, comprehensive laboratory analysis of recent WTP solid samples is included in this report. The recent Uranium Material test results are taken to be representative of the material characteristics over the WTPs operating life, as the characteristics have not varied widely across different periods of WTP operation. As a result, these studies provide sufficiently representative characterization to assess the regulatory status, worker safety environmental hazards, and chemical and processing properties of the Uranium Material.

Table 2 presents the results of 2009 and 2010 toxicity characteristic leaching procedure ("TCLP") analyses for the eight RCRA metals. Table 3 presents testing results of the Uranium Material for RCRA hazardous waste characteristics including organochlorine pesticides, chlorinated herbicides, volatiles and semi-volatiles, and for corrosivity, reactivity and ignitability. Table 4 presents total analyses of the Uranium Material for uranium, 20 metals, total volatile and



semi-volatile organics, gasoline range organic and diesel range organics, inorganic parameters including ammonia and nitrate plus nitrite as well as gross alpha beta.

The following contamination evaluation is based on:

1. Midnite Mine Superfund Site Record of Decision
2. Current Midnite Mine Uranium Material analytical data
3. Historic Midnite Mine Water Quality and Uranium Material analytical data
4. Denison estimated tailings compositional data for tailings
5. Denison Protocol for Determining Whether Alternate Feeds Are Listed Hazardous Wastes (Denison, November 1999).
6. Radioactive Material Profile Record for the Dawn Mining Company Midnite Mine Uranium Material (September 2010)
7. Affidavit of Robert Nelson, Midnite Mine Site Supervisor (Attachment 2 - October 2010).

Denison has developed a "Protocol for Determining Whether Alternate Feed Materials are Listed Hazardous Wastes" (November 22, 1999) (the "Protocol"). The Protocol has been developed in conjunction with, and accepted by, the State of Utah Department of Environmental Quality ("UDEQ") (Letter of December 7, 1999). Copies of the Protocol and UDEQ letter are provided in Attachment 2 of the License Amendment Application. The RCRA evaluation and recommendations in this Report were developed in accordance with the Protocol.

### **3. Application of Protocol to Uranium Material**

#### **3.1 Source Investigation**

Several of the information sources enumerated above were used to perform the Source Investigation indicated in Box 1 of the flow diagram (the "Protocol Diagram") that forms part of the Protocol.

The following sections describe the status of the Uranium Material relative to RCRA Characteristic and RCRA Listed Hazardous Waste regulations, and relative to the specific parameters identified in the Denison/UDEQ Hazardous Waste Protocol. Although alternate feed materials may contain RCRA characteristic wastes, for completeness, this Report also determines whether or not the Uranium Material contains any characteristic wastes.

#### **3.2 Determination Methods in the Denison / UDEQ Protocol**

##### **3.2.1 Regulatory History of the Midnite Mine Uranium Material**

As mentioned in Section 1.0 of this Report, DMC applied to the EPA for a NPDES permit in February of 1985 to allow for the discharge of treated water from the open pits (Pits 3 and 4) and other waters collected on the Site. In September of 1986, the EPA's Region 10 issued DMC an NPDES permit (WA 002572-1), which was administered by the State of Washington. In 1987 a Compliance Order was issued by EPA under the Clean Water Act requiring DMC to eliminate discharges of pollutants to waters of the United States. Subsequently, DMC developed a seep collection and pumpback program that collected water from Site drainages and returned them to a pollution control pond and Pit 3.

In 1988, DMC built the WTP at the Midnite Mine to treat the accumulating water in the open pits. However, the treatment plant was not operated until approximately four years later. In 1991 the



BLM issued an order requiring DMC to dewater the open pits for compliance with the NPDES permit issued in 1986, and in 1992 the WTP began treating pit water.

The Washington Department of Health, under the authority of the Nuclear Regulatory Commission ("NRC") Agreement State Program, issued a Radioactive Materials License (WN-10390-1) in 1992 for possession of the Uranium Material. This License was terminated by the State of Washington on December 31, 2008. Operation of the WTP is currently administered by the EPA under CERCLA.

In 1998, EPA performed an Expanded Site Investigation and scored the Site using the Hazard Ranking System to determine the eligibility of the Site for inclusion on the National Priorities List ("NPL"). The Site was included in the NPL and a Record of Decision ("ROD") was signed on September 29, 2006, which established the Selected Remedy for the Site. Part of the Selected Remedy for Operable Unit 1 (Mined Area and the Mining Affected Area, which includes Pit 3 and Pit 4) included treatment of seep collection system waters and the pit waters, with on-site discharge of treated water in compliance with interim discharge limits (EPA, 2006).

The Uranium Material generated from the treatment of these mine waters were processed off site at the Dawn Uranium Mill ("Dawn Mill") for their source material content under the Dawn Mill License (WN-1043-2) from 1992 until the mill was decommissioned in 2001. Following mill decommissioning, the solids were placed directly in the Dawn Mill tailings facility (License Conditions 9.B, and Conditions 28 through 33). The Uranium Material are currently being disposed of at the Tailings Disposal Area 4 ("TDA-4") at the Dawn Mill Site. However, per the ROD, alternate disposal of the Uranium Material is required starting in 2011 due to mandated reclamation of the tailings facility.

The Rod states that the Uranium Material may be disposed of at a licensed off-site disposal facility, or additional treatment, such as ion exchange for uranium removal to modify solids characteristics, may be implemented for alternative disposal options. The Dawn Mill tailings and reclamation materials are not included in the materials to be sent to the White Mesa facility, only newly generated Uranium Material from the Midnite Mine.

The Uranium Material, which has materially not changed in form or content since first being produced in 1992, remain definitional source material as per 40 CFR Part 261.4, and is explicitly exempt from regulation under RCRA. However, for the sake of completeness, Denison has required the following evaluation to confirm that even if the Uranium Material were not exempt from RCRA, it is not and does not contain, a RCRA-listed waste, nor does it contain any characteristic wastes.

### **3.2.2 Evaluation of Potential RCRA Listings Associated with Specific Contaminants**

For potential alternate feeds that are not exempt from RCRA, the Protocol describes additional steps Denison will take to assess whether contaminants associated with any potential RCRA waste listings are present, and the likelihood that they resulted from RCRA listed hazardous wastes or RCRA listed processes. These steps include tabulation of all potential listings associated with each known chemical contaminant at the site, and the review of chemical process and material/waste handling history at the site to assess whether the known chemical contaminants in the material resulted from listed or non-listed sources. This evaluation is described in Box 8 and Decision Diamonds 9 through 11 in the Protocol Diagram.



If the results of the evaluation indicate that the contaminants are not listed waste, the Protocol specifies an additional assessment of whether the data on which this determination was made is sufficiently representative, or whether an ongoing acceptance sampling program should be implemented, and a similar evaluation performed on any new constituents identified during acceptance sampling.

In the case of the DMC Uranium Material, Steps 9 through 11 is not required as indicated by the statements provided in the Affidavit of Robert Nelson (Attachment 1). However, for the sake of a thorough due diligence evaluation, Steps 9 through 11 were completed, and the results are presented below.

#### **4. Chemical Contaminants**

The chemical contamination profile reported for the DMC Uranium Material includes historic WTP influent water quality data (Table 1), limited historical testing of the Uranium Material (Table 2), and three Uranium Material samples collected during the 2010 WTP operations period. These 2010 samples were analyzed for the following RCRA characteristic and listed hazardous waste properties: total uranium, total mercury, total metals, TCLP metals and mercury, Lead-210, isotopic thorium, total alpha emitting radium, volatile organic compounds ("VOCs"), semi-volatile organic compounds ("SVOCs"), diesel range organics ("DRO"), gas range organics ("GRO"), pesticides, herbicides, inorganics (reactive cyanides and reactive sulfides), and ignitability. These analyses were performed to determine whether the Uranium Material is classified as a listed waste under RCRA and to determine the RCRA characteristics for processing and disposal considerations at the Mill.

A summary of the RCRA listed hazardous waste findings for metal analytes is provided in Table 4 of this Report.

Determination of whether the Uranium Material is listed according to RCRA regulations included consideration of the source history and the total constituent analytical values from material sampling analyses presented in Table 4. The Uranium Material has not been classified or treated as listed hazardous waste nor has it been in contact with any listed hazardous wastes as attested to in Attachment 2 of the License Application Amendment (Affidavit of Robert Nelson, October 2010).

There were no processes conducted at the site which fall under the "F" listed hazardous wastes from non-specific sources and designated in the following seven categories:

- Spent solvent wastes (F001-F005)
- Wastes from electroplating and other metal finishing operations (F006-F012, F019)
- Dioxin-bearing wastes (F020-F023 and F026-F028)
- Wastes from the production of certain chlorinated aliphatic hydrocarbons (F024, F025)
- Wastes from wood preserving (F032, F034, and F035)
- Petroleum refinery wastewater treatment sludges (F037 and F038)
- Multi-source leachate (F039)

There were no processes conducted at the site which fall under the "K" listed hazardous wastes from specific sources and designated in the following 14 categories:

- Wood preservation (K001)



- Inorganic pigment manufacturing (K002 –K008)
- Organic chemicals manufacturing (K009-K030, K083, K085, K093-K096, K103-K105, K107-K118, K136, K149-K151, K156-K159, K161, K174-K175, K181)
- Inorganic chemicals manufacturing (K071, K073, K106, K176-178)
- Pesticides manufacturing (K031-K043, K097-K099, K123-K126, K131-K132)
- Explosives manufacturing (K044-K047)
- Petroleum refining (K048-52, K170-K172)
- Iron and steel production (K061-K062)
- Primary aluminum production (K088)
- Secondary lead processing (K069, K100)
- Veterinary pharmaceuticals manufacturing (K084, K101-K102)
- Ink formulation (K086)
- Coking (K060, K087, K141-K145, K147-K148)
- Military munitions

The Uranium Material does not contain any “P” or “U” listed wastes as there have been no discarded commercial chemical products, off-specification species, container residues, and spill residues thereof. Any chemicals used at the WTP are used for their intended purpose and are not waste materials.

#### **4.1 Volatile Organic Compounds**

The sampling results for the total VOCs in Table 4 indicate that acetone, methylene chloride, and toluene were reported at very low concentrations in the three samples for total analysis. Acetone was reported at concentrations ranging from 22 milligrams per kilogram (“mg/kg”) to 33 mg/kg with an average value of 28 mg/kg. Methylene chloride was reported at concentrations ranging from 3.7 mg/kg to 5.8 mg/kg with an average value of 4.4 mg/kg. Toluene was reported at concentrations ranging from 1.5 mg/kg to 2.7 mg/kg with an average value of 2.1 mg/kg. However all of these constituents were also detected in the method blanks for the coinciding sample runs. Chloroform was detected in the three samples just above the method detection limit (“MDL”). The method blank samples did indicate low levels of total chloroform; however the detection of chloroform in the blank was below the MDL and was therefore not reported by the laboratory as stated in the email from laboratory personnel Jeff Kujawa (Attachment 3). As indicated; chloroform, methylene chloride, and toluene were therefore present due to laboratory interferences, and not present in the Uranium Material.

Trichloroethene (or trichloroethylene) was reported at very low concentrations from the TCLP testing of only two of the Uranium Material samples with concentrations ranging from 1.5 micrograms per liter (“µg/L”) to 2.7. µg/L with an average concentration of 2.1 µg/L. However, trichloroethene was detected in the leachate method blank at 3.3 ug/L which was above the MDL, but below the reporting limit (“RL”). Two of the three associated samples had detectable amounts less than the RL and less than 10 times the amount found in the method blank, so the samples were qualified as “U”, raising the amount to the RL (5 ug/L). That is, trichloroethene was identified in the results due to laboratory interferences, and is not present in the Uranium Material.

Review of the site operational history, WTP processes and chemicals, as well as sample collection, preservation and shipping methods did not identify any source of potential sample contamination for these constituents. Since these compounds were present in the method blank and there are no known sources for these constituents from the Site or from the sampling



preservation or shipping methods, their detection is apparently due to laboratory influences, and does not indicate they are present in the Uranium Material. These are common laboratory solvents and there are multiple laboratory pathways that could introduce them during analytical processes, including the use of methylene chloride for extraction of SVOCs in other analytical procedures.

#### 4.2 Semi-Volatile Organic Compounds

The sampling results for the total semi-volatile organic compounds in Table 4 indicate that there was no detection of any of the constituents tested for and are consistent with plant operations and activities historically conducted at the mine site.

#### 4.3 Other Non-Metal Inorganic Compounds

The sampling results for Ammonia, Nitrate/Nitrite, and Fluoride indicate low levels of these constituents in the Uranium Material. Historic water quality sampling data indicate that all three of these constituents are present in the feed water to the WTP as presented below.

Historic Water Quality for Selected Parameters

	<b>Fluoride (mg/L)</b>	<b>Ammonia (mg/L)</b>	<b>Nitrate/Nitrite as N (mg/L)</b>
<b>Min</b>	0.2	0.02	0.01
<b>Max</b>	5.0	0.1	46.0
<b>Avg</b>	1.2	0.1	4.3
<b>Count</b>	25	4	154

##### 4.3.1 Ammonia as N

In general, nitrogen (ammonia, nitrate/nitrite) compounds may carry the following RCRA listings: P002, P007, P008, P009, P020, P024, P027, P031, P034, P041, P042, P044, P045, P046, P047, P048, P066, P069, P070, P071, P076, P077, P078, P081, P082, P084, P089, P097, P101, P112, P119, P128, P185, P189, P191, P194, P197, P198, P203, U003, U005, U009, U010, U011, U012, U014, U021, U026, U035, U049, U058, U059, U073, U091, U092, U093, U095, U105, U106, U110, U111, U149, U150, U152, U155, U158, U163, U167, U168, U169, U170, U171, U172, U173, U174, U176, U177, U178, U179, U180, U181, U185, U194, U206, U217, U221, U222, U234, U236, U237, U271, U328, U353, U394, and U404 if they resulted from the disposal of commercial chemical products, or manufacturing of chemical intermediates associated with each hazardous waste number. There is no reason that any of these compounds would be present as chemical product, off-spec product, or manufacturing byproduct on the Site.

Nitrogen wastes may carry the following F or K listings if they resulted from the specific industries listed here:

F004, F005	Spend Solvent Wastes
K060, K144	Coking
K011, K013-014, K025, K104, K111-116	Organic Chemical Manufacturing



None of the above operations or processes was ever conducted at the Midnite Mine. It is present in the Uranium Material as an impurity precipitated during the water treatment process and none of the F or K listings are applicable to the Uranium Material.

Ammonia compounds may be present in the Uranium Material as a trace residue from the historical use of blasting caps during mining operations, or as a result of nitrogen rich windblown soils from nearby agricultural operations in the area of the Site. Nitrogen is also naturally occurring in the surface water and groundwater seeps due to the natural nitrogen cycle in which nitrogen in the atmosphere is converted in the soils initially to ammonium and further converted into nitrate and nitrite. These nitrogen constituents are incorporated into the surface water and groundwater systems resulting in detectable amounts of ammonia and nitrate/nitrite.

#### **4.3.2 Nitrate/Nitrite as N**

Nitrate/nitrite compounds may be present in the Uranium Material as a trace residue from the historical use of blasting caps during mining operations, or as a result of nitrogen rich windblown soils from nearby agricultural operations in the area of the Site. Nitrogen is also naturally occurring in the surface water and groundwater seeps due to the natural nitrogen cycle in which nitrogen in the atmosphere is converted in the soils initially to ammonium and further converted into nitrate and nitrite. These nitrogen constituents are incorporated into the surface water and groundwater systems resulting in detectable amounts of ammonia and nitrate/nitrite.

#### **4.3.3 Chlorides**

Chlorides may carry RCRA listings U216, P033 or P095 if they resulted from the disposal of thallium chloride, cyanogen chloride, or carbonic chloride as commercial chemical products, off-spec commercial chemical products, or manufacturing chemical intermediates.

Thallium chloride is used as a catalyst in chlorination reactions, and as a radiation sensor in applications such as control on sun lamps. Cyanogen chloride is used in organic synthesis, as an active agent in tear gas, and as a warning agent (due to odor warning properties) in fumigation gases. Phosgene is used widely in synthesis for addition of carbon groups to larger structures, particularly in manufacture of isocyanate intermediates, other polymers, and pesticides. It was formerly used in chemical warfare agents as a choking agent. There is no reason that any of these compounds would be present as chemical product, off-spec product, or manufacturing byproduct on the Site.

None of the above RCRA listings applies to the chlorides present in the WTP pits. Chlorides are naturally present as trace contaminants in many transition metal and rare earth ores, and the addition of barium chloride to the influent Pit 3 water may contribute minimal amounts of chlorides. This is the most likely source of the chlorides in the Uranium Material. Chlorides from ore sources are not associated with any RCRA hazardous waste listings.

#### **4.3.4 Fluorides**

Fluorides may carry RCRA listings U005, U033, U075, U134, U121, U120, P043, P056, P057, P058 if they resulted from the disposal of acetamide, carbonic difluoride, dichlorodifluoromethane, fluoranthene, hydrofluoric acid, trichlorofluoromethane, diisopropylfluorophosphate (DFP), fluorine, fluoroacetamide, or fluoroacetic acid.



None of the above RCRA listings applies to the chlorides present in the WTP pits. Fluorides are naturally present as trace contaminants in many transition metal and rare earth ores. This is the most likely source of the fluorides in the Uranium Material. Fluorides from ore sources are not associated with any RCRA hazardous waste listings.

#### **4.3.5 Sulfates**

Sulfates can carry RCRA listing U103 if they resulted from the disposal of dimethyl sulfate commercial chemical products, off-spec commercial chemical products, or manufacturing chemical intermediates. Dimethyl sulfate is used in organic synthesis as a methylating agent for production of amines, phenols, and polyurethanes adhesives. There is no reason dimethyl sulfate would be present as chemical product, off-spec product, or manufacturing byproduct on the Site.

Sulfates can also carry RCRA listing P115 if they result from the disposal of thallium sulfate commercial chemical products, off-spec commercial chemical products, or manufacturing chemical intermediates. Thallium sulfate is used as a rodenticide and pesticide, in the measure of ozone content in gases, and as an indicator in testing for iodine in the presence of chlorine. There is no reason thallium sulfate would be present as chemical product, off-spec product, or manufacturing byproduct on the Site.

Neither of the above RCRA listings applies to the sulfates present in the WTP pits. As indicated in the historic process information from Site, sulfates resulted from the metal sulfates in the influent from the pits, which are not associated with any RCRA hazardous waste listings.

#### **4.4 Metals**

A summary of the RCRA evaluation findings for the metal analytes identified in the Uranium Material is provided in Tables 2, 3 and 4 of this report.

The three 2010 samples were analyzed for total metals and results indicate that 14 metals: barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, and zinc were present in the Uranium Material.

All of the metals are known to be constituents of uranium ores with the exception of barium, which is added to the treatment process for radon removal. Residues from processing of uranium are not RCRA listed hazardous wastes.

Barium may be associated with one RCRA listing, P013, if it resulted from the disposal of barium cyanide commercial chemical products, off-spec commercial chemical products, or manufacturing chemical intermediates. Barium cyanide is used in metal finishing and electroplating. There is no reason barium would be present as a chemical product, off-spec product, or manufacturing byproduct on the Site.

Barium chloride is added in the water treatment plant to precipitate out the radium from the influent water from Pit 3 and Pit 4. It is therefore an impurity precipitated out during the water treatment process and the P013 listing does not apply to the Uranium Material.



#### **4.5 Summary of RCRA Listed Material Findings**

Based on the information presented above, none of the constituents in the Uranium Material would be indicative of RCRA listed hazardous waste, even if the Uranium Material were not already exempt from RCRA as source material.

#### **5. RCRA Characteristics**

Three Uranium Material samples collected during the 2010 operational period were analyzed for RCRA TCLP including Organochlorine Pesticides, Chlorinated Herbicides, SVOCs, VOCs, Inorganics, Metals, and Mercury (Tables 2 and 3) as well as the RCRA characteristics corrosivity, ignitability, and reactivity. In addition, four samples from 2009 were analyzed for TCLP metals (Table 3).

These test results demonstrate that the Uranium Material is not ignitable, corrosive, or reactive per the RCRA definitions of these characteristics. No organic or inorganic contaminant exceeded its respective TCLP threshold for RCRA toxicity characteristic as defined in Table 1 of 40 CFR Part 261.24(b) (Table 3) with the exception of trichloroethene. The laboratory results indicate that this constituent was detected at a concentration of 2.7 µg/L in WTPS-1 and 1.5 µg/L in WTPS-2 but not in WTPS-3. However, trichloroethene was also detected in the leachate method blank at 3.3 µg/L which was above the MDL, but below the adjusted RL of 5 µg/L. Though detected, these laboratory QA results indicate that the compound is not likely present in either of the samples. Regardless, the results are two orders of magnitude below the regulatory action level of 0.5 mg/L (500 µg/L) for trichloroethylene and, therefore, this constituent does not exhibit RCRA characteristic concentrations.

Therefore, the test results indicate that the Uranium Material does not have the RCRA characteristic of toxicity. The Affidavit from the Midnite Mine Site Supervisor (Attachment 1) affirms that the Uranium Material has never been classified for shipment or off-site management as a RCRA characteristic waste. This is consistent with the source of the constituents and the treatment process used to develop the DMC Uranium Material. The historic solids testing data from 2001 to 2009 (Table 2) and the historic water quality data for the same period (Table 1) show relatively consistent results in the constituents and concentrations in the plant feed water.

As discussed in the introduction to this report, the Uranium Material is exempt from regulation under RCRA; however, even if it were classified as a characteristic hazardous waste, alternate feed materials are permitted to contain RCRA characteristic wastes under NRC's Alternate Feed Guidance (10 CFR 40, Appendix A).

Based on all of the above information, the DMC WTP Uranium Material is not a RCRA characteristic hazardous waste.

#### **6. Conclusions and Recommendations**

In summary, the following conclusions can be drawn from the RCRA analysis of the Site information presented above:



1. The Uranium Material is not a RCRA listed hazardous waste because it has a natural uranium content of greater than 0.05 weight percent, is therefore source material and, as a result, is exempt from regulation under RCRA.
2. Even if the Uranium Material were not source material, it would not be a RCRA listed hazardous waste for the following additional reasons:
  - a) It was generated from a known process under the control of the generator, who has provided an Affidavit declaring that the Uranium Material is not and does not contain RCRA listed hazardous waste. This determination is consistent with Boxes 1 and 2 and Decision Diamonds 1 and 2 in the Denison/UDEQ Protocol Diagram;
  - b) The five volatile organic compounds detected at very low concentrations in the Uranium Material have been attributed to laboratory contamination and are not actual contaminants in the DMC uranium Material;
  - c) None of the metals in the Uranium Material samples came from RCRA listed hazardous waste sources. This determination is consistent with Box 8 and Decision Diamonds 9 through 11 in the Denison/UDEQ Protocol Diagram.
3. The Uranium Material does not exhibit any of the RCRA characteristics of ignitability, corrosivity, reactivity, or toxicity for any constituent.



## **7. References**

Midnite Mine Superfund Site. Spokane Indian Reservation Washington Record of Decision (ROD), EPA Region 10, September 2006.

Title 10 Code of Federal Regulations; Chapter I – Nuclear Regulatory Commission, Part 40 – Domestic Licensing of Source Material: 40.4 – Definitions (10 CFR 40.4)

Title 10 Code of Federal Regulations; Appendix A – Nuclear Regulatory Commission, Part 40 – Domestic Licensing of Source Material: 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 (10 CFR 40 Appendix A)

Title 40 Code of Federal Regulations; Protection of the Environment, Part 261 – Identification and Listing of Hazardous Waste: Subpart A, 261.4 – Exclusions: Subpart B – Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste.



Table 1. Historic Water Quality of DMC WTP Influent

Location ID	Collection Date	Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
SW-39 (PIT-3)	2/25/1998					43	--	280	--				86000	--				3500	--	4.41	--	2	U	22	--	22	--
SW-39	4/29/1998					46	--	250	--				85000	--				3400	--	4.26	--			18	--	18	--
SW-39	7/22/1998					49	--	260	--				90000	--				3500	--	4.09	--						
SW-39	10/14/1998	61900	--	20	U	46	--	1000	U	7	B	89700	--	1810	--	23688.2	--	3660	--	4.45	--	5	U	67.2	--	67.2	--
SW-39	10/27/1998					48	--	260	--				95000	--				3700	--	4.4	--						
SW-39	11/15/1998	60500	--	5	B	43	--	1000	U	4	B	96400	--	1790	--	24632.7	--	3600	--	4.41	--	5	U				
SW-39	12/10/1998	58600	--	5	B	37	--	1000	U	5	--	81000	--	1650	--	18140.9	--	3000	B	4.56	--	14	B	45.6	--	45.6	--
SW-39	1/25/1999					46	--	230	--				85000	--				3500	--	4.64	--						
SW-39	4/15/1999					34	--	230	--				70000	--				3000	--	4.76	--						
SW-39	4/21/1999	49900	--	10	U	26	--	210	--	2	U	62200	--	20	U	12084.0	--	2500	--	4.13	--	5	U	23	--	23	--
SW-39	5/17/1999	50300	--	5	B	34	--	269	--	2	B	69200	--	1310	--	18021.0	--	3000	--	4.44	--	5	U	24	--	24	--
SW-39	6/15/1999	56200	--	7	--	33.3	--	160	--	3.7	--	82900	--	1480	--	17751.1	--	3270	--	4.26	--	5	U	29	--	29	--
SW-39	7/27/1999					43	--	230	--				85000	--				3400	--	4.05	--						
SW-39	10/6/1999					49	--	250	--				95000	--				1100	--	4.45	--						
SW-39	12/12/1999	46800	--	8	B	51.8	--	228	--	5.9	--	79300	--	1430	--	18545.7	--	3210	--	4.38	--	5	U	30	--	30	--
SW-39	1/27/2000					69	--	200	--				130000	--				5700	--	3.91	--						
SW-39	2/4/2000	92300	--	100	U	70	B	200	B	20	U	120000	--	2430	--	2051.0	--	5480	--	4.04	--	12	B	36	--	36	--
SW-39	4/7/2000	20100	--	1	B	25.6	--	181	--	3.1	--	32200	--	640	--	11334.3	--	1410	--	4.32	--	8	B	31	--	31	--
SW-39	4/17/2000					29	--	240	--				46000	--				1900	--	4.37	--	3	U				
SW-39	5/12/2000	44200	--	1	B	49.5	--	258	--	6.2	--	62600	--	1180	--	10614.7	--	2500	--	4.35	--	5	U	42	--	42	--
SW-39	6/7/2000	51000	--	7	B	56.1	--	313	--	8.9	--	70500	--	1370	--			2960	--	4.1	--	5	U	45	--	45	--
SW-39	7/13/2000	68600	--	6	B	58	--	225	--	9	--	95800	--	1940	--			4220	--	3.94	--	5	U	57	--	57	--
SW-39	7/20/2000					46	--	300	--				85000	--				3600	--	3.85	--	3	U				
SW-39	8/15/2000	97200	--	10	B	82	--	199	--	10	--	129000	--	2620	--			5720	--	3.9	--	5	U	83	--	83	--
SW-39	9/14/2000	105000	--	3	U	64	--	190	--	15.1	--	146000	--	2800	--			6160	--	4.06	--	6	B	70	--	70	--
SW-39	10/25/2000					63	--	230	--				140000	--				5700	--	4.12	--	3	U				
SW-39	10/30/2000	98900	--	5	U	81	--	165	--	7	--	146000	--	2910	--			6620	--	4.34	--	5	U	70	--	70	--
SW-39	1/17/2001					54	--	200	--				120000	--				5000	--	4.65	--	3	U				
SW-39	1/27/2001	76500	--	5	U	57	--	149	--	8	--	121000	--	2310	--			4670	--	4.51	--	8	B	54	--	54	--
SW-39	4/6/2001					83	--	770	--				120000	--				5100	--	4.52	--	3	U	82	--	82	--
SW-39	4/26/2001	61900	--	3	U	71	--	522	--	7	--	84200	--	1700	--			3690	--	4.32	--	5	U				
SW-39	7/5/2001					71	--	630	--				110000	--				4600	--	4.08	--	3	--				
SW-39	10/4/2001	69600	--	10	U	80	--	560	--	10	--	118000	--	2090	--	24000.0	--	4400	--	4.33	--	5	--	48	--	48	--
SW-39	2/7/2002	14900	--	1	U	16	--	95	--	2	--	31300	--	658	--	8850.0	--	1360	--	4.49	--			32.6	--	32.6	--
SW-39	4/17/2002	12800	--	10	U	20	--	80	--	10	U	30200	--	550	--	7430.0	--	1130	--	4.91	--	10	U	20.6	--	20.6	--
SW-39	7/11/2002	24000	--	10	U	20	--	180	--	10	U	53400	--	810	--	11300.0	--	1680	--	4.4	--	5	U	38.7	--	38.7	--
SW-39	10/9/2002	36500	--	10	U	40	--	300	--	10	U	62200	--	1110	--	14800.0	--	2310	--	4.49	--	0.05	U	53.9	--	53.9	--
SW-39	1/15/2003	34800	--	10	U	40	--	290	--	10	U	57400	--	1050	--	12100.0	--	2220	--	4.49	--	8	--	40.8	--	40.8	--
SW-39	4/24/2003	36500	--	10	U	30	--	260	--	10	U	48600	--	1100	--	12000.0	--	2390	--	4.62	--	5	U	40.3	--	40.3	--





Table 1. Historic Water Quality of DMC WTP Influent Continued

Location ID	Collection Date	Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
SW-40 (PIT-4)	1/15/1998					5	U	6	--			1100	--					10	--	6.22	--	3	U	1.9	--	1.9	--
SW-40	4/29/1998					4	U	10	--			880	--					7	--	7.78	--			3	--	3	--
SW-40	7/22/1998					4	U	5	U			370	--					2	U	6.79	--						
SW-40	10/14/1998	80	B	10	U	2	U	10	U	2	U	262	--	10	U	3280.0	--	20	U	7.54	--	5	U	1.78	--	1.78	--
SW-40	10/27/1998					4	U	5	U			490	--					6	--	7.57	--						
SW-40	11/15/1998	90	B	2	U	1	U	5	U	1	U	518	--	10	U	3520.0	--	10	B	7.1	--	5	U	2.06	--	2.06	--
SW-40	12/10/1998	120	B	2	U	0.4	U	10	B	0.4	U	505	--	10	U	3810.0	--	20	U	7.02	--	5	U	3.23	--	3.23	--
SW-40	1/14/1999					9	--	4	U			630	--					13	--	6.81	--						
SW-40	1/14/1999	120	B	2	U	0.4	U	2	U	0.4	U	574	--	10	B	3820.0	--	26	--	6.85	--	5	U	5.52	--	5.52	--
SW-40	2/20/1999	210	--	5	U	1	U	7	B	1	U	663	--	20	B	3070.0	--	30	B	6.92	--	5	U	8.76	--	8.76	--
SW-40	4/15/1999					3	U	5	--			940	--					29	--	6.61	--						
SW-40	4/21/1999	500	--	2	U	0.4	U	3	B	0.4	U	649	--	660	--	1370.0	--	60	B	7	--	5	U	7.6	--	7.6	--
SW-40	5/17/1999	90	B	2	U	0.4	U	3	B	0.4	U	764	--	30	B	2420.0	--	20	--	7.43	--	5	U	5.1	--	5.1	--
SW-40	6/15/1999	120	B	1	B	0.2	B	2	B	0.2	U	747	--	30	B	2830.0	--	26	--	6.99	--	5	U	3.7	--	3.7	--
SW-40	7/27/1999					4	U	6	--			1000	--					31	--	6.79	--						
SW-40	10/6/1999					4	U	4	U			460	--					10	--	7.16	--			1.1	--	1.1	--
SW-40	1/27/2000					4	U	4	U			860	--					22	--	6.74	--			9.7	--	9.7	--
SW-40	4/17/2000					4	U	9	--			1000	--					29	--	6.04	--	5	--	8.6	--	8.6	--
SW-40	7/20/2000					3	U	6	--			300	--					3	--	7.07	--	3	U	1.6	--	1.6	--
SW-40	10/25/2000					4	U	11	--			290	--					2	U	6.72	--	3	U	2.8	--	2.8	--
SW-40	1/17/2001					4	U	40	--			660	--					2	U	5.36	--	3	U	4.5	--	4.5	--
SW-40	4/6/2001					4	U	5	--			660	--					16	--	7.35	--	3	U	4.3	--	4.3	--
SW-40	7/5/2001					4	U	4	U			370	--					2	U	6.96	--	3	U	2.9	--	2.9	--
SW-40	10/4/2001	100	U	10	U	10	U	10	U	10	U	710	--	10	U	6000.0	--	10	U	6.86	--	10	U	4.1	--	4.1	--
SW-40	2/7/2002	1	U	1	U	1	U	6	--	1	U	1610	--	55	--	4770.0	--	62	--	6.47	--	10	U	29.6	--	29.6	--
SW-40	4/17/2002	100	--	10	U	10	U	10	U	10	U	1640	--	60	--	2430.0	--	90	--	5.82	--	10	U	21.1	--	21.1	--
SW-40	7/11/2002	100	U	10	U	10	U	10	U	10	U	1250	--	40	--	3830.0	--	50	--	6.51	--	5	U	4.2	--	4.2	--
SW-40	10/9/2002	10	U	10	U	10	U	10	U	10	U	1040	--	30	--	5500.0	--	40	--	7.28	--	5	U	3.3	--	3.3	--
SW-40	1/15/2003	600	--	10	U	10	U	10	U	10	U	2190	--	70	--	5600.0	--	110	--	6.63	--	5	U	27.8	--	27.8	--
SW-40	4/24/2003	10	U	10	U	10	U	10	U	10	U	1280	--	60	--	3510.0	--	60	--	7.26	--	5	U	8.6	--	8.6	--
SW-40	7/15/2003	10	U	10	U	10	U	10	U	10	U	940	--	30	--	3430.0	--	20	--	7.66	--	5	U	4.1	--	4.1	--
SW-40	10/23/2003	10	U	10	U	10	U	10	U	10	U	490	--	20	--	4030.0	--	20	--	7.43	--	5	U	2.3	--	2.3	--
SW-40	1/14/2004	200		10	U	10	U	10	U	10	U	930		20		4740.0		20		6.83		5	U	2.8		2.8	
SW-40	4/23/2004	100	U	10	U	10	U	10	U	10	U	880		30		4050.0		50		7.32		5	U	9.2		9.2	
SW-40	7/16/2004	200		10	U	10	U	10	U	30		280		10		3720.0		60		7.19		5	U	1.7		1.7	
SW-40	10/13/2004	100	U	10	U	10	U	10	U	10	U	150		10	U	4260.0		10	U	7		5	U	1.5		1.5	
SW-40	4/22/2005	300		10	U	10	U	10	U	10	U	530		20		4880.0		30		6.74				6.4		6.4	
SW-40	7/14/2005	2400		10	U	10	U	10	U	10	U	260		10	U	4520.0		410		7.57		5	U	2.3		2.3	
SW-40	10/11/2005	100		10	U	10	U	10	U	10	U	210		10	U	5460.0		10	U	6.65				1.5		1.5	
SW-40	4/20/2006	100	U	10	U	10	U	10	U	10	U	1360		60		1280.0		80		6.72		5	U	12.1		12.1	

**Table 1. Historic Water Quality of DMC WTP Influent Continued**

Location ID	Collection Date	Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
SW-40 (PIT-4)	7/13/2006	100	U	10	U	10	U	10	U	10	U	1370		40		2060.0		40		6.98		5	U	5.9		5.9	
SW-40	10/11/2006	100	U	10	U	10	U	10	U	10	U	500		20		3060.0		30		7.64		5	U	1.8		1.8	
SW-40	1/25/2007	100		10	U	10	U	10	U	10	U	600		20		3380.0		40		7.69		5	U	8		8	
SW-40	4/19/2007	100	U	10	U	10	U	10	U	10	U	821		26.1		2660.0		31.6		7.7		10	U	5		5	
SW-40	7/11/2007	100	U	10	U	10	U	10	U	10	U	445		14.4		2410.0		13		7.14		5	U	1.9		1.9	
SW-40	10/4/2007	100	U	10	U	10	U	10	U	10	U	128		10	U	2960.0		10.9		7.1		5	U	0.9		0.9	
SW-40	4/25/2008	100	U	10	U	10	U	10	U	10	U	767		29.8		2200.0		36.9		8.36		5	U	7.3		7.3	
SW-40	7/22/2008	17.4		10	U	10	U	10	U	10	U	201		10	U	1930.0		10	U	7.01		2		1.3		1.3	
SW-40	10/2/2008	10	U	1.18		1	U	1	U			90.5		2.25		3420.0		10	U	8.45		5	U	0.57		0.57	
SW-40	4/27/2009	<100		<10		<10		<10		<10		606		34.2		2150.0		43		6.90		<1					
SW-40	7/10/2009	<100		<10		<10		<10		<10		177		<10		2310.0		<10		7.48		2				2.2	
SW-40	10/6/2009	<100		<10		<10		<10		<10		116		<10		3100.0		<10		6.92		1				1.2	
<b>Summary</b>																											
		Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
	<b>SW-40 (Pit 4)</b>																										
	<b>Count (n)</b>	34		34		49		49		33		52		35		37		50		52		40		44		46	
	<b>Max</b>	2,400		10		10		40		30		2,190		660		6,000		410		8		10		30		30	
	<b>Min</b>	1		1		0		1		0		91		2		1,280		2		5		2		1		1	
	<b>Avg</b>	191		8		6		8		8		697		44		3,453		36		7		5		6		6	
	<b>Std Dev</b>	410		4		4		5		6		438		109		1,185		59		1		2		6		6	
	<b>2 x Std Dev</b>	820		7		8		11		11		877		217		2,369		118		1		4		13		12	
		Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
	<b>COMBINED</b>																										
	<b>Count (n)</b>	79		76		109		109		74		112		80		75		110		112		88		87		91	
	<b>Max</b>	105,000		100		83		1,000		30		146,000		2,910		24,633		6,620		8		14		83		83	
	<b>Min</b>	1		1		0		1		0		91		2		1,280		2		4		0		1		1	
	<b>Avg</b>	28,501		9		28		153		8		42,724		805		8,906		1,774		6		5		21		21	
	<b>Std Dev</b>	29,100		11		23		202		5		44,432		803		6,350		1,838		1		2		20		20	
	<b>2 x Std Dev</b>	58,200		22		46		403		9		88,864		1,607		12,700		3,677		3		5		40		40	



TETRA TECH

Table 2. Uranium Material Metals Analysis for RCRA Characteristics

Sample ID	Sample Date	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	2002	<0.05	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2003	<0.5	<10	0.2	<0.5	<0.5	<0.02	<0.1	<0.5
	2004	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2005	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2006	<0.5	<10	0.25	<0.5	<0.5	<0.02	<0.1	<0.5
	2007	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2008	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	5/20/2009	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	9/17/2009	<0.06	0.083	<0.005	<0.01	<0.04	<0.0002	<0.06	<0.01
	9/19/2009	<0.04	0.16	0.019	<0.01	<0.04	<0.0002	<0.04	<0.01
	9/23/2009	<0.04	0.12	0.011	<0.01	<0.04	<0.0002	<0.04	<0.01
	10/6/2009	<0.1	0.066	0.03	0.03	<0.08	<0.0002	0.2	<0.02
WTSP-1	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.051	<0.1
WTSP-2	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.054	<0.1
WTSP-3	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.054	<0.1
	<b>Count</b>	15	15	15	15	15	15	15	15
	<b>Min</b>	<0.04	0.066	<0.005	<0.01	<0.03	<0.0002	<0.04	<0.01
	<b>Max</b>	<0.1	<10	<0.05	<0.5	<0.5	<0.02	0.2	<0.5
	<b>40 CFR Part 261.24</b>	5	100	1	5	5	0.2	1	5
	<b>PASS?</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yrs	Yes

**Table 3. Uranium Material Organics and Pesticides Analyses for RCRA Characteristics**

Target Analyte	Units	Results		
		WTSP-1	WTSP-2	WTSP-3
<b>Organochlorine Pesticides - Method SW8081A - TCLP Leachate</b>				
Gamma-BHC (Lindane)	mg/L	<0.0001	<0.0001	<0.0001
Heptachlor	mg/L	<0.00015	<0.00015	<0.00015
Heptachlor Epoxide	mg/L	<0.000079	<0.000079	<0.000079
Gamma-Chlordane	mg/L	<0.000078	<0.000078	<0.000078
Alpha-Chlordane	mg/L	<0.00009	<0.00009	<0.00009
Endrin	mg/L	<0.000096	<0.000096	<0.000096
Methoxychlor	mg/L	<0.00039	<0.00039	<0.00039
Toxaphene	mg/L	<0.0051	<0.0051	<0.0051
Chlordane	mg/L	<0.0011	<0.0011	<0.0011
<b>Chlorinated Herbicides - Method SW8151A - TCLP Leachate</b>				
2,4-D	µg/L	<1.6	<1.6	<1.6
Silvex	µg/L	<0.12	<0.12	<0.12
<b>GC/MS Semivolatiles - Method SW8270D - TCLP Leachate</b>				
Pyridine	mg/L	<0.02	<0.02	<0.02
1,4-Dichlorobenzene	mg/L	<0.02	<0.02	<0.02
2-Methylphenol (o Cresol)	mg/L	<0.02	<0.02	<0.02
3+4-Methylphenol (m+p Cresol)	mg/L	<0.02	<0.02	<0.02
Hexachloroethane	mg/L	<0.02	<0.02	<0.02
Nitrobenzene	mg/L	<0.02	<0.02	<0.02
Hexachlorobutadiene	mg/L	<0.02	<0.02	<0.02
2,4,6-Trichlorophenol	mg/L	<0.02	<0.02	<0.02
2,4,5-Trichlorophenol	mg/L	<0.02	<0.02	<0.02
2,4-Dinitrotoluene	mg/L	<0.02	<0.02	<0.02
Hexachlorobenzene	mg/L	<0.02	<0.02	<0.02
Pentachlorophenol	mg/L	<0.043	<0.043	<0.043
<b>GC/MS Volatiles - Method SW8260_25B - Leachate</b>				
Vinyl Chloride	µg/L	<0.83	<0.83	<0.83
1,1-Dichloroethene*	µg/L	<0.83	<0.83	<0.83
2-Butanone (Methyl Ethyl Keytone)	µg/L	<8.3	<8.3	<8.3
Chloroform	µg/L	<0.83	<0.83	<0.83
Carbon Tetrachloride	µg/L	<0.83	<0.83	<0.83
1,2-Dichloroethane	µg/L	<0.83	<0.83	<0.83
Benzene	µg/L	<0.83	<0.83	<0.83
Trichloroethene*	µg/L	2.7 B,J	1.5 B,J	<0.83
Tetrachloroethene*	µg/L	<0.83	<0.83	<0.83
Chlorobenzene	µg/L	<0.83	<0.83	<0.83
<b>Inorganics - Method SW 846_7.3.1 (Cyanide) &amp; _7.3.2 (Sulfide), SW9045C (pH)</b>				
Reactive Cyanide	mg/kg	<0.1	<0.1	<0.1
Reactive Sulfide	mg/kg	<50	<50	<50
Solid pH in Water @ 25°C	pH	9.09	9.19	9.26
<b>Ignitability - Method SW1010A</b>				
Ignitability - 95°C	°C	U	U	U
<p>B=This flag is used when the analyte is detected in the associated method blank as well as in the sample. It indicates probable blank contamination and warns the data user. This flag shall be used for a tentatively identified compound (TIC) as well as for a positively identified target compound.</p> <p>J=This flag indicates an estimated value. This flag is used as follows: (1) when estimating a concentration for tentatively identified compounds (TICs) where a 1:1 response is assumed; (2) when the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semi-volatile GC/MS identification criteria, and the result is less than the reporting limit (RL) but greater than the method detection limit (MDL); (3) when the data indicate the presence of a compound that meets the identification criteria, and the result is less than the RL but greater than the MDL; and (4) the reported value is estimated.</p> <p>*IUPAC compounds ending in "ethene" are equivalent to "ethylene".</p>				

**Table 4. Uranium Material Analyses for RCRA Listed Hazardous Waste**

Target Analyte <sup>(1)</sup>	Units	Laboratory Results			Calculated Average
		WTPS-1	WTPS-2	WTPS-3	
<b>Total Uranium - Method SW6020A</b>					
Total Uranium	mg/kg	15,000	16,000	15,000	15,333
<b>Total ICP Metals - Method SW6010B</b>					
Arsenic	mg/kg	<5.9	<5.9	<5.7	<5.8
Barium	mg/kg	8,100	7,900	7,200	7,733
Beryllium	mg/kg	33	36	36	35
Cadmium	mg/kg	40	44	43	42
Calcium	mg/kg	15,000	16,000	16,000	15,667
Chromium	mg/kg	19	20	19	19
Cobalt	mg/kg	1,200	1,200	1,100	1,167
Copper	mg/kg	160	180	170	170
Iron	mg/kg	690	740	740	723
Lead	mg/kg	18	19	17	18
Manganese	mg/kg	110,000	110,000	96,000	105,333
Molybdenum	mg/kg	<5.8	<6.0	<5.7	<5.8
Nickel	mg/kg	1,700	1,800	1,800	1,767
Selenium	mg/kg	25	26	26	26
Silver	mg/kg	11	12	11	11
Thallium	mg/kg	<580	<600	<570	<583
Tin	mg/kg	<29	<30	<29	<29
Vanadium	mg/kg	<5.8	<6.0	<5.7	<5.8
Zinc	mg/kg	3,400	3,600	3,600	3,533
<b>Total Mercury - Method SW7471A</b>					
Total Mercury	mg/kg	<0.19	<0.2	<0.19	<0.19
<b>GC/MS Total Volatile Organics - Method SW8260</b>					
Chloromethane	µg/kg	<1.1	<1.2	<1.1	<1.1
Acetone	µg/kg	22 B	29 B	33 B	28
Methylene Chloride	µg/kg	3.8 J,B	3.7 J,B	5.8 J,B	4.4
2-Butanone	µg/kg	<5.7	<5.9	<5.7	<5.8
Tetrahydrofuran	µg/kg	<7.2	<7.4	<7.2	<7.3
Chloroform	µg/kg	1.7 J	2 J	1.2 J	1.6
Carbon Tetrachloride	µg/kg	<1.3	<1.4	<1.3	<1.3
Benzene	µg/kg	<0.94	<0.96	<0.93	<0.94
Toluene	µg/kg	2.2 J,B	1.9 J,B	1.3 J,B	1.8
m,p-Xylene	µg/kg	<1.9	<1.9	<1.9	<1.9
o-Xylene	µg/kg	<0.95	<0.97	<0.94	<0.95
Naphthalene	µg/kg	<1.4	<1.4	<1.4	<1.4

<sup>(1)</sup> All values as reported by ALS Laboratory as dry weight values

**Table 4. Uranium Material Analyses for RCRA Listed Hazardous Waste Cont'd**

Target Analyte	Units <sup>(1)</sup>	Laboratory Results			Calculated Average
		WTPS-1	WTPS-2	WTPS-3	
<b>GC/MS Total Semi-Volatile Organics - Method SW8270D</b>					
Pyridine	µg/kg	<310	<320	<320	<317
1,4-dichlorobenzene	µg/kg	<310	<320	<320	<317
2-methylphenol	µg/kg	<310	<320	<320	<317
3+4-methylphenol	µg/kg	<310	<320	<320	<317
Hexachloroethane	µg/kg	<310	<320	<320	<317
Nitrobenzene	µg/kg	<310	<320	<320	<317
Hexachlorobutadiene	µg/kg	<310	<320	<320	<317
2,4,6-trichlorophenol	µg/kg	<310	<320	<320	<317
2,4,5-trichlorophenol	µg/kg	<310	<320	<320	<317
2,4-dinitrotoluene	µg/kg	<310	<320	<320	<317
Hexachlorobenzene	µg/kg	<310	<320	<320	<317
Pentachlorophenol	µg/kg	<490	<500	<500	<497
<b>Gasoline Range Organics - Method SW8015B</b>					
Gasoline Range Organics	mg/kg	<0.38	<0.35	<0.39	<0.37
<b>Diesel Range Organics - Method SW8015MB</b>					
Diesel Range Organics	mg/kg	<6.5	<6.6	<6.8	<6.6
<b>Oil &amp; Grease</b>					
Oil & Grease	mg/kg	<120	<120	<120	<120
<b>Inorganics</b>					
Ammonia as N - Method EPA350.1	mg/kg	7.9	7.9	8.3	8.0
Nitrate/Nitrite as N - Method EPA353.2 Revision 2	mg/kg	3.1	3.2	3.1	3.1
Total Dissolved Solids - EPA160.1	mg/kg	26,000	26,000	27,000	26333.3
Fluoride - Method EPA300.0 Revision 2.1	mg/kg	38	38	40	38.7
Chloride - Method EPA300.0 Revision 2.1	mg/kg	40	39	41	40
Sulfate - Method EPA300.0 Revision 2.1	mg/kg	17,000	17,000	17,000	17,000
<b>Gross Alpha/Beta - GFPC</b>					
Gross Alpha	pCi/g	4,310±690	4,830±770	5,440±870	4,860
Gross Beta	pCi/g	4,870±780	4,780±760	4,860±780	4,867
<b>Lead-210 - Liquid Scintillation</b>					
Lead-210	pCi/g	33.1±8.0	34.7±8.4	32.0±7.8	33.3
<b>Radium-226 - GFPC</b>					
Radium-226	pCi/g	22.8±5.8	25.7±6.6	23.8±6.1	24.1
<b>Total Alpha Emitting Radium - GFPC</b>					
Total Radium	pCi/g	39.7±10	41±11	36.6±9.4	39.1
Total Radium (duplicate sample)	pCi/g	35.8±9.2			
<b>Isotopic Thorium - Alpha Spectroscopy</b>					
Th-228	pCi/g	1.24±0.99	1.50±0.74	0.93±0.67	1.22
Th-230	pCi/g	20.4±3.8	21.4±3.9	20.4±3.7	20.7
Th-232	pCi/g	1.14±0.48	0.66±0.34	0.71±0.32	0.84

<sup>(1)</sup> All values as reported by ALS Laboratory as dry weight values

**ATTACHMENT 5**



## Technical Memorandum

To: Jo Ann Tischler

From: Jen Hudson

Company: Denison Mines (USA) Corp.

Date: April 27, 2011

Re: Review of Chemical Contaminants in Dawn Mining Company Midnite Mine (DMC) Uranium Material to Determine Worker Safety and Environmental Issues and Chemical Compatibility at the Denison Mines White Mesa Mill

Project #: 114-181850/300

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### Introduction

This report summarizes the assessment of the Dawn Mining Company's ("DMC") water treatment plant ("WTP") solids ("Uranium Material") to be transported from the DMC Midnite Mine, Wellpinit, Washington to determine whether processing the Uranium Material at the Denison Mines (USA) Corp. ("Denison") White Mesa Mill (the "Mill") may pose any worker safety or environmental hazards, or may be incompatible with the Mill's existing tailings system. The results will provide information to Denison to determine the requirements, if any, for changes to worker safety practices, or potential incompatibilities to the White Mesa Uranium Mill for the processing of this Uranium Material as an alternate feed material. This report will also provide comparison of constituents of the Uranium Material and the Denison groundwater ("GW") monitoring program to identify any constituents which are not covered under the Denison GW monitoring program and whether these additional parameters need to be added to the sampling requirements.

The following questions were considered for the evaluation of potential safety and environmental hazards and compatibility with the Mill's tailings system and GW monitoring requirements:

- 1) Will any constituents of the Uranium Material volatilize at the known conditions on the Mill site or in the Mill circuits? If so, will they create any potential environmental, worker health, or safety impacts?
- 2) Will the Uranium Material or any of its constituents create a dust or off-gas hazard at the known conditions on the Mill site or in the Mill circuit? If so, will they create any potential environmental, worker health, or safety impacts?
- 3) Will any constituents of the Uranium Material react with other materials in the Mill circuits?
- 4) Will any constituents of the Uranium Material create any impacts on the tailings system?

- 5) Does the Uranium Material contain any constituents that are not present in the current Mill GW monitoring program and not sufficiently represented by the Mill's groundwater monitoring analyte list and need to be added to the analyte list?
- 6) What, if any, limitations on feed acceptance criteria or added operational controls are recommended in connection with processing the Uranium Material at the Mill?

An evaluation of the regulatory status of the Uranium Material relative to the Resource Conservation and Recovery Act ("RCRA") regulations is provided in a separate technical memorandum.

## **1.0 Basis and Limitations of this Evaluation**

The Uranium Material to be processed at the Mill consists solely of the Uranium Material produced from the existing DMC WTP. The Uranium Material was assessed to determine if it was, or contained, a listed Hazardous Waste under RCRA. In addition, historical Uranium Material data were reviewed and three solids samples were recently analyzed for the following RCRA characteristic hazardous waste properties: total uranium, total mercury, total metals, toxicity characteristic leaching procedure ("TCLP") metals and mercury, Lead-210, isotopic thorium, total alpha emitting radium, volatile organic compounds ("VOCs"), semi-volatile organic compounds ("SVOCs"), pesticides, herbicides, inorganics (reactive cyanides and reactive sulfides), and ignitibility.

Information presented in Table 1 details potential incompatibilities and chemical hazards associated with constituents within the Uranium Material. The historic water quality results of the WTP influent are presented in Table 2. Historic Uranium Material Total concentration data for uranium and radium-226 are presented in Table 3. Table 4 presents historic and current Uranium Material Metals Toxicity Characteristic Leaching Procedure ("TCLP") analysis for evaluation of RCRA characteristics; Table 5 includes Uranium Material Total analyses for evaluation of RCRA listed hazardous waste properties; the comparison of the Uranium Material and Mill tailings composition for Cell 4A or 4B is included in Table 6.

The following contamination evaluation is based on:

1. Current Midnite Mine WTP Uranium Material analytical data
2. Material Safety Data Sheet ("MSDS") for polymer in Midnite Mine Uranium Material (Attachment 1)
3. Historic Midnite Mine Water Quality and Uranium Material analytical data
4. Radioactive Material Profile Record ("RMPR") for the DMC Midnite Mine Uranium Material
5. Denison estimated composition data for tailings
6. Current technical literature from the internet and other sources on performance of liner materials



## **2.0 Site History and Background**

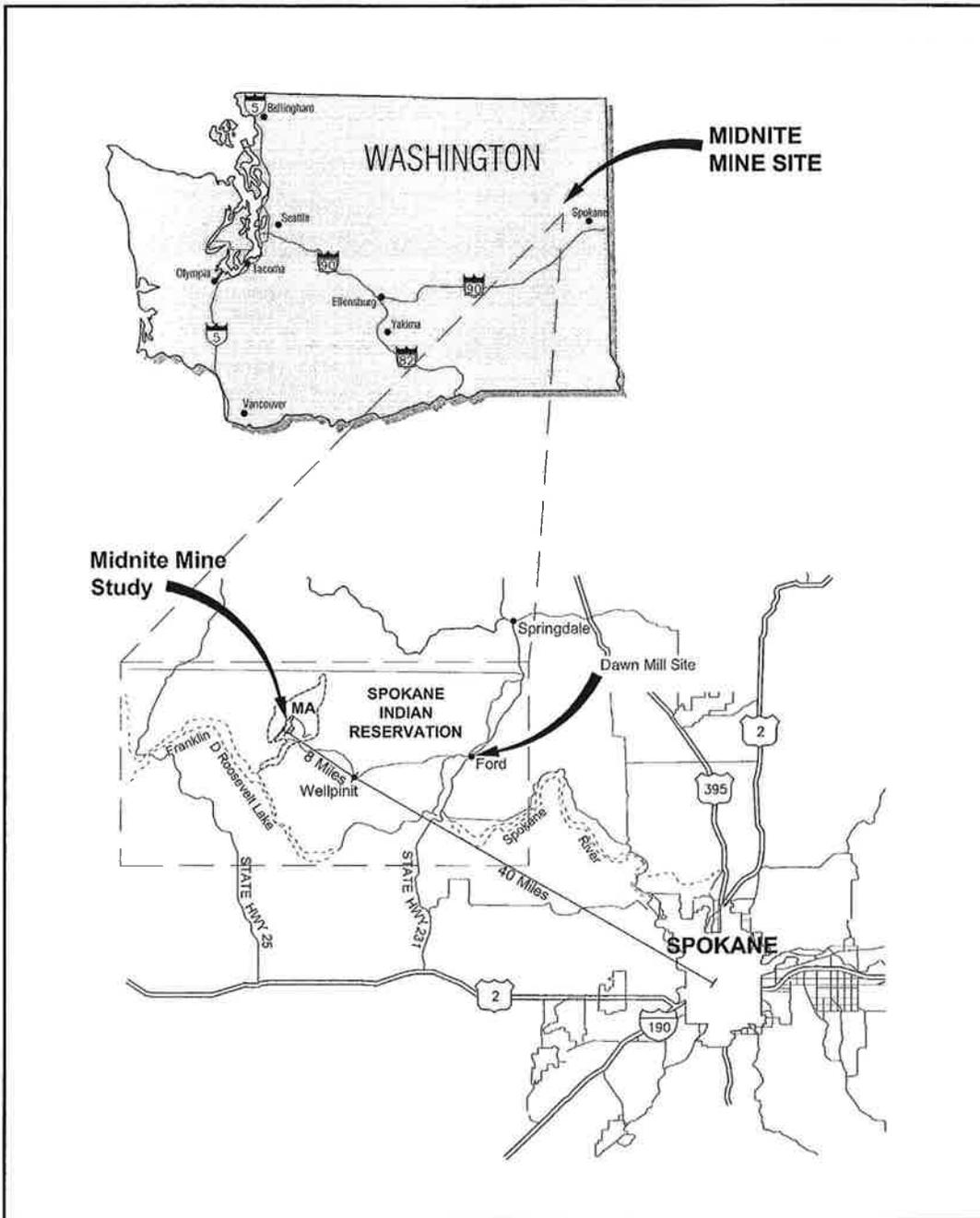
The Midnite Mine Superfund Site ("Site") is an inactive open-pit uranium mine that is currently administrated by the Environmental Protection Agency ("EPA") Region 10 under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), also known as Superfund. The Site EPA Identification Number is WA980978753.

The Site is located on the Spokane Indian Reservation in eastern Washington State, approximately 48 air miles northwest of Spokane (Figure 1). These lands are owned by the federal government and held in trust for the Spokane Tribe of Indians ("Tribe") and individual tribal members.

Uranium was discovered on the site in 1954. The prospectors and several tribal members subsequently formed Midnite Mines, Inc. and acquired the mining leases at the Site. Midnite Mines, Inc. then joined with Newmont Mining Company ("Newmont") to create the DMC, with Newmont Mining Company as the 51 percent shareholder and Midnite Mines, Inc. owning 49 percent. Newmont USA Limited is the corporate successor of Newmont Mining Company and continues to be the majority shareholder of DMC (EPA, 2006).

The mine operated from 1954 until 1965, providing uranium under contracts with the United States Atomic Energy Commission ("AEC"). The mine went into standby from 1965 and resumed mining in 1969. The ores were milled at the DMC Mill site, located near Ford, Washington. Mining was suspended in 1981 due to decreases in uranium prices and never resumed. The Mine was regulated by several United States Department of the Interior ("USDOI") agencies, including U.S. Geological Survey, U.S. Bureau of Mines, and U.S. Bureau of Land Management ("BLM") Minerals Management Service. The Bureau of Indian Affairs ("BIA") represented the Tribe and individual tribal allotment owners in matters related to leases and royalties.

An estimated 5.3 million tons of ore and proto-ore (i.e., low-grade mineralized rock) and 33 million tons of waste rock were removed from nine pits between 1955 and 1981. All but two of the mine pits have been backfilled using waste rock. The last two pits to be mined consisted of Pit 3 and Pit 4. These pits were not backfilled and remain open (EPA, 2006). Several reclaimed waste rock piles remain on the mine property and an estimated 2.4 million tons of ore and proto-ore were stockpiled and currently remain on Site.



DATE: Sep 27, 2006 FILE: PMXRegional Map



**Figure 1. Midnite Mine Site Location**

## **Seep and Surface Water Collection System**

In the late 1970s, seeps with dissolved ore-derived constituents were observed at the toe of the largest waste rock piles at the Midnite Mine. The BLM ordered DMC to construct a control pond (the Pollution Control Pond, or "PCP") in 1979 to capture the seeps for evaporation. Following the suspension of mining in 1981, DMC began pumping water from the PCP to the now inactive Pit 3 in response to growing quantities of water in the PCP and newly identified seeps at the base of the largest waste rock pile. Since cessation of mining operations, mine site surface runoff water has been collected in engineered channels and diverted to the inactive open mining pit, Pit 3. In addition, natural ground water from the ore zones of the pits has flowed into and accumulated in the two open mining pits, Pit 3 and Pit 4, at the site. In February of 1985, DMC applied to the EPA for a National Pollution Discharge Elimination System ("NPDES") permit to allow for the discharge of treated water from those pits and other waters collected on the site. In September of 1986, the EPA issued DMC an NPDES permit.

In 1987 a Compliance Order was issued by EPA under the Clean Water Act ("CWA") NPDES program requiring DMC to eliminate discharges of pollutants to waters of the United States above the limits in the existing NPDES Permit. Subsequently, DMC developed a seep collection and pumpback program that collected water from Site drainages and returned them to the PCP and Pit 3. Existing seep and surface water collection occurs at six specific locations throughout the Midnite Mine Site as part of this seep collection and pumpback program including the PCP. Pit 3 water consists of mine site waters collected and pumped from the seep collection and pumpback program, direct precipitation and local mine surface runoff in the immediate area of Pit 3, and natural ground water inflow from the Pit 3 ore zones. The water that accumulates in Pit 4 consists of direct precipitation, groundwater inflow, and surface runoff in the immediate area of Pit 4. All waters collected in the seep collection and pumpback system are derived from seeps from waste rock piles or surface runoff at the Site. The seep collection and pumpback system does not collect water from any areas that have ever been known to contain or currently contain any listed hazardous wastes or from any operations other than the mining of natural uranium ores.

In 1988, DMC built a water treatment plant at the Site to treat the accumulating water in the open pits. In 1991, the BLM issued an order requiring DMC to dewater the open pits for compliance with the NPDES permit issued in 1986, and in 1992 the WTP began treating pit water. These waters contain primarily metals, sulfate, and uranium.

There are no shop areas, petroleum tanks, or other sources of hydrocarbons at the mine site with the exception of a 300 gallon diesel fuel tank for the Pit 4 pump, and a 300 gallon tank of gasoline for WTP equipment. The diesel fuel tank and pump are located in secondary containment near Pit 4 with a maximum volume stored of 300 gallons and the 300 gallon gasoline tank is located next to the WTP. These fuels are stored and managed separately from the Uranium Material and have not impacted the Uranium Material in the past, nor do they have a reasonable potential to do so in the future. The constituents precipitated from the WTP influent are derived from flow of natural precipitation through uranium mine waste rock and



natural ore, collected surface runoff from natural materials, and natural ground water inflow from the ore zones into one of the two remaining open pits, Pit 3 and Pit 4 as discussed above.

### **Water Treatment Plant Process Description**

The WTP is a conventional lime treatment high-density solids process in which the metals and uranium are precipitated out in the treatment process, and includes addition of barium chloride for radium removal. A polymer coagulant is added and the resultant slurry is settled and filtered to produce a solution free of solids for surface discharge under the CWA NPDES program and EPA CERCLA program. The precipitate is currently centrifuged and the final solids contain on average 0.18 wet weight percent uranium (0.21 wet weight percent  $U_3O_8$ ) at an average historical solids content of 15 percent. However, the centrifuges are to be replaced with a hydraulic filter press in 2011, increasing the percent solids of the final Uranium Material to between 25% and 45% resulting in a proportional increase in weight percent uranium estimated to be between 0.3 and 0.55 wet weight percent uranium (0.35 and 0.63 wet weight percent  $U_3O_8$ ). As uranium ores are typically evaluated on a dry percent  $U_3O_8$  basis, the actual (dry) percent  $U_3O_8$  of the Uranium Material is estimated to be approximately 1.4 percent  $U_3O_8$ .

The WTP is typically operational from early May through the end of October and operates 24 hours per day, four days per week. WTP influent is derived from approximately 400 gallons per minute ("gpm") influent from Pit 3 and approximately 50 gpm influent from Pit 4. The pit waters are pumped to the WTP using positive displacement pumps which are piped separately to the WTP through polyethylene piping. The WTP reagents are pre-mixed in individual mixing tanks prior to addition to the treatment stream. The hydrated lime and flocculent are pre-mixed using makeup water from Pit 4 while the barium chloride is mixed with potable water.

Barium chloride is added to the influent water stream, which is then mixed with approximately 90 gpm from the clarifier bottoms (clarifier underflow) to increase the overall final WTP solids density. Then hydrated lime is added for the precipitation of uranium and metals. Waters recovered from the dewatering process are also added back to the process stream at this point. An anionic water soluble polymer (Neo Solutions, NS-6852) is subsequently added as a coagulant to facilitate clarification.

This process stream is then sent to one of two clarifiers. The precipitated solids are drawn from the clarifier bottom and, as mentioned previously, approximately 20% of the clarifier underflow (approximately 90 gpm) is pumped back to the beginning of the process to increase overall WTP solids density. The liquid fraction of the remaining process stream (approximately 360 gpm) is decanted from the top of the clarifier for further treatment and discharge separate from the solids, while the remaining solids fraction from the clarifier underflow is sent to the centrifuge for dewatering. The centrifuge will be replaced for the 2011 operating season with a hydraulic filter press as discussed in more detail below.

The dewatered solids are currently transferred from the centrifuge to the hauling truck via a discharge conveyor. The transport truck is housed within the WTP building and remains in that location until it is hauled for final disposal, thereby eliminating any opportunity for other waste materials to be introduced into the Uranium Material.



The time period from 2001-2008 is the most representative of treatment volumes processed in the WTP. Before this time period, pit dewatering and other site activities increased the volumes treated. Therefore these are the years used for this analysis.

From 2001 through 2008 the WTP process produced between 164,000 dry lbs and 393,500 dry lbs per year (82 to 194 dry tons per year) of treatment solids (average 294,700 dry lbs or 147 dry tons). The maximum annual total volume of Pit water treated was approximately 76.5 million gallons for the period of 2001 through 2008. Volumes vary depending on how much precipitation the site receives in a given year.

The plant will be modified for the 2011 operational season, and the centrifuges currently used for Uranium Material dewatering will be replaced by a hydraulic filter press. It is expected that the same water soluble polymer will be used for coagulation; however the polymer application rate may be increased from the current rate to improve the dewatering characteristics of the solids. The Uranium Material solids percent is expected to increase from an average of 15 weight percent solids to between 25 and 45 percent. The total wet concentrations of the constituents present in the Uranium Material are expected to increase by 67 to 300 percent from the analytical values reported for the current Uranium Material as a result of decreased water content due to dewatering with the filter press. The dry concentrations should not change.

In addition, a Remedial Investigation/Feasibility Study (RI/FS) was completed on 9/30/05 for the Midnite Mine. The Selected Remedy for the Site is Alternative 5a (Complete Pit Backfill with Passive Drains and Ex-Situ Water Treatment) of the FS. Based on the FS and issued in the Record of Decision (ROD) as the Selected Remedy ("Remedy"), Pits 3 and 4 will be backfilled, waste rock and proto-ore will be moved and capped, and a new passive water collection system will be installed to capture groundwater from these and other backfilled pit areas. The surface water management will be designed to divert surface flows around sources of contamination and therefore minimize the volume of water to be treated after the Remedy is implemented. The existing WTP is located on a waste rock pile that must be removed for the Remedy. Therefore, a new water treatment plant will be built before construction of the Remedy begins. It is estimated that the construction will begin in the beginning of 2013 and will require approximately 2 years ending at the end of 2014, and the new WTP must be capable of treating water at a rate of 1,000 gpm year round for the construction phase. The new WTP will be comparable to the current treatment employed using lime and barium addition for removal of constituents from the feed water. This higher design flow will allow for rapid dewatering of the pits during backfilling, as well as groundwater collection and surface water collection treatment. After construction, it is expected that the flows will be reduced to an ultimate annual value of 65 million gpm and will take an estimated 6 to 7 years to reach these reduced flows.

The water quality during construction is assumed to be the same composition as currently is captured and treated, and it is expected that the water quality after implementation of the Remedy will be improved from current water quality.

The estimated production of dry Uranium Material before during and after the Remedy is implemented is projected to range from 996 tons per year during the two year construction phase down to 2.8 tons after the remedy has become effective .

### 3.0 Assumptions Regarding White Mesa Mill Processing of the Uranium Material

This evaluation was based on the following process assumptions:

- a) The Mill will process the Uranium Material either in the main circuit mixed with conventional ore or in the alternate circuit alone.
- b) The Uranium Material will be delivered to the Mill in conventional covered end or side dump haul trucks, which will be unloaded onto the Mill's ore pad. It will be temporarily stored on the ore pad, similar to conventional ores, pending processing.
- c) If the Uranium Material is processed in the Mill circuit, it will be added in a manner similar to that used for the normal processing of conventional ores and other alternate feed materials. It will either be dumped into the ore receiving hopper and fed to the SAG mill, run through an existing trommel before being pumped to Pulp Storage, or may be fed directly to Pulp Storage.
- d) If the Uranium Material is processed in the alternate circuit, it will be dumped to the filter cake acid tank.
- e) The Mill does not anticipate any significant modifications to the leaching circuit or recovery process areas for the processing of the Uranium Material.
- f) The Uranium Material may be processed in combination with other approved alternate feed materials.
- g) Tailings from processing of the Uranium Material will be sent to Cell 4A, or Cell 4B, or potentially to subsequently-constructed tailings cells.
- h) Tailings from the Mill circuit historically disposed of in Cell 3 will be sent to Cell 4A or Cell 4B, and thereafter to subsequently-constructed tailings cells.

### 4.0 Chemical Composition of the Uranium Material

The characterization data and the RMPR provided include historical WTP influent water quality data, historical Uranium Material analysis, and analysis of representative Uranium Material samples in 2010. The 2010 Uranium Material analyses included three WTP solid samples analyzed for radionuclides, recoverable metal values, RCRA regulated organic and inorganic contaminants, diesel and gas range organics ("DRO" and "GRO") as well as for RCRA hazardous waste characteristics. Radionuclide analyses included Lead-210, isotopic thorium, gross alpha and beta, and total alpha emitting radium. Additional parameters including nutrients (ammonia and nitrate/nitrite), and other non-metals were included in the analysis to assess compatibility with existing tailings and process chemicals at the White Mesa Mill. The total uranium values from the 2010 sampling results indicate average uranium concentration in the sludge to be 15,333 mg/kg (1.5 percent U<sub>or</sub> or 1.8 percent U<sub>3</sub>O<sub>8</sub>) on a dry basis and are consistent with the historical uranium values for the Uranium Material.

The TCLP results, RCRA characteristic test results, and the total constituent values of the Uranium Material were evaluated and presented in *Technical Memorandum: Review of Chemical Contaminants in Dawn Mining Company (DMC) Midnite Mine Uranium Material to Determine the Potential Presence of RCRA Characteristic or RCRA Listed Hazardous Waste* (Tetra Tech, 2011).

As a result of the RCRA characteristic waste evaluation, it was concluded that the Uranium Material does not exhibit any of the RCRA characteristics of ignitability, corrosivity, reactivity, or toxicity for any constituent. The sampling results of the RCRA characteristic evaluation are consistent with the constituents found in the total constituent evaluation.

The historical water quality data indicates that influent water parameters are relatively consistent over the WTP operational history (Table 2). Based on process history of the source of the Uranium Material organic constituents of any are not expected to be present and have not historically been analyzed in the WTP influent, or the final Uranium Material; however, comprehensive laboratory analysis of recent Uranium Material samples, including analyses for organic compounds, is included in this report. The Uranium Material test results presented herein are taken to be representative of the range of material characteristics of the Uranium Material. As a result, these studies provide sufficiently representative characterization to assess the regulatory status, worker safety environmental hazards, and chemical and processing properties of the Uranium Material.

The list of constituents sampled for in the Uranium Material, included in Table 5 were generated from the parameters in the White Mesa Mill groundwater permit and annual tailings characterization program as appropriate to the Uranium Material.

#### **4.1 Organic Constituents**

The sampling results for the total volatile organic compounds in Table 5 indicate that acetone, methylene chloride, and toluene were reported at very low concentrations in the three samples for total analysis. Acetone was reported at concentrations ranging from 22 milligrams per kilogram ("mg/kg") to 33 mg/kg with an average value of 28 mg/kg. Methylene chloride was reported at concentrations ranging from 3.7 mg/kg to 5.8 mg/kg with an average value of 4.4 mg/kg. Toluene was reported at concentrations ranging from 1.5 mg/kg to 2.7 mg/kg with an average value of 2.1 mg/kg. However all of these constituents were also detected in the method blanks for the coinciding sample runs. Chloroform was detected in the three samples just above the method detection limit ("MDL"). The method blank samples did indicate low levels of total chloroform; however the detection of chloroform in the blank was below the MDL and was therefore not reported by the laboratory, as stated in the email from laboratory personnel Jeff Kujawa (Attachment 2). As indicated; chloroform, methylene chloride, and toluene were therefore present due to laboratory interferences, and not present in the Uranium Material.

Trichloroethene (or trichloroethylene) was reported at very low concentrations from the TCLP testing of only two of the Uranium Material samples with concentrations ranging from 1.5 micrograms per liter ("µg/L") to 2.7 µg/L with an average concentration of 2.1 µg/L. However, trichloroethene was detected in the leachate method blank at 3.3 ug/L which was above the MDL, but below the reporting limit ("RL"). Two of the three associated samples had detectable amounts less than the RL and less than 10 times the amount found in the method blank, so the samples were qualified as "U", raising the concentration to the RL (5 ug/L).

Review of the site operational history, WTP processes and chemicals, as well as sample collection, preservation and shipping methods did not identify any source of potential sample contamination for these constituents.

Since these compounds were present in the method blank and there are no known sources for these constituents from the Site or from the sampling preservation or shipping methods, their detection is apparently due to laboratory influences, and does not indicate they are present in the Uranium Material. These are common laboratory solvents and there are multiple laboratory pathways that could introduce them during analytical processes, including the use of methylene chloride for extraction of SVOCs in other analytical procedures.

The sampling results for the total herbicides and total organochlorine pesticides (Table 5) indicate that there was no detection of any of the constituents tested.

The sampling results for the total semi-volatile organic compounds in Table 5 indicate that there was no detection of any of the constituents tested for. Therefore the results of the VOC and SVOC analyses for the Uranium Material indicate that there are no volatile or semi-volatile components present in the Uranium Material to be shipped to the White Mesa Mill.

DRO and GRO were analyzed to ensure that these components were not present in the Uranium Material; test results are included in Table 5. The DRO and GRO results indicate no detection of these constituents.

## **4.2 Inorganic Constituents**

### **4.2.1 Non-Metal Inorganic Compounds**

Five non-metal inorganic constituents were identified in the Uranium Material: ammonia, nitrate/nitrite, fluoride, chloride, and sulfate. It was determined in the RCRA analysis that these constituents are not hazardous compounds as contained in the Uranium Material.

The constituent with the highest concentrations in the Uranium Material was sulfate with a concentration of 17,000 mg/kg in all three samples. All other constituents were present at much lower levels with concentrations ranging from approximately 3 mg/kg to around 40 mg/kg.

### **4.2.2 Metals**

The three Uranium Material samples were analyzed for total metals, total alkali metals, and total alkaline earth metals. According to the sampling results, of the 20 non-radioactive metals and metalloids analyzed in the Uranium Material, 14 were present including: barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, and zinc. These constituents can be categorized based on their elemental characteristics and chemical properties as follows:

<b>Class</b>	<b>Component of the Uranium Material</b>
Alkaline Earths	Barium, Beryllium, Calcium
Transition Metals	Cadmium, Chromium, Cobalt, Copper, Iron, Manganese, Nickel, Silver, Zinc
Other Metals	Lead

With the exception of barium, the metal species presented above are natural constituents in uranium ores and surface and ground waters in contact with these ores at the Site. The source for the barium is the barium chloride added to the water treatment process for removal of radium from the influent water. Calcium is a natural constituent in the influent water to the treatment system; however, additional calcium is introduced into the Uranium Material by addition of lime for metals precipitation.

The Uranium Material samples were not analyzed for their actual mineral composition. As a result, their exact compound forms have not been identified. Assumptions regarding their form, based on process knowledge and prior experience with leached metal tailings, are discussed below.

It should be noted that the chemical properties and reactivities discussed below for apply to metals, hydroxides, or oxides in pure or high concentrations in dry or "neat" form, not to precipitated salts or sludges in a wet matrix. These properties are discussed below for completeness and conservatism of the assessment.

#### **4.2.3 Potential Effects in Mill Process**

The metals in the Uranium Material are expected to be in the form of metal hydroxides and metal sulfates. The overall maximum mass contribution of 197 dry tons per year of Uranium Material is not expected to have a significant effect on the concentrations of constituents in the impoundments. Historical data for Cell 3 in 2004 at the White Mesa Mill are presented in the Statement of Basis for the Utah Groundwater Discharge Permit for the Mill. The mass in Cell 3 at that time was estimated to be 1,769,000 dry tons of tailings material. Cell 3 is full and is no longer able to accept process residuals from the Mill. The tailings from the Uranium Material to be processed will be sent to either Cell 4A or Cell 4B or to a subsequently-constructed tailings cell. It is assumed that the composition of the Cell 4A and Cell 4B tailings material will be similar to Cell 3. Therefore the compositional data from Cell 3 has been used to determine the impact of the Uranium Material to the tailings cells in the future. Table 5 presents the comparison of estimated Mill tailings composition before and after processing of the Uranium Material. The analysis assumed for the first two years, the treatment plant will be operated under the existing historical conditions at an estimated 76.5 million gallons (MG) of water to be treated with a sludge production of 29 dry tons of Uranium Material. The construction of the Remedy is anticipated to begin in Year 3 and last for two years. The estimated volume treated and sludge produced for Years 3 and 4 are 405 MG and 154 tons of dry Uranium Material produced. Once construction is complete, it is estimated that treated flows will decrease from the current value of 76.5 MG (yielding 29 dry tons per year of solids) to an ultimate value of 65 MG (yielding less than 25 tons per year of solids) over a 6 year period. For the current analysis as detailed in Table 5, years 5-10 were estimates based on a reduction of 20 percent per year of the difference between the existing flow (76.5 MG) and the ultimate flow (65 MG) annually.

The analysis compares the tailings composition before and after processing of the Uranium Material on an annual basis for ten years. It is estimated that either Cell 4A or 4B will take approximately this long to fill to capacity. The results indicate that the impact to the tailings cell

for the metals contained in the Uranium Material is minimal when comparing the overall quantity to be processed. Over the ten year period, it is estimated that tailings from approximately 283 dry tons of Uranium Material in total will be added to the estimated total of 2.15 million tons of tailings from current operations, which is equivalent to less than 1/100<sup>th</sup> of one percent of the total or the equivalent of a few hours of conventional ore production, that is, the contribution of the Uranium Materials to the tailings system will be negligibly small.

All sampled metals have been introduced into the milling process and impoundments at the Mill. All analyzed radio-isotopes have already been introduced into the milling process at the Mill as a result of processing uranium ores as presented in the historic data from cell tailings. All constituents analyzed and detected in the Uranium Material except barium are natural constituents in the mining and processing of uranium ores and therefore are expected to be present at the Mill as a result of processing of uranium ores.

Most of the metal species resulting from natural ores in the Uranium Material are present at parts per million ("ppm") levels or lower (or at percent levels in the highest case). The concentrations of these constituents will be further reduced by introduction into the leach circuit, where they will be present at fractional ppm levels or lower in large volumes of aqueous acid solution. These constituents will be processed in the same manner as natural uranium ores processed at the Mill and will be discharged to the Mill tailings system just as the uranium ores currently are.

In addition to these constituents, barium chloride is added to the WTP feed water for radon removal, calcium is added in the form of lime for metals precipitation of the WTP feed water, and an anionic water-soluble polymer is added during the metals precipitation process at the DMC WTP site and are discussed below.

The majority of the metal hydroxides, hydrates, and other mineral salts will be converted to sulfate salt forms in the leach system. The insoluble forms will be precipitated with the solids removed from the alternate feed circuit.

All the known Uranium Material components in their anticipated oxidation or mineral states are compatible with aqueous sulfuric acid, which will be used for leaching the Uranium Material, and all other chemicals and materials to which they may be exposed in the Mill.

Since the metals, hydroxides, hydrates and other salts are expected to be converted to insoluble sulfates, it can be assumed that the non-uranium constituents that enter the leach system will leave the leach system, proceed no further than the CCD step or Tank 11A or 11B, and be discharged from the circuit to the tailings.

Barium chloride is added to the WTP feed water to remove radium from the stream. The average barium concentration in the feed is 7,733 ppm and is expected to be in the form of barium sulfate. The data from Cell 3 indicate that barium has already been introduced into the Mill process from other alternate feed materials, and the assumption is that barium will also be present in the Cell 4A and 4B tailings from such other sources. Barium concentrations as high as 43,000 ppm have been processed to date at the Mill with no adverse process, environmental, or safety issues. Incompatible materials listed for barium sulfate include phosphorous and

aluminum. The barium will not be exposed to these materials, and the addition of sulfuric acid at the Mill will not create any additional worker safety or environmental hazards.

Some of the metals and metal hydroxides, in dry forms or at high concentrations, are known to decompose at high temperatures, breaking down into volatile oxide forms (such as  $As_2O_5$  decomposing to a trioxide). However, as described above, the metals and metal hydroxides will be short-lived in the process, as they will be converted into aqueous sulfates in the leach acid. The metals and their hydroxides will not be exposed to any conditions that can produce gaseous byproducts. The sulfate forms are stable and non-reactive and will be precipitated from the circuit in post-leach steps and discharged to the tailings system.

The polymer added for coagulation of the metal precipitates in the DMC sludge production process is NeoSolution NS-6852. The polymer is a stable compound and in its pure form may result in generation of heat upon addition of a strong oxidizing agent according to the MSDS (Attachment 1). The polymer will be introduced to the circuit not as pure polymer, but primarily bound within the precipitated solids from the WTP. Since there are no strong oxidizers in the milling process, and the Uranium Material containing the polymer will be introduced immediately into aqueous solutions in the leach circuit, the polymer will not cause any adverse reactions or polymerization as a result of processing at the Mill. It is expected that the polymer will be broken down into smaller inert organic molecules by the addition of acid, and will have the same fate as other anionic polymers used in the Mill's clarifiers with no adverse effects to the Mill process.

#### **4.2.4 Alkaline Earth Metals**

Metal oxides are more reactive in an acid leach system than metal hydroxides or metal sulfates. Although the metal compounds will be primarily metal hydroxides and metal sulfates, the chemical reactivity discussed below is focused on the reactivity of the metal oxides to provide conservatism for the worker safety evaluation. Although in some circumstances, the introduction of oxides of alkaline earths in sufficient quantities into an acid leach circuit has the potential to result in unwanted excess chemical reactivity, this situation will not result from processing the Uranium Material at the Mill for the reasons described below.

Manufacturer's MSDS and National Institute for Occupational Safety and Health ("NIOSH") safety hazard information indicate that in pure form or high concentration the alkaline earths: barium, beryllium, and calcium are reactive with water resulting in an exothermic (heat generating) reaction if they are present as a pure or high concentration product (percent levels or more).

The historical tailings data for Cell 3 indicate that barium has been introduced into the tailings system, and it is assumed that tailings similar to the tailings historically sent to Cell 3 will now be sent to Cell 4A and 4B, and barium concentrations in Cell 4A and 4B will be comparable to Cell 3. For this analysis, historical Cell 3 barium concentrations were used. During processing of the Uranium Material, calcium may be present at 15,667 ppm and barium and beryllium may be present at 7,733 ppm and 35 ppm, respectively, in the ore feed area to the circuit (Table 6). These constituents have been introduced to the Mill process in other feed materials in concentrations as high as 217,000 ppm for calcium, 43,000 ppm for barium, and 105 ppm for

beryllium. The resulting increase in concentration to the tailings is 21.9 ppm for calcium, 0.049 ppm for beryllium, and 10.8 ppm for barium, or increases of 22.7 and 11.2 percent for calcium and barium, and an imperceptible 0.051 percent increase for beryllium, based on the concentrations in Cell 3. These low levels will not pose a heat of reaction hazard with the water rates in the dust control system. Any water reactivity will also be quenched immediately by the large volume of sulfuric acid solution in the leach system. Pure or high concentrations of these hydroxides in dry form can also decompose under heat to generate hazardous byproduct gases. However, these materials will not be exposed to heating conditions during processing at the Mill. As discussed above, the metals and metal oxides are expected to be converted into metal sulfate salts in the acid leach system and be precipitated with solids removed from the post leach thickeners in the CCD circuit. These metals will be removed from the Mill process in the CCD thickeners and then discharged to the tailings, and therefore will not be exposed to the elevated temperatures further in processing of the uranium.

#### **4.2.5 Transition Metals**

Chemical behavior and incompatibilities for the transition metals vary, so they are discussed individually in this section.

Although in some circumstances, the introduction of oxides of the transition metals in sufficient quantities into an acid leach circuit has the potential to result in unwanted excess chemical reactivity, this situation will not occur from processing the Uranium Material at the Mill for the reasons described below.

Cadmium oxide is reactive with pure product magnesium and decomposes at elevated temperature to release cadmium fumes. The metal compounds will be present as hydroxides and sulfates and therefore there will be no pure metal magnesium for reaction with cadmium oxide. Cadmium oxides are insoluble in water and soluble in and compatible with acids and alkalis. They will be converted into sulfates in the acid leach system and will be precipitated and discharged into the tailings and will not be subject to elevated temperatures during processing. They do not pose any incompatibility hazards in the Mill process.

Chromium oxides are oxidizers themselves and are incompatible with combustible organic materials due to the potential for ignition. However, chromium oxides will not be present and the metal hydroxides will be precipitated and discharged into the tailings before the aqueous streams are contacted with organic hydrocarbons in subsequent uranium concentration steps, eliminating any contact with organic materials.

Cobalt oxides are insoluble in water and slightly soluble in and compatible with acids and alkalis. They will be converted into sulfates in the acid leach system and will be precipitated and discharged into the tailings. Cobalt oxides do not pose any incompatibility hazards in the Mill process.

Cupric oxides are insoluble in water and soluble in acids, and toxic metal fumes may form when heated to decomposition. However cupric oxides are only present at trace levels and will be converted into sulfates in the acid leach system and discharged into the tailings and will not be

subject to elevated temperatures during processing. They do not pose any incompatibility hazards in the Mill process.

Iron oxides are reactive with calcium hypochlorite, carbon monoxide gas, and hydrogen peroxide. The Uranium Material will not be in contact with any of these materials at any time in the Mill process.

Other compounds of iron, (i.e. chlorides and sulfates) are compatible with the solutions in the leach circuit. They will be precipitated as sulfates or other insoluble salts, and discharged to the tailings. They do not pose any incompatibility hazards in the Mill process.

Manganese and its oxides are not soluble in water but are soluble in strong acids. They will be converted to sulfates in the acid leach system, and will be precipitated and discharged to the tailings. They do not pose any incompatibility hazards in the Mill process.

Nickel and its oxides are reactive and incompatible with gaseous iodine and hydrogen sulfide. The Uranium Material will not be in contact with either of these materials at any time in the Mill process and therefore do not pose any incompatibility hazards.

Silver oxide in pure or high concentration poses a fire and explosion risk in contact with organic materials and ammonia. Silver oxides will not be in contact with organic materials or ammonia at any time in the Mill process. Insoluble salts of silver will be precipitated with solids removed from the post-leach thickeners in the alternate feed circuits and will be discharged to the tailings and will proceed no further with the uranium through subsequent processing steps. Although the Uranium Material contains trace amounts of ammonia, the concentrations are not sufficiently high to create instability within the Uranium Material as delivered to the Mill. Also, within the processing at the Mill, concentrated uranium brines are precipitated with ammonia at this later phase, the insoluble silver salts will already have been removed from the process and the solids sent to the tailings prior to the ammonia precipitation of uranium, and silver oxides will not come into contact with the ammonia.

Zinc and its oxides are stable and insoluble in water, but soluble in most acids and bases at ambient temperatures. They will be converted to sulfates in the acid leach system, and will be precipitated and discharged to the tailings. They do not pose any incompatibility hazards in the Mill process.

#### **4.2.6 Other Metals**

Although in some circumstances, the introduction of oxides of lead in sufficient quantities into the acid leach circuit has the potential to result in unwanted excess chemical reactivity, this situation will not result from processing the Uranium Material at the Mill for the reasons described below.

Manufacturers' MSDS and NIOSH safety hazard information indicate that lead and its oxides are incompatible with strong oxidizers, halogen gases, and some acids.

Oxidants are sometimes added to the leaching system at the Mill to improve uranium recovery from some types of feeds. Sodium chlorate, the typical oxidizing agent used in the Mill's leach circuit is a moderately effective oxidizer, but not considered a strong oxidizer. It is introduced in a relatively dilute aqueous solution in the leach system. Lead is present in low concentrations in the Uranium Material with an average value of 18 ppm. As a result, hazards associated with reactions between lead oxides with strong oxidizers are not applicable to the processing of the Uranium Material.

The Uranium Material will not be in contact with halogen gases at any time in the Mill process. Lead oxides react strongly with strong mineral acids such as nitric and sulfuric acids. The sulfuric acid added to the acid leach system is relatively dilute and not an oxidizing acid. These oxides will be converted into sulfates in the acid leach system and precipitated with the solids removed to the tailings.

#### **4.2.7 Metalloids**

Although in some circumstances, the introduction of selenium oxides in sufficient quantities into the acid leach circuit has the potential to result in unwanted excess chemical reactivity, this situation will not result from processing the Uranium Material at the Mill for the reasons described below.

Manufacturers' MSDS and NIOSH safety hazard information indicate that selenium and its oxides are incompatible with strong acids, organic materials, and ammonia.

Selenium oxides in pure form or high concentrations pose a fire and explosion risk in contact with organic materials and ammonia. Selenium oxides will not be in contact with organic materials or ammonia at any time in the Mill process. Insoluble salts of selenium will be precipitated with solids removed from the post-leach thickeners in the alternate feed circuit and will be discharged to the tailings and will proceed no further with the uranium through subsequent processing steps. Although the Uranium Material contains trace amounts of ammonia, the concentrations are not sufficiently high to create instability within the Uranium Material as delivered to the Mill. Also, within the processing at the Mill, concentrated uranium brines are precipitated with ammonia at this later phase, the insoluble selenium salts will already have been removed from the process and the solids sent to the tailings prior to the ammonia precipitation of uranium, and selenium oxides will not come into contact with the ammonia.

#### **4.3 Non-Metals**

Nitrates have been introduced into the Mill's circuit with natural ores and alternate feeds at levels as high as 350,000 mg/kg. The average nitrate concentration in the Uranium Material is 3.1 mg/kg. The Mill has handled nitrate compounds in the Mill circuit and tailings system with no adverse process, environmental, or safety issues.

Chlorides have been introduced into the Mill's circuit with natural ores and alternate feeds at levels as high as 89,900 mg/kg. The average chloride concentration in the Uranium Material is 40 mg/kg. The Mill has handled chloride compounds in the Mill circuit and tailings system with no adverse process, environmental, or safety issues.

Fluorides have been introduced into the Mill's circuit with natural ores and alternate feeds at levels as high as 460,000 mg/kg. The average fluoride concentration in the Uranium Material is 39 mg/kg. The Mill has handled fluoride compounds in the Mill circuit and tailings system with no adverse process, environmental, or safety issues.

Sulfates have been introduced into the Mill's uranium circuit with natural ores and alternate feeds at levels as high as 300,000 mg/kg. Sulfates are also generated by the reaction of sulfuric acid with other metal cations in the acid leach system. The Mill has handled sulfate compounds in the Mill circuit and tailings system with no adverse process, environmental, or safety issues.

Ammonia was reported at very low levels, with an average value of 8.0 mg/kg. Anhydrous ammonia gas in high concentrations of ammonium hydroxide solutions are incompatible with strong oxidizers, halogen gases, acids, and salts of silver and zinc. Ammonia is present as low concentration aqueous ammonium salts (chlorides and sulfates) and as mineral complexes, and will not be present as anhydrous ammonia gas or high concentration ammonium hydroxide.

The ammonium compounds will not contact halogen gases at any time in the Mill process. While ammonia may be present in the reactive form (ammonium hydroxide) it will be at concentrations too low to react with the silver and zinc already present in the Mill tailings, or with the moderate oxidizer that may be added in the Mill acid leach circuit.

#### **4.4 Organic Compounds**

As discussed in Section 4.1, there was no detection of any organic compounds sampled for with a reasonable degree of accuracy. Although the polymer added to the feed water in the water treatment system is organic, analytical results indicate that there are no organic compounds present in the Uranium Material as analyzed, and therefore there will be no effect on the Mill processing as a result of organic compounds. The organic polymer is expected to decompose in the Mill processing and will have no affect on the on the Mill processing.

#### **5.0 Potential Worker Safety Issues**

According to manufacturers' MSDS and the NIOSH literature (2007), the primary worker health hazards from the metal oxides are associated with inhalation of dusts and fines. If inhaled in pure or high concentrations in dry form, the oxide dusts of the lower metals are as hazardous as those of uranium. However, the Uranium Material is expected to have an average moisture content of approximately 25 to 45 percent, which will minimize the potential for dusting, and which ensures that all metal oxides will be present in the Uranium material in hydrated, not dry, form. If required, normal dust controls, such as water sprays, can be implemented to minimize any worker exposure to dusts from unloading operations. In addition, normal operations in this area require the use of worker personal protective equipment for prevention of dust inhalation and skin exposure; therefore, normal worker protections already in place will be sufficient to prevent exposure to any additional metal oxides, sulfates, or nitrates during processing of the Uranium Material.

## **6.0 Radiation Safety**

The Uranium Material is derived from natural uranium ores, or through contact of surface or groundwater with these ores. The Uranium Material contains the same radionuclides as natural ores; however the concentrations of the uranium daughters are much lower. The concentrations of Ra-226, Th-230 and Pb-210 are lower in the feed as a result of the low concentrations in the feed water to the treatment plant. The concentrations of these daughter products in the feed water are lower than the concentrations typically found in ore due to the limited solubility in groundwater. The derived air concentrations, radiation protection measures, and emissions control measures used for the ores and alternate feeds at the Mill are sufficiently protective for the processing of the Uranium Material.

## **7.0 Potential Air Emissions Impacts**

The introduction of a solid powder like the Uranium Material to any process may produce two potential forms of air emissions: fugitive dusts, and/or hazardous gases. Discussions in the previous sections demonstrate that engineering controls already in place at the Mill will prevent the generation or dispersion of both of these types of emissions. The Uranium Material will have a moisture content of approximately 25 to 45 percent, which will minimize dusting of finely divided and powdered alternate feed materials. In addition, the impurities will almost immediately be converted from volatile oxides to sulfates or other stable aqueous ionic forms, which are non-volatile and produce no off gases.

Because the metals and ions in the Uranium Material are present at trace levels, they are not expected to generate a significant increase in load on the existing bag-house system and air pollution control devices even if they reach the air control system as solids from spills in the pre-leach area.

In sum, the air emissions impacts from processing the Uranium Material will not be different in any significant way from processing conventional ores at the Mill.

## **8.0 Potential Effects on Tailings System**

### **8.1 Tailings Cell Liner Material Compatibility**

The Uranium Material will be received as a precipitated solid from lime treatment of the WTP influent water. A portion of this material may be insoluble in the acid leach process at the Mill and therefore, the discharge sent to tailings may contain some solid material ("sand"). The remainder of the Uranium Material will be soluble and therefore be contained in the liquid phase after processing in the acid leach system. Tailings from processing the Uranium Material will be sent to one of two tailings cells at the Mill, Cell 4A or Cell 4B or a subsequently-constructed cell. The solutions from the Uranium Material tailings will be recirculated through the mill process for reuse of the acidic properties in the solution. The sands will be only a portion of the total mass of Uranium Material sent to the Mill from the Site. However, assuming a worst case scenario that all of the solid material ends up as sand in the tailings, it is estimated that for the main processing circuit, the additional load to the tailings will be minimal (Table 6).

Cell 4A and 4B both have high-density polyethylene (“HDPE”) liners. Cell 4A went into service in October of 2008 and contains conventional ore tailings sands. Solutions from the Mill, starting in July 2009, are also sent to this Cell. Cell 4B was constructed and placed in to operation in February of 2011 and is expected to receive the same type of materials as Cell 4A when operational.

The constituents in the sands and liquids resulting from processing the Midnite Mine Uranium Materials are not expected to be significantly different from those in the conventional ores either in composition or in concentration of constituents. Table 7 indicates that when comparing the Uranium Material to the tailings, all of the constituents found in the Uranium Material are currently processed in the Mill’s main circuit and/or the alternate feed circuit in other ores and alternate feed materials.

The constituents that will be added to the Mill process are similar to conventional ores, , and contain calcium, barium, and polymer due to the addition of these constituents in the WTP process. These components are not expected to have any adverse effect on the Mill processing system or to the tailings cells. According to Gulec, et al. (2005), a study on the degradation of HDPE liners under acidic conditions (synthetic acid mine drainage), HDPE was found to be chemically resistant to solutions similar to the tailings solutions at the Mill. Mitchell (1985) studied the chemical resistivity of PVC and HDPE at a pH range of 1.5 to 2.5 standard units using sulfuric acid. This study concluded that PVC performed satisfactorily under these conditions and HDPE performed better and was overall more stable under these acidic conditions.

As described above, it is expected that most of the metal and non-metal impurities entering the leach system with the Uranium Material will be converted to sulfate ions, precipitated, and eventually discharged to the tailings system.

Every metal and non-metal cation and anion component in the Uranium Material already exists in the Mill’s tailings system and/or is analyzed under the GW monitoring program. A summary of the potential tailings composition before and after processing the Uranium Material using historical data for tailings Cell 3 is presented in Table 6 for projected tailings composition before and after processing the Uranium Material using data for Cell 4A or 4B.

Every component in the Uranium Material has been:

1. detected in analyses of the existing tailings cells liquids;
2. detected in analyses of existing tailings cells solids;
3. detected in analyses of alternate feed materials that have already been licensed for processing at the Mill; or
4. detected in process streams or intermediate products when previous alternate feeds were processed at the Mill,

at concentrations that are generally comparable to the concentrations in the Uranium Material. Due to the small annual and total quantities of the Uranium Material, an increase in the concentration of any analyte in the Mill’s tailings is not expected to be significant.



The constituents in the Uranium Material, i are expected to produce no incremental additional environmental, health, or safety impacts in the Mill's tailings system beyond those produced by the Mill's processing of natural ores or previously approved alternate feeds. Since the impacts of all the constituents on the tailings system are already anticipated for normal Mill operations, and permitted under the Mill's license, they have not been re-addressed in this evaluation.

### **Groundwater Monitoring Program**

One difference in the milling process of Uranium Material and disposal of tails in the tailings cells at the Mill compared to processing conventional ore, is the introduction of barium to the tailings cells. However, as discussed above barium is currently present in Cell 3, and has been introduced at higher concentration than in the Uranium Material, from other alternate feed materials. Barium is not a constituent that is monitored under the Mill's GWDP. Calcium is also contained in the Uranium Material, but is found in conventional ores and it is monitored under the Mill's GWDP. As discussed below, there is no need to add barium to the Mill's GWDP monitoring program.

Barium will be introduced to the Mill's tailings cells with disposal of the tailings from processing the Uranium Material. The chemistry of the tailings cells would limit the mobility of barium due to the abundance of sulfate in the tailings cells. The insolubility of barium in the presence of sulfate is generally consistent regardless of the liquid medium. That is, the solubility of barium sulfate in cold water is 0.022 mg/L and in concentrated sulfuric acid is 0.025 mg/L (Handbook of Chemistry and Physics, 68<sup>th</sup> Edition). At the listed concentrations of sulfate in the tailings solutions (67,600 mg/L to 87,100 mg/L in Cell 4A), a change in the ambient barium concentration in the tailings solutions (0.02 mg/L) would be negligible. Therefore, given the strong tendency of barium to partition to solids, especially in the presence of sulfate, there is no reasonable potential for barium to migrate to ground water from the tailings cells at the Mill in the unlikely event of a leak in the tailings cells. Calcium Kd value in UDEQ Statement of Basis for the permit (December 1, 2004) contains published Kd values for calcium of 5 to 100 L/kg for sandy to clayey soils. The Kd for barium is 100 to 150,000 L/kg for the same soil types indicating less mobility in groundwater, and Tetra Tech has therefore concluded that barium is sufficiently represented by monitoring for calcium and has identified no technical reason to add barium to the list of constituents monitored in ground water in the vicinity of the tailings cells.

Excluding barium, chemical and radiological make-up of the Uranium Material is similar to other ores and alternate feed materials processed at the Mill, and their resulting tailings will have the chemical composition of typical uranium process tailings, for which the Mill's tailings system was designed. As a result, the existing groundwater monitoring program at the Mill will be adequate to detect any potential future impacts to groundwater.

### **Conclusions and Recommendations**

While concentrated levels of certain constituents in the Uranium Material may be present, no additional material management requirements during handling and processing will be required. The Mill has successfully implemented processing of previous alternate feeds with similar or higher concentrations of the constituents contained in the Uranium Material. For example, the Mill has successfully processed and recovered uranium from uranium-bearing salts, calcium

fluoride precipitates, recycled metals, metal oxides, and calcified product, all of which posed potential chemical reactivity and material handling issues comparable to or more significant than those associated with this Uranium Material.

Based on the foregoing information, it can be concluded that:

1. All the constituents in the Uranium Material have either been reported to be, or can be assumed to be, already present in the Mill's tailings system or were reported in other alternate feeds processed at the Mill, at levels generally comparable to those reported in the Uranium Material.
2. All the constituents in the Uranium Material have either been reported to be, or can be assumed to be, previously introduced into the Mill's process, with no adverse effects to the process, or worker health and safety.
3. All the known impurities in the Uranium Material have either been reported to be, or can be assumed to be, previously introduced into the Mill tailing impoundments, with no adverse effects to the tailings system, or human health and safety.
4. There will be no significant incremental environmental impacts from processing Uranium Material beyond those that are already anticipated in the Final Environmental statement and subsequent Environmental Assessments for the Mill.
5. Spill response and control measures designed to minimize particulate radionuclide hazards will be more than sufficient to manage chemical hazards from particulate metal oxides.

It should be noted that the Uranium Material originated entirely from the contact of sources of environmental water (surface and or groundwater) with natural uranium ore. Every constituent in the Uranium Material, except barium, is a constituent of natural uranium ore and is present in the Uranium Material as a result of natural leaching from uranium ore. Every constituent in the ore is already present in natural ores including the ores stored on the Mill's ore pad, and is already present in the Mill circuit and tailings system.

Further, the total quantity of Uranium Material is very low. The entire annual volume of Uranium Material to be shipped to the Mill constitutes only a small fraction of one day's processing in the Mill. The entire volume of Uranium Material will make an insignificant contribution to the total volume of tailings in the Mill's tailings system.

As discussed in the section on Effects on Tailings System, above, after processing of the Uranium Material all constituents except beryllium, calcium and manganese, will have a deminimis or no impact on the tailings composition, will create a slight reduction in the average concentrations in the tailings cells, or will create a change that is within the range of increases created by other alternate feeds.

Of the three whose impact may be detectable, manganese and calcium (a non-hazardous nutrient surface and groundwater, are already monitored under the Mill's groundwater monitoring program. As discussed above, barium is well represented geochemically by calcium which is already monitored in the Mill's groundwater monitoring program.

Due to the above facts, specifically that the Uranium Material originated from natural ore and will be shipped and processed at very low rates, the constituents in the Uranium Material could be

expected to have a negligible effect on the Mill process and the tailings system, and will have no discernable environment or health and safety effects beyond the effects of natural ore processing.

## **References**

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**Table 1. Incompatibilities and Chemical Hazards for Components of the Uranium Material**

Component	Chemical Symbol	Estimated Concentration Range in Uranium Material at 25% to 45% Solids (ppm)	Incompatibilities
Ammonia	NH <sub>4</sub>	14-26	Strong oxidizers, halogens, acids, salts of silver and zinc
Barium	Ba	14,667-26,400	As Barium oxides – reacts with water to form hydroxides; reacts with N <sub>2</sub> O <sub>4</sub> , hydroxylamines, SO <sub>3</sub> , H <sub>2</sub> S
Beryllium	Be	63-114	As BeO – gives off toxic gases in fire
Cadmium	Cd	77-139	As CdO – reacts with magnesium, decomposes on heating to form cadmium fumes
Calcium	Ca	28,417-51,150	As Ca oxides – react with water
			As Ca hydroxides – react with water
			As CaSO <sub>4</sub> – diazomethane, aluminum, phosphorous, water
			As CaSiO <sub>3</sub> or CaOSiO <sub>2</sub> - none
Chloride	Cl	72-130	Varies with compound form. As inorganic salts - none
Chromium	Cr	36-64	As CrO <sub>2</sub> - none
			As CrO <sub>3</sub> – combustible materials (paper, wood, sulfur, aluminum, plastics)
Cobalt	Co	2,200-3,960	As CoO - none
Copper	Cu	312-561	As CuO – acetylene, zirconium
Fluoride	F	70-125	Varies with compound form. As inorganic salts - none
Iron	Fe	1,311-2,360	As Fe <sub>2</sub> O <sub>3</sub> – calcium hypochlorite, carbon monoxide, hydrogen peroxide
			As Fe <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> – decomposes at high temperature
			As As <sub>2</sub> Fe <sub>2</sub> O <sub>6</sub> – decomposes on heating to yield fumes of arsenic and iron
Lead	Pb	34-61	As PbO – strong oxidants, aluminum powder, sodium; also decomposes on heating to form lead fumes
Manganese	Mn	201,667-363,000	As Mn(OH) <sub>3</sub> Mn <sub>2</sub> O <sub>3</sub> , MnO - none
Nickel	Ni	3,208-5,775	As NiO- iodine, H <sub>2</sub> S
Nitrates	NO <sub>x</sub>	6-10	None reported
Selenium	Se	47-84	As SeO - none
Silver	Ag	21-38	As Ag <sub>2</sub> O – fire and explosion hazard with organic material or ammonia
Sulfate	SO <sub>4</sub>	31,167-56,100	As SO <sub>4</sub> compounds, see other compounds in this table
Zinc	Zn	6,417-11,550	As ZnO - none

**Table 2. Historic Water Quality of DMC WTP Influent**

Location ID	Collection Date	Aluminum µg/L	Arsenic µg/L	Cadmium µg/L	Copper µg/L	Lead µg/L	Manganese µg/L	Nickel µg/L	Uranium µg/L	Zinc µg/L	pH S.U.	TSS mg/L	Ra-226 (diss) pCi/l	Ra-226 (total) pCi/l					
SW-39 (PIT-3)	2/25/1998			43	280		86000			3500	4.41	2	22	22					
SW-39	4/29/1998			46	250		85000			3400	4.26		18	18					
SW-39	7/22/1998			49	260		90000			3500	4.09								
SW-39	10/14/1998	61900	20	U	46	1000	U	7	B	89700	1810	23688.2	3660	4.45	5	U	67.2	67.2	
SW-39	10/27/1998			48	260		95000			3700	4.4								
SW-39	11/15/1998	60500	5	B	43	1000	U	4	B	96400	1790	24632.7	3600	4.41	5	U			
SW-39	12/10/1998	58600	5	B	37	1000	U	5		81000	1650	18140.9	3000	4.56	14	B	45.6	45.6	
SW-39	1/25/1999			46	230		85000			3500	4.64								
SW-39	4/15/1999			34	230		70000			3000	4.76								
SW-39	4/21/1999	49900	10	U	26	210	2	U	62200	20	U	12084.0	2500	4.13	5	U	23	23	
SW-39	5/17/1999	50300	5	B	34	269	2	B	69200	1310	18021.0	3000	4.44	5	U	24	24		
SW-39	6/15/1999	56200	7		33.3	160	3.7		82900	1480	17751.1	3270	4.26	5	U	29	29		
SW-39	7/27/1999			43	230		85000			3400	4.05								
SW-39	10/6/1999			49	250		95000			1100	4.45								
SW-39	12/12/1999	46800	8	B	51.8	228	5.9		79300	1430	18545.7	3210	4.38	5	U	30	30		
SW-39	1/27/2000			69	200		130000			5700	3.91								
SW-39	2/4/2000	92300	100	U	70	B	200	B	20	U	120000	2430	2051.0	5480	4.04	12	B	36	36
SW-39	4/7/2000	20100	1	B	25.6	181	3.1		32200	640	11334.3	1410	4.32	8	B	31	31		
SW-39	4/17/2000			29	240		46000			1900	4.37	3	U						
SW-39	5/12/2000	44200	1	B	49.5	258	6.2		62600	1180	10614.7	2500	4.35	5	U	42	42		
SW-39	6/7/2000	51000	7	B	56.1	313	8.9		70500	1370		2960	4.1	5	U	45	45		
SW-39	7/13/2000	68600	6	B	58	225	9		95800	1940		4220	3.94	5	U	57	57		
SW-39	7/20/2000			46	300		85000			3600	3.85	3	U						
SW-39	8/15/2000	97200	10	B	82	199	10		129000	2620		5720	3.9	5	U	83	83		
SW-39	9/14/2000	105000	3	U	64	190	15.1		146000	2800		6160	4.06	6	B	70	70		
SW-39	10/25/2000			63	230		140000			5700	4.12	3	U						
SW-39	10/30/2000	98900	5	U	81	165	7		146000	2910		6620	4.34	5	U	70	70		
SW-39	1/17/2001			54	200		120000			5000	4.65	3	U						
SW-39	1/27/2001	76500	5	U	57	149	8		121000	2310		4670	4.51	8	B	54	54		
SW-39	4/6/2001			83	770		120000			5100	4.52	3	U	82	82				
SW-39	4/26/2001	61900	3	U	71	522	7		84200	1700		3690	4.32	5	U				
SW-39	7/5/2001			71	630		110000			4600	4.08	3							
SW-39	10/4/2001	69600	10	U	80	560	10		118000	2090	24000.0	4400	4.33	5		48	48		
SW-39	2/7/2002	14900	1	U	16	95	2		31300	658	8850.0	1360	4.49			32.6	32.6		
SW-39	4/17/2002	12800	10	U	20	80	10	U	30200	550	7430.0	1130	4.91	10	U	20.6	20.6		
SW-39	7/11/2002	24000	10	U	20	180	10	U	53400	810	11300.0	1680	4.4	5	U	38.7	38.7		
SW-39	10/9/2002	36500	10	U	40	300	10	U	62200	1110	14800.0	2310	4.49	0.05	U	53.9	53.9		
SW-39	1/15/2003	34800	10	U	40	290	10	U	57400	1050	12100.0	2220	4.49	8		40.8	40.8		
SW-39	4/24/2003	36500	10	U	30	260	10	U	48600	1100	12000.0	2390	4.62	5	U	40.3	40.3		



Table 2. Historic Water Quality of DMC WTP Influent Continued

Location ID	Collection Date	Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
SW-39 (PIT-3)	7/15/2003	44800	--	10	U	40	--	280	--	10	U	68400	--	1260	--	14400.0	--	2660	--	4.26	--	5	U	30.1	--	30.1	--
SW-39	10/23/2003	42400	--	10	--	50	--	260	--	10	U	66800	--	1270	--	15900.0	--	2680	--	4.5	--	5	U	21.6	--	21.6	--
SW-39	1/14/2004	53400		10	U	50		280		10	U	76700		1440		16400.0		3110		4.58		5	U	30		30	
SW-39	4/23/2004	40300		10	U	50		180		10	U	55300		1080		12100.0		2520		4.5		5	U	37.5		37.5	
SW-39	7/16/2004	49500		10	U	50		230		10		78400		1310		19100.0		2810		4.24		5	U	33.3		33.3	
SW-39	10/13/2004	58700		10		60		230		10	U	80000		1550		17600.0		3350		4.5		5	U	22.8		22.8	
SW-39	4/22/2005	35700		10	U	40		140		10	U	60900		1070		12400.0		2350		4.71				21.3		21.3	
SW-39	7/14/2005	45900		10	U	40		150		10	U	76300		1230		16900.0		2700		4.41		5	U	24		24	
SW-39	10/11/2005	46000		10	U	50		150		10	U	83000		1430		15800.0		2960		4.68				25.6		25.6	
SW-39	4/20/2006	32300		10	U	30		150		10	U	43900		910		10200.0		1910		4.56		5	U	23.7		23.7	
SW-39	7/13/2006	60300		10	U	30		180		10	U	49600		1180		11200.0		2400		4.23		5	U	31.7		31.7	
SW-39	10/11/2006	40300		10	U	40		170		10	U	60800		1220		13100.0		2570		4.6		5	U	33.9		33.9	
SW-39	4/19/2007	39500		10	U	33.8		137		10	U	56000		1080		12700.0		2950		4.56		10	U	20.5		20.5	
SW-39	7/11/2007	47200		10	U	40.9		150		10	U	67700		1210		15400.0		2570		4.39		5	U	29.6		29.6	
SW-39	10/4/2007	42700		10	U	48.2		159		10	U	64200		1340		14200.0		2980		4.52		5	U	28.3		28.3	
SW-39	4/25/2008	37100		10	U	27.5		161		10	U	47400		1220		9770.0		2480		4.74		1	U	18.9		18.9	
SW-39	7/22/2008	40700		10	U	44.8		162		10	U	49700		1420		12500.0		2750		4.31		4		27		27	
SW-39	10/2/2008	45400		6.65		39.5		139				73100		1600		14400.0		2870		4.26		5	U	19		19	
SW-39	4/27/2009	31400		<10		28.9		118		<10		45000		865		9160.0		1850		4.66		1					
SW-39	7/10/2009	46200		<10		29.9		132		<10		76000		1170		14200.0		2430		4.4		3				34	
SW-39	10/6/2009	36300		<10		40.2		133		<10		58500		1250		15400.0		2620		4.37		2				32	
	SW-39 (Pit 3)																										
	<b>Count (n)</b>	45		42		60		60		41		60		45		38		60		60		48		43		45	
	<b>Max</b>	105,000		100		83		1,000		20		146,000		2,910		24,633		6,620		5		14		83		83	
	<b>Min</b>	12,800		1		16		80		2		30,200		20		2,051		1,100		4		0		18		18	
	<b>Avg</b>	49,891		10		46		271		9		79,147		1,397		14,215		3,223		4		5		37		37	
	<b>Std Dev</b>	20,343		15		16		207		3		28,429		575		4,539		1,243		0		3		17		17	
	<b>2 x Std Dev</b>	40,685		29		32		414		7		56,859		1,149		9,078		2,486		0		5		34		34	



Table 2. Historic Water Quality of DMC WTP Influent Continued

Location ID	Collection Date	Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
SW-40 (PIT-4)	1/15/1998					5	U	6	--			1100	--					10	--	6.22	--	3	U	1.9	--	1.9	--
SW-40	4/29/1998					4	U	10	--			880	--					7	--	7.78	--			3	--	3	--
SW-40	7/22/1998					4	U	5	U			370	--					2	U	6.79	--						
SW-40	10/14/1998	80	B	10	U	2	U	10	U	2	U	262	--	10	U	3280.0	--	20	U	7.54	--	5	U	1.78	--	1.78	--
SW-40	10/27/1998					4	U	5	U			490	--					6	--	7.57	--						
SW-40	11/15/1998	90	B	2	U	1	U	5	U	1	U	518	--	10	U	3520.0	--	10	B	7.1	--	5	U	2.06	--	2.06	--
SW-40	12/10/1998	120	B	2	U	0.4	U	10	B	0.4	U	505	--	10	U	3810.0	--	20	U	7.02	--	5	U	3.23	--	3.23	--
SW-40	1/14/1999					9	--	4	U			630	--					13	--	6.81	--						
SW-40	1/14/1999	120	B	2	U	0.4	U	2	U	0.4	U	574	--	10	B	3820.0	--	26	--	6.85	--	5	U	5.52	--	5.52	--
SW-40	2/20/1999	210	--	5	U	1	U	7	B	1	U	663	--	20	B	3070.0	--	30	B	6.92	--	5	U	8.76	--	8.76	--
SW-40	4/15/1999					3	U	5	--			940	--					29	--	6.61	--						
SW-40	4/21/1999	500	--	2	U	0.4	U	3	B	0.4	U	649	--	660	--	1370.0	--	60	B	7	--	5	U	7.6	--	7.6	--
SW-40	5/17/1999	90	B	2	U	0.4	U	3	B	0.4	U	764	--	30	B	2420.0	--	20	--	7.43	--	5	U	5.1	--	5.1	--
SW-40	6/15/1999	120	B	1	B	0.2	B	2	B	0.2	U	747	--	30	B	2830.0	--	26	--	6.99	--	5	U	3.7	--	3.7	--
SW-40	7/27/1999					4	U	6	--			1000	--					31	--	6.79	--						
SW-40	10/6/1999					4	U	4	U			460	--					10	--	7.16	--			1.1	--	1.1	--
SW-40	1/27/2000					4	U	4	U			860	--					22	--	6.74	--			9.7	--	9.7	--
SW-40	4/17/2000					4	U	9	--			1000	--					29	--	6.04	--	5	--	8.6	--	8.6	--
SW-40	7/20/2000					3	U	6	--			300	--					3	--	7.07	--	3	U	1.6	--	1.6	--
SW-40	10/25/2000					4	U	11	--			290	--					2	U	6.72	--	3	U	2.8	--	2.8	--
SW-40	1/17/2001					4	U	40	--			660	--					2	U	5.36	--	3	U	4.5	--	4.5	--
SW-40	4/6/2001					4	U	5	--			660	--					16	--	7.35	--	3	U	4.3	--	4.3	--
SW-40	7/5/2001					4	U	4	U			370	--					2	U	6.96	--	3	U	2.9	--	2.9	--
SW-40	10/4/2001	100	U	10	U	10	U	10	U	10	U	710	--	10	U	6000.0	--	10	U	6.86	--	10	U	4.1	--	4.1	--
SW-40	2/7/2002	1	U	1	U	1	U	6	--	1	U	1610	--	55	--	4770.0	--	62	--	6.47	--	10	U	29.6	--	29.6	--
SW-40	4/17/2002	100	--	10	U	10	U	10	U	10	U	1640	--	60	--	2430.0	--	90	--	5.82	--	10	U	21.1	--	21.1	--
SW-40	7/11/2002	100	U	10	U	10	U	10	U	10	U	1250	--	40	--	3830.0	--	50	--	6.51	--	5	U	4.2	--	4.2	--
SW-40	10/9/2002	10	U	10	U	10	U	10	U	10	U	1040	--	30	--	5500.0	--	40	--	7.28	--	5	U	3.3	--	3.3	--
SW-40	1/15/2003	600	--	10	U	10	U	10	U	10	U	2190	--	70	--	5600.0	--	110	--	6.63	--	5	U	27.8	--	27.8	--
SW-40	4/24/2003	10	U	10	U	10	U	10	U	10	U	1280	--	60	--	3510.0	--	60	--	7.26	--	5	U	8.6	--	8.6	--
SW-40	7/15/2003	10	U	10	U	10	U	10	U	10	U	940	--	30	--	3430.0	--	20	--	7.66	--	5	U	4.1	--	4.1	--
SW-40	10/23/2003	10	U	10	U	10	U	10	U	10	U	490	--	20	--	4030.0	--	20	--	7.43	--	5	U	2.3	--	2.3	--
SW-40	1/14/2004	200		10	U	10	U	10	U	10	U	930		20		4740.0		20		6.83		5	U	2.8		2.8	
SW-40	4/23/2004	100	U	10	U	10	U	10	U	10	U	880		30		4050.0		50		7.32		5	U	9.2		9.2	
SW-40	7/16/2004	200		10	U	10	U	10	U	30		280		10		3720.0		60		7.19		5	U	1.7		1.7	
SW-40	10/13/2004	100	U	10	U	10	U	10	U	10	U	150		10	U	4260.0		10	U	7		5	U	1.5		1.5	
SW-40	4/22/2005	300		10	U	10	U	10	U	10	U	530		20		4880.0		30		6.74				6.4		6.4	
SW-40	7/14/2005	2400		10	U	10	U	10	U	10	U	260		10	U	4520.0		410		7.57		5	U	2.3		2.3	
SW-40	10/11/2005	100		10	U	10	U	10	U	10	U	210		10	U	5460.0		10	U	6.65				1.5		1.5	
SW-40	4/20/2006	100	U	10	U	10	U	10	U	10	U	1360		60		1280.0		80		6.72		5	U	12.1		12.1	

**Table 2. Historic Water Quality of DMC WTP Influent Continued**

Location ID	Collection Date	Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.	TSS mg/L		Ra-226 (diss) pCi/l	Ra-226 (total) pCi/l			
SW-40 (PIT-4)	7/13/2006	100	U	10	U	10	U	10	U	10	U	1370		40		2060.0		40		6.98	5	U	5.9		5.9		
SW-40	10/11/2006	100	U	10	U	10	U	10	U	10	U	500		20		3060.0		30		7.64	5	U	1.8		1.8		
SW-40	1/25/2007	100		10	U	10	U	10	U	10	U	600		20		3380.0		40		7.69	5	U	8		8		
SW-40	4/19/2007	100	U	10	U	10	U	10	U	10	U	821		26.1		2660.0		31.6		7.7	10	U	5		5		
SW-40	7/11/2007	100	U	10	U	10	U	10	U	10	U	445		14.4		2410.0		13		7.14	5	U	1.9		1.9		
SW-40	10/4/2007	100	U	10	U	10	U	10	U	10	U	128		10	U	2960.0		10.9		7.1	5	U	0.9		0.9		
SW-40	4/25/2008	100	U	10	U	10	U	10	U	10	U	767		29.8		2200.0		36.9		8.36	5	U	7.3		7.3		
SW-40	7/22/2008	17.4		10	U	10	U	10	U	10	U	201		10	U	1930.0		10	U	7.01	2		1.3		1.3		
SW-40	10/2/2008	10	U	1.18		1	U	1	U			90.5		2.25		3420.0		10	U	8.45	5	U	0.57		0.57		
SW-40	4/27/2009	<100		<10		<10		<10		<10		606		34.2		2150.0		43		6.90	<1						
SW-40	7/10/2009	<100		<10		<10		<10		<10		177		<10		2310.0		<10		7.48	2				2.2		
SW-40	10/6/2009	<100		<10		<10		<10		<10		116		<10		3100.0		<10		6.92	1				1.2		
<b>Summary</b>																											
		Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
	<b>SW-40 (Pit 4)</b>																										
	<b>Count (n)</b>	34		34		49		49		33		52		35		37		50		52		40		44		46	
	<b>Max</b>	2,400		10		10		40		30		2,190		660		6,000		410		8		10		30		30	
	<b>Min</b>	1		1		0		1		0		91		2		1,280		2		5		2		1		1	
	<b>Avg</b>	191		8		6		8		8		697		44		3,453		36		7		5		6		6	
	<b>Std Dev</b>	410		4		4		5		6		438		109		1,185		59		1		2		6		6	
	<b>2 x Std Dev</b>	820		7		8		11		11		877		217		2,369		118		1		4		13		12	
		Aluminum µg/L		Arsenic µg/L		Cadmium µg/L		Copper µg/L		Lead µg/L		Manganese µg/L		Nickel µg/L		Uranium µg/L		Zinc µg/L		pH S.U.		TSS mg/L		Ra-226 (diss) pCi/l		Ra-226 (total) pCi/l	
	<b>COMBINED</b>																										
	<b>Count (n)</b>	79		76		109		109		74		112		80		75		110		112		88		87		91	
	<b>Max</b>	105,000		100		83		1,000		30		146,000		2,910		24,633		6,620		8		14		83		83	
	<b>Min</b>	1		1		0		1		0		91		2		1,280		2		4		0		1		1	
	<b>Avg</b>	28,501		9		28		153		8		42,724		805		8,906		1,774		6		5		21		21	
	<b>Std Dev</b>	29,100		11		23		202		5		44,432		803		6,350		1,838		1		2		20		20	
	<b>2 x Std Dev</b>	58,200		22		46		403		9		88,864		1,607		12,700		3,677		3		5		40		40	



**Table 3. Historic Total WTP Uranium Material Testing Data**

Date	Initial Composite Sample		Annual Composite Sample	
	U-nat	Ra-226	U-nat	Ra-226
	(mg/kg)	(pCi/g)	(mg/kg)	(pCi/g)
4/1/2003	11,100	5.7	9,700	5.3
4/1/2004	9,060	7.6	8,600	2.4
4/1/2005	12,900	14	19,000	11
4/1/2006	5,200	4.3	11,200	9.1
4/2/2007	2,700	4.7	12,000	24.2
4/9/2008	19,000	5.1	13,500	10.8
5/20/2009		8.7		
4/13/2010	15,333			
Count	7	7	6	6
Max	<b>19,000</b>	<b>8.7</b>	<b>19,000</b>	<b>24</b>
Min	<b>2,700</b>	<b>4.3</b>	<b>8,600</b>	<b>2</b>
Avg	<b>10,756</b>	<b>7.2</b>	<b>12,154</b>	<b>10</b>
Data from Dawn Mining Annual Environmental Reports unless noted				
All results are presented on a dry weight basis				



TETRA TECH

Table 4. Uranium Material Metals Analysis for RCRA Characteristics

Sample ID	Sample Date	Arsenic mg/L	Barium mg/L	Cadmium mg/L	Chromium mg/L	Lead mg/L	Mercury mg/L	Selenium mg/L	Silver mg/L
	2002	<0.05	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2003	<0.5	<10	0.2	<0.5	<0.5	<0.02	<0.1	<0.5
	2004	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2005	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2006	<0.5	<10	0.25	<0.5	<0.5	<0.02	<0.1	<0.5
	2007	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	2008	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	5/20/2009	<0.5	<10	<0.1	<0.5	<0.5	<0.02	<0.1	<0.5
	9/17/2009	<0.06	0.083	<0.005	<0.01	<0.04	<0.0002	<0.06	<0.01
	9/19/2009	<0.04	0.16	0.019	<0.01	<0.04	<0.0002	<0.04	<0.01
	9/23/2009	<0.04	0.12	0.011	<0.01	<0.04	<0.0002	<0.04	<0.01
	10/6/2009	<0.1	0.066	0.03	0.03	<0.08	<0.0002	0.2	<0.02
WTSP-1	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.051	<0.1
WTSP-2	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.054	<0.1
WTSP-3	4/13/2010	<0.1	<1	<0.05	<0.1	<0.03	<0.002	0.054	<0.1
	<b>Count</b>	15	15	15	15	15	15	15	15
	<b>Min</b>	<0.04	0.066	<0.005	<0.01	<0.03	<0.0002	<0.04	<0.01
	<b>Max</b>	<0.1	<10	<0.05	<0.5	<0.5	<0.02	0.2	<0.5
<b>40 CFR Part 261.24</b>		5	100	1	5	5	0.2	1	5
<b>PASS?</b>		Yes	Yes	Yes	Yes	Yes	Yes	Yrs	Yes

**Table 5. Uranium Material Analyses for RCRA Listed Hazardous Waste**

Target Analyte <sup>(1)</sup>	Units	Laboratory Results			Calculated Average
		WTPS-1	WTPS-2	WTPS-3	
<b>Total Uranium - Method SW6020A</b>					
Total Uranium	mg/kg	15,000	16,000	15,000	15,333
<b>Total ICP Metals - Method SW6010B</b>					
Arsenic	mg/kg	<5.9	<5.9	<5.7	<5.8
Barium	mg/kg	8,100	7,900	7,200	7,733
Beryllium	mg/kg	33	36	36	35
Cadmium	mg/kg	40	44	43	42
Calcium	mg/kg	15,000	16,000	16,000	15,667
Chromium	mg/kg	19	20	19	19
Cobalt	mg/kg	1,200	1,200	1,100	1,167
Copper	mg/kg	160	180	170	170
Iron	mg/kg	690	740	740	723
Lead	mg/kg	18	19	17	18
Manganese	mg/kg	110,000	110,000	96,000	105,333
Molybdenum	mg/kg	<5.8	<6.0	<5.7	<5.8
Nickel	mg/kg	1,700	1,800	1,800	1,767
Selenium	mg/kg	25	26	26	26
Silver	mg/kg	11	12	11	11
Thallium	mg/kg	<580	<600	<570	<583
Tin	mg/kg	<29	<30	<29	<29
Vanadium	mg/kg	<5.8	<6.0	<5.7	<5.8
Zinc	mg/kg	3,400	3,600	3,600	3,533
<b>Total Mercury - Method SW7471A</b>					
Total Mercury	mg/kg	<0.19	<0.2	<0.19	<0.19
<b>GC/MS Total Volatile Organics - Method SW8260</b>					
Chloromethane	µg/kg	<1.1	<1.2	<1.1	<1.1
Acetone	µg/kg	22 B	29 B	33 B	28
Methylene Chloride	µg/kg	3.8 J,B	3.7 J,B	5.8 J,B	4.4
2-Butanone	µg/kg	<5.7	<5.9	<5.7	<5.8
Tetrahydrofuran	µg/kg	<7.2	<7.4	<7.2	<7.3
Chloroform	µg/kg	1.7 J	2 J	1.2 J	1.6
Carbon Tetrachloride	µg/kg	<1.3	<1.4	<1.3	<1.3
Benzene	µg/kg	<0.94	<0.96	<0.93	<0.94
Toluene	µg/kg	2.2 J,B	1.9 J,B	1.3 J,B	1.8
m,p-Xylene	µg/kg	<1.9	<1.9	<1.9	<1.9
o-Xylene	µg/kg	<0.95	<0.97	<0.94	<0.95
Naphthalene	µg/kg	<1.4	<1.4	<1.4	<1.4

<sup>(1)</sup> All values as reported by ALS Laboratory as dry weight values



**Table 5. Uranium Material Analyses for RCRA Listed Hazardous Waste Continued**

Target Analyte	Units <sup>(1)</sup>	Laboratory Results			Calculated Average
		WTPS-1	WTPS-2	WTPS-3	
<b>GC/MS Total Semi-Volatile Organics - Method SW8270D</b>					
Pyridine	µg/kg	<310	<320	<320	<317
1,4-dichlorobenzene	µg/kg	<310	<320	<320	<317
2-methylphenol	µg/kg	<310	<320	<320	<317
3+4-methylphenol	µg/kg	<310	<320	<320	<317
Hexachloroethane	µg/kg	<310	<320	<320	<317
Nitrobenzene	µg/kg	<310	<320	<320	<317
Hexachlorobutadiene	µg/kg	<310	<320	<320	<317
2,4,6-trichlorophenol	µg/kg	<310	<320	<320	<317
2,4,5-trichlorophenol	µg/kg	<310	<320	<320	<317
2,4-dinitrotoluene	µg/kg	<310	<320	<320	<317
Hexachlorobenzene	µg/kg	<310	<320	<320	<317
Pentachlorophenol	µg/kg	<490	<500	<500	<497
<b>Gasoline Range Organics - Method SW8015B</b>					
Gasoline Range Organics	mg/kg	<0.38	<0.35	<0.39	<0.37
<b>Diesel Range Organics - Method SW8015MB</b>					
Diesel Range Organics	mg/kg	<6.5	<6.6	<6.8	<6.6
<b>Oil &amp; Grease</b>					
Oil & Grease	mg/kg	<120	<120	<120	<120
<b>Inorganics</b>					
Ammonia as N - Method EPA350.1	mg/kg	7.9	7.9	8.3	8.0
Nitrate/Nitrite as N - Method EPA353.2 Revision 2	mg/kg	3.1	3.2	3.1	3.1
Total Dissolved Solids - EPA160.1	mg/kg	26,000	26,000	27,000	26333.3
Fluoride - Method EPA300.0 Revision 2.1	mg/kg	38	38	40	38.7
Chloride - Method EPA300.0 Revision 2.1	mg/kg	40	39	41	40
Sulfate - Method EPA300.0 Revision 2.1	mg/kg	17,000	17,000	17,000	17,000
<b>Gross Alpha/Beta - GFPC</b>					
Gross Alpha	pCi/g	4,310±690	4,830±770	5,440±870	4,860
Gross Beta	pCi/g	4,870±780	4,780±760	4,860±780	4,867
<b>Lead-210 - Liquid Scintillation</b>					
Lead-210	pCi/g	33.1±8.0	34.7±8.4	32.0±7.8	33.3
<b>Radium-226 - GFPC</b>					
Radium-226	pCi/g	22.8±5.8	25.7±6.6	23.8±6.1	24.1
<b>Total Alpha Emitting Radium - GFPC</b>					
Total Radium	pCi/g	39.7±10	41±11	36.6±9.4	39.1
Total Radium (duplicate sample)	pCi/g	35.8±9.2			
<b>Isotopic Thorium - Alpha Spectroscopy</b>					
Th-228	pCi/g	1.24±0.99	1.50±0.74	0.93±0.67	1.22
Th-230	pCi/g	20.4±3.8	21.4±3.9	20.4±3.7	20.7
Th-232	pCi/g	1.14±0.48	0.66±0.34	0.71±0.32	0.84

<sup>(1)</sup> All values as reported by ALS Laboratory as dry weight values

**Table 6 – Cell 3 Historical Mill Tailings Composition and Uranium Material Comparison**

Component	Midnite Mine Uranium Material Composition				Cell 3 Composition in 2004			Baseline for Cell 4A (or 4B)		Year 1			
	A Conc. in Ores and Other Alternate Feeds (ppm) <sup>1</sup>	B Range in Uranium Material (mg/kg) <sup>2</sup>	C Estimated Average Conc. in Uranium Material (mg/kg) <sup>3</sup>	D Estimated Historical Maximum Annual Mass in Uranium Material (tons) <sup>4</sup>	E Estimated Conc. Range in Cell 3 Mill Tailings solution (mg/L or ppm) <sup>5</sup>	F Estimated Average Conc. in Cell 3 Mill Tailings solution (mg/L or ppm) <sup>5</sup>	G Estimated Mass in Cell 3 Mill Tailings 2004 (tons) <sup>6</sup>	H Estimated Annual Mass in Cell 4A or 4B Mill Tailings (tons) <sup>7</sup>	I Conc. in Cell 4A (or 4B) Mill Tailings (ppm) <sup>8</sup>	J Estimated Mass in Uranium Material (tons) <sup>9</sup>	K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>
Acetone		U	U	0	28-514	192	340	41.3	192.0	0.000	41.3	192.0	0.0
Ammonia (NH <sub>4</sub> )	100-730	7.9-8.3	8.0	0.002	3-13,900	3,131	5,539	673.2	3131.0	0.002	673.2	3130.6	-0.4
Arsenic (As)	3.5-16,130	U	U	0	0.3-440	149	264	32.0	149.0	0.000	32.0	149.0	0.0
Barium (Ba)	21-43,000	7,200-8,100	7,733	1.523	0.021-0.1	0.02	0.035	0.0	0.0	1.52	1.5	7.1	7.1
Beryllium (Be)	1-105	33-36	35	0.007	0.347-0.78	0.5	0.88	0.1	0.5	0.007	0.1	0.5	0.0
Cadmium (Cd)	0.004-16	40-44	42	0.008	1.64-6.6	3.4	6.0	0.7	3.4	0.008	0.7	3.4	0.0
Calcium (Ca)	up to 217,000	15,000-16,000	15,667	3.086	90-630	368	651	79.1	368.0	3.09	82.2	382.3	14.3
Cobalt (Co)	9-350,400	1,100-1,200	1,167	0.230	14-120	60.7	107	13.1	60.7	0.230	13.3	61.8	1.1
Chromium (Cr)	8-16,000	19-20	19	0.004	1.0-13	6.2	11	1.3	6.2	0.004	1.3	6.2	0.0
Chloride (Cl)	07-89,900	39-41	40	0.008	2,110-8,000	4,608	8,152	990.7	4608.0	0.008	990.7	4607.4	-0.6
Copper (Cu)	Unknown	160-180	170	0.033	Unknown	Unknown	Unknown	0.0	0.0	0.033	0.0	0.2	0.2
Fluoride (F)	3-460,000	38-40	38.7	0.008	0.02-4,440	1,695	2,998	364.4	1695.0	0.008	364.4	1694.8	-0.2
Iron (Fe)	up to 46,000	690-740	723	0.142	1,080-3,400	2,212	3,913	475.6	2212.0	0.142	475.7	2212.4	0.4
Lead (Pb)	9-236,000	17-19	18	0.004	0.21-6.0	3	5	0.6	3.0	0.004	0.6	3.0	0.0
Manganese (Mn)	172-3,070	96,000-110,000	105,333	20,751	74-222	146	258	31.4	146.0	20.8	52.1	242.5	96.5
Mercury (Hg)	0.0004-14	U	U	0	0.0008-17.6	3.5	6	0.8	3.5	0.000	0.8	3.5	0.0
Molybdenum (Mo)	12-17,000	U	U	0	0.44-240	52.8	93	11.4	52.8	0.000	11.4	52.8	0.0
Nickel (Ni)	7-450,000	1,700-1,800	1,767	0.348	7.2-370	83	147	17.8	83.0	0.348	18.2	84.6	1.6
Nitrates (NO <sub>x</sub> )	0.6-350,000	3.1-3.2	3.1	0.001	24	24	42	5.2	24.0	0.0006	5.2	24.0	0.0
Selenium (Se)	0.02-710	25-26	26	0.005	0.18-2.4	1.4	2.5	0.3	1.4	0.0051	0.3	1.4	0.0
Silver (Ag)	0.007-80	11-12	11	0.002	0.005-0.14	0.1	0.2	0.0	0.1	0.002	0.0	0.1	0.0
Sulfate (SO <sub>4</sub> )	24-300,000	17,000	17,000	3,349	28,900-190,000	64,914	114,833	13956.5	64914.0	3,349	13959.9	64920.5	6.5
Thallium (Tl)	0.02-960	U	U	0	0.7-45	16	28	3.4	16.0	0.000	3.4	16.0	0.0
Tin (Sn)	20,900-116,000	U	U	0	<5	5	9	1.1	5.0	0.000	1.1	5.0	0.0
Vanadium (V)	10-25,000	U	U	0	138-510	263	465	56.5	263.0	0.000	56.5	263.0	0.0
Zinc (Zn)	8-14,500	3,400-3,600	3,533	0.696	50-1,300	641	1,134	137.8	641.0	0.696	138.5	644.1	3.1
Total Selected Components										30.2			
Total Tailings Cell Mass								215000.0			215030.2		

- \* - Assume 20% reduction per year for 5 years from historical maximum levels (190 tons per year) to final remedy estimate of 18 tons per year dry uranium material.
- The concentration in other alternate feeds represents some selected concentrations for constituents found in characterization data for other alternate feed materials licensed for processing at the Mill, for comparison purposes.
  - The range in the Uranium Material is based on three sampling events for the DMC WTP solids.
  - The estimated average concentration in Uranium Material has been calculated as the mean value reported.
  - Estimated mass in the Uranium Material is calculated by assuming 197 tons dry annually from historical values.
  - Mill tailings range and average concentrations were taken from Mill tailings samples to date, as summarized in Table 5 of the draft Statement of Basis for the Utah Groundwater Discharge Permit for the Mill (November 29, 2004).
  - Estimated current mass in Mill tailings is calculated by multiplying the estimated average concentration in the Mill tailings in Column F by 1,769,000 dry tons of tailings reported in the Mill's active Tailings Cell No. 3.
  - The baseline estimated annual mass in Mill tailings for cell 4A or 4B is calculated by multiplying the estimated mass in Cell 3 (Column G) by the ratio of Cell 4A (or 4B) total mass capacity of 2,150,000 dry tons to capacity of Cell 3 of 1,769,000 dry tons as of November 29, 2004 and dividing it by ten years as the estimated time to fill cell 4A (or 4B).
  - The baseline concentration in Cell 4A (or 4B) Mill tailings is calculated by dividing Column H by 215,000 dry tons as the assumed annual mass addition of tailings to the Cell without the Uranium Material.
  - Year 1 and Year 2 estimated mass in the Uranium Material is assumed to be equal to Column D historical values.
  - The mass in Mill tailings after Uranium Material processing is calculated by adding the total tailings mass from the previous year to the total additional tailings mass added in the current year.
  - The concentration in Cell 4A (or 4B) Mill tailings after Uranium Material processing is calculated by dividing the Mass in Cell 4A (or 4B) Mill tailings for that year by the total cumulative mass in cell 4A (or 4B) tailings after Uranium Material is processed.
  - The increase in baseline Mill tailings concentration after Uranium Material processing is calculated by subtracting baseline concentration (Column I) from the concentration in Cell 4A (or 4B) after Uranium Material processing for that year.
  - The Year 3 and Year 4 approximate estimated mass in the Uranium Material is assumed to be 5 times the amount in Column D based on the estimated increased flow treated to be 1,000 gpm for 7 months of the year and 450 gpm for the remaining 5 months.
  - The Year 5 through Year 10 approximate estimated mass in the Uranium Material is assumed to be reduced from the maximum historical value per year to the final remedy estimate of dry Uranium Material (20% reduction per year) after 2 years of construction.
  - The Estimated Mass in Uranium Material over 10-Year Period is the Cumulative Contribution from the Uranium Material to the tailings.
  - The Estimated Mass in Cell 4A (or 4B) Mill tailings over 10-year period after Uranium Material processing is the total cumulative mass contribution from including Uranium Material to the tailings.
  - The approximate percent total contributed from Uranium Material is the 10-year contribution to the tailings from the Uranium Material.

Component	Year 2				Year 3 (Const)				Year 4 (Const)			
	2J Estimated Mass in Uranium Material (tons) <sup>9</sup>	2K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	2L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	2M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>	3J Estimated Mass in Uranium Material (tons) <sup>13</sup>	3K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	3L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	3M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>	4J Estimated Mass in Uranium Material (tons) <sup>13</sup>	4K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	4L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	4M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>
Acetone	0.000	82.6	192.0	0.0	0.000	123.8	191.9	-0.1	0.000	165.1	191.9	-0.1
Ammonia (NH <sub>4</sub> )	0.002	1346.3	3130.6	-0.4	0.008	2019.5	3129.9	-1.1	0.008	2692.7	3129.6	-1.4
Arsenic (As)	0.000	64.1	149.0	0.0	0.000	96.1	148.9	-0.1	0.000	128.1	148.9	-0.1
Barium (Ba)	1.52	3.1	7.1	7.1	8.067	11.1	17.2	17.2	8.067	19.2	22.3	22.3
Beryllium (Be)	0.007	0.2	0.5	0.0	0.037	0.4	0.6	0.1	0.037	0.5	0.6	0.1
Cadmium (Cd)	0.008	1.5	3.4	0.0	0.044	2.3	3.5	0.1	0.044	3.0	3.5	0.1
Calcium (Ca)	3.09	164.4	382.3	14.3	16.344	259.9	402.8	34.8	16.344	355.3	413.0	45.0
Cobalt (Co)	0.230	26.6	61.8	1.1	1.217	40.8	63.3	2.6	1.217	55.1	64.0	3.3
Chromium (Cr)	0.004	2.7	6.2	0.0	0.020	4.0	6.2	0.0	0.020	5.4	6.3	0.1
Chloride (Cl)	0.008	1981.5	4607.4	-0.6	0.042	2972.2	4606.5	-1.5	0.042	3963.0	4606.1	-1.9
Copper (Cu)	0.033	0.1	0.2	0.2	0.177	0.2	0.4	0.4	0.177	0.4	0.5	0.5
Copper (Cu)	0.033	0.1	0.2	0.2	0.177	0.2	0.4	0.4	0.177	0.4	0.5	0.5
Fluoride (F)	0.008	728.9	1694.8	-0.2	0.040	1093.3	1694.5	-0.5	0.040	1457.8	1694.4	-0.6
Iron (Fe)	0.142	951.4	2212.4	0.4	0.754	1427.8	2212.9	0.9	0.754	1904.1	2213.1	1.1
Lead (Pb)	0.004	1.3	3.0	0.0	0.019	2.0	3.0	0.0	0.019	2.6	3.1	0.1
Manganese (Mn)	20.8	104.3	242.5	96.5	109.885	245.6	380.6	234.6	109.885	386.8	449.6	303.6
Mercury (Hg)	0.000	1.5	3.5	0.0	0.000	2.3	3.5	0.0	0.000	3.0	3.5	0.0
Molybdenum (Mo)	0.000	22.7	52.8	0.0	0.000	34.1	52.8	0.0	0.000	45.4	52.8	0.0
Nickel (Ni)	0.348	36.4	84.6	1.6	1.843	56.1	86.9	3.9	1.843	75.8	88.1	5.1
Nitrates (NO <sub>x</sub> )	0.0006	10.3	24.0	0.0	0.003	15.5	24.0	0.0	0.003	20.6	24.0	0.0
Selenium (Se)	0.0051	0.6	1.4	0.0	0.027	0.9	1.5	0.1	0.027	1.3	1.5	0.1
Silver (Ag)	0.002	0.0	0.1	0.0	0.011	0.1	0.1	0.0	0.011	0.1	0.1	0.0
Sulfate (SO <sub>4</sub> )	3.349	27919.7	64920.5	6.5	17.735	41894.0	64929.7	15.7	17.735	55868.2	64934.3	20.3
Thallium (Tl)	0.000	6.9	16.0	0.0	0.000	10.3	16.0	0.0	0.000	13.8	16.0	0.0
Tin (Sn)	0.000	2.2	5.0	0.0	0.000	3.2	5.0	0.0	0.000	4.3	5.0	0.0
Vanadium (V)	0.000	113.1	263.0	0.0	0.000	169.6	262.9	-0.1	0.000	226.2	262.9	-0.1
Zinc (Zn)	0.696	277.0	644.1	3.1	3.686	418.5	648.7	7.7	3.686	560.0	650.9	9.9
Total Selected Components	30.2				160.0				160.0			
Total Tailings Cell Mass		430060.4				645220.4				860380.3		

\* - Assume 20% reduction per year for 5 years from historical maximum levels (190 tons per year) to final remedy estimate of 18 tons per year dry uranium material.

- The concentration in other alternate feeds represents some selected concentrations for constituents found in characterization data for other alternate feed materials licensed for processing at the Mill, for comparison purposes.
- The range in the Uranium Material is based on three sampling events for the DMC WTP solids.
- The estimated average concentration in Uranium Material has been calculated as the mean value reported.
- Estimated mass in the Uranium Material is calculated by assuming 197 tons dry annually from historical values.
- Mill tailings range and average concentrations were taken from Mill tailings samples to date, as summarized in Table 5 of the draft Statement of Basis for the Utah Groundwater Discharge Permit for the Mill (November 29, 2004).
- Estimated current mass in Mill tailings is calculated by multiplying the estimated average concentration in the Mill tailings in Column F by 1,769,000 dry tons of tailings reported in the Mill's active Tailings Cell No. 3.
- The baseline estimated annual mass in Mill tailings for cell 4A or 4B is calculated by multiplying the estimated mass in Cell 3 (Column G) by the ratio of Cell 4A (or 4B) total mass capacity of 2,150,000 dry tons to capacity of Cell 3 of 1,769,000 dry tons as of November 29, 2004 and dividing it by ten years as the estimated time to fill cell 4A (or 4B)
- The baseline concentration in Cell 4A (or 4B) Mill tailings is calculated by dividing Column H by 215,000 dry tons as the assumed annual mass addition of tailings to the Cell without the Uranium Material
- Year 1 and Year 2 estimated mass in the Uranium Material is assumed to be equal to Column D historical values.
- The mass in Mill tailings after Uranium Material processing is calculated by adding the total tailings mass from the previous year to the total additional tailings mass added in the current year.
- The concentration in Cell 4A (or 4B) Mill tailings after Uranium Material processing is calculated by dividing the Mass in Cell 4A (or 4B) Mill tailings for that year by the total cumulative mass in cell 4A (or 4B) tailings after Uranium Material is processed.
- The increase in baseline Mill tailings concentration after Uranium Material processing is calculated by subtracting baseline concentration (Column I) from the concentration in Cell 4A (or 4B) after Uranium Material processing for that year.
- The Year 3 and Year 4 approximate estimated mass in the Uranium Material is assumed to be 5 times the amount in Column D based on the estimated increased flow treated to be 1,000 gpm for 7 months of the year and 450 gpm for the remaining 5 months.
- The Year 5 through Year 10 approximate estimated mass in the Uranium Material is assumed to be reduced from the maximum historical value per year to the final remedy estimate of dry Uranium Material (20 %reduction per year) after 2 years of construction.
- The Estimated Mass in Uranium Material over 10-Year Period is the Cumulative Contribution from the Uranium Material to the tailings
- The Estimated Mass in Cell 4A (or 4B) Mill tailings over 10-year period after Uranium Material processing is the total cumulative mass contribution from including Uranium Material to the tailings
- The approximate percent total contributed from Uranium Material is the 10-year contribution to the tailings from the Uranium Material.

Component	Year 5				Year 6				Year 7			
	5J Estimated Mass in Uranium Material (tons) <sup>14</sup>	5K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	5L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	5M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>	6J Estimated Mass in Uranium Material (tons) <sup>14</sup>	6K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	6L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	6M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>	7J Estimated Mass in Uranium Material (tons) <sup>14</sup>	7K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	7L Conc. in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	7M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>
Acetone	0.000	206.4	191.9	-0.1	0.000	247.7	191.9	-0.1	0.000	289.0	191.9	-0.1
Ammonia (NH <sub>3</sub> )	0.002	3365.8	3129.8	-1.2	0.001	4039.0	3130.0	-1.0	0.001	4712.2	3130.1	-0.9
Arsenic (As)	0.000	160.2	148.9	-0.1	0.000	192.2	148.9	-0.1	0.000	224.2	149.0	0.0
Barium (Ba)	1.52	20.7	19.3	19.3	1.25	22.0	17.0	17.0	0.97	23.0	15.2	15.2
Beryllium (Be)	0.007	0.6	0.6	0.1	0.006	0.7	0.6	0.1	0.004	0.9	0.6	0.1
Cadmium (Cd)	0.008	3.8	3.5	0.1	0.007	4.5	3.5	0.1	0.005	5.2	3.5	0.1
Calcium (Ca)	3.09	437.5	406.9	38.9	2.53	519.2	402.3	34.3	1.97	600.3	398.7	30.7
Cobalt (Co)	0.230	68.4	63.6	2.9	0.188	81.6	63.2	2.5	0.147	94.8	63.0	2.3
Chromium (Cr)	0.004	6.7	6.2	0.0	0.003	8.1	6.2	0.0	0.002	9.4	6.2	0.0
Chloride (Cl)	0.008	4953.7	4606.3	-1.7	0.006	5944.4	4606.5	-1.5	0.005	6935.2	4606.7	-1.3
Copper (Cu)	0.033	0.5	0.4	0.4	0.027	0.5	0.4	0.4	0.021	0.5	0.3	0.3
Fluoride (F)	0.008	1822.2	1694.4	-0.6	0.006	2186.7	1694.5	-0.5	0.005	2551.1	1694.6	-0.4
Iron (Fe)	0.142	2379.8	2213.0	1.0	0.117	2855.5	2212.8	0.8	0.091	3331.2	2212.8	0.8
Lead (Pb)	0.004	3.3	3.0	0.0	0.003	3.9	3.0	0.0	0.002	4.6	3.0	0.0
Manganese (Mn)	20.8	439.0	408.2	262.2	17.0	487.4	377.7	231.7	13.2	532.0	353.4	207.4
Mercury (Hg)	0.000	3.8	3.5	0.0	0.000	4.5	3.5	0.0	0.000	5.3	3.5	0.0
Molybdenum (Mo)	0.000	56.8	52.8	0.0	0.000	68.1	52.8	0.0	0.000	79.5	52.8	0.0
Nickel (Ni)	0.348	94.0	87.4	4.4	0.285	112.1	86.9	3.9	0.222	130.2	86.5	3.5
Nitrates (NO <sub>x</sub> )	0.0006	25.8	24.0	0.0	0.0005	31.0	24.0	0.0	0.0004	36.1	24.0	0.0
Selenium (Se)	0.0051	1.6	1.5	0.1	0.0042	1.9	1.5	0.1	0.0033	2.2	1.5	0.1
Silver (Ag)	0.002	0.1	0.1	0.0	0.002	0.2	0.1	0.0	0.001	0.2	0.1	0.0
Sulfate (SO <sub>4</sub> <sup>=</sup> )	3.349	69628.1	64931.5	17.5	2.74	83787.3	64929.5	15.5	2.14	97746.0	64927.9	13.9
Thallium (Tl)	0.000	17.2	16.0	0.0	0.000	20.6	16.0	0.0	0.000	24.1	16.0	0.0
Tin (Sn)	0.000	5.4	5.0	0.0	0.000	6.5	5.0	0.0	0.000	7.5	5.0	0.0
Vanadium (V)	0.000	282.7	262.9	-0.1	0.000	339.3	262.9	-0.1	0.000	395.8	262.9	-0.1
Zinc (Zn)	0.696	698.5	649.6	8.6	0.570	836.9	648.6	7.6	0.444	975.2	647.8	6.8
<b>Total Selected Components</b>	30.2				24.7				19.3			
<b>Total Tailings Cell Mass</b>		1075410.5				1290435.3				1505454.5		

- \* - Assume 20% reduction per year for 5 years from historical maximum levels (190 tons per year) to final remedy estimate of 18 tons per year dry uranium material.
- The concentration in other alternate feeds represents some selected concentrations for constituents found in characterization data for other alternate feed materials licensed for processing at the Mill, for comparison purposes.
  - The range in the Uranium Material is based on three sampling events for the DMC WTP solids.
  - The estimated average concentration in Uranium Material has been calculated as the mean value reported.
  - Estimated mass in the Uranium Material is calculated by assuming 197 tons dry annually from historical values.
  - Mill tailings range and average concentrations were taken from Mill tailings samples to date, as summarized in Table 5 of the draft Statement of Basis for the Utah Groundwater Discharge Permit for the Mill (November 29, 2004).
  - Estimated current mass in Mill tailings is calculated by multiplying the estimated average concentration in the Mill tailings in Column F by 1,769,000 dry tons of tailings reported in the Mill's active Tailings Cell No. 3.
  - The baseline estimated annual mass in Mill tailings for cell 4A or 4B is calculated by multiplying the estimated mass in Cell 3 (Column G) by the ratio of Cell 4A (or 4B) total mass capacity of 2,150,000 dry tons to capacity of Cell 3 of 1,769,000 dry tons as of November 29, 2004 and dividing it by ten years as the estimated time to fill cell 4A (or 4B).
  - The baseline concentration in Cell 4A (or 4B) Mill tailings is calculated by dividing Column H by 215,000 dry tons as the assumed annual mass addition of tailings to the Cell without the Uranium Material.
  - Year 1 and Year 2 estimated mass in the Uranium Material is assumed to be equal to Column D historical values.
  - The mass in Mill tailings after Uranium Material processing is calculated by adding the total tailings mass from the previous year to the total additional tailings mass added in the current year.
  - The concentration in Cell 4A (or 4B) Mill tailings after Uranium Material processing is calculated by dividing the Mass in Cell 4A (or 4B) Mill tailings for that year by the total cumulative mass in cell 4A (or 4B) tailings after Uranium Material is processed.
  - The increase in baseline Mill tailings concentration after Uranium Material processing is calculated by subtracting baseline concentration (Column I) from the concentration in Cell 4A (or 4B) after Uranium Material processing for that year.
  - The Year 3 and Year 4 approximate estimated mass in the Uranium Material is assumed to be 5 times the amount in Column D based on the estimated increased flow treated to be 1,000 gpm for 7 months of the year and 450 gpm for the remaining 5 months.
  - The Year 5 through Year 10 approximate estimated mass in the Uranium Material is assumed to be reduced from the maximum historical value per year to the final remedy estimate of dry Uranium Material (20 %reduction per year) after 2 years of construction.
  - The Estimated Mass in Uranium Material over 10-Year Period is the Cumulative Contribution from the Uranium Material to the tailings.
  - The Estimated Mass in Cell 4A (or 4B) Mill tailings over 10-year period after Uranium Material processing is the total cumulative mass contribution from including Uranium Material to the tailings.
  - The approximate percent total contributed from Uranium Material is the 10-year contribution to the tailings from the Uranium Material.

Component	Year 8				Year 9				Year 10			
	8J Estimated Mass in Uranium Material (tons) <sup>14</sup>	8K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	8L Conc. In Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	8M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>	9J Estimated Mass in Uranium Material (tons) <sup>14</sup>	9K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	9L Conc. In Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	9M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>	10J Estimated Mass in Uranium Material (tons) <sup>14</sup>	10K Mass in Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (tons) <sup>10</sup>	10L Conc. In Cell 4A (or 4B) Mill Tailings after Uranium Material Processing (ppm) <sup>11</sup>	10M Increase in Baseline Mill Tailings Conc. After Uranium Material Processing (ppm) <sup>12</sup>
Acetone	0.000	330.2	191.9	-0.1	0.000	371.5	192.0	0.0	0.000	412.8	192.0	0.0
Ammonia (NH <sub>3</sub> )	0.001	5385.3	3130.2	-0.8	0.000	6058.5	3130.2	-0.8	0.000	6731.7	3130.3	-0.7
Arsenic (As)	0.000	256.3	149.0	0.0	0.000	288.3	149.0	0.0	0.000	320.4	149.0	0.0
Barium (Ba)	0.70	23.7	13.7	13.7	0.42	24.1	12.4	12.4	0.14	24.2	11.3	11.2
Beryllium (Be)	0.003	1.0	0.6	0.1	0.002	1.1	0.6	0.1	0.001	1.2	0.6	0.051
Cadmium (Cd)	0.004	6.0	3.5	0.1	0.002	6.7	3.5	0.1	0.001	7.4	3.5	0.1
Calcium (Ca)	1.41	680.8	395.7	27.7	0.85	760.8	393.1	25.1	0.29	840.2	390.7	22.7
Cobalt (Co)	0.105	108.0	62.8	2.1	0.063	121.1	62.6	1.9	0.022	134.2	62.4	1.7
Chromium (Cr)	0.002	10.7	6.2	0.0	0.001	12.1	6.2	0.0	0.000	13.4	6.2	0.0
Chloride (Cl)	0.004	7925.9	4606.8	-1.2	0.002	8916.6	4606.9	-1.1	0.001	9907.3	4607.0	-1.0
Copper (Cu)	0.015	0.5	0.3	0.3	0.009	0.5	0.3	0.3	0.003	0.5	0.2	0.2
Fluoride (F)	0.003	2915.5	1694.6	-0.4	0.002	3279.9	1694.6	-0.4	0.001	3644.4	1694.7	-0.3
Iron (Fe)	0.065	3806.8	2212.7	0.7	0.039	4282.5	2212.6	0.6	0.013	4758.1	2212.6	0.6
Lead (Pb)	0.002	5.2	3.0	0.0	0.001	5.9	3.0	0.0	0.000	6.5	3.0	0.0
Manganese (Mn)	9.5	572.9	333.0	187.0	5.7	610.0	315.2	169.2	2.0	643.3	299.2	153.2
Mercury (Hg)	0.000	6.0	3.5	0.0	0.000	6.8	3.5	0.0	0.000	7.5	3.5	0.0
Molybdenum (Mo)	0.000	90.6	52.8	0.0	0.000	102.2	52.8	0.0	0.000	113.5	52.8	0.0
Nickel (Ni)	0.159	148.2	86.1	3.1	0.096	166.1	85.8	2.8	0.033	184.0	85.6	2.6
Nitrates (NO <sub>x</sub> )	0.0003	41.3	24.0	0.0	0.0002	46.4	24.0	0.0	0.0001	51.6	24.0	0.0
Selenium (Se)	0.0023	2.5	1.4	0.0	0.0014	2.8	1.4	0.0	0.0005	3.1	1.4	0.0
Silver (Ag)	0.001	0.2	0.1	0.0	0.001	0.2	0.1	0.0	0.000	0.2	0.1	0.0
Sulfate (SO <sub>4</sub> <sup>=</sup> )	1.53	111704.0	64926.5	12.5	0.92	125661.4	64925.3	11.3	0.32	139618.3	64924.2	10.2
Thallium (Tl)	0.000	27.5	16.0	0.0	0.000	31.0	16.0	0.0	0.000	34.4	16.0	0.0
Tin (Sn)	0.000	8.6	5.0	0.0	0.000	9.7	5.0	0.0	0.000	10.8	5.0	0.0
Vanadium (V)	0.000	452.4	262.9	-0.1	0.000	508.9	262.9	-0.1	0.000	565.5	262.9	-0.1
Zinc (Zn)	0.318	1113.3	647.1	6.1	0.192	1251.3	646.5	5.5	0.066	1389.2	646.0	5.0
Total Selected Components	13.8				8.3				2.9			
Total Tailings Cell Mass		1720468.3				1935476.7				2150479.5		

- \* - Assume 20% reduction per year for 5 years from historical maximum levels (190 tons per year) to final remedy estimate of 18 tons per year dry uranium material.
- The concentration in other alternate feeds represents some selected concentrations for constituents found in characterization data for other alternate feed materials licensed for processing at the Mill, for comparison purposes.
  - The range in the Uranium Material is based on three sampling events for the DMC WTP solids.
  - The estimated average concentration in Uranium Material has been calculated as the mean value reported.
  - Estimated mass in the Uranium Material is calculated by assuming 197 tons dry annually from historical values.
  - Mill tailings range and average concentrations were taken from Mill tailings samples to date, as summarized in Table 5 of the draft Statement of Basis for the Utah Groundwater Discharge Permit for the Mill (November 29, 2004).
  - Estimated current mass in Mill tailings is calculated by multiplying the estimated average concentration in the Mill tailings in Column F by 1,769,000 dry tons of tailings reported in the Mill's active Tailings Cell No. 3.
  - The baseline estimated annual mass in Mill tailings for cell 4A or 4B is calculated by multiplying the estimated mass in Cell 3 (Column G) by the ratio of Cell 4A (or 4B) total mass capacity of 2,150,000 dry tons to capacity of Cell 3 of 1,769,000 dry tons as of November 29, 2004 and dividing it by ten years as the estimated time to fill cell 4A (or 4B)
  - The baseline concentration in Cell 4A (or 4B) Mill tailings is calculated by dividing Column H by 215,000 dry tons as the assumed annual mass addition of tailings to the Cell without the Uranium Material
  - Year 1 and Year 2 estimated mass in the Uranium Material is assumed to be equal to Column D historical values.
  - The mass in Mill tailings after Uranium Material processing is calculated by adding the total tailings mass from the previous year to the total additional tailings mass added in the current year.
  - The concentration in Cell 4A (or 4B) Mill tailings after Uranium Material processing is calculated by dividing the Mass in Cell 4A (or 4B) Mill tailings for that year by the total cumulative mass in cell 4A (or 4B) tailings after Uranium Material is processed.
  - The increase in baseline Mill tailings concentration after Uranium Material processing is calculated by subtracting baseline concentration (Column I) from the concentration in Cell 4A (or 4B) after Uranium Material processing for that year.
  - The Year 3 and Year 4 approximate estimated mass in the Uranium Material is assumed to be 5 times the amount in Column D based on the estimated increased flow treated to be 1,000 gpm for 7 months of the year and 450 gpm for the remaining 5 months.
  - The Year 5 through Year 10 approximate estimated mass in the Uranium Material is assumed to be reduced from the maximum historical value per year to the final remedy estimate of dry Uranium Material (20 %reduction per year) after 2 years of construction.
  - The Estimated Mass in Uranium Material over 10-Year Period is the Cumulative Contribution from the Uranium Material to the tailings
  - The Estimated Mass in Cell 4A (or 4B) Mill tailings over 10-year period after Uranium Material processing is the total cumulative mass contribution from including Uranium Material to the tailings
  - The approximate percent total contributed from Uranium Material is the 10-year contribution to the tailings from the Uranium Material.

Component	Final		
	N Estimated Mass in Uranium Material over 10-year Period (tons) <sup>16</sup>	Estimated Mass in Cell 4A (or 4B) Mill Tailings over 10-year Period After Uranium Material Processing (tons) <sup>16</sup>	P Percent Total Contributed from Uranium Material <sup>17</sup>
Acetone	0.0	412.8	0.000%
Ammonia (NH <sub>3</sub> )	0.0	6731.7	0.000%
Arsenic (As)	0.0	320.4	0.000%
Barium (Ba)	24.2	24.2	100%
Beryllium (Be)	0.1	1.2	9.24%
Cadmium (Cd)	0.1	7.4	1.77%
Calcium (Ca)	49.0	840.2	5.83%
Cobalt (Co)	3.6	134.2	2.72%
Chromium (Cr)	0.1	13.4	0.444%
Chloride (Cl)	0.1	9907.3	0.001%
Copper (Cu)	0.5	0.5	100%
Fluoride (F)	0.1	3644.4	0.003%
Iron (Fe)	2.3	4758.1	0.048%
Lead (Pb)	0.1	6.5	0.865%
Manganese (Mn)	329.4	643.3	51.2%
Mercury (Hg)	0.0	7.5	0.000%
Molybdenum (Mo)	0.0	113.5	0.000%
Nickel (Ni)	5.5	184.0	3.00%
Nitrates (NO <sub>x</sub> )	0.0	51.6	0.019%
Selenium (Se)	0.1	3.1	2.63%
Silver (Ag)	0.0	0.2	13.79%
Sulfate (SO <sub>4</sub> <sup>=</sup> )	53.2	139618.3	0.038%
Thallium (Tl)	0.0	34.4	0.000%
Tin (Sn)	0.0	10.8	0.000%
Vanadium (V)	0.0	565.5	0.000%
Zinc (Zn)	11.0	1389.2	0.795%
<b>Total Selected Components</b>	479.5		0.0223%
<b>Total Tailings Cell Mass</b>		2150479.5	

- \* - Assume 20% reduction per year for 5 years from historical maximum levels (190 tons per year) to final remedy estimate of 18 tons per year dry uranium material.
1. The concentration in other alternate feeds represents some selected concentrations for constituents found in characterization data for other alternate feed materials licensed for processing at the Mill, for comparison purposes.
  2. The range in the Uranium Material is based on three sampling events for the DMC WTP solids.
  3. The estimated average concentration in Uranium Material has been calculated as the mean value reported.
  4. Estimated mass in the Uranium Material is calculated by assuming 197 tons dry annually from historical values.
  5. Mill tailings range and average concentrations were taken from Mill tailings samples to date, as summarized in Table 5 of the draft Statement of Basis for the Utah Groundwater Discharge Permit for the Mill (November 2004).
  6. Estimated current mass in Mill tailings is calculated by multiplying the estimated average concentration in the Mill tailings in Column F by 1,769,000 dry tons of tailings reported in the Mill's active Tailings Cell No. 3.
  7. The baseline estimated annual mass in Mill tailings for cell 4A or 4B is calculated by multiplying the estimated mass in Cell 3 (Column G) by the ratio of Cell 4A (or 4B) total mass capacity of 2,150,000 capacity of Cell 3 of 1,769,000 dry tons as of November 29, 2004 and dividing it by ten years as the estimated time to fill cell 4A (or 4B).
  8. The baseline concentration in Cell 4A (or 4B) Mill tailings is calculated by dividing Column H by 215,000 dry tons as the assumed annual mass addition of tailings to the Cell without the Uranium Material.
  9. Year 1 and Year 2 estimated mass in the Uranium Material is assumed to be equal to Column D historical values.
  10. The mass in Mill tailings after Uranium Material processing is calculated by adding the total tailings mass from the previous year to the total additional tailings mass added in the current year.
  11. The concentration in Cell 4A (or 4B) Mill tailings after Uranium Material processing is calculated by dividing the Mass in Cell 4A (or 4B) Mill tailings for that year by the total cumulative mass in cell 4A (or 4B) tailings after Uranium Material processing.
  12. The increase in baseline Mill tailings concentration after Uranium Material processing is calculated by subtracting baseline concentration (Column I) from the concentration in Cell 4A (or 4B) after Uranium Material processing.
  13. The Year 3 and Year 4 approximate estimated mass in the Uranium Material is assumed to be 5 times the amount in Column D based on the estimated increased flow treated to be 1,000 gpm for 7 months of the year.
  14. The Year 5 through Year 10 approximate estimated mass in the Uranium Material is assumed to be reduced from the maximum historical value per year to the final remedy estimate of dry Uranium Material (20% reduction).
  15. The Estimated Mass in Uranium Material over 10-Year Period is the Cumulative Contribution from the Uranium Material to the tailings.
  16. The Estimated Mass in Cell 4A (or 4B) Mill tailings over 10-year period after Uranium Material processing is the total cumulative mass contribution from including Uranium Material to the tailings.
  17. The approximate percent total contributed from Uranium Material is the 10-year contribution to the tailings from the Uranium Material.



**TETRA TECH**

**Attachment 1 – Material Safety Data Sheet for Polymer Coagulant**

**MATERIAL SAFETY DATA SHEET**

Page 1 of 5  
Rev. Date : 7/30/02

**1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY**

Product Name : NS 6852  
 Company : Neo Solutions, Inc.  
 P.O. Box 26  
 Beaver, PA 15009  
 Emergency Telephone Number : (724) 728-1847 Fax : (724) 728-3440  
 Product Use : Process aid for industrial applications.

**2. COMPOSITION / INFORMATION ON INGREDIENTS**

Identification of the preparation : Anionic water-soluble polymer.

**3. HAZARDS IDENTIFICATION**

Aqueous solutions or powders that become wet render surfaces extremely slippery.

**4. FIRST AID MEASURES**

Inhalation : Move to fresh air.  
 Skin contact : Wash with water and soap as a precaution. In case of persistent skin irritation, consult a physician.  
 Eye contact : Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.  
 Ingestion : The product is not considered toxic based on studies on laboratory animals.

**5. FIRE-FIGHTING MEASURES**

Suitable extinguishing media : Water, water spray, foam, carbon dioxide (CO<sub>2</sub>), dry powder.  
 Special fire-fighting precautions : Aqueous solutions or powders that become wet render surfaces extremely slippery.  
 Special protective equipment for firefighters : No special protective equipment required.

**6. ACCIDENTAL RELEASE MEASURES**

- Personal precautions : No special precautions required.
- Environmental precautions : Do not contaminate water.
- Methods for cleaning up : Do not flush with water. Clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

**7. HANDLING AND STORAGE**

- Handling : Avoid contact with skin and eyes. Avoid dust formation. Do not breathe dust. Wash hands before breaks and at the end of workday.
- Storage : Keep in a dry, cool place (0 - 35 °C).

**8. EXPOSURE CONTROLS / PERSONAL PROTECTION**

- Engineering measures to reduce exposure : Use local exhaust if dusting occurs. Natural ventilation is adequate in absence of dusts.
- Personal protection equipment :
- Respiratory protection : Dust safety masks are recommended where concentration of total dust is more than 10 mg / m<sup>3</sup>.
  - Hand protection : Rubber gloves.
  - Eye protection : Safety glasses with side-shields. Do not wear contact lenses.
  - Skin and body protection : Chemical resistant apron or protective suit if splashing or repeated contact with solution is likely.
- Hygiene measures : Wash hands before breaks and at the end of workday. Handle in accordance with good industrial hygiene and safety practice.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

- Form : granular solid
- Color : white
- Odor : none
- pH : 4 - 9 @ 5 g/L (for product series. See Technical Bulletin for specific value)
- Melting point (°C) : Not applicable.
- Flash point (°C) : Not applicable.
- Autoignition temperature (°C) : Not applicable.
- Vapor pressure (mm Hg) : Not applicable.
- Bulk density : See Technical Bulletin.
- Water solubility : See Technical Bulletin.
- Viscosity (mPa's) : See Technical Bulletin.

Product Name : NS 6852

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**10. STABILITY AND REACTIVITY**

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- Stability : Product is stable, no hazardous polymerization will occur.
- Materials to avoid : Oxidizing agents may cause exothermic reactions.
- Hazardous decomposition products : Thermal decomposition may produce : nitrogen oxides (NO<sub>x</sub>), carbon oxides.

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**11. TOXICOLOGICAL INFORMATION**

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**Acute toxicity :**

- Oral : LD50 / oral / rat > 5000 mg/kg
- Dermal : The results of testing on rabbits showed this material to be non-toxic even at high dose levels.
- Inhalation : The product is not expected to be toxic by inhalation.
- Irritation :
- Skin : The results of testing on rabbits showed this material to be non-irritating to the skin.
- Eyes : Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight transitory conjunctival effects similar to those which all granular materials have on conjunctivae.
- Sensitization : The results of testing on guinea pigs showed this material to be non-sensitizing.
- Chronic toxicity : A two-year feeding study on rats did not reveal adverse health effects. A one-year feeding study on dogs did not reveal adverse health effects.

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**12. ECOLOGICAL INFORMATION**

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**Acute aquatic toxicity :**

- Fish : LC50 / Danio rerio / 96 hours > 100 mg/L (OECD 203)
- Daphnids : EC50 / Daphnia magna / 48 hours > 100 mg/L (OECD 202)
- Algae : IC50 / Scenedesmus subspicatus / 72 hours > 100 mg/L (OECD 201)
- Hydrolysis : Does not hydrolyze.
- Biodegradation : Not readily biodegradable.
- LogP<sub>ow</sub> : 0
- Bioaccumulation : Does not bioaccumulate.

Product Name : NS 6852

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## 16. OTHER INFORMATION

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### Further information :

This MSDS was prepared in accordance with the following :

Council Directive 92 / 32 / EEC of 30 April 1992 amending for the seventh time Directive 67 / 548 / EEC on the approximation of the laws, regulations, and administrative provisions relating to the classification, packaging, and labeling of dangerous substances and all subsequent adaptations to technical progress.

Directive 1999 / 45 / EC of the European Parliament and the Council of 31 May 1999 concerning the approximation of the laws, regulations, and administrative provisions of the Member States relating to the classification, packaging, and labeling of dangerous preparations.

Commission Directive 2001 / 58 / EC of 27 July 2001 amending for the second time Directive 91 / 155 / EEC defining and laying down the detailed arrangements for the system of specific information relating to dangerous preparations in implementation of Article 14 of European Parliament and Council Directive 1999 / 45 / EC and relating to dangerous substances in implementation of Article 27 of Council Directive 67 / 548 / EEC (safety data sheets).

ISO 11014-1 : Material Safety Data Sheet for Chemical Products.

Person to contact : Product Manager

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The information provided in this Safety Data Sheet is correct to the best of our knowledge, information, and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal, and release, and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process unless specified in the text.

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Product Name : NS 6852

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**13. DISPOSAL CONSIDERATIONS**

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Waste from residues / unused products : In accordance with local and national regulations.

Contaminated packaging : Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations.

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**14. TRANSPORT INFORMATION**

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Remarks : Not classified as dangerous in the meaning of transport regulations.

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**15. REGULATORY INFORMATION**

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This product is not a hazardous article and need not be labeled according to EC-Directives as amended.

Inventory status :

EINECS (Europe) : Existing polymer according to the definition in the 7<sup>th</sup> Amendment to Directive 67 / 548 / EEC. All starting materials and additives are listed in EINECS.

TSCA (USA) : Complies with all applicable rules or orders under TSCA.

DSL (Canada) : All components listed on inventory.

AICS (Australia) : All components listed on inventory.

MITI (Japan) : All components listed on inventory.

ECL (Korea) : All components listed on inventory.

NEPA (China) : All components listed on inventory.

PICCS (Philippines) : All components listed on inventory.



TETRA TECH



Attachment 2 – Email from Jeff Kujawa

**From:** Jeff Kujawa [Jeff.Kujawa@ALSGlobal.com]  
**Sent:** Friday, August 20, 2010 6:41 PM  
**To:** Hudson, Jen  
**Subject:** Chloroform in 1007337 - WTP Sludge  
Here is what I was able to get back from Salt Lake.

All results are flagged with a J indicating an estimate because it is below the PQL. The samples were only 27% solid meaning all the results are getting multiplied by a factor of almost 4. That could be causing the number to "look" higher than it is. Chloroform occasionally gets into the water/air in the building and could conceivably be causing the contamination. There are trace amounts in the blank at a level about half that of the uncorrected samples (0.2 ug/Kg) but the result was less than the MDL of 0.291. Hopefully this is helpful.

How was your customer experience? Please send us your feedback.

**Jeff Kujawa**  
PROJECT MANAGER

**ALS | Enviromental**

225 Commerce Drive  
Fort Collins, CO 80524

PHONE: +1 970 490 1511  
FAX: +1 970 490 1522

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\*\*\*\*\*

The OC Pest has low recovery for Endrin in the LCS and LCSD at 53% and 57%. The LCL is 60%

The Herbicide analysis has low surrogate recoveries for samples 1007337-1, 1007337-2 and 1007337-3 at 38%, 10% and 34%. The LCL is 57%.

We will document the excursion in the case narratives.

How was your customer experience? Please send us your feedback.

**Jeff Kujawa**

**PROJECT MANAGER**

**ALS | Enviromental**

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