

**Safety Evaluation Report  
For  
The Denison Mines  
White Mesa Mill  
2007 License Renewal Application**

**October, 2011**

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

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## ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
BAT	Best Available Technology
CaF <sub>2</sub>	Calcium Fluoride
CFR	Code of Federal Regulations
cm	centimeter
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DRC	Utah Division of Radiation Control
DUSA	Denison Mines (USA) Corporation
EPA	U.S. Environmental Protection Agency
FWPCA	Federal Water Pollution Control Act
ICTM	Infiltration and Contamination Transportation Modeling
GWQDP	Groundwater Quality Discharge Permit
KF	Potassium Fluoride
km	kilometers
KOH	Potassium Hydroxide
LDS	Leak Detection System
Licensee	Denison Mines (USA) Corporation
LRA	License Renewal Application
MDA	Minimum Detectable Activity
Mill	the White Mesa Mill in Blanding, Utah
millirem	one thousandth of one Roentgen Equivalent Man
NRC	U.S. Nuclear Regulatory Commission
OSL	Optically Stimulated Luminescence
pCi	picocurie; 10 <sup>-12</sup> curie
rem	Roentgen Equivalent Man
RML	Radioactive Materials License
RPP	Respiratory Protection Program
RSO	Radiation Safety Officer
RST	Radiation Safety Technician
RWP	Radiation Work Permit
SER	Safety Evaluation Report
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasures
s	second
TDS	total dissolved solids
TEDE	Total Effective Dose Equivalent
UAC	Utah Administrative Code
UF <sub>4</sub>	Uranium Tetrafluoride
U <sub>3</sub> O <sub>8</sub>	Uranium Oxide
yd	yard
5h:1v	five horizontal units (5h) to one vertical unit (1v); represents slope or steepness

## **INTRODUCTION**

The purpose of this Safety Evaluation Report (SER) is to identify and summarize the information the Utah Division of Radiation Control (DRC) evaluated in its review of Denison Mines Corp. (the Licensee) White Mesa Mill's February 2007 License Renewal Application (LRA) and the grounds upon which the DRC staff concluded whether regulatory requirements are satisfied. The Radiation Control Act, Utah Code Title 19 Chapter 3, provides the Department of Environmental Quality's Radiation Control Board the authority to make rules to protect the public and environment from significant sources of radiation. The DRC is the agency in administering these rules and regulates activities in the State of Utah that involve radioactive materials, some types of radioactive waste, and radiation. Pursuant to regulation implementation, the DRC has issued a Radioactive Material License (RML) to the Licensee to possess and manage radioactive materials and 11e.(2) wastes. In order to assist the DRC in ensuring that all applicable regulatory requirements are currently being satisfied and will continue to be satisfied, the DRC statutes require the Licensee to have their RML routinely reviewed and renewed.

As part of their responsibility, the DRC enforces requirements defined by the State of Utah rules. The specific rule that deals with uranium mills is contained in the Utah Administrative Code (UAC), Section R313-24, "Uranium Mills and Source Material Mill Tailings Disposal Facility Requirements." Section R313-24 references other rules that are contained in the UAC including: Sections R313-12 "General Provisions", R313-15, "Standards for Protection Against Radiation", R313-18 "Notices, Instructions and Reports to Workers by Licensees or Registrants - Inspections", R313-19 "Requirements of General Applicability to Licensing of Radioactive Material", R313-21 "General Licenses", R313-22, "Specific Licenses" and R313-70 "Payments, Categories and Types of Fees." Federal regulations and NRC Regulatory Guides are also applicable via reference in UAC R313-24, in License Conditions contained in the Licensee's RML and in the License Renewal Application.

Since the license renewal process was commenced back in 2007, several unrelated licensing actions have been requested and granted. These include:

- The Tailing Cell 4A approval letter authorizing operation of the disposal cell was issued September 17, 2008; and
- The Tailing Cell 4B License Amendment was completed on June 17, 2010.

Additional information on these Amendments/Permit Modifications can be found in the Statement of Basis for each approval, dated October 24, 2007 and April 6, 2010, respectively.

## **1 PROPOSED ACTIVITIES**

Section 5 of the DRC Form (DRC-01 09/06) for the License Renewal Application asks the applicant to identify the radioactive material to be possessed and Section 6 asks the purpose for which licensed material will be used. In Volume 1, Section 2 of the Licensee's 2007 Renewal Application, the Licensee outlined the proposed activities as

follows: “*Denison proposes to continue to operate the Mill, producing a calendar year limit of 4,380 tons U<sub>3</sub>O<sub>8</sub>.*” The Licensee continued in Section 2.1 “*Feed for the Mill will be provided through: 1) mining operations of Denison and its affiliates, and 2) other uranium/vanadium mining operations; and 3) alternate feed materials.*” The Licensee also stated that Mill tailings will be deposited in existing authorized tailing cells with the possibility of additional cells being constructed and liquid waste is retained in lined cells.

The DRC also noted that the Licensee included a brief description of the Mill and a map showing its location, the corporate entities involved, the maximum design throughput of the Mill, U<sub>3</sub>O<sub>8</sub> content of the ore to be processed, concentrate yield, milling process, and tailings management. The DRC concluded that the Licensee provided all necessary information in Volume 1 through Volume 4 in their License Renewal Application in accordance with the requirements of Sections 5 and 6 of the License Renewal Application.

## **2 SITE CHARACTERISTICS**

Volume 1 of the Licensee’s 2007 Renewal Application referenced the Environmental Report, which was located in Volume 4 for all Site Characteristics information. Each section is discussed below.

### **2.1 Geography and Demography**

In Section 3.9 Volume 4 of the 2007 License Renewal Application, the Licensee documented the Mill’s Geography and Demography. These are discussed below.

#### **2.1.1 Geography**

The Environmental Report describes the Geography for the region around the Mill. This description includes maps showing the location of the site with respect to State, county, and local nearby inhabited areas and showing the Mill, mill perimeter, tailings location, exclusion area boundary, company property, abutting and adjacent properties, nearby water bodies, and inhabited areas. The DRC has determined that all relevant information has been provided, as required by UAC R313-24-4 which references 10CFR40, Appendix A, Criterion 4.

#### **2.1.2 Demography**

The Environmental Report describes the demography including the socioeconomic profile for the region around the Mill. Information was obtained from the U.S. Census Bureau using the 2000 Census, which provided information for population centers within 50 miles of the Mill. The DRC determined all relevant information has been provided, as required by UAC R313-24-4 which references 10CFR40, Appendix A, Criterion 4.

##### **2.1.2.1 Land Use Survey**

A Land Use Survey Report requirement was added to the RML in a new License Condition 12.3. The purpose of the report is to document the changes to land use surrounding the Mill property. This information can be used to help the Mill maintain compliance with UAC R313-24-4. This report will also identify any potential routes of

exposure of contaminants and dose to the general public. The report is required to be submitted every other year on or before June 30<sup>th</sup>. The Licensee is required to conduct the land use survey on even numbered years. The radius surrounding the Mill's property boundary for this report has been set at 5 km.

## ***2.2 Meteorology***

The Environmental Report describes the Climate and Meteorology around the region and near the Mill. The Licensee also provided more detailed information in the 2004-2006 Meteorological Reports. These two sources of information included: (1) diurnal and monthly averages and extremes of temperature and humidity, (2) monthly wind characteristics including speeds and direction, annual joint frequency of wind speed, and direction by stability category, (3) data on precipitation, and (4) frequency of occurrence and effects of storms. The DRC has determined that all relevant information has been provided, as required by UAC R313-24-4 which references 10CFR40, Appendix A, Criterion 4.

## ***2.3 Hydrology***

In Section 3.7 Volume 4 of the 2007 License Renewal Application, the Licensee documented the hydrology of the Mill site and surrounding area. This issue is discussed below.

### **2.3.1 Groundwater**

The hydrogeology and groundwater for the region and near the Mill is discussed in the Environmental Report. The report discusses the different water bearing zones with both the main aquifer and the perched hydrogeologic zones for the immediate Mill vicinity. Groundwater monitoring, issues and contaminate investigations are discussed in Section 5.6 of this document.

### **2.3.2 Surface Water**

As indicated in the Environmental Report, there is no perennial surface water at the Mill site. There are two surface water sources at the Mill site, which are the Mill's wildlife ponds and the seeps and springs surrounding the facility. The seeps and springs are monitored annually in accordance of the Mill's GWQDP. Surface water monitoring is discussed in Section 5.6.1.1 of this document.

## ***2.4 Geology and Seismology***

In Section 3.4 Volume 4 of the 2007 License Renewal Application, the Licensee documented the Mill's Geology and Seismology. These are discussed below.

### **2.4.1 Geology**

The Environmental Report discusses the regional and local geology. This included a brief description of the geologic features of the region, a stratigraphic section, a geologic map, and a description of the local soils. The DRC determined all relevant information has been provided, as required by UAC R313-24-4 which references 10CFR40, Appendix A, Criterion 4.

## **2.4.2 Seismology**

The Environmental Report discusses the seismology of the area using the regions historical record. The DRC determined all relevant information has been provided, as required by UAC R313-24-4, which references 10CFR40, Appendix A, Criterion 4.

## **3 MILL PROCESS AND EQUIPMENT**

Section 9 of the License Renewal Application Form asks the applicant to identify the facilities and equipment to be used. The DRC used Draft NRC Regulatory Guide 3.5 Section 3.0 as a guide to evaluate the requirements in Section 9 of the License Renewal Application Form. Section 4.0 Volume One of the 2007 License Renewal Application documents the Mill's process and equipment. The different circuits are discussed below.

### **3.1 Mill Process**

The Licensee provides in Section 4.1.1 of Volume One of the 2007 License Renewal, a Mill Process Summary. This included a description of feed rates, the different ore process stages, a flow chart diagram, and a general Mill layout. The DRC evaluated the description of the Mill's processes and confirmed that it meets all applicable requirements.

### **3.2 Mill Equipment**

#### **3.2.1 Conventional Ore Circuit**

In Section 4.1.2 through 4.1.9 of Volume One of the 2007 License Renewal Application, the Licensee provided a detailed description of each stage in processing uranium ore. The DRC evaluated the description of the Mill's conventional ore circuit and confirmed that it meets all requirements for Section 9 of the License Renewal Application Form.

#### **3.2.2 Vanadium Circuit**

In Section 4.1.10 through 4.1.12 of Volume One of the 2007 License Renewal Application, the Licensee provided a detailed description of each stage in recovering vanadium. The DRC evaluated the description of the Mill's Vanadium Recovery circuit and confirmed that it meets all requirements for Section 9 of the License Renewal Application Form.

#### **3.2.3 Alternate Feed Circuit**

During the time in which the License Renewal Application was under review, the Licensee added a new Alternate Feed Circuit to the Mill. In the Second Round of Health Physics Interrogatories the DRC requested additional information of the Alternate Feed Circuit.

The Licensee responded to the Second Round of Health Physics Interrogatories with additional information on the new Alternate Feed Circuit which included a schematic and the following explanation for the new circuit: *"Historically the Mill has processed alternate feed materials utilizing existing Mill equipment and facilities. However:*

*In most cases the portions of the existing Mill circuit used for alternate feed processing could not simultaneously be used for conventional ore processing thereby resulting in alternate feed processing displacing conventional ore processing; and cleaning up the process circuits between different alternate feed processing runs and prior to subsequent conventional ore processing runs can be costly and time-consuming.*

*In order to eliminate these two issues the Mill constructed a new alternate feed circuit (the "Circuit") that can be run simultaneously and independently from a number of the conventional ore processing circuits. The solvent extraction, precipitation, drying and packaging stages, however, will normally continue to be performed as needed by the use of existing facilities."*

After reviewing the additional information provided by the Licensee the DRC has concluded that the Licensee has met all requirements for Section 9 of the License Renewal Application form.

### **3.2.3.1 Alternate Feed Program**

In Section 4.2 of Volume One of the 2007 License Renewal Application, the Licensee provided a detailed description of the Mill's Alternate Feed Program. Alternate feed is uranium-bearing material other than conventionally mined ore such as residues from other processing facilities. Currently, the Mill's RML contains fourteen license amendments which allow the Mill to process seventeen different alternate feeds.

During the review of the LRA, the DRC staff had concerns about how the Licensee was maintaining and tracking the alternate feed stock piles. Therefore, the DRC requested in the first round of Health Physics Interrogatories additional information on inspection procedure requirements of the alternate feed material that are stored in containers other than drums and alternate feed being stored on the Ore storage pad, and how the Licensee keeps track of alternate feed from when the Mill takes acceptance of the material until they process the material and the procedure used to determine how and when alternate feed material is to be processed through the Mill.

The Licensee responded in their submittal dated February 5, 2009, that all alternate feed materials stored off the ore pad is subject to Mill procedure *Containerized Alternate Feedstock Material Storage Procedure, No. PBL-19* and they provided a copy of this procedure in an attachment. All alternate feeds are required to be inspected as per that procedure. The Licensee then added that all alternate feed material stored on the ore pad are inspected by the *White Mesa Mill Tailings Management System Discharge Minimization Technology (DMT) Monitoring Plan* and "any alternate feed material stored in super sacks or otherwise, on the ore pad are subject to the controls and inspections applicable to bulk materials stored on the ore pad." The Licensee explained that concerns with alternate feed being exposed to the elements particularly wind dispersment is addressed in the Mill's *Tailings Dust Minimization* and the *White Mesa Mill Work Practice Standards for Control of Fugitive Dust-Ore Receipt and Front-End Loader Operations* as per an Approval Order from the State of Utah Air Quality Division. Finally, Alternate feed procedures are developed on how each alternate feed

will be processed, but not when they will be processed. The Alternate feed will be processed when it is determined there is enough material onsite to process.

In the second round of Health Physics Interrogatories, the DRC staff requested that the Licensee be more specific on how Mill workers and the general public are protected from unnecessary external and potential inhalation exposure from alternate Feed Stocks that are allowed to be managed like conventional ore on the ore pad. Additional radiation safety information was also provided. The DRC also requested a list of alternate feed material that Denison Mines no longer is accepting, include an updated list of approved alternate feeds with their corresponding License Condition.

The Licensee responded in a submittal dated August 14, 2009, as follows: *“Alternate feed materials are managed at the Mill in such manner as to keep potential exposures to the public and occupational exposures within the exposure levels for conventional ore operations at the Mill.”*

As part of the 2007 LRA, the Licensee performed a MILDOS AREA Modeling on Arizona Strip ores which have an average grade of 0.64%  $U_3O_8$  and Colorado Plateau ores with an average grade of 0.25%  $U_3O_8$ . The Licensee also stated that: *“The foregoing analysis for conventional ores sets the environmental envelope for Mill operations that can be performed without considering the need for further modeling. Alternate feed materials are handled so as not to allow potential exposures to the public to exceed the potential exposures from processing Arizona Strip ores at full capacity without further modeling and if further modeling is required without exceeding the applicable regulatory standards and ALARA goal specified in R313-15-101 R313-15-301 and 40 CFR 190. Similarly alternate feed materials are only handled in manner that ensures that occupational exposures are kept within the Mill’s ALARA goal of 1250 mrem per year. To date all alternate feed materials have fallen well within this envelope and no feed-specific modeling has been required.”*

The Licensee further states: *“In order to meet these requirements the following practices have been followed for alternate feed materials:*

- *High grade alternate feed materials typically with 1.0%  $U_3O_8$  or greater are usually received at the Mill and stored in drums or other containers. This is the way that CaF<sub>2</sub>, KOH, Rhone Poulenc, Cotter Concentrates and the Cameco KF, Calcined, Regen and UF<sub>4</sub> alternate feed materials have been received and stored at the Mill;*
- *Alternate feed materials that are received in bulk and that have higher risk of public or occupational exposure than Arizona Strip ores such as may result from high radioactivity and/or fine dry particles relative to Arizona Strip ores have been covered by less radioactive materials while stored on the Mill’s ore pad. This is the way the Heritage alternate feed materials were handled on site; and*
- *Alternate feed materials that are received in bulk and that have lower risk of public or occupational exposure than Arizona Strip ores have been stored in bulk on the site in the same manner as conventional ores. This is the way the Ashland*

*Ashland and Linde FUSRAP materials and the Cabot and FMRI materials have been handled on site.”*

The Licensee concluded, “Based on the foregoing practices Denison is satisfied that all alternate feed materials are handled at the Mill in manner that ensures that exposures to the public and occupational exposures are kept within the environmental assumptions for the site and well within applicable regulatory standards and ALARA goals.”

In addition the Licensee provided information on the new Alternate Feed circuit that was discussed above and provided a list of approved Alternate feeds that are no longer being accepted. After reviewing the additional information provided by the Licensee, the DRC concluded that the Licensee has met all applicable requirements.

### **Modification / Removal of Previous Alternate Feed Requirements**

License Condition 10.1 - the Licensee is not allowed to bring a new alternate feed material to the Mill until the Licensee has demonstrated the following.

1. Sufficient Disposal Capacity – that there is sufficient disposal capacity currently available at the White Mesa facility such that the proposed alternate feed material and any liquid by-products, will be permanently disposed in tailings cells designed and constructed to meet the Best Available Technology requirements in Part I.D.5 (Cell 4A) and Part I.D.12 (Cell 4B) of the Mill’s GWQDP, and
2. Adequate Disposal Cell Operation – that the disposal of by-product material rendered by recovery operations for the proposed alternate feed material will not lead to or cause a violation of the disposal cell performance standards set in Parts I.D.6 (Cell 4A) and I.D.13 (Cell 4B) of the Permit, including, but not limited to maximum wastewater levels in the cells (or minimum freeboard limits).
3. NRC Alternate Feed Policy – that the proposed fee material meets all the criteria / requirements of the NRC alternate feed policy, found in NRC Regulatory Issue Summary, RIS 2000-23, dated November 30, 2000. This includes a 3-point test defined in Attachment 2 of the NRC document.

After receipt of Executive Secretary approval of the above demonstrations, and opportunity for formal public comment, pursuant to UAC R313-17, and resolution of all comments received, the License may be amended to allow receipt and processing of a specific source, or campaign, of alternate feed. As a result of this change, previous NRC wording was simplified in existing License Conditions 10.14 thru 10.18.

During the renewal process, DRC staff determined that there were 3 sources of alternate feed material, approved by the NRC in the past that the Licensee would not receive in the future. These included:

1. Cotter Concentrates (former License Condition 10.8),
2. Ashland 2 FUSRAP material (former License Condition 10.10), and

3. Ashland 1 FUSRAP material (former License Condition 10.12).

As a result, these feed sources were removed from the license and receipt of this material is no longer authorized.

### **3.3 Instrumentation**

In Section 4.1.14 of Volume One of the 2007 License Renewal Application, the Licensee provided a detailed description on instrumentation used at the Mill. The DRC evaluated the description of the Mill's instrumentation and confirmed that it meets all requirements for Section 9 of the License Renewal Application Form.

## **4 WASTE MANAGEMENT SYSTEM**

Section 11 of the License Renewal Application Form asks the applicant to identify how the facility will conduct waste management activities. Section 5.0 Volume One of the 2007 License Renewal Application, the Licensee documented the Mill's Waste Management systems. These systems are discussed below.

### **4.1 Gaseous**

In Volume I, Section 5.1 *Gaseous-Mill*, the Licensee discusses all of the engineering controls and administrative procedures that are in place for the emission sources at the Mill. This included stack emissions and airborne dust and fume control for the Mill, the stockpiles and the Mill's laboratory. The DRC determined all relevant information has been provided.

### **4.2 Liquids and Solids**

In Volume I, Section 5.2 *Liquids and solids* the Licensee states, "*The design of the Mill is such that any leaks or spills are collected and recycled to the appropriate part of the process, thus eliminating any product loss, hazard to personnel, or contamination of the surrounding area.*" Additionally the Licensee stated, "*Most process liquids are recycled in the Mill; however, about one ton of liquid (water) for every one ton of tailings solids is discharged to the impoundment area the water is required to transport the solid tailings. In addition, the elimination of some process water in this manner avoids a buildup in chemical ions that could affect the Milling process.*" The Licensee has also developed a Spill Prevention, Control and Countermeasure (SPCC) Plan and Storm Water Best Management Practice Plan. A procedure for cleaning up spills inside the Mill are included in the *Ore Receiving, Feed and Grind Manual* (Appendix F of the 2007 RML Renewal Application) and the *Yellow Precipitation Manual* (Appendix G of the 2007 RML Renewal Application) The DRC determined all relevant information has been provided.

### **4.3 Contaminated Equipment**

In Volume I, Section 5.2.3 *Contaminated Equipment* the Licensee states, "*All equipment contaminated by source material in the Mill process is buried in a designated zone per 10 CFR Part 40 within the tailings impoundments or, if released, is decontaminated for unrestricted use as specified in 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, NRC, May, 1987. All solid contaminated waste from Milling operations will be buried in the Mill's tailings retention system.*" The DRC has determined that both practices are acceptable methods of disposal of contaminated equipment. Disposal of contaminated equipment is discussed further in the Mill's Reclamation Plan and reviewed annually in the Mill's surety review. The DRC determined all relevant information has been provided.

#### **4.4 ISL Byproduct Disposal (11e(2) Material)**

License Condition 10.5 authorizes the disposal of byproduct material generated at licensed in-situ leach (ISL) facilities. Up to 5,000 cubic yard of material from any one source.

After reviewing the License Condition 10.5 and all of the applicable State of Utah Statues, there appears to be no conflict. Under State Statue 59-24-102(7)(b) "byproduct material" is defined as radioactive waste. In addition, Statue 59-24-102 (8)(b) defines a uranium mill as a radioactive waste facility. License Condition 10.5 is for the disposal of byproduct material at the White Mesa Uranium Mill. However, Statue 19-3-105(10)(a) excludes all existing facilities prior to December 31, 2006 from governor, legislative and county approval. Paragraph (c) also excludes RML amendments and renewals from governor, legislative and county approval as long as the boundaries of the facility do not change. Denison Mines is not changing their existing boundary (as defined in License Condition 9.1 and 2007 RML renewal application) in the License Renewal or in the last amendment; therefore, no governor, legislative and county approval is required. It was noticed during this review, that License Condition 9.1 description of the authorized location is the White Mesa uranium milling facility. The legal description of the White Mesa uranium facility was added to License Condition 9.1 during this license renewal process.

## **5 OPERATIONS**

### ***5.1 Corporate Organization and Administrative Procedures***

In Section 6.1 of Volume One of the 2007 License Renewal Application, the Licensee documented the Corporate Organization of the Mill and described the duties and responsibilities of each level of management. The Licensee also provided an organizational flow diagram to further clarify the line of authority. The DRC determined all relevant information has been provided and is consistent with the current organizational structure and UAC R313-24-4, which references 10CFR40.31(h), by using Section 5.1 of draft NRC Regulatory Guide 3.5.

### ***5.2 Qualifications***

#### **5.2.1 Radiation Safety Officer (RSO)**

Section 7 of the License Renewal Application Form, asks the applicant to list the Individual(s) responsible for Radiation Safety Program and their training and experience. The Licensee provided the RSO's resume outlining his training and experience. In addition the Licensee committed that the Mill's RSO will be qualified and receive training as outlined in NRC Regulatory Guide 8.31 as referenced by the Licensee in Appendix I, ALARA Program, of the February 2007 License Renewal Application.

During the review of the LRA the DRC staff voiced a concern about the number of additional responsibilities that the Mill's RSO oversees, These responsibilities include the Radiation Safety Department, the Environmental Department, and the Occupational Safety Department. The Mills RSO also acts as the Mill's Fire Chief and the Response Team Leader in case of a transportation accident. Therefore, the DRC requested in the first round of Health Physics Interrogatories, the staff organizational charts and information on staff training for the Mill's Radiation Safety Department, the Environmental Department, and the Occupational Safety Department.

After reviewing the RSO's resume and the additional information provided by the Licensee in their February 5, 2009 submittal, the DRC staff was able to confirm that the Licensee has complied with the guidance found in NRC Regulatory Guide 8.31 Section 2.4.1 to meet the required information requested in Section 7 of the License Renewal Application Form.

#### **5.2.1.1 Radiation Safety Staff**

Section 7 of the License Renewal Application Form, asks the applicant to list the Individual(s) responsible for Radiation Safety Program and their training and experience. In the Licensee's February 2007 License Renewal Application Volume 1 Section 6.1.1 Management: states that "*the RSO may be assigned staff to maintain compliance with the applicable regulations*" and Radiation Safety Technicians (RST) shall receive training as

outlined in NRC Regulatory Guide 8.31, as referenced by the Licensee in Appendix I, ALARA Program.

After reviewing the training requirements for RSTs and the organizational chart for the Radiation Safety Department provided by the Licensee in their February 5, 2009 submittal, the DRC staff was able to confirm that the Licensee has complied with the guidance found in NRC Regulatory Guide 8.31 Section 2.4.2 to meet the required information requested in Section 7 of the License Renewal Application Form.

### **5.3 Training**

Section 8 of the License Renewal Application Form asks the applicant to identify the training of individuals working in or frequenting the restricted area of the Mill.

#### **5.3.1 Radiation Safety Training Program**

The White Mesa Mill Radiation Safety Training Program states *“The purpose of the initial training is to instruct all Mill workers on the inherent risks of exposure to radiation and the fundamentals of protection against exposure to uranium and its daughters before beginning their jobs.”* To accomplish this, the Licensee in Appendix I, ALARA Program, of the February 2007 License Renewal Application, references NRC Regulatory Guide 8.31 Section 2.5 and that the Radiation Safety training will follow the topics listed in six subsections.

During the review of the Mill’s Radiation Safety Training Program the DRC staff had concerns if all of the topics outlined in NRC Regulatory Guide 8.31 were being covered; therefore, in the first round of Health Physics Interrogatories these concerns were raised. The DRC staff also asked for a clarification on what a passing score is and what happens when an employee does not pass the Mill’s training programs. The Licensee revised and reformatted their Radiation Safety Training Program (dated May 15, 2009) and the DRC staff reviewed the new revision, which included: descriptions of the training that will be provided, a description of who will be required to take radiation safety training, outlines of the topics to be covered during radiation safety training, copies of handouts that will be given to employees, example exams, a copy of NRC Regulatory Guide 8.13, and copies of forms used to document the training that each employee has received.

In the second round of Interrogatories the DRC staff requested that all types of ionizing radiation be discussed and a section on the three fixed nuclear gauges be included in the Radiation Safety Training Program. The Licensee added language to the Mill’s Radiation Safety Training Program in their response dated August 14, 2009 that covered all forms of ionizing radiation and the three fixed nuclear gauges. After reviewing the additional changes to the revised Radiation Safety Training Program, DRC staff was able to confirm that the Licensee has complied with all of the requirements in NRC Regulatory Guide 8.31.

### **5.3.1.1 Respiratory Protection Training**

The Mill's Radiation Safety Training Program states "*This program outlines the radiation safety training (including respiratory protection training) that will be given to all Mill workers, as well as to contractors and visitors at the Mill.*" In Appendix I, ALARA Program, Section 2.7.5 the Licensee commits that the Respiratory Protection Program follows NRC Regulatory Guide 8.15. Section 5.2 of NRC Regulatory Guide 8.15 outlines the topics to be covered by the Respiratory Protection Training.

During the review of the Mill's Radiation Safety Training Program, the DRC staff had concerns if all of the topics outlined in NRC Regulatory Guide 8.15 for Respiratory Protection Training were being covered. The DRC requested additional information in the first round of Health Physics Interrogatories. The Licensee revised, reformatted and resubmitted their Radiation Safety Training Program (dated May 15, 2009) and included an enhanced respiratory protection section, which included an outline of discussion topics and a separate respiratory protection exam to test employee's knowledge of the Mill's Respiratory Protection Program. After reviewing the additional changes to the revised Radiation Safety Training Program section on Respiratory Protection, DRC staff confirmed that the Licensee has complied with the requirements in NRC Regulatory Guide 8.15.

## **5.4 Security**

### **5.4.1 Security Program**

In Section 6.3.4 and Appendix K of the 2007 License Renewal Application, the Licensee documents the security procedures and program implemented at the Mill. This includes a description of the areas fenced and posted and visitor and contractor requirements. The DRC evaluated the Mill's Security Program and confirm that it meets the requirements in UAC R313-24-4, which references 10CFR40.31(h), by using Section 5.4 of draft NRC Regulatory Guide 3.5.

## **5.5 Radiation Safety**

The state requirements for Radiation Protection Programs are found in UAC R313-15-101, which is included below:

UAC R313-15-101. Radiation Protection Programs.

(1) Each licensee or registrant shall develop, document, and implement a radiation protection program sufficient to ensure compliance with the provisions of Rule R313-15. See Section R313-15-1102 for recordkeeping requirements relating to these programs.

(2) The Licensee or registrant shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

(3) The Licensee or registrant shall, at intervals not to exceed 12 months, review the radiation protection program content and implementation.

(4) To implement the ALARA requirements of Subsection R313-15-101(2), and notwithstanding the requirements in Section R313-15-301, a constraint on air emissions of radioactive material to the environment, excluding radon-222 and its decay products, shall be established by licensees or registrants such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 0.1 mSv (0.01 rem) per year from these emissions. If a licensee or registrant subject to this requirement exceeds this dose constraint, the Licensee or registrant shall report the exceedance as provided in Section R313-15-1203 and promptly take appropriate corrective action to ensure against recurrence.

Section 10 of the License Renewal Application Form asks the applicant to explain the radiation safety program of the Mill. To comply with this requirement the Licensee has established the following Mill programs discussed below:

#### **5.5.1 ALARA Program**

The Licensee states in their ALARA Program in the section titled Management Commitment *“Denison Mines (USA) Corp. (“Denison”) is committed to maintaining occupational exposures of personnel, contractors and visitors and effluent releases at the White Mesa Mill (the “Mill”) as low as reasonably achievable (“ALARA”).”* The Licensee continues *“This ALARA program is to be achieved through systematic worker monitoring and an on-going review process between the radiation protection staff and plant operation management with secondary audits performed by corporate environmental and health and safety personnel.”* This program outlines for the ALARA auditor the commitments that the Licensee has established to maintain the Mill’s ALARA goals.

During the review of the ALARA Program, DRC staff became concerned with the designated eating areas within the restricted area of the Mill. During the first round of Health Physics Interrogatories, the DRC requested justification of having designated eating areas and the number of eating areas within the restricted area and an explanation of the process and criteria used by the RSO in determining appropriate eating areas within the restricted area and how is the criteria maintained. The Licensee responded in their submittal dated February 5, 2009 that they follow the guidelines in NRC regulatory Guide 8.30 Section 2.5 and that the number of designated eating areas within the Mill’s restricted area is kept to a minimum.

In the second round of Health Physics Interrogatories the DRC staff requested the Licensee be more specific and define what controls each Designated Eating Area must have (i.e. frisking requirements, wash facilities, Entry Procedures, etc.) to be a suitable Designated Eating Areas. The Licensee’s response dated August 14, 2009 adds the following language to the ALARA Program:

*“The ALARA Program now spells out in more detail the criteria that must be applied by the Mill RSO in designating an eating area. Specifically each designated eating area must now meet all of the following criteria:*

- *located in an area where work with uranium is not performed and there is little likelihood of contamination;*
- *wash facilities are located close by to allow workers to wash their hands etc prior to entering the designated eating area;*
- *scanning machines are placed at each entry into the designated eating area; and*
- *each worker entering designated eating area must perform and record personal alpha scan in the same manner as if the worker were leaving the Mill’s restricted area and must be free of contamination prior to entering the designated eating area.”*

The Licensee also reduced the number of designated eating areas in the Mill’s restricted area to two, the existing Lunch Room/Training Room and the area above the Warehouse offices. After reviewing the changes to the revised ALARA Program Section 2.2.2 on Policy for eating in the Restricted Area, DRC staff was able to confirm that the Licensee has complied with all of the requirements in NRC Regulatory Guide 8.30 Section 2.5.

### **5.5.2 Radiation Protection Manual**

The Licensee describes their Radiation Protection Program as *“The program consists of management controls, administrative procedures and monitoring programs. Management controls and administrative procedures are designed to ensure the existence of and adherence to a Mill program that is functional in achieving corporate and regulatory agency compliance. The monitoring programs consist of personnel exposure documentation, Mill effluent identification and control, process system operation documentation, off-site environment exposure documentation, and quality control procedures, both analytical and managerial.”*

There are six sections to the Mill’s Radiation Protection Program. Each section is discussed below.

#### **5.5.2.1 Radiation Monitoring-Personnel**

Section 1.0 of Appendix E of the 2007 License Renewal Application contains the procedures for personnel monitoring which include procedures for airborne particulates, alpha surveys, beta/gamma surveys and urinalysis surveys. The airborne particulate section is further divided into personnel breathing zone samplers and ambient air high volume samplers.

During the review, the DRC noticed in Subsection 1.3.1 that it stated an OSL badge may be worn on the torso of the body or on the exterior of the hard hat. UAC R313-15-503(1) states: *“Location of Individual Monitoring Devices: An individual monitoring device used for monitoring the dose to the whole body shall be worn at the unshielded location of the whole body likely to receive the highest exposure. When a protective apron is worn, the location of the individual monitoring device is typically at the neck (collar).”*

In the first round of Health Physics Interrogatories, the DRC requested additional information on OSL badges being worn on hard hats, new employees not being assigned OSL badge at the beginning of employment, and the Breathing Zone Sampling sheet.

In the Licensee response to the first round of Health Physics Interrogatories, the Licensee explained that the practice for wearing OSL badges on the hard hat was changed and the change was implemented on September 12, 2007 and those changes were not in affect when the license renewal application was submitted. The Licensee then continued that the necessary change would be made to the Radiation Protection Manual and the Training Manual. The Licensee also committed to having OSL badges available to new employees when they start and add further explanation to the Breathing Zone Sampling sheet.

After reviewing the added subsection to Section 3 of the Radiation Protection Manual the DRC staff was able to confirm that the Licensee has complied with all applicable requirements.

#### **5.5.2.2 Radiation Monitoring-Area**

Section 2.0 of Appendix E of the 2007 License Renewal Application contains procedures on High Volume Airborne Area Air Sampling, Radon, Alpha Area Surveys, Beta/Gamma Area Surveys, External Gamma Surveys, Equipment Release Surveys, and Product Release Surveys.

During the review, the DRC noticed in this section of the Radiation Protection Manual that the description of surveying product drums to be released from the restricted area was detailed and the description of surveying equipment to be released from the restricted area was very limited. The DRC also noticed that the techniques described in the product drum survey procedures were different then what is described in DOT Regulation 49 CFR 173.443(a). In the first round of Health Physics Interrogatories, the DRC requested additional information on release surveys for product drums and equipment. Specifically, the DRC requested an explanation why the Mill did not use survey techniques that were described in 49 CFR 173.443(a) and a description on how these release surveys were documented.

In the Licensee's response to the first round of Health Physics Interrogatories, the information on survey techniques and documentation was addressed. In response to the DRC inquiry of 49 CFR 173.443(a), the Licensee quoted 49 CFR 173.443(b) which states other survey techniques may be used if they are of equal or greater efficiency.

After reviewing the Licensee's response to the first round of Health Physics Interrogatories, the DRC requested additional information. In the second round of Health Physics Interrogatories the DRC asked the Licensee to *"Provide a procedure that instructs radiation safety technicians on how to perform and document radiological surveys for releasing equipment from the Mill's restricted area."* In addition, to verify that release surveys meet the requirements to 49 CFR 173.443(b), the DRC asked the Licensee to *"Provide efficiency calculations to determine the efficiency of this method. Include the survey procedure used, the efficiency of the meters and probes used in*

*relation to U-238. Show that the meters and probes that are/will be used has the appropriate sensitivity to provide a small enough reading to measure the required release limits.”*

In the Licensee’s response to the second round of Health Physics Interrogatories dated August 14, 2009 it states “*Denison will add new Section 6.0 to the Mill’s Radiation Protection Manual which will provide details on the actual survey procedures.*” (Section 6.0 is discussed in further detail in Section 5.5.2.3 of this report.) Also in the August 14, 2009 submittal the Licensee provided additional survey information and MDA calculations to show that their survey techniques met the requirements of 49 CFR 173.443(b) of equal or greater efficiency as compared to the survey requirements in 49 CFR 173.443(a). When reviewing the MDA calculations, the DRC requested additional information via email of copies of the survey meters used calibration sheets. The DRC also contacted the manufacture of the meters that the Licensee uses for more information on the efficiency of the meters for U-238. Using the information from the manufacturer of the meters and probes used at the Mill, the DRC calculated the MDA for Alpha radiation and found that some of the meters and probes used at the Mill were not sensitive enough for Alpha radiation to meet regulatory requirements.

Based off of the information provided in the calibration sheets and the information received from the survey meters manufacturer, the DRC requested that the Licensee “*Re-evaluate the efficiency for the Ludlum Model-3 survey meters with the 44-9 GM pancake probe using U-238*” in the third round of Interrogatories. The survey meters used by the Licensee were calibrated with a high energy Beta radiation source (Cs-137) and not an Alpha radiation source (U-238 or similar). The numbers used in the MDA calculations that the Licensee provided were not be representative to the Mill’s radiological conditions.

In the Licensee response, dated March 3, 2010, they agreed with the MDA that the DRC calculated for alpha for the Ludlum Model-3 survey meter with a 44-9 GM pancake probe is 2,906 dpm/100cm<sup>2</sup>. However, the licensee argued that “*the meter and probe are used to measure contamination on an ore truck or other equipment, it is reading both alpha and beta*” and “*the combined alpha and beta reading of less than 2,906 dpm/100 cm<sup>2</sup> would be indicated as a non-detect.*” The licensee continued “*a total count reading of non-detect (<2,200 dpm/100cm<sup>2</sup>) would mean that, for ore tucks, the total alpha contamination would be less than about 1,500 dpm/100cm<sup>2</sup>.*” This argument is incorrect because the 2,200 dpm/100 cm<sup>2</sup> limit is not a combined limit for Alpha and Beta contamination and the licensee needs to show compliance for both separately.

However, the Licensee made the following commitment in their response dated March 3, 2010 “*Denison will use alpha detectors with the same or equal efficiency as the alpha detectors currently being used at the Mill for surveying equipment for unrestricted release at the site, such as the Ludlum Model 177 counter and 43-5 alpha detector, for measuring potential alpha contamination on tucks and other vehicles and equipment.*” The DRC reviewed the additional information and commitments in the Licensee’s response to third round of Health Physics interrogatories. Based off the additional

information and the descriptions of all types of radiological surveys, locations of surveys and the frequency that surveys performed at the Mill in the original 2007 license renewal application submittal the DRC was able to confirm that the Licensee has complied with requirements in UAC R313-15-501(1)&(2).

### **5.5.2.3 Equipment/Calibration**

In Section 3.0 of Appendix E of the 2007 License Renewal Application, the Licensee describes the calibration procedure and function tests for the radiation survey equipment and the calibration procedures for the air monitoring equipment.

In the first round of Health Physics Interrogatories the DRC requested that the SOP for using the DRY CAL or equivalent for calibrating air sampling equipment based during on inspections of the Mill the DRC inspectors observed a different method for calibrating air samplers than what was described in the renewal application.

In the Licensee response to the first round of Health Physics Interrogatories, the Licensee added Subsection 3.2.3 “Electronic Calibration Method” for air sample pumps. After reviewing the added subsection to Section 3 of the Radiation Protection Manual and the previous submitted material in the 2007 license renewal application, the DRC staff was able to confirm that the Licensee has complied with all requirements in UAC R313-15-501(2).

### **5.5.2.4 Exposure Calculations and Record Maintenance**

In Section 4.0 of Appendix E of the 2007 License Renewal Application, the Licensee documented how the Derived Air Concentration (DAC) is calculated for conventional ores, alternate feed and tailings. The licensee also documented how dose was calculated for each employee and what records were kept and maintained. The DRC evaluated the exposure calculations and records maintenance and confirmed that it meets all requirements in UAC R313-24-4 which references 10CFR40.61.

### **5.5.2.5 Radiation Work Permits**

In Section 5.0 of Appendix E of the 2007 License Renewal Application, the Licensee documented the RWP procedures and program implemented at the Mill. This included a description of when a RWP is required, what information is required on each RWP, and how a RWP is obtained. The DRC evaluated the description of the Mill’s RWP process and confirmed that it meets all requirements as outline in NRC Regulatory Guide 8.31 Section 2.2.

### **5.5.2.6 Release Surveys**

During the review of the 2007 License Renewal Application, the DRC noticed the description of surveying product drums to be released from the restricted area was detailed in Appendix B and Appendix E, Section 2.7. The DRC also noticed that the description of releasing ore trucks, intermodal containers, and equipment from the restricted area was very limited. The DRC also noticed that the techniques described in the product drum survey procedures were different then what is described in DOT

Regulation 49 CFR 173.443(a). In the first round of Health Physics Interrogatories, the DRC requested additional information on release surveys for ore trucks, intermodal containers, equipment, and product drums. Specifically, the DRC requested two procedures (End Dump Trailer Acceptance, Handling and Release, PBL-9, Rev. No. R-0 and Intermodal Container Acceptance, Handling and Release, PBL-2, Rev. No. R-0) that were referenced in the Mill's ALARA Program. The DRC also requested that the Licensee provide an explanation why the Mill did not use survey techniques that were described in 49 CFR 173.443(a) and a description on how these release surveys were documented.

In the Licensee's response to the first round of Health Physics Interrogatories, the licensee provided the procedures requested by the DRC plus additional information on survey techniques and documentation. In response to the DRC inquiry of 49 CFR 173.443(a), the Licensee quoted 49 CFR 173.443(b) which states other survey techniques may be used if they are of equal or greater efficiency.

After reviewing the Licensee's response to the first round of Health Physics Interrogatories, the DRC requested additional information. In the second round of Health Physics Interrogatories the DRC asked the Licensee to *"Provide a procedure that instructs radiation safety technicians on how to perform and document radiological surveys for releasing equipment from the Mill's restricted area."* In the Procedures, End Dump Trailer Acceptance, Handling and Release, PBL-9, Rev. No. R-0 and Intermodal Container Acceptance, Handling and Release, PBL-2, Rev. No. R-0, in Section 5 of both these procedures say that decontaminated ore trucks and intermodal containers will be surveyed to document that the trucks and intermodal containers meet the different DOT release criteria. These procedures did not instruct the Mill's Radiation Technicians the proper survey methods to perform radiological surveys to verify that the DOT criteria have been met. To verify that release survey meet the requirements to 49 CFR 173.443(b), the DRC asked the Licensee to *"Provide efficiency calculations to determine the efficiency of this method. Include the survey procedure used, the efficiency of the meters and probes used in relation to U-238. Show that the meters and probes that are/will be used has the appropriate sensitivity to provide a small enough reading to measure the required release limits."*

In the Licensee's response to the second round of Health Physics Interrogatories dated August 14, 2009 it states *"Denison will add new Section 6.0 to the Mill's Radiation Protection Manual which will provide details on the actual survey procedures."* Additionally, the Licensee added language to the End Dump Trailer Acceptance, Handling and Release, PBL-9, Rev. No. R-0 and the Intermodal Container Acceptance, Handling and Release, PBL-2, Rev. No. R-0 referencing this new section in the Radiation Protection Manual. The September 14, 2009 submittal included a new section that it was described as *"This Section contains the following procedures for the release of equipment and product drums from the Mill: (1) restricted release of exclusive use vehicles; and (2) un-restricted release of tractors, trailers, intermodal containers ("IMCs") and other vehicles, other equipment and product drums."* Also in the August 14, 2009 submittal, the Licensee provided additional survey information and MDA calculations to show that

their survey techniques met the requirements to 49 CFR 173.443(b) of equal or greater efficiency as compared to the survey requirements in 49 CFR 173.443(a). When reviewing the MDA calculations the DRC requested additional information via email of copies of the survey meters used calibration sheets. The DRC also contacted the manufacture of the meters that the Licensee uses for more information on the efficiency of the meters for U-238. Using the information from the manufacturer of the meters and probes used at the Mill, the DRC calculated the MDA for Alpha radiation and found that the meter and probe used to release End Dump trucks was not sensitive enough for Alpha radiation to meet regulatory requirements.

Based off of the information provided in the calibration sheets and the information received from the survey meters manufacturer, the DRC requested the Licensee that “*Re-evaluate the efficiency for the Ludlum Model-3 survey meters with the 44-9 GM pancake probe using U-238*” in the third round of Interrogatories. The Ludlum Model-3 survey meters with the 44-9 GM pancake probe used by the Licensee were calibrated with a high energy Beta radiation source (Cs-137) and not an Alpha radiation source (U-238 or similar). In addition, the meters and probes are source checked with a high energy Beta radiation source (Co-60) and not an Alpha radiation source (U-238 or similar) which makes their efficiencies higher than they actually are. Due to the high Beta radiation sources used to calibrate and source check the Ludlum Model-3 survey meters with the 44-9 GM pancake probes, the efficiency numbers used in the MDA calculations that the Licensee provided were not representative to the Mill’s radiological conditions.

In the Licensee’s response, dated March 3, 2010, they agreed with the MDA that the DRC calculated for alpha for the Ludlum Model-3 survey meter with a 44-9 GM pancake probe is 2,906 dpm/100cm<sup>2</sup>. However, the Licensee argued that “*the meter and probe are used to measure contamination on an ore truck or other equipment, it is reading both alpha and beta*” and “*the combined alpha and beta reading of less than 2,906 dpm/100 cm<sup>2</sup> would be indicated as a non-detect.*” The Licensee continued “*a total count reading of non-detect (<2,200 dpm/100cm<sup>2</sup>) would mean that, for ore tucks, the total alpha contamination would be less than about 1,500 dpm/100cm<sup>2</sup>.*” This argument is incorrect because the 2,200 dpm/100 cm<sup>2</sup> limit is not a combined limit for Alpha and Beta contamination and the licensee needs to show compliance for both separately.

However, the licensee made the following commitment in their response dated March 3, 2010 “*Denison will use alpha detectors with the same or equal efficiency as the alpha detectors currently being used at the Mill for surveying equipment for unrestricted release at the site, such as the Ludlum Model 177 counter and 43-5 alpha detector, for measuring potential alpha contamination on tucks and other vehicles and equipment.*”

Methods to estimate the MDA (minimum detectable activity) for survey instruments and counters are discussed in NRC'S NUREG-1507 (Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, 1998).

The licensee further justified this commitment with the following calculation:

From NUREG-1507 (Equation 3-10), the following is given for the MDA when measuring surface contamination:

$$\text{MDA} = \frac{3 + 4.65\sqrt{\text{CB}}}{Kt}$$

Where:

MDA = minimum detectable activity in disintegrations/min/100 cm<sup>2</sup>;

CB = background count rate (cpm);

t = counting time (min); and

K = proportionality constant which includes adjustments for detector efficiency and geometry (e.g. coverage relative to 100 cm<sup>2</sup>).

Typical Denison data for the Model 177 counter with 43-5 alpha detector are:

Background count rate (CB) = 20 cpm

Background counting time (t) = 1 min.

Detector alpha efficiency = 11 % (0.11)

Probe active area = 50 cm<sup>2</sup> (or 0.50 of 100 cm<sup>2</sup> area under consideration)

Using these values in Equation (1), the MDA is estimated as:

$$\text{MDA} = \frac{3 + 4.65\sqrt{20}}{(0.11 \times 0.50 \times 1)}$$

= 430 dpm/100 cm<sup>2</sup> (rounded to two significant figures).

This MDA is well below both the 49 CFR173.443 standard of 22 dpm/cm<sup>2</sup> (2200 dpm/100 cm<sup>2</sup>) for non-fixed alpha contamination for restricted release of ore trucks and other equipment, and NRC's 1000 dpm/100 cm<sup>2</sup> standard for non-fixed alpha contamination for unrestricted release of trucks and all other equipment from the Mill's restricted area (see NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities at Table 2 and Section 2.7). The DRC has reviewed the additional information and commitments in the Licensee's response to third round of Health Physics interrogatories and was able to confirm that the Licensee has complied with requirements in UAC R313-15-501(1)&(2).

### 5.5.3 Respiratory Protection Program

The Licensee in their final revision, described the Respiratory Protection Program (RPP) as follows: "*The Respiratory Protection Program is established for the Mill to protect its workers from occupational exposure to harmful concentrations of radioactive and/or toxic materials in the air.*" The DRC evaluated Licensee's Respiratory Protection Program on its compliance with UAC R313-15-702 through 703 and NRC Regulatory Guide 8.15 as referenced by the Licensee in Appendix I, the ALARA Program, of the February 2007 License Renewal Application.

During the review the DRC staff requested additional information from the Licensee on their RPP in the first round of Health Physics Interrogatories regarding respirator

issuance, fit testing, record keeping, radiological surveys of respirators, and respiratory protection procedures required by R313-15-702(d) and NRC Regulatory Guide 8.15, Section 3.2. The Licensee revised their RPP and resubmitted it for review. After reviewing the revised RPP, DRC staff was able to confirm that the Licensee has complied with the requirements in UAC R313-15-702 through 703 and NRC Regulatory Guide 8.15.

#### **5.5.4 Surety**

The surety is reviewed annually by the DRC and is current and in compliance with UAC R313-24-4, which references 10CFR40, Appendix A, Criterion 9. However, several changes have been made to this section including the following:

##### **Chloroform Remediation Costs (License Conditions 9.5 and 10.20)**

A reference was added to the License to require the annual surety estimate include future costs for completion of groundwater remediation, now required by new License Condition 10.20. This groundwater remediation is mandated by the Co-Executive Secretary of the Water Quality Board, and will soon be executed in a revised Ground Water Corrective Action Order (Order) for the known chloroform plume (and related contaminants) found on and around the Mill site. It is appropriate to account for these costs in the annual surety estimate, in that the Nuclear Regulatory Commission has determined that the chloroform contaminant plume is 11e.(2) byproduct material. These increased costs are to be added to the surety estimate report due March 4, 2012. This will allow sufficient time for the Division to complete public comment and to execute the final Order, which is soon to begin. In the future, as the Licensee completes remediation of this groundwater contamination, and receives approval by the Co-Executive Secretary, the Division can consider possible reduction of the annual surety estimate.

##### **Surety Changes for New Cover Design**

License Condition 9.5 requires the Licensee to annually evaluate the estimated costs for closure of both the Mill facility and tailings cells. Inherently, these cost estimates must be closely coordinated with the Reclamation Plan that is currently approved by the Executive Secretary. Evaluation of the status of the surety is also an important part of License renewal.

As discussed below, the Permit since 2005 has included a requirement for the Licensee to submit an Infiltration and Contaminant Transport Model (ICTM) Report to evaluate the long-term ability of the NRC approved tailings cell cover design (riprap rock armor, etc) to protect local groundwater quality, public health and the environment (Permit, Part I.H.2). To date, this evaluation remains incomplete and unapproved. Meanwhile, the Licensee has sought design approval for re-lining Cell 4A and new construction of Cell 4B. To facilitate this expansion, the DRC has authorized limited changes to the Reclamation Plan, discussed below, which allowed the Licensee to horizontally extend the existing NRC approved cover system over these two new tailings cells.

However, without resolution of the ICTM Report, the DRC is unable to determine if the Reclamation Plan and its tailings cell cover system design (approved by the NRC) and

the current surety amount is adequate. Consequently, it is unknown if the existing surety amount required by the License is sufficient to bring the facility to closure in a manner that will provide long-term protection of public health, groundwater quality, and the environment.

As an attempt to strengthen the surety assumptions, the Licensee has proposed submittal of a new Reclamation Plan (Revision 5.0) which includes a new tailing cell cover design, in addition to Revision 4.0 which is still under DRC consideration (pending review and approval of the ICTM Report). The Licensee has claimed that Revision 5.0 will incorporate the analysis found in the latest version of the ICTM Report, submitted by the Licensee on March 31, 2010, that has yet to be approved.

To facilitate license renewal, the Licensee has proposed to increase the surety amount to reflect the unit costs and unit quantities that will be implied by and incorporated in Revision 5.0, and to amend the surety accordingly. This interim increase in the surety is outlined in new License Condition 9.11.C. The Executive Secretary has determined to accept this proposal on faith, with the understanding that an increase in surety is better than no increase at all.

A meeting was held with the Licensee on September 14, 2011 regarding the License Renewal. After the meeting, a follow up e-mail was sent to DUSA that specified that *“Under no circumstances shall the Revised Surety be less than \$18,777,388, which was approved by the Executive Secretary on December 20, 2010.”*

DUSA submitted the new Reclamation Plan (Revision 5.0), which includes a new tailing cell cover design on September 29, 2011. The DRC conducted a cursory review of parts of the submittal, which showed that the surety for proposed reclamation was actually less (\$17,708,939) than the \$18,777,388 previously approved by the Executive Secretary. Therefore, the DRC will not accept this revised Surety on good faith. Surety for the White Mesa Uranium Mill will remain at a minimum of \$18,777,388 until the ICTM Report and Reclamation Plan (Revisions 4.0 and 5.0) are approved.

After resolution and DRC approval of the ICTM Report and Reclamation Plan (Revisions 4.0 and 5.0), the renewed License now calls for a more final update of the surety estimate in new License Condition 9.11.E.

It is important to note, that because the new wording in License Condition 9.1 prohibits new tailings cell construction without resolution of License Condition 9.11, the Licensee will also be compelled to resolve the ICTM Report, update the Reclamation Plan, and adjust the surety to the satisfaction of the Executive Secretary, before any new tailings cell construction.

A new paragraph was also added to end of License Condition 9.5, to mandate that the Licensee include groundwater remediation costs in the next annual surety evaluation report, due on March 4, 2012. These added costs will need to address corrective actions

for the chloroform and nitrate contaminant plume known to exist at the White Mesa facility.

### **5.5.5 Reclamation Plan**

The original Section 8, *Reclamation Plan*, of Volume One of the 2007 License Renewal application the Licensee indicated that the Reclamation Plan for the license renewal was transmitted separately by letter but the Licensee did not provide the date of the letter. In the first round of Engineering Interrogatories the DRC Engineering staff noted the renewal application failed to include a copy of the Reclamation Plan, and requested that the Licensee "... update and complete the Section 8 of the License Renewal Application, regarding the Reclamation Plan. Please include the current approved version of the Reclamation Plan as an Appendix to the License Renewal Application."

For reference, when DRC became an Agreement State (August, 2004), the Reclamation Plan in force was Revision 3.0 (approved by the NRC), and included among other things, a riprap cover layer over Tailings Cells 1, 2, and 3.

Since March, 2005, the Ground Water Quality Discharge Permit (Permit) for the White Mesa facility has required the Licensee to complete an infiltration and contaminant transport model (ICTM) report to justify the tailings cover design. These requirements found in Part I.H.2 of the current Permit, provided that:

1. The Licensee submit an ICTM Report, for Co-Executive Secretary approval, to evaluate the long-term ability of the tailings cover system (and Reclamation Plan) to meet performance standards set out in Permit, Part I.D.8, including, but not limited to:
  - a. Minimization of infiltration into the radon barrier and tailings
  - b. Prevention of accumulation of tailings leachate on the bottom tailings liner ("bath-tub" effect), and
  - c. Protection of underlying groundwater quality at point of compliance wells identified in the Permit, and
2. Upon approval of the ICTM Report, the Co-Executive Secretary may mandate that the Licensee revise the Reclamation Plan to protect public health and the environment.

While a significant effort has been spent by both DRC and the Licensee in the last six years on the ICTM Report, the Division has been unable to resolve the ICTM project and its evaluation, and must conclude the ICTM Report is yet incomplete. For details on progress to date, see chronology in Attachment 2, below. As a result, the Permit requirement is currently un-fulfilled, and Executive Secretary unable to confirm that the cover system (and the Reclamation Plan) are adequate to protect underlying groundwater quality, public health, and the environment.

Current status of the Licensee Reclamation Plan and resolution of the ICTM Report and cover system evaluation is further complicated by three other events, namely:

1. Tailings Cell 4A Re-Lining Approval –the 2005 Permit required the Licensee re-line Tailings Cell 4A to meet Best Available Technology Standards. As a part of this design review and approval, the Licensee revised and the Executive Secretary approved a revision of the Licensee Reclamation Plan on August 4, 2008. This version was later referred to later as Revision 3.1, and included, in part, a horizontal extension of the riprap type cover system over Tailings Cells 1, 2, 3, and 4A. Tailings disposal in Cell 4A began in September, 2008.
2. Tailings Cell 4B Design and Construction Approval – in a submittal dated December 7, 2007 the Licensee submitted a proposal to construct a new Tailings Cell 4B. After DRC review, the Executive Secretary proposed approval of the engineering design and specifications for the new cell, and solicited public comments in April and May, 2010. This design was authorized by DRC in a license amendment issued on June 17, 2010, and construction shortly followed. During construction, the Licensee submitted a revised Reclamation Plan to provide cover system details for closure of Tailings Cells 1, 2, 3, 4A, and 4B. This version became known as Revision 3.2, and was approved by DRC on January 26, 2011. The Licensee also revised the surety to accommodate future cover construction on Cell 4B, and the new surety amount was approved on January 27, 2011. Tailings disposal in Cell 4B shortly followed.
3. Proposed Cover System Design Overhaul - by letter of November 25, 2009, and as a response to the first round of Engineering Interrogatories, the Licensee provided Reclamation Plan Revision 4.0. In contrast to the previous versions, Revision 4.0 included a vegetated cover that was to be constructed over Tailings Cells 1, 2, 3, and 4A. Unfortunately, the design changes suggested in Revision 4.0 were made before any DRC approval of the ICTM Report. As shown in Attachment 2, DRC approval of the ICTM Report has not yet been issued. Consequently, the design changes proposed in Revision 4.0 were and still are premature.

DRC issued a review of the Licensee proposed vegetated cover system via a URS supplemental interrogatory (Supplemental Interrogatory 1A) dated April 6, 2011. The interrogatory requested additional information from the Licensee to support the transmitted design (vegetated cover system). To date, the Licensee has yet to respond to the April 6, 2011 DRC Interrogatory 1A.

In April, 2011, DRC staff approached the Licensee with a request for financial assistance to expedite review of Revision 4.0, the ICTM Report, and issuance of license renewal, by outsourcing the review work to the URS Corporation (DRC's consultant). To date, the DRC continues in its shortage of financial and staff resources to complete the work needed to resolve the compliance status of the Reclamation Plan, Revision 4.0, and ICTM Report. As of today, the Licensee has also been non-responsive in providing the requested additional financial resources.

The Executive Secretary has determined that approval of the ICTM Report is pre-requisite to approval of the proposed Reclamation Plan, Revision 4.0 design. In order to expedite issuance of the License renewal, the Executive Secretary has unilaterally prohibited future construction of any new tailings cells (beyond Cell 4B) until the Licensee secures approval of both the ICTM Report and a revised Reclamation Plan.

**Revised Reclamation Plan, Revision 5.0 (License Condition 9.11)**

In License Condition 9.11 requires that a number of items be completed before any new tailings cells will be constructed at the White Mesa Mill. These items are as follows:

- 1) Secure Approval of the Infiltration and Contaminant Transport Modeling (ICTM) Report - by the Co-Executive Secretary of the Water Quality Board pursuant to the requirements of Part I.H.2 of the Permit. Said ICTM Report shall demonstrate that the final tailings cell cover system design, specifications, and construction will meet the long term performance requirements established in Part I.D.8 of the Permit.
- 2) Submit a Revised Reclamation Plan (Revision 5.0) - on or before October 1, 2011 the licensee shall submit a Revised Reclamation Plan (Revision 5.0) for Executive Secretary review and approval. Said revised plan shall:
  - Provide all engineering design, specifications, construction, and other details regarding site closure and a new cover design for the final tailings embankments (Cells 1, 2, 3, 4A, and 4B), and
  - Be based upon and justified by the ICTM Report that complies with the requirements of Parts I.H.2 and I.D.8 of the Permit, as approved by the Co-Executive Secretary.
- 3) Submit Interim Surety Cost Estimate Report - on or before October 1, 2011, the licensee shall submit a revised surety report for Executive Secretary review and acceptance. Said report shall include a detailed and comprehensive description and justification for all unit quantities and unit costs related to site closure and the new cover design to be proposed under License Condition 9.11.A. Under no circumstances shall the surety amount be less than that already approved by the Executive Secretary on December 20, 2010 (\$18,777,388). After Executive Secretary acceptance, the licensee shall submit written evidence to demonstrate the revised interim surety is fully funded within 60 calendar days of written Executive Secretary acceptance.

To review the above submittals, the Licensee will reimburse the Executive Secretary for all third-party consultant review costs of the ICTM, Reclamation Plan (Revision 5.0), and Interim Surety Report, and any subsequent submittals determined necessary by the Executive Secretary. Reimbursement of the above review costs shall be in accordance with a Memorandum of Agreement (MOA) to include deadlines and a timeline agreed to by both the Licensee and the Executive Secretary.

After Executive Secretary Approval of the Revised Reclamation Plan (Revision 5.0) and ICTM Report, the Licensee will submit as final surety cost estimate report for Executive Secretary review and approval within 30 calendar days. Upon Executive Secretary approval of the final Surety amount, the Licensee will be required to submit written evidence of the final approved surety amount within 60 calendar days.

## **5.6 Environmental Protection**

### **5.6.1 Environmental Protection Program**

A review of the Environmental Protection Program was conducted as a part of the Division's evaluation of the License Renewal Application. Details follow below:

#### **5.6.1.1 Semi-Annual Effluent Monitoring**

The Licensee is required to perform environmental monitoring for many media and points of compliance. The Licensee used guidance from NRC Regulatory Guide 4.14 to develop their effluent monitoring program. The following monitoring is done at the Mill:

- 1) Bi-annual stack effluent sampling at the yellowcake drier to determine flow rate. The Licensee reports the uCi/cc concentration in the stack emissions and the stacks radionuclide release rate is uCi/sec for Uranium-Natural (U-Nat), Th-230, Ra-226 and Pb-210 at each of the stacks sampled.
- 2) Quarterly high volume air particulate (HVAP) monitoring at five locations around the milling facility (stations BHV-1, 2, 4 thru 6). Weekly samples are collected and then composited for quarterly analysis. The analytical parameters that the samples are analyzed for are U-Nat, Thorium-230, Radium-226, Lead-210 activity and particulate loading.
- 3) Semi-annual surface water sampling is conducted at two locations, Cottonwood Wash and Westwater Creek. During this review the wildlife ponds were also identified by the DRC as surface water within the Mill's property boundary, but they are not currently monitored. Surface water samples are analyzed for U-Nat, Th-230 and Ra-226.
- 4) Quarterly gamma monitoring is done utilizing passive integrating devices thermoluminescent dosimeters (TLDs).
- 5) Radon monitoring done at the same locations as HVAP monitoring stations.
- 6) Vegetation sampling is done at three locations in the early Spring, late Spring, and in the Fall. They are analyzed for Radium-226 and Lead-210 activity.
- 7) Soil sampling is collected annually during the third quarter at stations BHV-1 thru 6. All soil samples will be analyzed, on a dry basis, for Ra-226 and U-Nat.

- 8) Groundwater sampling, as discussed below under GWQDP.
- 9) Seeps and Springs sampling is performed as part of the monitoring done for the GWQDP.

During review of the license renewal application, DRC staff concluded that the frequency and type of environmental monitoring for the White Mesa facility is adequate.

#### **5.6.1.2 Chloroform Investigation**

The Licensee has conducted a Chloroform Investigation of on-site groundwater as part of the Environmental Protection Program since August, 1999. As a part of this investigation, a series of quarterly monitoring reports has also been submitted to the Division for review by the Co-Executive Secretary of the Utah Water Quality Board (Co-Executive Secretary). During the course of this investigation the Licensee has installed 27 monitoring wells, mostly located along the eastern margin of the facility. During the course of this investigation, the Licensee has converted 5 of these to active pumping wells as a means of providing hydraulic control and removal of the chloroform plume. Said pumping is the first phase of groundwater corrective action at the facility. For further information, see groundwater remediation section below.

#### **5.6.1.3 Nitrate Investigation**

During preparation of a Permit Modification for the DUSA White Mesa Mill in 2008, DRC staff identified that a Nitrate + Nitrite (as N) [hereafter Nitrate] plume existed at the Mill in a number of wells on site. On September 30, 2008, the DRC sent DUSA a Request for Voluntary Plan and Schedule to Investigate and Remediate Nitrate plume. On January 27, 2009, DRC and DUSA entered into a Stipulated Consent Agreement (UGW-09-03). In the Consent Agreement, DUSA agreed to conduct a contamination investigation to determine the source of the Nitrate contamination. On December 30, 2009 DUSA submitted a Contamination Investigation Report (CIR) to the DRC. After DRC review of the CIR, the DRC notified DUSA in an October 5, 2010 letter that the CIR was incomplete and additional work was needed. In an October 26, 2010 meeting, DUSA presented a Theory that the high Nitrate concentrations observed in the on-site wells could be due to a Natural Nitrate Salt Reservoir. This Theory was based on DUSA's review of scientific literature. Both sides agreed that this new theory and the other potential sources identified in the October 5, 2010 DRC letter warranted additional investigation.

After over two years of investigation it has been determined that there are site conditions that make it difficult to determine the total number, locations, magnitude of contribution, and proportion of the various nitrate and chloride source(s) at the White Mesa site. Therefore, DUSA and the Executive Secretary agreed that it has not been possible to date to determine the source(s), cause(s), attribution, magnitudes of contribution, and proportion(s) of the local nitrate and chloride in groundwater and thereby cannot eliminate Mill activities as a potential cause, either in full or in part, of the contamination. As a result, DUSA and the Executive Secretary agree that resources will be better spent in developing a Corrective Action Plan (CAP) in accordance with UAC R317- 6-6.15(D),

rather than continuing with further investigations as to the source(s) and attribution of the groundwater contamination. A Stipulated Consent Agreement (SCA) was signed by both parties on September 30, 2011. The SCA mandates that DUSA submit a CAP for Nitrate contamination observed on site on or before November 30, 2011.

**5.6.1.4 Groundwater Quality Discharge Permit**

The most recent modifications of the Mill’s Groundwater Quality Discharge Permit (Permit) are summarized in the table below.

Modification / Execution Date	Summary / Description – Including:
July 14, 2011	Change in Slimes Drain Recovery Monitoring frequency
February 15, 2011	Approval to use Tailings Cell 4B
June 17, 2010	Approval of Tailings Cell 4B design / specifications
January 20, 2010	Determination of background groundwater quality and Ground Water Compliance Levels (GWCLs) for each well / contaminant

In the January 20, 2010 Permit Modification, the Co-Executive Secretary approved both GWCLs and background ground water quality determinations after consideration of statistical analysis of historic and recent groundwater quality sampling data at the 22 POC wells near the tailings cells. Prior to this modification, the Co-Executive Secretary had determined groundwater monitoring frequency for these 22 POC, resulting in a baseline frequency of semi-annual and quarterly based on groundwater velocity determined near each well. Quarterly sampling is required for those wells where groundwater velocity is equal to or greater than 10 feet / year (see Permit, Part I.E.1).

A minor amendment to license condition [11.2(C)] was added to the renewed RML to indicate the Licensee’s obligation to comply with the requirements of its current Groundwater Quality Discharge Permit for all ground water related environmental monitoring and protection requirements.

**5.6.1.5 Ground Water Remediation**

In August, 1999, the Co-Executive Secretary issued a Ground Water Corrective Action Order to the White Mesa facility to require investigation of chloroform contamination in the shallow aquifer in well MW-4. During the course of the investigation, and beginning in April, 2003, the Licensee began active pumping of two wells (MW-4 and TW4-19) as a means of controlling the chloroform contamination. Since that time, three other active pumping wells have been deployed by the Licensee, including wells MW-26 (August, 2003), TW4-20 (July, 2005) and TW4-4 (January, 2010).

The Co-Executive Secretary recognizes that additional monitoring and pumping wells may be needed in the future in order to demonstrate the full physical extent of the contamination and its hydraulic intercept and control. To date, the Co-Executive Secretary has used an ad hoc approach to inform the Licensee when new monitoring or pumping wells are needed. However, a formal process will soon be implemented by

which the Licensee will have performance standards to guide decisions regarding the adequacy of monitoring and hydraulic control. Requirements for this future work will be detailed in a formal Corrective Action Order to be prepared by the Co-Executive Secretary and exposed to public comment, as mandated by the Utah Ground Water Quality Protection Rules [UAC R317-6-6.15(E)].

In order to recognize the upcoming issuance of a Ground Water Corrective Action Order, License Condition 10.20 was added to require the Licensee to remediate the chloroform contamination, and related co-contaminants, in a manner approved by the Co-Executive Secretary. The new license condition also recognizes that all of the groundwater contamination and wastewater generated by any remedial effort is by definition an 11.e(2) by-product material, and therefore also regulated under the License. In the event that other groundwater contaminants are identified at the facility, and remediation required, these may be added to the license at a future date.

Related changes were also made at License Condition 9.5, to reference new Condition 10.20, as a means to ensure that the annual surety estimate is adequate to remediate groundwater quality at the facility, in the event that the Licensee defaults before completing this activity.

#### **5.6.1.6 Changes to Cell 1, 2, and 3 Leak Detection Requirements**

On June 3, 2010 the Licensee notified the Utah Division of Radiation Control (DRC) by telephone that on June 2, 2010 an accumulation of fluid was discovered within the Tailings Cell 1 leak detection system (LDS). An initial pH paper test showed that the fluid in the LDS indicated a pH of 2.0 to 3.0; therefore, the fluid found in the LDS originated from Cell 1. Written notification of the Tailings Cell 1 leak was made in a June 7, 2010 the Licensee letter. In the letter, the Licensee states “...a repair report will be submitted to the Executive Secretary with 30 days of the initial telephone notification...” This repair report was not submitted by July 5, 2010 as committed to by the Licensee.

To repair the liner, the Licensee lowered the solution level in Cell 1 to 5613.10 feet amsl. This appeared to eliminate the flow of wastewater to the LDS. The Licensee maintenance identified some FML damage and performed repairs during the period when the water level was lowest. Following the repairs, the Cell 1 liquid level was allowed to return to the June 3, 2010 level. The Cell 1 LDS remained dry until fluid was observed again in the LDS on August 7, 2010. The DRC was made aware of the August 7, 2010 Cell 1 leak in an August 8, 2010 telephone call. During an August 12, 2010, telephone call, the DRC agreed with the Licensee that both the June and August 2010 identifications of fluid in the Cell 1 LDS were part of one event. Apparently, the repairs made to the Cell 1 liner prior to August 7, 2010 were not successful in identifying all the damage which required repair.

During the August 12, 2010 phone call, the Licensee agreed to provide the DRC with a written plan and schedule for: 1) determination of the root cause, 2) identification of the extent of damage, and

3) execution and reporting of repairs to the Cell 1 liner system.

In an August 18, 2010 the Licensee letter, the Licensee provided a plan and schedule for Cell 1 Inspection and Repair. The Licensee's proposed plan and schedule was to be conducted in phases.

After review of the August 18, 2010 Cell 1 repair plan and schedule, the DRC identified three concerns, as follows:

- The proposed repair plan schedule was open ended and there was no specific date where the Licensee committed it would have the Cell 1 leak fully repaired and the LDS dry.
- The phased approach as proposed may take several years before the Cell 1 leak repaired. This was not appropriate, nor was it timely, the Licensee needed to set a date when the entire liner will be checked and repaired above 5,613 feet amsl.
- The August 18, 2010 repair plan failed to include a table for the estimated Cell 1 leakage rate for the leak identified on August 7, 2010.

On August 23, 2010 the DRC shared these concerns with the Licensee in a conference call. In the meeting, the Licensee agreed to submit a revised repair plan by August 30, 2010. This repair plan would include a Cell 1 leakage rate for the leak identified on August 7, 2010 and a date when the entire Cell 1 liner will be checked and repaired fully and completely across all inside slope areas above 5,613 feet amsl, if necessary.

An enforcement conference was held with the Licensee by telephone on September 15, 2010. Commitments made were later documented in a September 22, 2010 DRC Confirmatory Action Letter, which included the following:

- 1) Determination of the root cause of discrepancies determined in the Licensee's reported LDS flow rates by September 30, 2010,
- 2) Completion of a video log of the Cell 1 LDS access pipe, and submittal of a report thereof by November 1, 2010,
- 3) Completion of any additional corrective actions that might be required by the Executive Secretary after review of the November 1, 2010 report, and
- 4) Completion of the Cell 1 FML investigation and all necessary repairs on the inside sideslope above an elevation of 5,613 ft amsl on or before July 31, 2012.
- 5) Submittal of a Cell 1 Repair Report with the next quarterly DMT Report, required by Part I.F.2 of the Permit, i.e., due on September 1, 2012.

In a submittal of November 11, 2010, the Licensee provided a copy of the video log, which showed a significant amount of blockage at the bottom of the Cell 1 LDS access pipe (dirt and debris). After review, the Executive Secretary concluded that: 1) the Licensee had been neglectful in maintenance of the Cell 1 LDS access pipe and that improvements were warranted, 2) the blockage impeded both free draining conditions of the LDS, and rapid reporting and detection of a FML leak, and 3) the leak detection

method and equipment historically used at Cells 1, 2, and 3 was ineffective, and in need of revision.

In an enforcement conference via telephone on November 17, 2010, the Licensee agreed to remove the blockage from the Cell 1 LDS access pipe and re-run a confirmation video log. Division staff also asked the Licensee to perform a second video log of the Cell 3 LDS access pipe, and perform similar maintenance if it was found to also be blocked. No additional work was requested for the Cell 2 LDS access pipe. In a December 27, 2010 submittal the Licensee provided video logs of the LDS access pipes at both Cells 1 and 3. These logs included conditions both before and after cleaning of the access pipes.

In an enforcement conference via telephone on April 28, 2011, the Licensee made additional commitments, which were later formalized in a May 10, 2011 Confirmatory Action Letter by the Division. The additional actions required were by June 1, 2011: 1) submit photographic evidence that the LDS access pipes had been raised at Cells 1 and 3, and 2) submittal of a plan and schedule to replace the current LDS monitoring method and equipment, for approval of the Executive Secretary.

As a result of these activities, the Executive Secretary has decided to modify License Condition 11.3 to make certain improvements to the performance standards / requirements for LDS monitoring, operation, and maintenance at Cells 1, 2, and 3, as follows:

- 1) Annual video log is required. In the event that any blockage is determined, the Licensee will remove all blockages within 14 calendar days of discovery, and submit a written report for Executive Secretary approval within 30 calendar days of discovery.
- 2) Improve LDS monitoring, by measuring depths to fluids in the LDS in a manner approved by the Executive Secretary, removal of the fluid within 24-hours of discovery, and physical measurement of the volumes removed by methods such as totalizing flow meters, filling of graduated tanks or containers, etc. It is expected that these monitoring improvements would be done as a future revision to the DMT Monitoring Plan required by Part I.F.2 of the Permit.
- 3) Deadline for completion of corrective actions is needed, as evidenced by the compliance history described above. Therefore, the written report required within 30 calendar days of LDS fluid discovery, will include a deadline for completion of corrective actions.
- 4) Mandate that all fluids removed from a LDS access pipe will be returned to an authorized disposal cell, regardless of the volume or flow rate of such fluid.
- 5) Additional written reporting requirements, including: 1) an annual video log report and documentation of the timeliness of any blockage removal (if observed), 2) upon determination of cell leakage, a written report that includes either evidence of corrective actions already completed, or submittal of a detailed plan and schedule for said completion.

## **6 ACCIDENTS**

When applying for a specific license UAC R313-22-32 (8)(c) identifies what is required in an emergency response plan for radioactive material. The NRC in Regulatory Guide 3.67 and NUREG-1140 has provided supplemental material to assist an applicant in developing emergency response plans. Below discusses the Mill's submittals:

### ***6.1 Emergency Response Plan***

In Appendix D of the 2007 License Renewal Application, the Licensee documented the Mill's Emergency Response Plan. During the review of the 2007 License Renewal Application, the DRC noticed the submitted Emergency Response Plan did not sufficiently address all of Staff Emergency Assignments that should be covered. These include but were not limited to Radiological Surveys and Assessments, Decontamination of the Mill's Personnel and Facility, First Aid and etc. In the first round of Health Physics Interrogatories, the DRC requested additional information on how the Mill plans on addressing these and other issues in the event of an emergency.

In the Licensee's response to the first round of Health Physics Interrogatories, the Licensee provided a revised Emergency Response Plan (Rev. 2) dated April 20, 2009. After reviewing the revised Emergency Response Plan, DRC staff was able to confirm that the Licensee has complied with the requirements in UAC R313-22-32 (8)(c), NRC Regulatory Guide 3.67 and NUREG-1140.

### ***6.2 Transportation Accidents Plan***

In Appendix N of the 2007 License Renewal Application, the Licensee documented the Mill's Transportation Accident Response Plan for Uranium Concentrate Spill. The Mill has established this procedure to assist in a transportation accident involving radioactive materials. This procedure identifies four phases: Initial, confinement, cleanup, and cost recovery. The DRC evaluated the Mill's Transportation Accident Response Plan and confirmed that it meets all applicable requirements.

## **7 QUALITY ASSURANCE**

No independent Quality Assurance Plan was submitted to the DRC as part of the 2007 License Renewal Application. In round one of the Health Physics interrogatories, the DRC requested a list of all procedures that the Mill uses. After receiving the list of procedures that the Mill uses, the DRC compiled a list of procedures that the Licensee needed to submit for the License Renewal. As part of the round two Health Physics Interrogatories, the DRC requested the Mill's Quality Assurance Program.

In response to the round two Health Physics Interrogatories, the Licensee stated: *"The Mill had generic Quality Assurance Program years ago. However, that program is no longer in existence. It has been replaced by specific Quality Assurance provisions inserted in individual SOPs where appropriate and for groundwater sampling by the Mills Groundwater Monitoring Quality Assurance Plan."* DRC staff was able to confirm that the Licensee has complied with all requirements UAC R313-24-4, which references 10CFR40.31(h), by using Section 7 of Draft NRC Regulatory Guide 3.5.

## **8 EVALUATION OF ALTERNATIVES**

An Evaluation of the Alternatives was discussed in Environmental Report located in Volume 4 of the 2007 License Renewal. The Alternatives discussed included:

- Renewal of the License with its existing terms and conditions;
- Renewal the License with additional conditions;
- Deny renewal of the License;
- A brief description of why an alternative location was not evaluated; and
- A brief description of alternative Engineering Methods.

The DRC determined that all reasonable alternatives were considered, as required in UAC R313-24-3(1)(c).

# ATTACHMENT 1

## RADIOACTIVE MATERIAL LICENSE NO. UT 1900479

### SUMMARY OF LICENSE CHANGES

October 10, 2011

The changes that will be integrated into 2011 Renewal of the DUSA License are summarized in the table below.

#### License Change Summary

License Condition <sup>(1)</sup>	Change Type <sup>(2)</sup>	Description of Changes
3	Minor	Reset amendment number to "5" for new license cycle.
4	Minor	Reset expiration date to be 5 years from license execution.
6	Minor	Added 11(e)2 By-product Material and Approved Alternate Feed Material
9.1	Major	Added the legal description of the White Mesa Uranium Mill property to clarify the authorized location where licensed activities shall be permitted. Also added to the License Condition that any mill process water, wastewater storage, and/or tailings disposal embankments is prohibited until after the Licensee demonstrates compliance with the requirements of License Condition 9.11, and receives prior Executive Secretary approval.
9.2	Minor Minor	Multiple changes were made: <ul style="list-style-type: none"> <li>• Changed the street address. The DRC moved to a new address in 2010; and</li> <li>• Added language to clarify that all written notices and submittal shall include a searchable electronic copy as required by Utah Administrative Code (UAC) R313-12-111.</li> </ul>
9.3	Minor	Changed dates to reflect the Licensee's submittals for the 2007 License renewal.
9.4	Minor	Multiple changes were made: <ul style="list-style-type: none"> <li>• Added NRC to Paragraph B(3) to clarify the appropriate Environmental Assessment that was referenced.</li> <li>• Section D. Changed NRC to Executive Secretary and changed the date referenced from June 10, 1997 to February 27, 2007.</li> </ul>
9.5	Major Minor	Multiple changes were made related to Surety requirements, including: <ul style="list-style-type: none"> <li>• First Paragraph: new License Condition 10.20 is referenced for future costs of groundwater remediation; and</li> <li>• Fourth Paragraph: to reflect existing surety details.</li> </ul>

- 1 License conditions not listed in the table are those that remain unchanged from the last License amendment.
- 2 The Executive Secretary deems minor changes as those that are insignificant in nature, or result in more protection of human health, safety, and/or the environment. Major changes are those found otherwise, and are only made after exposure of the License to public comment and resolution thereof.

License Condition <sup>(1)</sup>	Change Type <sup>(2)</sup>	Description of Changes
	Major	<ul style="list-style-type: none"> <li>• Fifth paragraph: added to provide clarification on when the annual surety estimate need to be adjusted by the Licensee for: 1) the DOE / EPA tailings cell cover system now required by License Condition 9.11, and 2) future costs for remediation of groundwater contamination now required in License Condition 10.20.</li> </ul>
9.6	Minor Major	<p>Multiple changes were made:</p> <ul style="list-style-type: none"> <li>• Changed wording of the License Condition to improve the readability and understandability of the Condition;</li> <li>• Added language that the Licensee shall provide up-to date copies, on an annual basis, of White Mesa Mill’s Standard Operational Procedure(s) (SOP) to the Utah Division of Radiation Control (DRC) to: <ul style="list-style-type: none"> <li>○ Improve Communication between the Licensee and the DRC; and</li> <li>○ Improve the Understanding for the DRC staff of the Licensee activities at the White Mesa Mill.</li> </ul> </li> </ul>
9.7	Minor	Minor typographical corrections.
9.10	Major	<p>Multiple changes were made:</p> <ul style="list-style-type: none"> <li>• Added language to incorporate specific procedures on the release of ore trucks and intermodal containers from the restricted area of the White Mesa Mill;</li> <li>• Added language to reference the Department of Transportation release standards that shall be used to release ore trucks and intermodal containers from the restricted area of the White Mesa Mill; and</li> <li>• Added language referencing NRC Regulatory Guide 8.16 “Termination of Operating Licenses of Nuclear Reactors” dated June 1974. This guidance has the exact requirements found in the NRC document “Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material” dated May 1987 but it is easier to find for referencing purposes.</li> </ul>
9.11	Major	<p>Former requirements removed and replaced with multiple changes to require the Licensee to submit for Executive Secretary approval, the following:</p> <ul style="list-style-type: none"> <li>• Opening paragraph the following shall be completed prior to any new tailing cell construction;</li> <li>• Section A: Approval of the ICTM report;</li> <li>• Section B: requires the Licensee to submit a new Reclamation Plan and Specification (Revision 5.0) by October 1, 2011 for Executive Secretary approval;</li> <li>• Section C: Submit an interim surety report for approval by the Executive Secretary and after acceptance provide written evidence to demonstrate the revised interim surety is fully funded within 60 calendar days;</li> <li>• Section D: Reimburse the Executive Secretary for third party review of Reclamation Plan (5.0), ICTM report and Tailing Cell cover design</li> <li>• Section E: requires the Licensee submit a final surety report after Reclamation Plan 5.0, ICTM report and the new tailing cell cover design is approved</li> </ul>

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License Condition <sup>(1)</sup>	Change Type <sup>(2)</sup>	Description of Changes
9.12	Minor	This is a new license condition and was added to state that the License will not be transfers unless the Groundwater Discharge Permit is also transferred.
10.1	Minor	Made a Minor wording change to Paragraph E
10.3	Minor	Multiple Changes were made: <ul style="list-style-type: none"> <li>• Minor format change</li> <li>• Changed reference in Paragraph B from License Condition 12.3 to 12.2 to reflect the renumbering of the referenced licensed condition</li> <li>• Changed the freeboard limits to Tailings 4B only</li> </ul>
10.6	Minor	In the second round of Health Physics Interrogatories the DRC requested that the Licensee identify approved alternate feeds that the White Mesa Mill will no longer be accepting for processing. The alternate feed associated with License Condition 10.10 was identified and deleted from the License.
10.7	Minor	Renumbered License Condition 10.6 to 10.7
10.8	Major	In the second round of Health Physics Interrogatories the DRC requested that the Licensee identify approved alternate feeds that the White Mesa Mill will no longer be accepting for processing. The alternate feed associated with License Condition 10.8 was identified and deleted from the License.
10.10	Major	In the second round of Health Physics Interrogatories the DRC requested that the Licensee identify approved alternate feeds that the White Mesa Mill will no longer be accepting for processing. The alternate feed associated with License Condition 10.10 was identified and deleted from the License.
10.12	Major	In the second round of Health Physics Interrogatories the DRC requested that the Licensee identify approved alternate feeds that the White Mesa Mill will no longer be accepting for processing. The alternate feed associated with License Condition 10.12 was identified and deleted from the License.
10.14 thru 18	Minor	Deleted sections of these license conditions due to the requirements in License Condition 10.1.
10.19	n/a	None
10.20	Minor	This is a new license condition and was added to: <ol style="list-style-type: none"> <li>1) Require the Licensee to remediate known groundwater contaminant plumes at the facility in a manner and schedule approved by the Co-Executive Secretary of the Utah Water Quality Board,</li> <li>2) Define all contaminated wastewater or groundwater generated by the remediation process as 11.e.(2) material,</li> <li>3) Clarify and define the specific groundwater contaminants that require remediation as of July 1, 2011.</li> </ol>
11.2	Minor	Minor formatting changes and added the words “current” and “(Permit)” to the License Condition 11.2(c).

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License Condition <sup>(1)</sup>	Change Type <sup>(2)</sup>	Description of Changes
11.3	Minor	<p>Multiple Changes were made:</p> <ul style="list-style-type: none"> <li>• Added a new section A to require: <ul style="list-style-type: none"> <li>○ All tailing cell leak detection system access pipes are open, free draining, fully functional, and well maintained.</li> <li>○ An annual video log to verify these pipe conditions, and submittal to the Executive Secretary for approval.</li> <li>○ A new performance standard, to require removal of any access pipe blockages within 14 calendar days of discovery and subsequent reporting within 30 calendar days</li> </ul> </li> <li>• Added language to section B clarifies how liquid in the leak detection will be detected by approved methods, and removed within 24-hours. Volume of removed fluids shall be measured and documented.</li> <li>• Added language to section E to clarify that both on-site records retention and written reporting are required.</li> </ul>
11.5	Minor	Minor typographical correction.
11.7	Minor	Changed references from License Condition 12.3 to 12.2 to reflect the renumbering of the referenced licensed condition
11.8	Minor	Changed references from License Condition 12.3 to 12.2 to reflect the renumbering of the referenced licensed condition
12.1	Minor	Renumbered license condition from 12.2 to 12.1. The original 12.1 was deleted by the NRC in amendment 13.
12.2	Minor	Renumbered license condition from 12.3 to 12.2 and fixed a font style and size so that the entire paragraph was consistent throughout.
12.3	Major	<p>This is a new license condition and was added to:</p> <ol style="list-style-type: none"> <li>1) Document land uses and changes to land surrounding the Licensee's property; and</li> <li>2) Identify any potential routes of exposure of contaminants and dose to the general public from the Licensee's property.</li> <li>3) To aid the Licensee's in demonstrating compliance with 40 CFR 190</li> </ol>
Signature Block	Minor	Name of new Executive Secretary.

## ATTACHMENT 2

### Chronology Summary:

Utah Division of Radiation Control (DRC) and Denison Mines (USA) Corp (THE  
 LICENSE)

Interaction Regarding

THE LICENSE Reclamation Plan (Revisions 3.1, 3.2 and 4.0) and  
 Infiltration and Contaminant Transport Modeling (ICTM) Report

Since issuance of the March 8, 2005 DRC Ground Water Discharge Permit (Permit), No. UGW370004; multiple documents have been exchanged between the Permittee and the DRC and multiple meetings have taken place, regarding the ICTM Report. DUSA has also proposed changes to the Reclamation Plan on three separate occasions to support: 1) approval of Tailings Cell 4A re-lining (Revision 3.1), 2) approval of Tailings Cell 4B construction (Revision 3.2), and 3) overhaul of engineering design for a vegetated cover (Revision 4.0). The former two revisions were approved by the DRC. Revision 4.0 remains unapproved, currently, in that it is directly related to the ICTM Report requirements. These documents and meetings are summarized in the following table:

Document/Meeting Date	Author / Event	Document Title / Summary / Description
March 8, 2005	DRC	Issuance of first Permit for White Mesa facility. Part I.H.11 (now I.H.2) provided that: <ol style="list-style-type: none"> <li>1. DUSA submit an ICTM Report to demonstrate the tailings cover system meet the performance standards found in Part I.D.6 (now I.D.8) of the Permit, including:                             <ol style="list-style-type: none"> <li>a. Minimization of infiltration into the radon barrier and tailings</li> <li>b. Prevention of accumulation of tailings leachate (surface infiltration) on the bottom tailings liner (“bath-tub” effect), and</li> <li>c. Protection of underlying groundwater quality resources and public health at point of compliance wells identified in the Permit, and</li> </ol> </li> <li>2. After Co-Executive Secretary approval of the ICTM, the Reclamation Plan may be modified to protect public health and the environment.</li> </ol>
8/26/2005	Meeting	Meeting amongst DUSA (IUC), MWH Americas, and DRC to discuss concepts for the ICTM for Tailings Cell 3.
11/03/2006	DRC	Minor Permit Modification (No. 2), Change removes

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		requirement for Co-Executive Secretary approval of the Work Plan and allows DUSA to go straight to preparing the ICTM Report.
11/27/2006	DRC	Minor Permit Modification (No. 3) Extends the deadline for the ICTM Report from June 1, 2007 to September 1, 2007
2/28/2007	DUSA	Submittal of License renewal application. Application Section 8 (p. 74) addresses facility reclamation, but fails to provide or reference a reclamation plan. Section 8 also describes Permit requirements for the ICTM Report establish objectives and are inter-related to the reclamation plan.
11/21/2007	DUSA	ICTM Report (Prepared by MWH Americas)
7/25/2008	DUSA	Submittal of Reclamation Plan, Revision 3.1 for new Tailings Cell 4A (rock armor design, no vegetation). Revised surety estimate also included.
8/4/2008	DRC	Approval of Reclamation Plan, Revision 3.1 – includes cover system for new Tailing Cell 4A.
2/2/2009	DRC	“Request for Information” (RFI) Letter sent to DUSA regarding DRC review of the 11/07 ICTM Report. Letter calls out multiple problems/deficiencies.
3/31/2009	Meeting	Meeting amongst DUSA, MWH Americas, and DRC (Salt Lake City) to discuss the ICTM report findings.
4/23/2009	DUSA	Draft minutes for the 3/31/2009 meeting.
4/28/2009	DRC	DRC comments sent to DUSA regarding the draft 3/31/2009 meeting minutes.
4/30/2009	DUSA	Draft response to the 2/2/209 DRC RFI.
8/5/2009	DRC	DRC comments regarding the DUSA Draft response to the 2/2/2009 RFI and requesting a meeting and recommended agenda items.
9/2/2009	Meeting	Meeting amongst DUSA, MWH Americas, and DRC to discuss issues related to the 11/1/2007 ICTM Report and agreed upon strategies and needed improvements for a revised ICTM Report. DUSA agrees that: 1) ICTM Report and Reclamation Plan Rev. 4.0 are interrelated, 2) Approval ICTM Report needs to should come before cover system re-design, and 2) the review process for both documents is iterative.
9/3/2009	DRC	E-mail to DUSA which clarifies that all issues related to radon emanation from the cover and potential burrowing animal intrusion into the cover needs to be included in the revised ICTM Report.

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11/5/2009	Phone Conference	Phone call between DRC and DUSA to discuss the timeline for the DUSA final response to the 2/2/2009 DRC RFI and submission of the revised ICTM Report. Per the call DUSA agreed to provide the RFI response to DRC by 12/1/2009 and to provide the revised ICTM to DRC by 3/31/2010.
11/12/2009	DUSA	Draft meeting minutes for the 9/2/2009 meeting.
11/16/2009	DRC	DRC Confirmatory Action Letter (CAL) outlining the agreed upon dates for deliverables per the 11/5/2009 telephone call.
11/18/2009	DUSA	Transmittal of final meeting minutes for the 3/31/2009 meeting.
11/25/2009	DUSA	Submittal of Reclamation Plan, Revision 4.0, including vegetated cover design (part of response to 7/2/09 DRC Interrogatories (Round 2 – Health Physics, and Round 1 – Engineering). ICTM Report still not resolved.
12/1/2009	DUSA	Cover letter and 36 page technical memorandum in response to the 2/2/2009 DRC RFI transmitted to DRC regarding ICTM Report.
12/2/2009	DRC	Request to resubmit the 12/1/2009 technical memorandum, several figures were illegible
12/7/2009	DUSA	Revised copy of the 12/1/2009 technical memorandum submitted to DRC.
3/31/2010	DUSA	Revised ICTM Report submitted to DRC .
6/21/2010	DRC	Email to Harold Roberts to summarize telephone call on this day. During conversation, DUSA states that DRC / URS review of the Reclamation Plan, Rev. 4.0 should NOT include any effort to review the ICTM Report.
6/29/2010	DUSA	Submittal of Reclamation Plan, Revision 3.2 – includes cover design for new Tailings Cell 4B. Cover design includes riprap rock armor layer (no vegetation).
10/5/2010	Meeting	Meeting amongst DUSA, MWH, URS and DRC to discuss Reclamation Plan Rev. 4.0. Per discussion DUSA elected to pursue the vegetated cover design as part of the Reclamation Plan 4.0 review being done by URS. ICTM Report not yet approved.
10/7/2010	DUSA	DUSA submission of a proposed embankment vegetated top slope cover design via e-mail to DRC to be included with the Reclamation Plan Rev. 4.0 review.
4/6/2010	DRC	DRC transmittal of comments regarding the White Mesa Reclamation Plan Rev. 4.0, via URS

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		interrogatory. It was noted that several comments/questions included in the URS interrogatory were directly associated with issues to be addressed by the ICTM Report.
3/21/2011	DUSA	E-mail from DUSA agreeing that expansion of URS review to include the ICTM Report would make sense; however, DUSA expressed concerns about costs associated with the URS review.
4/7/2011	DRC	E-mail to DUSA including a URS cost proposal to complete review of the Reclamation Plan Rev. 4.0, Round 1A Interrogatory 1A (vegetated cover). Total cost estimate was \$19,779.
4/7/2011	DRC	E-mail to DUSA including a URS proposal and cost estimates to review the 3/31/2010 Revised ICTM Report, in order to complete the Reclamation Plan Rev. 4.0 review. Total cost estimate was \$64,868.
4/21/2011	DUSA	E-mail from DUSA to DRC approving the URS cost estimate of \$19,779 to complete the Round 1A Interrogatory (for Reclamation Plan, Rev. 4.0).
4/2011	Phone Conference	DRC/DUSA telephone conversation, DUSA concludes that URS review costs for the Revised ICTM Report are too high and suggested DRC share the review cost (50/50 split).
6/16/2011	DRC	Approval of Reclamation Plan, Revision 3.2 for Tailings Cell 4B (includes rock armor design).

As provided in the December 14, 2004 DRC SOB the Co-Executive Secretary determined that because the tailings cell cover system had not yet been constructed, it was feasible and timely to consider improvements in cover design as a means to protect long-term local groundwater quality. To this end, the ICTM Report requirement was included in the Permit (Part I.H.11, now I.H.2). After repeated attempts to resolve multiple technical issues, the ICTM Report has yet to demonstrate that either cover system is adequate to protect local groundwater quality. Meanwhile, execution of the License renewal has also been delayed since November, 2009; when DUSA requested DRC review / approval of a vegetated cover system, as found in Reclamation Plan, Revision 4.0. In the meantime, review of the License renewal application has reached a point where the Executive Secretary of the Radiation Control Board (hereafter Executive Secretary) is prepared to execute certain key improvements to radiation safety requirements at DUSA.

In order to expedite renewal of the License, the Division has established new requirements in the draft License renewal to: 1) prohibit construction of new tailings disposal cells until after resolution of the ICTM Report, and any subsequent changes to the Reclamation Plan. In addition, two sets of changes are required to the DUSA financial surety, one interim, to be submitted shortly, and a second change to be implemented after resolution of the ICTM Report and changes to the Reclamation Plan.

These changes to the License are prudent in order to:

- 1) Facilitate renewal of the License and timely implementation of needed improvements to radiation safety matters,
- 2) Focus DUSA attention on resolution of the ICTM Report requirement and development of a technically evaluated Reclamation Plan Cover Design, by prohibiting construction of new tailings cells, beyond Cell 4B, until after such resolution, and
- 3) Reaffirm the Co-Executive Secretary's original objectives in the March 8, 2005 Permit Compliance Schedule Requirement, *ICTM Work Plan and Report* (former Part I.H.11), to evaluate the ability of the facility's approved cover design to provide long-term protection of local groundwater quality resources and public health.

### **References**

1. Utah Division of Radiation Control, Radioactive Materials License No UT1900479, Denison Mines (USA) Corp., White Mesa Uranium Mill (Amendment 4)
2. Utah Division of Water Quality, February 14, 2011, Ground Water Discharge Permit, DUSA, Permit No. UGW370004.