

**DIVISION OF RADIATION CONTROL  
DENISON MINES (USA) CORP  
REVIEW OF LICENSE AMENDMENT REQUEST AND  
ENVIRONMENTAL REPORT FOR CELL 4B**

**SAFETY EVALUATION REPORT  
UNDER UAC R313-24 AND UAC R317-6**

**APRIL 6, 2010**

## TABLE OF CONTENTS

Section	Page
ACRONYMS AND ABBREVIATIONS .....	IV
UAC R313-24-3A: ENVIRONMENTAL ANALYSIS - RADIOLOGICAL AND NONRADIOLOGICAL IMPACTS .....	1
UAC R313-24-3B: ENVIRONMENTAL ANALYSIS - IMPACT ON WATERWAYS AND GROUNDWATER.....	6
UAC R313-24-3C: ENVIRONMENTAL ANALYSIS - ALTERNATIVES.....	11
UAC R313-24-3D: ENVIRONMENTAL ANALYSIS - LONG-TERM IMPACTS .....	13
10CFR40.26(C)(2): GENERAL LICENSE .....	16
10CFR40.31(H): APPLICATION FOR SPECIFIC LICENSES.....	18
10CFR40.61: RECORDS .....	19
10CFR40.65(A)(1): EFFLUENT MONITORING REPORTING REQUIREMENTS.....	21
10CFR40 INTRODUCTION: CAPACITY OF TAILINGS OR WASTE SYSTEMS OVER THE LIFETIME OF MILL OPERATIONS.....	22
10CFR40 APPENDIX A, INTRODUCTION: ALTERNATIVE REQUIREMENTS.....	23
10CFR40 APPENDIX A, CRITERION 1: PERMANENT ISOLATION WITHOUT ONGOING MAINTENANCE .....	24
10CFR40, APPENDIX A, CRITERION 2: PROLIFERATION.....	27
10CFR40, APPENDIX A, CRITERION 3: PLACEMENT BELOW GRADE .....	29
10CFR40, APPENDIX A, CRITERION 4: LOCATION AND DESIGN REQUIREMENTS.....	31
10CFR40, APPENDIX A, CRITERION 5A(1): GROUND-WATER PROTECTION STANDARDS ....	36
10CFR40, APPENDIX A, CRITERION 5A(1): GROUND-WATER PROTECTION STANDARDS ....	36
10CFR40, APPENDIX A, CRITERION 5A(2): LINER.....	37
10CFR40, APPENDIX A, CRITERION 5A(4): PREVENT OVERTOPPING.....	39
10CFR40, APPENDIX A, CRITERION 5A(5): DIKES.....	41
10CFR40, APPENDIX A, CRITERION 6(2): VERIFY EFFECTIVENESS OF FINAL RADON BARRIER .....	44
10CFR40, APPENDIX A, CRITERION 6(3): PHASED EMPLACEMENT OF FINAL RADON BARRIER .....	46
10CFR40, APPENDIX A, CRITERION 6(4): REPORT RADON BARRIER EFFECTIVENESS .....	49
10CFR40, APPENDIX A, CRITERION 6(5): ELEVATED RADIUM CONCENTRATIONS IN COVER MATERIALS.....	51
10CFR40, APPENDIX A, CRITERION 6(6): CONCENTRATIONS OF RADIONUCLIDES OTHER THAN RADIUM IN SOIL .....	53
10CFR40, APPENDIX A, CRITERION 6(7): NONRADIOLOGICAL HAZARDS.....	55
10CFR40, APPENDIX A, CRITERION 6A(1): COMPLETION OF FINAL RADON BARRIER.....	56
10CFR40, APPENDIX A, CRITERION 7: PREOPERATIONAL AND OPERATIONAL MONITORING PROGRAMS.....	57
10CFR40, APPENDIX A, CRITERION 8: EFFLUENT CONTROL DURING OPERATIONS .....	59
10CFR40, APPENDIX A, CRITERION 8A: DAILY INSPECTIONS .....	61
10CFR40, APPENDIX A, CRITERION 9: FINANCIAL SURETY ARRANGEMENTS .....	62
10CFR40, APPENDIX A, CRITERION 10: COSTS OF LONG-TERM SURVEILLANCE.....	65
UAC R317-6-6.3: GROUND WATER DISCHARGE PERMIT APPLICATION .....	66
UAC R317-6-6.4: ISSUANCE OF DISCHARGE PERMIT.....	72
UAC R317-6-6.9: PERMIT COMPLIANCE MONITORING .....	74
UAC R317-6-6.10: BACKGROUND WATER QUALITY DETERMINATION.....	76
UAC R317-6-6.12: SUBMISSION OF DATA .....	78

UAC R317-6-6.13: REPORTING OF MECHANICAL PROBLEMS OR DISCHARGE SYSTEM FAILURES .....	79
UAC R317-6-6.14: CORRECTION OF ADVERSE EFFECTS.....	80
UAC R317-6-6.16: OUT-OF-COMPLIANCE STATUS.....	81
UAC R317-6-6.17: PROCEDURE WHEN A FACILITY IS OUT-OF-COMPLIANCE.....	83
REFERENCES: .....	84

## ACRONYMS AND ABBREVIATIONS

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

kg	kilogram
km	kilometer; 1000 meters
lb	pound (16 ounces)
m	meter
mg/l	milligram per liter
mi	mile
millirem	one thousandth of one Roentgen Equivalent Man
mm	millimeter, 0.001 meter
m <sup>2</sup> s	square meter second; used as a measure of radon flux, e.g., pCi/m <sup>2</sup> s
NRC	U.S. Nuclear Regulatory Commission
NUREG	Series of reports prepared and issued by staff of USNRC
pCi	picocurie; 10 <sup>-12</sup> curie
RCRA	Resource Conservation and Recovery Act
rem	Roentgen Equivalent Man
RG	Regulatory Guide (NRC)
s	second
SC, SP, and SW	Soil classes under Unified Soil Classification System
TDS	total dissolved solids
TEDE	Total Effective Dose Equivalent
UAC	Utah Administrative Code
UDRC	Utah Division of Radiation Control
UMETCO	UMETCO Minerals Corporation
URS	URS Corporation, including Washington Division
USGS	US Geological Survey
yd, yd <sup>2</sup>	yard, square yards
5h:1v	five horizontal units (5h) to one vertical unit (1v); represents slope or steepness

## **UAC R313-24-3A: ENVIRONMENTAL ANALYSIS - RADIOLOGICAL AND NONRADIOLOGICAL IMPACTS**

### **REGULATORY BASIS:**

#### UAC R313-24-3:

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

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

### **SAFETY EVALUATION:**

The Licensee submitted an Environmental Report on April 30, 2008 (DUSA 2008a). Additional and related environmental information is found in other Licensee documents provided. The Licensee provided updated meteorological data, including observations through calendar year 2006, in Section 1.1 of Rev. 4.0 of the Reclamation Plan, recently submitted by letter dated November 24, 2009 (DUSA 2009b). Currently the November 24, 2009 Reclamation Plan is under separate review by the Division. The Licensee has summarized that data in its responses to Division interrogatories.

Section 3.10 of the *Environmental Report in Support of the License Renewal Application, State of Utah Radioactive Materials License No. UT1900479* (DUSA 2007a) shows that land use has changed little in the area of the mill since the FES, with the exception that the nearest residence is now approximately 1.6 miles from the mill, whereas the nearest residence at the time of the FES was approximately 4.8 miles from the mill. However, dose calculations found in the Mill's 2008 MILDOS Evaluation modeled the nearest potential residence, which is at the northern boundary of the mill property, approximately 1.2 miles from the mill, and found acceptable dose rates to the public at this location under current Division regulations.

Populations within a 50-mile radius of the mill have been updated since the FES and are included in Section 4.0 and Section 3.9 of DUSA 2008a. These updated demographics are also incorporated into the 2008 MILDOS Evaluation (Senes 2008). No significant trends are expected in population or industrial use patterns in the foreseeable future.

No significant changes have occurred nor are expected in:

- Average values of meteorological parameters.
- Locations, natures, and amounts of present and projected surface and ground-water use within five miles downgradient of the site.
- Present and projected population associated with each use point during the active life of the mill.

- Locations, distances from the mill, withdrawal rates, return rates, type of water use, depth of wells, groundwater elevation, drawdown rates or water use estimates downgradient of the proposed Cell 4B.
- Locations and populations of neighboring schools, facilities; hospitals; and residential areas within 5 miles from the Mill.

The 2008 MILDOS Evaluation (Senes 2008) takes into account recent demographic information within a 50-mile radius of the mill, and calculates the dose to the nearest potential residence, which is at the northern boundary of the mill. Therefore the potential radiological impacts from the addition of Cell 4B on populations and neighboring residences has been taken into account in that modeling.

For the purposes of evaluating radiological doses from the addition of Cell 4B, as set out in Senes 2008, the dose at the nearest potential residence, located approximately 1.2 miles north of the mill and some 0.40 miles closer to the site than the current actual nearest residence, has been calculated as the dose to the person likely to receive the highest dose from mill operations. .

Cattle grazing on lands abutting the mill's restricted area is similar to grazing that occurred at the time of the 1979 ER, and is taken into account in the 2008 MILDOS Evaluation (Senes 2008). There are no significant transient or seasonal population variations applicable to the area of the mill.

MILDOS-AREA calculates the impacts based on annual average air concentrations of radionuclides considered. The human pathways considered in MILDOS-AREA for individual and population impacts are: inhalation, external exposure from ground concentrations, external exposure from cloud immersion, ingestion of vegetables, ingestion of meat and ingestion of milk.

With respect to the ingestion of vegetables, the 2008 MILDOS Evaluation incorporated the default provisions of the MILDOS-AREA code, which assume that nearby receptors consume specified percentages of their total vegetable consumption from vegetables grown at their respective receptor locations (Senes 2008).

With respect to ingestion of meat and milk, the area immediately north of the mill is used only for grazing of beef cattle. A second location to the east and south of the mill is also used for the grazing of beef cattle. Although considered unlikely, the 2008 MILDOS Evaluation contemplated that in one worst case scenario, it is possible that the beef cattle grazed at these locations would be eaten by the residents near the mill. A scenario which supports dairy cattle grazing at these locations was not included in the modeling because the prospect of supporting dairy cattle grazing near the mill is not credible, given the arid climate and the much larger feed requirements of dairy cattle as opposed to beef cattle. Further, no dairy cattle have been observed near the Mill. The 2008 MILDOS evaluation assumed, as a worst case scenario, that the inhabitants at the nearest potential residence consumed all of their beef from the cattle grazing at the locations near to the Mill described above, which, based on historic grazing practices, were assumed to graze at those locations for two months each year. The 2008 MILDOS Evaluation also conservatively assumed that such residents drank all of their milk from cows that grazed at the location of the nearest potential residence (Senes 2008).

In this worst case scenario, the total dose to the person most likely to receive the highest exposure (i.e., residents at the nearest potential residence) was calculated to be well below the regulatory limit, as shown in Section 5.0 of the 2008 MILDOS Evaluation.

The updated meteorological data, thru 2006 has been used in the “2008 MILDOS simulations” (Senes 2008). No significant changes to MILDOS results were caused by incorporating this revised data into the MILDOS simulations. The Licensee provided the MILDOS input and output files from which the results presented in the 2008 MILDOS Evaluation were summarized. The Division has reviewed these files and concluded that they appropriately represent the White Mesa facility in its proposed operating and closed conditions.

The Licensee submitted a sensitivity analysis to demonstrate that reasonable variations in MILDOS input parameters (related to Cell 4B performance) do not change the conclusion of the 2008 MILDOS Evaluation (Senes 2008). The Division has reviewed this sensitivity study and concluded that it provides confidence that the projected dose rates during operations and following closure will satisfy applicable regulatory dose limits.

The construction and operation of Cell 4B will not add any new constituents of concern over and above existing licensed facilities at the Mill. The physical, chemical and radiological make up of the tailings to be disposed of in Cell 4B is expected to be appreciably similar to that of existing tailings and the assumptions upon which the 2008 MILDOS Evaluation is based.

The hazards and risks to human health and the environment created by all potential constituents of concern at the Mill site were originally assessed in detail by Dames and Moore in Section 5.0 of the 1978 Environmental Report (ER; D&M 1978) and by NRC in Section 4.0 of the Final Environmental Statement (FES; NRC 1979).

The 2008 MILDOS Evaluation provides an estimate of the maximum total effective dose equivalent (“TEDE”) for a number of receptors, including the nearest potential residence using updated meteorology. The nearest potential residence is at the northern boundary of the Mill property, close to air particulate monitoring station BHV-1, which is the closest private property that could be occupied full time by a member of the public. That location, BHV-1, is also in one of the predominant wind directions. All other site boundaries abut property managed by United States Bureau of Land Management (BLM), which could not be inhabited full time by a resident. Therefore, the person likely to receive the highest dose from the licensed operation, as contemplated by Utah Administrative Code (UAC) R313-15-301 and -302, would be a person at the nearest potential residence. BHV-1, the location of the nearest potential residence, is approximately 1.2 miles north of the mill site itself. The current nearest actual residence is approximately 1.6 miles north of the mill site. Therefore, the analyses and results of the 2008 MILDOS Evaluation conservatively overstate likely doses.

For processing of Colorado Plateau Ore, the maximum TEDE was calculated (Senes 2008) to be 1.4 mrem/yr for an infant at the nearest potential residence, BHV-1, while for processing higher grade Arizona Strip ores, it was calculated to be 3.1 mrem/yr for the same individual. This maximum projected dose to the nearest potential resident is about 3.1% of the 100 mrem/yr limit.

The Licensee asserts and the Division agrees that no changes to doses that result from transport via groundwater or surface water transport are likely to result from the updated meteorology



database. This conclusion is based on the relatively small changes that were reflected in meteorological parameters that affect the projected doses, namely, parameters such as wind speed, wind direction, wind stability, precipitation rates, evaporation rates, and temperatures. The concentrations of air particulate radionuclides and gamma concentrations at various receptor locations, including at the nearest potential residence (BHV-1) are reported in the Mill's Semi-Annual Effluent Reports that are submitted to the Executive Secretary. Doses (TEDEs) at the locations where humans or environmental populations could be reasonably exposed are estimated in the 2008 MILDOS Evaluation (Senes 2008).

The mill's training program is described in Section 6.3 of the 2007 License Renewal Application (DUSA 2007b). The training program was subsequently revised, as described in a letter dated May 15, 2009 from the Licensee to the Executive Secretary. The mill's training program applies to the mill generally and to the mill's tailings cells as a whole, and is currently being considered by the Executive Secretary as part of the 2007 License Renewal Application review process. The United States Mines Safety and Health Administration (MSHA) also reviews and approves the mill's training program.

Addendum 5 of the mill's current training program addresses general emergency procedures. Those procedures take into account the general shutdown of operational activities during an emergency evacuation event. During new hire training, the Emergency Response Plan is presented and specific items are covered including procedures and actions to take during the different emergency scenarios. The instructor covers the roles and responsibilities of each person, the organizational chart and who should be informed and when, and finally where the employees can periodically review the Plan to keep themselves familiar.

During annual refresher training for all employees, this information is again reviewed during the Escape and Emergency Evacuation Plans section. This usually takes place in August of each year. During this training, the instructor will address the existing Plan and then review the main ideas for the various scenarios. This information is presented orally with general feedback used as the evaluation method of knowledge.

All employees who receive training at the facility are documented using the MSHA 5000-23 form. These documents show the training received, i.e. Annual Refresher, Newly Employed Inexperienced Miner, or Experienced Miner. The amount of training each employee receives will vary depending on his or her classification upon hire. These documents are held in the employee's Safety folders which are maintained in the Mill's Radiation Safety Officer's office.

The Licensee is responding to Division directives to address and resolve groundwater contamination issues that predated operation of the milling facility or construction of the mill's tailings system (UDRC 1999). The groundwater chloroform contamination plume has been attributed to the operation of a temporary laboratory facility that was located at the site prior to and during construction and initial operation of the mill facility, and from septic drain fields that were used for laboratory and sanitary waste disposal during initial operation of the mill. DUSA efforts are underway to comply with all applicable regulatory requirements and License conditions. The evaluation of compliance of the recently discovered nitrate plume is still under investigation.

During mill operations, the doses to the member of the public most likely to be exposed are expected to continue to be approximately the same as they have been to date. Upon site closure, all mill buildings and contaminated areas, including wind-blown contamination, will be removed and placed into one of the tailings cells. The clean up standard for all non-tailings areas and surrounding areas is set out in Criterion 6(6) of 10 CFR 40, Appendix A (incorporated by reference into UAC R313-24-4).

After all non-tailings areas are cleaned up and contaminated materials are placed into one of the tailings cells, the tailings cells will be capped in place. The tailings cell cap must be designed and constructed to ensure that radon emanations do not exceed the regulatory limit of 20 pCi/m<sup>2</sup> per second, for 1,000 years to the extent reasonable practicable, and in any event for 200 years, as required by 10 CFR 40, Appendix A, Criterion 6. Additional requirements are found in Section 3.3.2 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which is currently under Division review. In the interim, the Division will approve Cell 4B for use in operations only after the Licensee provides revised cover system design documents and assurance that all applicable regulatory requirements and license conditions will be satisfied (see License Condition 9.11).

Upon License termination, the tailings cells will be transferred to the U.S. Department of Energy (DOE) for perpetual care and maintenance.

The doses to members of the public following facility closure and stabilization will be minimal and within regulatory standards over a 1,000 year time frame (Senes 2008). Upon transfer, DOE will be responsible to ensure that the tailings cells maintain their integrity and that these standards will continue to be met in perpetuity.

The accidents already considered in previous submittals to NRC or the Division adequately represent the accidents that might result during construction and operation of the proposed Cell 4B. The NRC's and Division's previous acceptance of such analyses for cell construction is the basis for accepting them as adequately representing accidents associated with Cell 4B.

**FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-3(1)(a).

## **UAC R313-24-3B: ENVIRONMENTAL ANALYSIS - IMPACT ON WATERWAYS AND GROUNDWATER**

### **REGULATORY BASIS:**

#### UAC R313-24-3:

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

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

### **SAFETY EVALUATION:**

The Licensee provided information on aquifer horizontal and vertical permeabilities and other physical / hydraulic properties, as well as well drawdown characteristics in Sections 6.3, 7.2, and 7.3 of the ER (DUSA 2008a). In addition, in response to the Round 1 Interrogatory, the Licensee discussed updated information obtained by the Licensee between January 8, 2008 and August 27, 2009 and that additional information in Section 2.5 of the September 1, 2009 Permit Renewal Application (DUSA 2009e).

The Licensee provided updated information on current uses of surface water in the area surrounding the mill in Section 1.4.1 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which is currently under Division review.

The State of Utah Division of Water Rights listed 261 ground water appropriations within a 5-mile radius of the mill. A summary of this list was included in DUSA 2009c. The legend to Table 2.2.2-1 was inadvertently omitted for that submittal. The legend clarifies the status of each of the water rights as Approved, Perfected, Terminated, or Unapproved. The legend is included as Attachment C to DUSA 2010a. Neither the list, nor the Division of Water Rights web site, lists pending water rights.

A search of the State of Utah, Division of Water Rights yielded information on six shallow wells located within one mile of the site. Two of the wells are located on the property owned by the Licensee, and have been previously described. These are the Hawkins and Jones wells. The records did contain a drill log for the Hawkins well, a copy of which is included as Attachment B to the Licensee's response to Round 2 Interrogatories (DUSA 2010a). The file also included correspondence on appropriation of the water rights. The Hawkins well was abandoned as a part of the construction of tailings Cell 2. No driller's log was available for the Jones well, although the file did include correspondence on appropriation of the water rights, a listing of which is included in Attachment B of DUSA 2010a. Both of these wells are downgradient or cross-gradient to the mill and tailings area.

Information was obtained on four other wells located up gradient and cross gradient (to the east) of the mill property. Records for the Holt well contained no drill logs, but did have an extensive correspondence file. Two wells drilled by Dale Lyman had drill logs, but no application number or correspondences file. The "USA Utah Launch Complex White Sands Missile Range" drilled a well east of the mill site. The records contained an extensive correspondence file but no drill log. Copies of the Lyman drill logs and the correspondence list for the other wells were submitted in Attachment B to DUSA 2010a.

The Licensee provided a discussion of groundwater usage in Section 1.5.6 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), currently under Division review). The information provided indicates that: (1) the well yields from wells completed in the Burro Canyon formation within the White Mesa site are generally lower than those obtained from wells in this formation upgradient of the site; and (2) documented pumping rates from on-site wells completed in the Burro Canyon formation are generally less than 0.7 cubic feet per second (cfs). The information provided shows that some on-site wells are located in a perched aquifer with limited permeability and saturated thickness. In addition, the saturated thickness of the perched aquifer appears to generally decrease in a southward direction. It is unknown if this thinning of saturation is caused by artificial recharge at the eastern part of the site caused by the Licensee's wildlife ponds, or to an overall limited vertical recharge at the land surface. Recent groundwater geochemical and isotopic studies by Hurst and Solomon (Hurst 2008) indicate the perched aquifer at the site is recharge limited. The groundwater mound caused by the Licensee's wildlife ponds in the eastern margin part of the site also demonstrates that a hydraulic connection exists between the land surface and the perched aquifer. To provide an improved understanding of the physical extent of the perched aquifer, its hydraulic connection to nearby surface water seeps and springs, and better estimate groundwater flow directions and travel times to downgradient discharge points, a new requirement has been added to the Groundwater Discharge Permit (Part I.H.10) as further described below.

The information provided by the Licensee indicates that similar observations have been noted in studies performed for the DOE's disposal site at Slick Rock, Colorado site, where the Dakota Sandstone, Burro Canyon Formation, and upper claystone of the Brushy Basin Member were not considered aquifers due to their low permeabilities, discontinuous natures, and limited thicknesses. The Executive Secretary agrees with this finding as it pertains to the Brushy Basin Member in that it provides a basal hydrogeologic no-flow boundary for the perched aquifer. However, while the two other overlying formations may have a low yield, this condition does not negate the need to protect groundwater quality there, in that no limitation for yield is provided in the definition of an aquifer under the Utah Ground Water Quality Protection Regulations (UAC R317-6-1.1). Further, it is also important to consider the arid nature of the mill site area, and the potential that nearby surface water sources may be hydraulically connected to the perched aquifer. Potential uses of said surface water sources, including wildlife and recreation, need to be considered. This information will also be helpful as the Licensee and Executive Secretary further determine long-term solutions for both the chloroform and nitrate groundwater contaminant plumes known to exist at the mill site property.

The Licensee's information also indicates that insufficient data are available to define the groundwater flow direction in the deep confined aquifer found in the Entrada / Navajo sandstone in the vicinity of the mill. However, because the Morrison and Summerville Formations form

greater than a 1,000-foot-thick, low-permeability barrier to vertical ground water flow separating the Entrada / Navajo Aquifer from the Burro Canyon perched zone, it is considered unlikely that constituents potentially released from the tailings disposal cells would ever impact water quality of this deep aquifer.

The Licensee provided updated information on surface water and groundwater quality and chemical characteristics for potentially impacted surface waters and groundwater out to at least a 1-mile radius from the site. The information was provided in Sections 1.5.2 through 1.5.5 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which is currently under Division review.

The Licensee has stated that “no significant changes are expected to occur in the surface water or groundwater use within a 5-mile radius of the mill site.” Surface water flows in the vicinity of the mill site are intermittent, fed only by storm water runoff and seasonal snow melt. Several springs, located in the canyon walls east and west of the mill site provide very small, seasonal contributions to surface water flows. The Licensee indicates that only Ruin Spring, located over two miles southwest of the mill site provides enough water to support wildlife and cattle grazing. The Division does not concur with the Licensee’s conclusion, in that other seeps west of the mill site also convey small, seasonal amounts of surface water flow. The Division’s requirement (added to the Permit as Part I.H.10) that the Licensee conduct an additional hydrogeologic and field investigation of the seeps west of the mill site and of Ruin Spring to further verify the relationship of groundwater flow in the perched water zone and these seeps and the spring, is intended to help resolve this issue. Prior to mill construction, several small surface water holding ponds were constructed in the vicinity of the Mill site to trap surface water flows to support cattle grazing. Since the construction of Recapture Reservoir in the 1980's, cattle grazing is now supported by stock watering tanks fed from water piped from Recapture Reservoir, and the land use has shifted from dry land farming and grazing to irrigated crops.

The Licensee provided information on groundwater resources in the vicinity of the mill site (from the shallow perched aquifer zone) in Sections 7.1 through 7.3 of DUSA 2008a, and the deeper confined Entrada / Navajo Aquifer is described in section 7.4 of DUSA 2008a. Within a 5-mile radius of the Mill site, groundwater appropriations from the shallow perched zone are mostly to the north of the mill site. Additional information on the shallow perched zone is included in the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), currently under Division review. The Licensee controls the land approximately 1.6 miles to the north of the mill. Therefore, no additional shallow wells can be drilled beyond that area. The location of the existing wells is upgradient of the mill site so they would not be impacted by mill operations. State and Federal agencies own the land to the west of the Mill. Therefore it is “highly unlikely that a residential development or single family homes would be constructed on land adjacent to the Mill property. Even if that were to occur, it is highly likely that domestic water would be supplied by the City of Blanding distribution system, which now extends past the municipal airport on the southern edge of the city.”

The Licensee provided information in DUSA 2010a to indicate that the community of White Mesa is the only known use of groundwater within a 5-mile radius to the south of the Mill site. The community of White Mesa draws domestic water from two deep wells drilled into the Entrada / Navajo Aquifer. The deep wells are located about 2 miles southeast of the Licensee's



southern property boundary, and just under five miles southeast of tailings Cell 4A, and supply all the needed water for domestic use. It is possible that a third well can be drilled if the White Mesa community population were to grow and require water in addition to what can be produced by the two deep wells. The White Mesa community wells are deep wells that have a thick interval of intervening low-permeability (Brush Basin Member and other formations) materials separating the perched water zone from the deep underlying aquifers. Another possible scenario, although not financially attractive, would be that the community could pay to extend the pipeline supplying domestic water from the City of Blanding distribution system.

The Licensee also has five deep wells drilled into the Entrada / Navajo Aquifer, located north, east and south of the mill facilities. Under the requirements of the Part I.H.3 of the existing Ground Water Quality Discharge Permit (hereafter Permit, UDRC 2010b), the Licensee is to evaluate and determine the physical integrity of the casing and annular casing seal in water supply well WW-2. In the event that hydraulic isolation of the perched aquifer and Entrada / Navajo Aquifer is uncertain or unsubstantiated for any reason, the Licensee is required to repair the well casing and annular seal to provide well construction that complies with applicable regulations or to abandon the well. This effort is being made as a means to protect groundwater quality conditions in the deep confined aquifer.

In DUSA 2010a, the Licensee provided additional information pertaining to the issue of projected future changes in surface water or groundwater use within five miles of the White Mesa mill site. The 5-mile radius is an acceptable distance for providing such information. The flow of surface water in the vicinity of the mill site is intermittent and fed by storm water runoff and seasonal snow melt. The majority of the shallow perched zone groundwater appropriations, within a 5-mile radius of the mill site, are to the north of the mill site. The Licensee currently controls the land approximately 1.2 miles to the north of the mill, so no additional shallow wells supplying culinary water for residential use can be drilled within that area.

**FINDING:**

The Division will require the Licensee to submit an updated, final Reclamation Plan, and revised Specifications for Reclamation, and any appropriate supporting analyses and calculations, as part of an ongoing License Renewal process. The Division will review the updated Reclamation Plan to ensure that it presents an assessment of any impact on waterways and groundwater resulting from proposed activities at the White Mesa Mill Facility, including final reclamation activities at the site. In addition, a new requirement (Part I.H.10) has been added to the forthcoming Permit modification to require the Licensee to conduct an additional hydrogeologic and field investigation in the area to the west of the Cell 4B footprint area, extending to, and including existing seeps (e.g. Cottonwood Seep and Westwater Seep) and Ruin Spring located west and southwest of the tailings management cells, and submission by the Licensee for approval by the Division of a report describing results of that hydrogeologic investigation prior to placing Cell 4B into service. The investigation will be conducted to further delineate the relationship of the (geologic) contact between the Brushy Basin and the Burro Canyon formations, and flow in the perched water zone downgradient of the mill site, to these seeps and Ruin Spring. The geologic contact surface could exert control on local groundwater flow directions in the perched zone, and location of potential points of exposure of the public to possible groundwater contamination.

Part I.H.10 of the Permit will also require that the Licensee determine the estimated travel time to the nearest perched water zone discharge location that potentially could receive contamination from the tailings management cells area, including Cell 4B.

The required changes to the Permit and the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R317-6-6.3 will yet be satisfied by complying with the Permit conditions prior to placing Cell 4B into service.

## **UAC R313-24-3C: ENVIRONMENTAL ANALYSIS - ALTERNATIVES**

### **REGULATORY BASIS:**

#### UAC R313-24-3:

- (1) *Each new license application, renewal, or major amendment shall contain an environmental report describing the proposed action, a statement of its purposes, and the environment affected. The environmental report shall present a discussion of the following: ... (c) Consideration of alternatives, including alternative sites and engineering methods, to the activities to be conducted pursuant to the license or amendment; and*

### **SAFETY EVALUATION:**

It is appropriate not to address alternatives to the site or milling process, since the mill is already licensed, constructed, and operating, and has been for more than 25 years. It is also appropriate not to address engineering alternatives to the design of the proposed Cell 4B, since the Licensee incorporates the same general design features for Cell 4B that the Division has already reviewed and approved for Cell 4A (URS 2009).

Cost estimates for decommissioning and stabilization of Cell 4B will be provided once the Licensee submits an As-Built Report for Cell 4B (see Permit, Part I.H.9), and a revised Reclamation Plan (see License Condition 9.11). The Division has reviewed the final engineering design and specifications for Cell 4B and intends to approve such through issuance of a modified Groundwater Quality Discharge Permit (see Permit, Part I.D.12). To ensure that the State's interests are adequately protected, conditions will be included in the forthcoming License amendment to require submission and approval of cost estimates and financial assurances related to Cell 4B prior to placing Cell 4B into service (see License Condition 9.5).

Discussion of cost estimates for closure and decommissioning of facility components other than Cell 4B is beyond the scope of this review.

The Licensee is responding to Division directives to address and resolve the chloroform groundwater contamination issues that predated, or are related to initial operation of the milling facility. It is the intent of the Division to require the Licensee to include an allowance for costs for the chloroform groundwater remediation during the review process for the 2010 annual surety report. Further, this new cost allowance will also be re-evaluated annually hereafter.

### **FINDING:**

With the exception of information that the Licensee must yet submit and that the Division will review and to ensure that it satisfies applicable requirements, the information submitted by the Licensee in the Cell 4B ER and related documents appears to satisfy the requirements of UAC R313-24-3(1)(c).



Information yet to be submitted, reviewed, and approved include, but are not limited to: a Cell 4B As-built Report, results of infiltration and transport modeling to justify a final cover design (see Permit, Part I.H.2), revised final cover system design information, and a revised Reclamation Plan and Specifications for Reclamation (see License Condition 9.11). To ensure that the State's interests are adequately protected, new conditions are included in the forthcoming License and Permit to require submission and approval of such information related to Cell 4B prior to placing Cell 4B into service.

## UAC R313-24-3D: ENVIRONMENTAL ANALYSIS - LONG-TERM IMPACTS

### REGULATORY BASIS:

#### UAC R313-24-3:

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

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

### SAFETY EVALUATION:

Currently, the Mill has a reclamation plan for tailings Cells 1, 2, and 3 (IUC 2000) that was approved by NRC on July 21, 2000 and judged to meet all applicable regulatory criteria, including those identified above. In a letter to the Executive Secretary, the Licensee submitted revised figures to the Reclamation Plan relating to Cell 4A (DUSA 2008b). The Executive Secretary approved these amendments prior to Cell 4A being authorized for re-use (UDRC 2008c).

The Licensee has provided engineering design and specifications for the liner and leak detection systems proposed beneath Cell 4B (see Geosyntec 2007, Geosyntec 2009, DUSA 2009d and DUSA 2009f). Review of these plans and reports has been conducted by the URS Corporation (URS) on behalf of the Executive Secretary; and findings thereof found in a November 5, 2009 URS memorandum (URS 2009). Based on this review, the Executive Secretary has determined:

- 1) The Cell 4B liners and leak detection system design is adequate to control and contain tailings wastes and wastewaters in the near-term,
- 2) The leak detection system proposed for Cell 4B will provide rapid reporting of any leakage to allow detection thereof before release to underlying groundwater resources,
- 3) Existing and soon to be installed groundwater monitoring wells near Cell 4B will detect any leakage releases before contamination has an opportunity to leave DUSA property, and
- 4) The long-term containment of tailings and wastewaters at Cell 4B can be addressed under a future Reclamation Plan, yet to be submitted by the Licensee, and approved by the Executive Secretary (before Cell 4B is put into service), pursuant to new License Condition 9.11. As a part of the Cell 4B application process, and in response to a Division interrogatory, the Licensee provided a November 24, 2009 Reclamation Plan submittal (DUSA 2009b), in part as an update to Revision 3.0 of the Reclamation Plan (IUC 2000), and to reflect current conditions at the site. This was necessary since the Revision 3.0 largely reflects site conditions when it was last approved by NRC in 2000.

However, the November 24, 2009 Reclamation Plan did not include cover design information for Cell 4B. Instead it provided, among other things, information on closure of Cells 1, 2, 3, and 4A. As a result, while the November 24, 2009 Reclamation Plan is an improvement over the existing reclamation plan previously approved by the Division for Cell 4A in August, 2008 (UDRC 2008c), additional information, specific to Cell 4B, is required by the Division to incorporate cover design requirements for Cell 4B that are similar to those already approved for Cell 4A (i.e., Revision 3.1 of the Reclamation Plan).

The Licensee indicated (DUSA 2010a, p. 11) that “The principal revisions and updates to the Plan that are incorporated into Rev 4.0 (the November 24, 2009 Reclamation Plan submittal) include:

- The addition of approved provisions relating to the Cell 1 Tailings Disposal Area;
- The addition of approved provisions relating to Cell 4A as an operating tailings cell, including the updates to the Plan conveyed by the Licensee’s letter of July 25, 2008;
- Updates to plans and figures, as applicable, to reflect current conditions;
- Administrative changes to reflect transfer of primary regulatory authority over the Mill site from NRC to the Division and the change in the name of the Licensee from International Uranium (USA) Corporation;
- Administrative changes in the nature of "clean-up" for internal consistency of the document;
- Updates to various information, including the following:
  - Updated climate data;
  - Updated archaeological status for the site;
  - Updated sections relating to surface water, groundwater, site hydrogeology, seeps and springs etc. to reflect new information about the site since 2000;
  - Other various updates to environmental information; and
  - Updated disclosure relating to current monitoring programs, particularly describing new groundwater and DMT monitoring requirements at the site since 2000.”

In addition to the Cell 4B Reclamation Plan required under License Condition 9.11, the Division is in the process of reviewing the 2007 License Renewal Application (DUSA 2007a and 2007b), which includes the November 24, 2009 Reclamation Plan (DUSA 2009b). In this process, the Executive Secretary will confirm that all of the foregoing requirements have been adequately addressed. This review may result in additional future changes to the Cell 4B Reclamation Plan required by License Condition 9.11.

The Licensee is also preparing an infiltration and contaminant transport model of the final tailings cover system (the "Infiltration Study") to demonstrate the long-term ability of the cover to protect nearby groundwater quality (see Permit, Part I.H.2). When this study is complete and

approved, the Executive Secretary will review the current Reclamation Plan and determine if future changes to the cover system are needed to ensure compliance with the performance criteria contained in Parts I.D.13 and I.D.12 of the Permit. If it is determined that changes are needed, the Reclamation Plan will be revised to incorporate any such changes. Being that the details have not been finalized at this time, the approved 2000 cover design and basis (Revision 3.0) continue to be referenced in the November 24, 2009 Reclamation Plan submittal.

To protect the State's interests, the Division will not authorize Cell 4B to operate until an updated financial surety is in place for completing final reclamation of the Mill Facility and for conducting post-closure care of the site. A new condition has been added to the License (see License Condition 9.11) to require that an updated Reclamation Plan, and revised Specifications for Reclamation, be submitted to the Executive Secretary for review and approval prior to placement of tailings and wastewater in Cell 4B. The revised Reclamation Plan required by Condition 9.11 requires that information on final cover design and final stormwater control systems be provided, together with estimated costs to complete final closure of the Mill Facility, including the costs for constructing the final closure cover and drainage systems associated with Cell 4B. The revised surety would then be based on that revised, approved plan. If, at the time of commencement of operation of Cell 4B, the Executive Secretary has approved amendments to the November 24, 2009 Reclamation Plan submittal, either as a result of the 2007 License Renewal Application review process or as a result of the Infiltration Study, then such amendments would also apply to Cell 4B and the revised surety. Any changes to the Reclamation Plan made after operations of Cell 4B begin, either through the 2007 License Renewal Application review process, the Infiltration Study, or otherwise, will apply to all tailings cells, and the surety will be revised at that time to reflect any such amendments.

Refer also to evaluation under UAC R317-6-6.3: Ground Water Discharge Permit Application, as stated below.

**FINDING:**

The Division will incorporate a new License condition to ensure that the requirements of UAC R313-24-3(1)(d) are satisfied and that Licensee submits the promised revisions to the cover design, the Reclamation Plan, and the Specifications for Reclamation to incorporate Cell 4B, and the appropriate required supporting analyses and calculations, and that the Division will review and approve these submittals before Cell 4B is placed into service.

## **10CFR40.26(C)(2): GENERAL LICENSE**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The system of conducting inspections, submitting reports, and retaining documents used at the mill is set out in the mill's original License Application and in subsequent renewal applications. The most recently approved License renewal application was submitted to NRC in August, 1991 and was approved by NRC in March 1997, at which time NRC renewed the License for 10 years, with an expiration date of March 31, 2007.

The Licensee submitted License Renewal Application in February 2007 (DUSA 2007b), thereby placing the License into timely renewal. Section 6.3 of the 2007 License Renewal Application describes the mill's systems relating to Management Controls, the ALARA Program, Training and Security, and refers to a number of Standard Operating Procedures, such as the mill's Environmental Protection Manual, Radiation Protection Manual and ALARA Program that are appended to the 2007 License Renewal Application and which further detail the mill's systems of inspections, reporting and retaining documents.

The Executive Secretary is currently reviewing the 2007 License Renewal Application through which the Executive Secretary will determine whether the administrative systems listed above continue to satisfy all regulatory requirements. Those matters apply to the mill generally and the mill's tailings system as a whole, not to Cell 4B alone, and are therefore more appropriately part of the License Renewal review process rather than the review process for Cell 4B.

NRC evidenced its approval of all such systems through the renewal of the License in 1997, with an expiration date of March 31, 2007. License Condition 9.3 of the mill's renewed NRC Source Material License states:

*“The licensee shall conduct operations in accordance with statements, representations, and conditions contained in the license renewal application submitted by letter dated August 23, 1991, as revised by submittals dated January 13, and April 7, 1992, November 22, 1994, July 27, 1995, December 13, and December 31, 1996, and January*

*30, 1997, which are hereby incorporated by reference, and for the Standby Trust Agreement, dated April 29, 1997, except where superseded by license conditions below.”*

License Condition 9.3 currently contains similar language.

The Licensee has implemented an extensive environmental monitoring and reporting system, including the conducting and documenting daily inspections of tailings and waste retention systems. The Licensee’s program requires the Executive Secretary immediately to be notified of any failure in a tailings or waste retention system that results in a release of tailings or waste into unrestricted areas (refer to Section 2.3 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b, currently under Division review), Part I.G.3 of the Permit, and the mill’s Emergency Response Plan). Documentation of daily inspections is retained for at least three years after each inspection is documented.

These monitoring, inspection, and record keeping requirements will apply to Cell 4B upon completion of construction and start of operations.

**FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40.26(c)(2), as they involve Cell 4B.

## **10CFR40.31(H): APPLICATION FOR SPECIFIC LICENSES**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The original application for the License and each renewal, including the 2007 License Renewal Application submitted to and currently being by the Division, contain written specifications relating to milling operations and the disposition of the resulting byproduct material to achieve the requirements and objectives set forth in Appendix A of 10 CFR Part 40. Each such application has demonstrated how the requirements and objectives set forth in Appendix A of 10 CFR Part 40 have been addressed. Issuance of the License in 1980 and renewals in 1985 and 1997 by NRC attest to the fact that such requirements have been satisfied.

Refer also to the evaluation under 10CFR40.26(C)(2): General License (refer to pages 16 and 17, above).

The written mill specifications relating to milling operations and the disposition of the resulting byproduct material prepared to achieve the requirements and objectives set forth in Appendix A of 10 CFR Part 40 are contained in Sections 4.0 and 5.0 of the 2007 License Renewal Application and in Sections 3.0 and 4.0 of the 1992 License Renewal Application. NRC approval of those specifications is evidenced by License Condition 9.3 of the License. Those specifications are currently being reviewed by the Executive Secretary as part of the 2007 License Renewal Application review process.

### **FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents demonstrate that the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40.31(h) have been satisfied, as they involve Cell 4B.



## **10CFR40.61: RECORDS**

### **REGULATORY BASIS:**

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

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

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

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

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

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

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

### **SAFETY EVALUATION:**

The mill has been operating since 1980 subject to and in compliance with the requirements of 10 CFR 40.61. The construction and operation of Cell 4B will not affect the application of these existing requirements to the mill, which requirements will continue to be met. Records of Cell 4B construction, tailings and wastewater placement, and other operational activities conducted in Cell 4B will be maintained in accordance with requirements specified in the Ground Water Discharge Permit. Commitments the Licensee has previously made in licensing actions by the NRC and the Division, when applied to the construction and operation of Cell 4B, will satisfy applicable requirements.

Refer also to the evaluation under 10CFR40.26(C)(2): General License (refer to pages 16 and 17, above).



Direct requirements of the applicable regulations, such as the time period for which records must be retained, apply to the entire mill facility, and need not be repeated or reflected in the Cell 4B procedures.

**FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40.61, as they involve Cell 4B.

## **10CFR40.65(A)(1): EFFLUENT MONITORING REPORTING REQUIREMENTS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The Licensee has implemented an environmental monitoring and reporting system, including semi-annually documenting liquid and gaseous effluents from the facility. The requirements for this monitoring program are mandated under existing License Condition 11.2.

Refer also to the evaluation under 10CFR40.26(C)(2): General License (refer to pages 16 and 17, above).

### **FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40.65(a)(1), as they involve Cell 4B.

## **10CFR40 INTRODUCTION: CAPACITY OF TAILINGS OR WASTE SYSTEMS OVER THE LIFETIME OF MILL OPERATIONS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

While proposed Cell 4B has not yet been constructed, it was contemplated, described, and assessed in the original License application to the NRC, being a critical component of the facility design and evaluated as part of the FES (NRC 1979). Initial environmental analyses and the License contemplated six tailings cells that would contain approximately 11 million tons of tailings solids, which would be the tailings resulting from 15 years of mill operations at full capacity (see Section 3.2.4.7 of NRC 1979 and Section 3.4 in both Appendices H and I of D&M 1978). These are evaporation pond Cell 1-I (now referred to as Cell 1), a second evaporation pond (Cell I-E), which has not been constructed, and a series of 80-acre cells, including Cells 2, 3, 4, and 5 (see Figure 3.4 of NRC, 1978). To date, Cells 2 and 3 (80 acres each) and half of Cell 4 (Cell 4A, 40 acres) have been constructed. Construction of Cell 4B (area of floor and interior slopes of Cell 4B will encompass approximately 40 acres) will consume the second 40 acres of the previously authorized 80 acre Cell 4 footprint, but will not exceed the total footprint contemplated in the original License application. Cell 4B would have a maximum capacity of about 1.9 million cubic yards of tailings material storage (as measured below the required 3-foot freeboard).

### **FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40. Appendix A, Introduction, as they involve Cell 4B.

## **10CFR40 APPENDIX A, INTRODUCTION: ALTERNATIVE REQUIREMENTS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

Proposed Cell 4B has been designed and will be constructed and operated in accordance with all applicable regulations, permits and licenses. Beyond the more specific requirements and Permit / License conditions imposed by the State of Utah, the Licensee has proposed no alternatives to the specific requirements in 10 CFR Part 40, Appendix A in the design, construction, or operation of Cell 4B.

### **FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40, Appendix A, Introduction, as they involve Cell 4B.

## **10CFR40 APPENDIX A, CRITERION 1: PERMANENT ISOLATION WITHOUT ONGOING MAINTENANCE**

### **REGULATORY BASIS:**

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

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

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

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

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

### **SAFETY EVALUATION:**

The NRC has evaluated and accepted the natural site at which the White Mesa facility is located in its review of the original License application. The initial NRC evaluation, as well as evaluations of subsequent License renewal applications, have involved consideration of all tailings management (impoundment) areas, including the area of proposed Cell 4B. Thus, suitability of the existing site is beyond the appropriate scope of this evaluation. Because of the climatic conditions at the mill site, potential surface water inflows are typically very small and easily diverted and managed by engineering design, without massive diversion structures.

Notwithstanding the above, during review of the License renewal application the Executive Secretary will require the Licensee to examine certain other criteria related to isolation of the tailings, including engineering design of the final cover system and final drainage systems for final reclamation of the tailings management cells, including Cell 4B, and to prepare and submit a final Reclamation Plan, together with associated final Specifications for Reclamation, for the Mill Facility. Elements addressed in the final Reclamation Plan will include, but not be limited to, the following:

- The ability of the cover system to respond without damage to whatever settlement and differential settlement may occur following construction of the cover;
- Stability against intermixing of cover layers with different size gradations;
- Protection provided to clay layers, if applicable, from freeze-thaw damage and desiccation;
- Protection provided against wind and surface water erosion;
- Protection of the radon barrier against biointrusion by deep-rooted plants and burrowing animals; and
- The Division will review the final design of drainage systems included for the final reclamation of the tailings management cells, including Cell 4B, as provided in the final Reclamation Plan that the Division will require the Licensee to submit, to assess design features for transitioning to, and conforming with, the natural surrounding landscape. The cover design will also provide for reduction of all perimeter slopes of the final cover closed tailings management cells to 5h:1v, or less, to minimize the potential for active management and repair of the slopes to be required.

The Licensee is currently operating Cell 4A under the Cell 4A BAT Monitoring, Operations and Maintenance Plan (UDRC 2008a). That Plan describes the acceptable operational methods for discharge into the cell of tailing solids and solution from pre-determined locations around the perimeter of the cell. The final tailings elevation will be less than the top of the flexible membrane liner (FML). Once the tailings solids reach the prescribed elevation, they will be contoured to final grades and the dewatering process will begin, concurrently with placement of the initial platform fill. Due to the proposed approval of Cell 4B, certain changes are needed in the existing BAT Monitoring, Operations and Maintenance Plan. These are mandated by the Permit, and will be approved prior to final approval for use of Cell 4B and prior to receiving liquids and tailings.

Installation of the final reclamation cap will be in accordance with the final Reclamation Plan approved at the time of cell closure. Currently the November 24, 2009 Reclamation Plan submittal (DUSA 2009b) is under Division review and is part of the License Renewal Application. That final Reclamation Plan, once approved, is intended to prepare the facility so that it can be transferred to DOE for perpetual care and maintenance. DOE's perpetual care and maintenance will be funded by the Licensee's Long Term Care fund.

With respect to Cell 4B, prior to placement of the approved cover, free water will be evaporated or pumped from the cell and the tailings will be graded to ensure that the final tailings elevations and contours are according to the approved design. The initial layer of the reclamation cap, or platform fill, will be installed over the contoured tailings. This activity may take place in increments as distinct portions of the cell are filled. The purposes of the platform fill are to

minimize the amount of radon emanating from the tailings sands; to minimize the potential for windblown tailings; and to place overburden material to create a surcharge on the placed tailings to aid in dewatering of the tailings.

Once free water has been evaporated or pumped from Cell 4B, the slimes drain system will be actively pumped to remove as much solution as possible from the tailings sands and slimes. Dewatering of the tailings will allow the material to consolidate, reducing potential differential settlement after final cover placement, and reducing the potential for liquefaction of the tailings during possible seismic events. The slimes drain design and dewatering modeling is presented in the Revised Cell 4B Design Report, Appendix D (DUSA 2009a). Based on these calculations, DUSA predicted that approximately 5.5 years of de-watering operations at Cell 4B will provide a steady-state condition of 1 foot of leachate over the cell's flexible membrane liner at the time of closure. All these factors will help to ensure that the final cover installation is maintenance free once the site is turned over to DOE for long term surveillance and monitoring.

The geotechnical stability of the tailings impoundment, slope stability, liquefaction potential and settlement are addressed in Appendix D of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which is currently under Division review. The liquefaction potential of the tailings solids was evaluated in Attachment E to the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which is currently under Division review. Any additional evaluations relating to embankment stability will be presented in the updated, final Reclamation Plan once it is prepared and submitted for review under the License Renewal Application process. The Division will review any such additional evaluations to confirm that these evaluations satisfy applicable requirements. If necessary, the Division will also impose additional License conditions to ensure that all requirements applicable to Cell 4B are satisfied as part of its final closure.

**FINDING:**

As described above, the Division will require the Licensee to submit a final Reclamation Plan, and revised Specifications for Reclamation, with appropriate required supporting analyses and calculations, as part of the License Renewal Application process.

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, in combination with the proposed License condition indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 1 will yet be satisfied prior to placing Cell 4B into service.

## **10CFR40, APPENDIX A, CRITERION 2: PROLIFERATION**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The mill's tailings management system has been designed as a large permanent waste disposal site, which can help to reduce proliferation of small sites on a national level, and thereby reduce perpetual surveillance obligations for the Federal government. This includes DUSA acceptance for permanent disposal, byproduct material from in situ leach (ISL) operations from outside of Utah that are licensed by the NRC or a corresponding Agreement State. License Condition 10.5 permits the mill to dispose of such ISL byproduct material, subject to specified conditions. Such disposal has historically and is currently done at the White Mesa mill.

License Condition 10.5.E requires the Licensee to submit for Executive Secretary approval a revised written Standard Operating Procedure (SOP) for ISL disposal on or before December 1, 2010. The revised SOP shall describe the documentation required for ISL disposal, which is to include several items.

### **FINDING:**

The revised SOP to be submitted by the Licensee as required by License Condition 10.5.E. is to include several items, mentioned below, that will protect tailings cell liners from damage, as well as increase the compaction and organization of the ISL material disposal areas.

- A. These items are specified to include that the ISL material disposal area must be located on a tailings beach area of the disposal cell or on an area of the cell that is underlain by tailings sands;
- B. The elevation of the material disposal area will not exceed the plane or grade of the elevations of the uppermost flexible membrane liner of the tailings cell; ISL byproduct material will be segregated from any mill material and equipment and other ISL byproduct material sources;
- C. Absence of void space inside barrels disposed, including physical verification before disposal; and



- D. Detailed engineering drawings which demonstrate there is at least 4 feet of tailings sands under the bottom of each disposal area; and the bottom of each disposal area is located at least 12 feet from the sides or dikes of the tailings cell.

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40, Appendix A, Criterion 2, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 3: PLACEMENT BELOW GRADE**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The first stage construction of the Mill's Tailings Management System, consisting of Cell 1 (originally designated Cell 1-I), Cell 2, and the Cell 2 Safety Dike (Cell 3 Dike) was authorized by NRC License Amendment 1, to SUA-1358, on October 12, 1979. The authorization referred to design documents, questions and responses during the review of the design. A copy of the License Amendment was included in Attachment D to DUSA 2010a.

Construction of the embankments and liner systems for the Initial Phase and Second Phase (including Cell 1, Cell 2, Cell 3, and the Cell 4 dike) was authorized by NRC License Amendment 10, to SUA-1358, on February 10, 1982. The authorization referred to design documents, questions and responses during the review of the design, and was essentially a revision to the earlier construction authorization of the first stage construction. A copy of that License amendment is included in Attachment D to DUSA 2010a.

Construction and operation of Cell 4A was authorized by NRC License Amendment 20, to SUA-1358, on March 1, 1990. The authorization referred to design documents, questions and responses during the review of the design, and was essentially a revision to the earlier construction authorization of the first stage construction. The authorization also set maximum solution elevations for Cell 1, Cell 3 and Cell 4A. A copy of that License amendment is included in Attachment D to UDSA 2010a.

Cell 4B will be excavated and constructed in a manner similar to that used for existing Cells 1, 2, 3 and 4A. It is anticipated that some blasting will be required in order to construct Cell 4B. Existing cells are partially below grade because of constraints imposed by the natural topography and bedrock conditions at the site. All tailings cells at the site are situated in a natural swale, thanks to the presence of minor natural north-south ridges that were located immediately west and east of the tailings cell locations. During construction, the tailings cells have been and will be excavated to the top of and partially within bedrock. This results in the north and east dikes of the cells being at or near surface grade. The southern dike of the southern-most cells (Cells 4A and 4B) has and will have an above-grade dike. Similarly, the western dike of Cell 4B will be partially above grade.

Geologic and topographic conditions make full below grade burial impracticable for two reasons. First, bedrock is sufficiently near the surface that blasting, at excessive cost, would be required to fully excavate a cell. Second, because of the natural topography that grades to the southwest, surface grade burial at the southwest corners of the cells would require much deeper sub-grade burial at the northeast corners. Previously, the NRC determined that more suitable alternative sites are not available. However, the size and steepness of the slopes associated with the exposed embankments of existing cells are, and Cell 4B will be, limited by excavation to the maximum extent reasonably achievable or appropriate depth given the geologic and hydrologic conditions at the site. As required by 10 CFR Part 40, Appendix A, Criterion 6, the cells, including Cell 4B have been designed to provide reasonable assurance that radiological hazards will be suitably controlled for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years.

**FINDING:**

The information submitted by the Licensee in the Cell 4B ER and related documents satisfies the requirements of UAC R313-24-4 that invokes the requirements of 10CFR40, Appendix A, Criterion 3, as they involve Cell 4B.

## 10CFR40, APPENDIX A, CRITERION 4: LOCATION AND DESIGN REQUIREMENTS

### REGULATORY BASIS:

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

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

*(b) Topographic features should provide good wind protection.*

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

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

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

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

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

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

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

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

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

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

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

## **SAFETY EVALUATION:**

In its initial licensing process and subsequent License renewal reviews, the NRC has reviewed and accepted site characteristics, including upstream rainfall catchment area, wind protection, and proximity to capable faults.

**Seismic Hazards** - DUSA provided a Technical Memorandum (Tetra Tech 2010) presenting an updated seismic hazard evaluation study that includes: (1) a summary of seismic studies done through 2006 to develop a design peak ground acceleration (PGA) for the design of disposal cells and for use during the operational period of those cells; (2) a review of updated data (through January 2010) on seismic activity within 200 miles of the White Mesa mill site; and (3) derivation of an updated predicted peak Horizontal Ground Acceleration (Peak HGA) value, based on a 10,000-year return period, for use in the final disposal closure design effort for proposed Cell 4B. The study addressed updated published information, including the most recent USGS National Seismic Hazard Maps. The study also considered other studies, including 2008 Deaggregation data, Next Generation Attenuation (2007) Project information, and consideration of the attenuation relationship of Campbell and Bozorgnia (2007).

Results of the study indicated that Peak HGA value of 0.15 g is appropriate for use in evaluating the stability of structures proposed in the final closure design of site facilities, including Cell 4B. The study concluded that, for a pseudo-static analysis, a value of 2/3 the Peak HGA, or 0.1 g, is appropriate, which is consistent with International Building Code (IBC) guidelines (IBC 2006), and with guidance contained in DOE 1989. The value of 0.1 g is consistent with the value of

design acceleration used in previous stability analyses done for the site. The Division has reviewed and found this updated seismic study to be acceptable.

**Cover System Slopes** - All slopes on the reclaimed mill site and tailings are 5h:1v or less (gentler). As one of several conditions in the Permit (Part I.H.2), an infiltration analysis of the tailings cover and re-design of the cover for better performance is in progress for all disposal cells at the site. It is anticipated that the final revised cover design will address surface water management issues and other design improvements associated with the addition of Cell 4B.

To ensure that the State's interests are adequately protected with regards to Cell 4B, as stated in License Condition 9.11, the Division will require submission and approval of a revised, final Reclamation Plan and revised Specifications for Reclamation (Attachment A to the Reclamation Plan) that include the final cover design selected for implementation at the White Mesa Mill site, including Cell 4B, and required supporting analyses. The revised Plan and revised Specifications for Reclamation are to be submitted and receive Executive Secretary approval before disposal of any tailings in Cell 4B.

**Cover Material Properties** - Physical properties of the construction materials and the stability of the Cells 1, 2, 3, and 4A impoundments are discussed in the November 24, 2009 Reclamation Plan recently submitted by the Licensee and currently under separate review by the Division. Physical properties and stability issues for Cell 4B will be addressed by the revised Reclamation Plan required under License Condition 9.11. Potential alternative cover designs for all the disposal cells are currently being reviewed by the Division for the facility in conjunction with the Division's review of an Infiltration and Contaminant Transport Study (see Permit, Part I.H.2). It is possible that a future acceptable alternative design could reduce the quantity, or eliminate most of the rip rap material needed for the final reclamation top slope.

The Licensee also provided information confirming that, based on the guidance contained in NUREG-1623, rock from the potential Brown Canyon Site borrow site would not be acceptable for use in areas of the White Mesa Site that the NRC would define as potentially "frequently saturated" areas. In terms of the cover design now found in the currently approved Reclamation Plan (Revision 3.0), this would include rock material for the base of the side slope areas of the tailings cells. If volume requirements necessitated the use of a second source, additional testing would need to be conducted on the Brown Canyon site. However, absent additional acceptable test results, the Brown Canyon site will be rejected by the Executive Secretary as a potential borrow source for rip rap in areas classified as "frequently saturated areas". As a result, the Brown Canyon rock material could potentially be used in other areas not classified as "frequently saturated areas". The revised cover design currently being evaluated under Part I.H.2 of the Permit, may reduce the amount of rip rap material required, and therefore reduce the volumes required from each of the designated source areas.

With regards to Cell 4B, it is assumed that the cover material will be specified in a similar fashion as was already approved by the NRC in the Licensee's Reclamation Plan, Rev. 3.0 (IUC 2000); under the assumption that the final cover system will be of a rock-armored design, similar to that found in Attachment H of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b). Said Attachment H presents the investigation and testing details for three potential borrow sources for the rip rap material needed for the final reclamation cap. The Brown Canyon site was found to be the least preferable of the sites, and also happens to be the second least



accessible of the sites. For the cost estimate included as Attachment C to the November 24, 2009 Reclamation Plan submittal (DUSA 20090b), the North Pit was assumed. The original basis for looking at several potential sites in the area was to ensure that sufficient quantities would be available for the top surface as well as the side slopes and toe aprons.

Material characteristics of tailings material and cover soils proposed for use at the site are described in D&M, 1978 and in Rev. 3.0, (IUC 2000) of the Reclamation Plan. Surface water management, erosion protection design, and tailings cell cover design are described in Attachment A and Attachment G of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b). Analysis of freeze-thaw cycles on the radon barrier are included in the 1978 ER, and the Reclamation Plan, Rev. 3.0 (IUC 2000). It is assumed that these characteristics are still included in the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), and will be further evaluated as part of the License Renewal process.

Identification of, and characteristics and performance of, materials to be used in the final cover system design for the tailings management cells that include Cell 4B will be addressed when the revised Reclamation Plan Revision 3.2, is submitted pursuant to License Condition 9.11. Additional updates and possible changes to the cover system design may occur during Division review of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b). As described above, the Division will require submission and approval of a revised Reclamation Plan, and Revised Specifications for Reclamation, that include the final cover design selected for implementation at the White Mesa Mill site, including Cell 4B, and supporting analyses.

**Settlement / Movement Monitoring** - Settlement monitors will be installed over areas of tailings that have reached the final design grade for disposal cells 1, 2, 3, and 4A, as described in the November 24, 2009 Reclamation Plan submittal (2009b). The vertical movement of these monitors is evaluated during the placement of the initial platform fill and the dewatering of the disposal cell. Final cover will be placed following dewatering of the placed tailings platform fill, reducing the potential for differential settlement and cracking of the radon barrier. Settlement due to earthquake-induced liquefaction of the tailings solids and the potential impact on the cell cover is discussed in Attachment E to the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), currently under Division review as a part of License renewal process. Additionally, as described above, the Division will require submission and approval of a revised Reclamation Plan, and Revised Specifications for Reclamation, that include the final cover design selected for implementation at the White Mesa Mill site, including Cell 4B. The November 24, 2009 Reclamation Plan submittal (DUSA 2009b) will be reviewed by the Executive Secretary as part of the ongoing License Renewal process.

Further, the Division will incorporate new License conditions (Condition 11.7 and 11.8) requiring the Licensee to submit, for Division approval, written Settlement Monitoring and Movement (Displacement) Monitoring Standard Operating Procedures for monitoring vertical settlement in the tailings management cell cover systems and monitoring potential vertical and horizontal movements in the constructed dike portions of the tailings management cells, as further described below.

**FINDING:**

As described above, on a separate track the Division has added a new license condition (License Condition 9.11) to ensure that before Cell 4B is put into service that an adequate cover design, and updated Reclamation Plan (Revision 3.2) and updated Specifications for Reclamation are provided and approved by the Executive Secretary. Further, at some future time, and as part of an ongoing License Renewal process this Reclamation Plan may be amended. .

The Division will require submission and approval of a Revision 3.2 of the Reclamation Plan and revised Specifications for Reclamation that include information on final cover design and final drainage system design to support updating of the cost estimate for completing reclamation activities at the White Mesa Mill site, including incorporating cover design requirements for Cell 4B that are similar to those already approved for Cell 4A (i.e., Revision 3.1 of the Reclamation Plan). This revised Plan and revised Specifications for Reclamation are to be submitted and receive Executive Secretary approval before disposal of any tailings in Cell 4B.

Additional License Condition 11.7 has been added to require the Licensee to submit, for Executive Secretary approval, a written Settlement Monitoring Standard Operating Procedure (SOP) that describes methods for monitoring vertical settlement in the tailings management cell cover systems. A new License Condition 11.8 has been added to require the Licensee to submit for review and approval a second SOP for monitoring potential vertical and horizontal movements in the constructed dike portions of the tailings management cells. The purpose for both of the SOPs is to record and document cover system and dike settlement and displacement monitoring data and comparing such data to previous data to track potential movement and settlement.

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, in combination with the proposed License Conditions, and with the requirement by the Division that the Licensee submit a revised, final Reclamation Plan, and Revised Specifications for Reclamation for Executive Secretary approval, indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 4 will yet be satisfied prior to placing Cell 4B into service.



## **10CFR40, APPENDIX A, CRITERION 5A(1): GROUND-WATER PROTECTION STANDARDS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

As detailed in the Cell 4B Design Report (DUSA 2009a), Cell 4B has been designed with two synthetic liners, a leak detection layer, and geosynthetic clay liner system, using Best Available Technology ("BAT"), that will prevent or minimize migration of wastes out of Cell 4B to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including closure period) of the cell. Further, Cell 4B has been designed to be closed with the liner system left in place. As a result, the liner system will be constructed of materials that can prevent or minimize wastes from migrating into the liner during the active life of the facility. It is the intent of the Division to approve the liner system proposed for Cell 4B, based on recent recommendations of the URS Corporation (URS 2009).

The design approach for the liner system to be incorporated into Cell 4B is identical to that used to design the liner system for Cell 4A, previously approved by the Division (UDRC 2008b). Final construction of Cell 4B will be documented by DUSA in a report that will be submitted for Executive Secretary review and approval before Cell 4B is put into service (see Permit, Part I.H.9).

Refer also to the evaluation under Appendix A, Criterion 3: Placement Below Grade, (refer to pages 29 and 30 above).

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 5A(1) have been met.

## **10CFR40, APPENDIX A, CRITERION 5A(2): LINER**

### **REGULATORY BASIS:**

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

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

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

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

### **SAFETY EVALUATION:**

On September 17, 2008, after submittal of an As-Built Report, the Executive Secretary authorized the use of the relined Tailings Cell 4A. The relining was completed in accordance with the previously approved Cell 4A Lining System Design Report. A copy of the approval was included in Attachment D of the Licensee’s responses to Round 2 interrogatories.

Cell 4B has also been designed to utilize current BAT, as approved by the Executive Secretary (URS 2009). This means that Cell 4B will be constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces); physical contact with the waste or leachate to which they are exposed; climatic conditions; the stress of installation; and the stress of daily operation.

Further, the Cell 4B liner system will be placed upon a foundation or base capable of supporting the liner and resisting pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift.

Finally, the Cell 4B liner system will cover all surrounding earth likely to be in contact with the wastes or leachate.

The Cell 4B liner system will be virtually identical to the Cell 4A liner system, which has previously been reviewed and approved by the Executive Secretary (URS 2009). The physical, chemical and radiological nature of the tailings to be disposed of in Cell 4B will not be significantly different from the tailings to be disposed of in Cell 4A.

**FINDING:**

The information contained in the proposed engineering design and construction specifications, and the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 5A(2) have been met.

## **10CFR40, APPENDIX A, CRITERION 5A(4): PREVENT OVERTOPPING**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

On September 17, 2008, the Executive Secretary authorized the use of the relined Tailings Cell 4A. The relining was completed in accordance with the previously approved Cell 4A Lining System Design Report. A copy of the approval is included in Attachment D. The approval also included the Cell 4A Best Available Technology, Operations and Maintenance Plan which included a calculation for measuring the acceptable freeboard. A minimum freeboard of 3.0 feet is specified based on State of Utah regulation, and the Plan also includes a provision for an annual re-calculation of the Cell 4A freeboard based on area and elevation of tailings sands.

Freeboard limits for Cell 1 and Cell 3 (Cell 2 is currently full and does not have a pond area) were initially set on the basis of the 1990 UMETCO Minerals Drainage Report, and approved by NRC License Amendment 20, to SUA-1358, on March 1, 1990. The authorization referred to design documents, questions and responses during the review of the design. The authorization also set maximum solution elevations for Cell 1, Cell 3 and Cell 4A. The maximum elevations for Cell 3 and Cell 4A were later modified by the Executive Secretary, by interim variance, to take into account changes in available storage volumes. See the letter dated October 9, 2008 from the Licensee to the Executive Secretary, and the Executive Secretary's response of November 20, 2008. Copies of those letters are attached as Attachment F to the Licensee's responses to Round 2 interrogatories.

Parts I.D.2 and I.D.6 of the Permit provide that under no circumstances shall the freeboard be less than 3 feet in tailings cells 1, 3, and 4A. Likewise Part I.D.13 of the proposed Permit mandates an equal freeboard requirement for Cell 4B. Cell 2 is filled with tailings solids, has an interim cover, and does not contain a pool area. In addition, freeboard limits have been calculated with an adequate level of protection against overtopping resulting from normal or abnormal operations, overfilling, wind and wave actions, rainfall, run-on, malfunctions of level controllers, alarms, and other equipment and from human error. Freeboard limits are set out in License Condition 10.3 and in the Cell 4A BAT, Monitoring, Operations and Maintenance Plan.

License Condition 10.3.C prohibits the Licensee from discharging of any surface water, stormwater or wastewater from Cells 3, 4A, and 4B other than through an Executive Secretary authorized spillway structure. Currently, the approved Cell 4B design has no spillway for release of such water from that impoundment to nearby adjoining native grades and elevations. Consequently, Cell 4B is designed to retain all surface and stormwater contributions from all

contributing upgradient locations. The restrictions in License Conditions 10.3.A and C do not apply to solutions that are pumped from time to time from one cell to another for operational purposes or to manage freeboard requirements.

Further, Part I.D.3(c) of the Ground Water Discharge Permit provides that upon closure of any tailings cell, the Permittee shall ensure that the maximum elevation of the tailings waste solids does not exceed the top of the flexible membrane liner in the cell.

A letter dated August 7, 2009 from the Licensee to the Division, also addresses questions relating to the Design Report and presents cell capacity calculations for Cell 4B as they relate to the freeboard requirement for Cell 4B (DUSA 2009d).

**FINDING:**

The Division has modified the License to reference Cell 4B in License Condition 10.3. That License Condition has also been modified to require that the discharge of any surface water, stormwater, or wastewater from Cells 3, 4A, and 4B shall only be through an Executive Secretary authorized spillway structure. This condition is designed to ensure that all surface water / stormwater runoff that drains to areas occupied by Cells 3, 4A, and 4B, and all process waters associated with the operation of Cells 3, 4A, and 4B, be contained within these three cells without overtopping, unless, in the future, if construction of a new cell were to be authorized, discharge from Cell 4B to that cell would be approved to occur, but only through an Executive Secretary-authorized spillway structure. This condition behooves the Licensee take action to assure that water does not overtop the specified tailings cell dikes, by constructing diversion channels or other means, such as pumping between cells, as needed.

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, in combination with the modified License condition, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 5(A4) will yet be satisfied prior to placing Cell 4B into service.

## **10CFR40, APPENDIX A, CRITERION 5A(5): DIKES**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

Refer to 10CFR40.26(C)(2)-02: General License. All dikes used to form Cell 4B have been designed and will be maintained and monitored to verify that they maintain sufficient structural integrity to prevent massive failure of the dikes. Division review has found the engineering design and construction specifications for Cell 4B to be acceptable (URS 2009). Through issuance of this SER, the proposed License and Permit, and related public participation, the Division intends on approving the Cell 4B design.

In a related effort, the Licensee is currently in preparation of an infiltration and transport modeling report under the requirements of Part I.H.2 of the Permit. Division review of this future report may result in additional changes to the cover system design for all tailings cells at the site.

### **FINDING:**

The Division has incorporated a new License condition (Condition 11.8) to require that the Licensee submit a Movement (Displacement) Monitoring Standard Operating Procedure (SOP) by December 1, 2010, for Executive Secretary review and approval, to describe methods for monitoring the dikes for movement and submittal of monitoring results to the Division. This change to the License combined with information contained in the Cell 4B Environmental Report and other relevant documents the Licensee has submitted, indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 5A(5) will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 6(1): COVER AND CLOSURE AT END OF MILLING OPERATIONS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The Division will require that the Licensee submit an updated Reclamation Plan, and Revised Specifications for Reclamation (required by new License Condition 9.11) providing information demonstrating that an adequate Reclamation Plan and adequate financial surety are in place before it grants permission for the Licensee to use Cell 4B in support of operations. In a parallel, but related effort, the Licensee is in the process of preparing an infiltration and transport modeling report under the requirements of Part I.H.2 of the Permit. Division review of this future report may result in changes / refinements to the final cover system design for all tailings cells at the site.

Refer also to the evaluation under UAC R313-24-3D: Environmental Analysis - Long-Term Impacts (refer to pages 13 through 15 above).

### **FINDING:**

The Division will require that the Licensee submit an updated Reclamation Plan, and Revised Specifications for Reclamation, for Cell 4B, and receive Executive Secretary approval before Cell 4B is placed into service. This requirement in License Condition 9.11, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, and with the requirement by the Division that the Licensee subsequently submit a revised, final Reclamation Plan and Revised Specifications for Reclamation that describes the final cover design selected for implementation at the Mill

Facility, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 6(1) will yet be satisfied, prior to placing Cell 4B into service.



## **10CFR40, APPENDIX A, CRITERION 6(2): VERIFY EFFECTIVENESS OF FINAL RADON BARRIER**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

As discussed in Section 2.4.1 of the DUSA December 23, 2009 Response to Interrogatories on the Cell 4B ER, in the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), the Licensee presents a plan for reclamation of the site, as it exists today, prior to the construction of Cell 4B. The Reclamation Plan will be further revised to incorporate the addition of Cell 4B prior to acceptance and authorization for use of Cell 4B by the Division, see proposed License Condition 9.11. Additional future changes to the Reclamation Plan may be made after Division review and approval of an infiltration and transport study (the "Infiltration Study") of the tailings cover and re-design of the cover for better performance, which is currently in progress.

The current tailings cover design proposed by the Licensee, and included as Appendix D to the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), is currently under Division review. This version of the Plan includes an analysis of radon attenuation characteristics of the cover, which appears to be designed to satisfy all radon emission standards. Section 3.3.2.1 of said Reclamation Plan describes the modeling that was performed to demonstrate that the current tailings cover design at Cells 1, 2, 3, and 4A will meet these regulatory criteria. At some future date, the Executive Secretary will complete review of the November 24, 2009 Reclamation Plan as a part of the License Renewal Application process. In this process it will be the burden of both the Licensee and the Executive Secretary to determine if any changes to cover system design and/or construction specifications satisfy all radon emission standards.

As required by UAC R313-24-4 [10 CFR Part 40, Appendix A, Criterion 6(2)], as soon as reasonably achievable after emplacement of the final cover over Cell 4B, and prior to placement of erosion protection barriers or other features necessary for long-term control of the tailings, DUSA will verify through appropriate testing and analysis that the design and construction of the final radon barrier is effective in limiting releases of radon-222 to a level not exceeding 20 pCi/m<sup>2</sup>s, averaged over the entire pile or impoundment using the procedures described in 40 CFR Part 61, Appendix B, Method 115, or another method of verification approved by the

Executive Secretary as being at least as effective in demonstrating the effectiveness of the final radon barrier.

**FINDING:**

The Division will require the Licensee to submit an updated Reclamation Plan, and Revised Specifications for Reclamation for Cell 4B, and receive approval thereof before Cell 4B is placed into service. Other changes to the Reclamation Plan may be made after Division review of the November 24, 2009 submittal, as a part of the License renewal process. Ultimately, the requirement to report the effectiveness of the radon barrier can only be satisfied once it is constructed and its effectiveness measured, which is not at question in this amendment request for construction of Cell 4B.

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, in combination with the above requirement, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 4 will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 6(3): PHASED EMPLACEMENT OF FINAL RADON BARRIER**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The Licensee provided information that the final reclamation of the tailings cells is planned as a phased approach. The timing of placement of the final cover over the platform fill is based on the physical condition of the tailings cell and management's decision on overall long range mill operations and economics. Final Cell 4B cover design will be evaluated as a part of the revised Reclamation Plan required by proposed License Condition 9.11.

The Licensee also stated that per 40 CFR Part 192 the EPA requires that a "uranium tailings cover be designed to produce reasonable assurance that the radon-222 release rate would not exceed 20 pCi/m<sup>2</sup>/sec for a period of 1,000 years to the extent reasonably achievable and in any case for at least 200 years when averaged over the disposal area over at least a one year period" (NRC, 1989). NRC regulations presented in 10CFR Part 40 (incorporated by reference into UAC R313-24-4) also restrict radon flux to less than 20 pCi/m<sup>2</sup>/sec.

The Licensee also provided a description of the modeling that was performed to demonstrate that the current tailings cover design will meet these regulatory criteria as described in Section 3.3.2.1 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which is currently under Division review. Section 3.3.2.2 of said Reclamation Plan also sets out actual radon flux measurements through the temporary cover for Cells 2 and 3 from 2004 through 2008. Radon flux rates over those years have all been lower than the regulatory standard, based solely on the interim random fill cover that has been placed over portions of those cells. Despite these promising recent radon measurements, it is unknown if the soil and moisture characteristics found in the existing Cell 2 and 3 temporary cover will be representative of long-term performance of the final cover system.

The Licensee also stated that a revised cover design for the Mill's tailings cells is currently being developed. The Licensee indicated that the revised cover design evaluation will include a demonstration that the revised cover design will also satisfy the regulatory radon emission standards for the facility.

The Licensee has indicated that when the maximum amount of tailings has been placed in Cell 4B, all the free water will be evaporated or pumped from the cell and the tailings will be graded

to ensure that the final tailings elevations and contours conform to the approved design. The initial layer of the reclamation cap, the platform fill, will be installed over the contoured tailings. This activity may take place in increments as distinct portions of the cell are filled, and therefore may take several years to be fully complete, depending on the mill's operating schedule.

If the mill were operated at full capacity, the Licensee has indicated that Cell 4B could be filled in 3 to 3.5 years. Realistically the Cell 4B operational period will be somewhat longer, as a portion of the tailings from mill operations will also be placed in Cell 4A. The active cells will be operated to maximize evaporation potential, while also bringing partial areas of a cell up to final grade as rapidly as possible in order to reduce radon emanation by placing the platform fill as soon as possible. The purposes of the platform fill are to minimize the amount of radon emanating from the tailings; to minimize the potential for windblown tailings, and to place a surcharge on the tailings to aid in dewatering. As platform fill is placed, settlement monitors will be installed to record the consolidation and settlement of the tailings. A Standard Operating Procedure (SOP) for this work is now required under new License Condition 11.7, which will need to be submitted to the Executive Secretary on or before December 1, 2010.

The Licensee stated that once the cell is filled and the free water has been evaporated or pumped from the cell, and the platform fill has been placed over the entire area, the slimes drain system will be actively pumped to remove as much solution as possible from the tailings sands and slimes. Dewatering of the tailings will allow the tailings sands and slimes to consolidate, reducing the potential differential settlement after final cover placement, and reducing the potential for liquefaction of the tailings during possible seismic events. The slimes drain design and dewatering modeling is presented in the Revised Design Report, Appendix D (DUSA 2009a).

Based on calculations provided by the Licensee, the time required to dewater Tailings Cell 4B, once the slimes drain pumping has started, and maintain a steady-state maximum head of 1.0 feet in the tailings (as measured from the lowest point of upper flexible membrane liner) is about 5.5 years or less. Once the satisfactory degree of dewatering has been achieved and the settlement monitors are showing little or no consolidation, the final layers of the reclamation cap can be placed. The Licensee has indicated that placement of the final layers of cap material should take less than one year.

**FINDING:**

The Division will incorporate a new license condition (Condition 9.11) to ensure that the existing Reclamation Plan (Revision 3.0) is revised to incorporate cover design requirements for Cell 4B that are similar to those already approved for Cell 4A. This revision will be named as Revision 3.2. As a part of the on-going License Renewal Application review process, the Division will examine the November 24, 2009 Reclamation Plan submittal (DUSA 2009b) to determine if it is adequate. If additional requirements are found to be necessary, the final Reclamation Plan may be modified at a future date. This requirement, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained

10CFR40, Appendix A, Criterion 6(3) have been met or will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 6(4): REPORT RADON BARRIER EFFECTIVENESS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

As required by UAC R313-24-4 [10 CFR Part 40, Appendix A, Criterion 6(4)], within ninety days of the completion of all testing and analysis relevant to the required verification in paragraphs (2) and (3) of 10 CFR Part 40, Appendix A, Criterion 6, the Licensee will report to the Executive Secretary the results detailing the actions taken to verify that levels of radon-222 released from the closed embankment do not exceed 20 pCi/m<sup>2</sup>s when averaged over the entire pile or impoundment. The Licensee will maintain records until termination of the License documenting the source of input parameters including the results of all measurements on which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine compliance. These records will be kept in a form suitable for transfer to the custodial agency at the time of transfer of the site to the DOE or the State for long-term care, if requested.

### **FINDING:**

The Division will require that the Licensee submit an updated Reclamation Plan, and Revised Specifications for Reclamation (License Condition 9.11), and that this plan be approved by the Division before Cell 4B is placed into service. The information contained in the Cell 4B Environmental Report and other relevant documents the Licensee has submitted indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 6(4) will yet be satisfied, as they involve Cell 4B. The requirement to report the effectiveness of the radon barrier will need to be satisfied once it is constructed and its effectiveness measured. The Division will review the revised, final Reclamation Plan for Cell 4B to ensure that the information needed to satisfy UAC R313-24-4, which invokes the requirement from 10CFR40, Appendix A, Criterion 6(4), is included and is appropriate and complete. Reasonable assurances have been provided in previous analyses that effective radon barriers can be constructed and

commitments made to report the measured effectiveness of such a barrier. Nothing done or left undone at this stage of the Cell 4B life cycle will preclude satisfying this requirement.

## **10CFR40, APPENDIX A, CRITERION 6(5): ELEVATED RADIUM CONCENTRATIONS IN COVER MATERIALS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The Licensee indicated that the construction of Cell 4B will generate approximately 680,000 cubic yards of soil and clay, and 790,000 cubic yards of rock. Cell 4B reclamation requirements are estimated to be 410,000 cubic yards of soil and rock, 68,000 cubic yards of clay, and 35,000 cubic yards of rip rap (DUSA 2009c). The Licensee also stated (DUSA 2009c) that the required amount of cover materials for Cell 4B can easily be met from material generated during construction or from off site locations. This conclusion is reasonable, given the amount of property that is currently controlled by the Licensee that is not located outside of the tailings management cells area.

The Licensee also provided information that all cover materials are native soils and rock generated from the construction of the tailings cells or from off-site borrow locations. The Licensee also stated that radium concentration of the cover materials will be at naturally-occurring levels, and are, by definition, at background levels. These earthen materials will have background concentrations of radium due to the fact that they will have been excavated from natural sources on site. Stockpiles of these on-site stored materials will be surveyed for possible contamination from any windblown or other contamination from ongoing mill operations on site. Any found contamination would be removed and disposed of in the tailings cells prior to use for the cover system (per Section 3.2.3 the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), currently under Division review. Due to these precautions, radium concentrations of earthen materials planned to be used in constructing the Cell 4B cover system will not exceed background levels for the vicinity of the mill.

### **FINDING**

The Division will require the Licensee to submit an updated Reclamation Plan, and Revised Specifications for Reclamation for Cell 4B, for approval by the Executive Secretary before Cell 4B is placed into service. Other changes to the Reclamation Plan, and the associated Specifications for Reclamation, may come about as part of an ongoing License Renewal process.

This requirement, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of



UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 6(5) will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 6(6): CONCENTRATIONS OF RADIONUCLIDES OTHER THAN RADIUM IN SOIL**

### **REGULATORY BASIS:**

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

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

### **SAFETY EVALUATION:**

The equivalent non-radium soil concentration requirements are set out in Section 3.2.3.2 of Revision 3.0 of the Reclamation Plan (IUC, 2000), in Sections 3.2 and 3.3 of Attachment A thereto, in Section 3.2.3.2 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), and Sections 3.2 and 3.3 of Attachment A thereto. NRC approved Revision 3.0 of the Reclamation Plan on July 21, 2000. This version was later revised by the Division in August, 2008 during approval of Cell 4A (UDRC 2008c), and it is currently in force. The November 24, 2009 Reclamation Plan (DUSA 2009b) is currently under Division review.

Section 3.3.3 of Attachment A to the November 24, 2009 Reclamation Plan submittal requires and describes how all areas contaminated through process activities or windblown contamination from the tailings areas will be remediated to meet applicable cleanup criteria for Ra-226, Th-230 and natural uranium. Section 3.3.3 further provides that contaminated areas will be remediated such that the residual radionuclides remaining on the site, that are distinguishable from background, will not result in a dose that is greater than that which would result from the radium

soil standard, as required by UAC R313-24-4 [10 CFR Part 40, Appendix A, Criterion 6(6)]. The procedures to be followed in taking the required surveys, including final surveys within specific 10-m by 10-m grids, are set out in Sections 3.3.3, 3.3.4, and 3.3.5 of Attachment A to the November 24, 2009 Reclamation Plan submittal.

As provided in the November 24, 2009 Reclamation Plan submittal, at the time of site closure, the Licensee will determine the potential peak annual total effective dose equivalent ("TEDE") within 1,000 years to the average member of the critical group that would result from applying the radium standard (not including radon) on the site. This determination will be documented and submitted to the Executive Secretary for approval, as required by UAC R313-24-4 [10 CFR Part 40, Appendix A, Criterion 6(6)].

These final site closure standards and procedures do not currently apply directly to tailings contained within any of the tailings management (impoundment) cells, which will be capped in place, including proposed Cell 4B. Instead they will apply to all areas impacted by the tailings cells at the time of site closure, including Cell 4B.

**FINDING:**

The Division will require the Licensee to submit an updated Reclamation Plan, and Revised Specifications for Reclamation for Cell 4B (License Condition 9.11), which will require Executive Secretary approval prior to placing Cell 4B into service. Appropriate and required supporting analyses and calculations may be required of the Licensee as part of an ongoing License Renewal Application review process. Any improvements to the Reclamation Plan, determined by the Executive Secretary, in the future, will be required during the License Renewal process. Said changes needed to the Reclamation Plan will be submitted for Executive Secretary approval thereafter.

This requirement, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 6(6) will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 6(7): NONRADIOLOGICAL HAZARDS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

The liner system for proposed Cell 4B is virtually identical to the liner system for Cell 4A, which has previously been approved by the Executive Secretary (UDRC 2008b), and which has been designed to hold tailings generated during mill operations during the operational life of Cell 4B, including all nonradiological constituents. In the event of failure in the liner system, a leak detection system is provided in the Cell 4B design. Further, nearby groundwater monitoring wells will be present to detect any potential leakage including three new required groundwater monitoring wells (see the evaluation under “10CFR40, Appendix A, Criterion 7: Preoperational and Operational Monitoring” section below. As a result, the Ground Water Discharge Permit addresses the radiological and nonradiological hazards associated with the mill tailings to be disposed of in the tailings cells, including proposed Cell 4B.

No nonradiological emissions of any significance from the tailings cells are expected when the cells are in operation. Following closure, additional isolation of the tailings should further reduce nonradiological emissions.

### **FINDING:**

The information contained in the Cell 4B engineering design, Environmental Report and other relevant documents the Licensee has submitted, indicate that the requirements of UAC R313-24-4 that invokes the requirement 10CFR40, Appendix A, Criterion 6(7) will yet be met, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 6A(1): COMPLETION OF FINAL RADON BARRIER**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

Refer to the evaluation under 10CFR40, Appendix A, Criterion 6(3): Phased Emplacement of Final Radon Barrier, refer pages 46 through 48, above.

### **FINDING:**

The Division will require the Licensee to submit an updated Reclamation Plan, and Revised Specifications for Reclamation for Cell 4B, and secure approval thereof, before Cell 4B is put into service. Other required supporting analyses and calculations may be required by the Executive Secretary as part of the ongoing License Renewal Application process, as an outgrowth of the review of the November 24, 2009 Reclamation Plan (DUSA 2009b). This requirement, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 6A(1) will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 7: PREOPERATIONAL AND OPERATIONAL MONITORING PROGRAMS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

An extensive preoperational monitoring program was performed at the mill site prior to initial construction and licensing of the mill, in order to provide complete baseline data on the mill site and its environs, as required by 10 CFR Part 40, Appendix A, Criterion 7. The results of this preoperational monitoring program are described in detail in the 1978 ER (D&M, 1978) and the FES (NRC 1979).

Operational monitoring programs have been conducted at the mill throughout the construction and operating phases of the mill, to measure and evaluate compliance with applicable standards and regulations; to evaluate performance of control systems and procedures; to evaluate environmental impacts of operation; and to detect potential long-term effects. The mill's operational monitoring programs are described in Section 2.3 of the November 24, 2009 Reclamation Plan submittal (DUSA 2009b). Monitoring results are reported in the mill's Semi Annual Effluent Reports and Quarterly Groundwater Monitoring Reports and other reports filed with the Executive Secretary.

Baseline data for new groundwater monitoring wells that will be installed in connection with the construction of Cell 4B will be obtained over the first eight quarters after installation of the wells (proposed Permit, Part I.H.7). Because any such monitoring wells will likely be installed in one or more of the Cell 4B dikes, being the downgradient locations closest to the cell, it will not be possible to install and monitor such wells prior to construction of Cell 4B. However, Cell 4B will have a BAT and state-of-the-practice leak detection system that will be monitored regularly once the cell begins to be used to support operations. As a result, there is reasonable assurance that the groundwater at any newly installed wells will not have been impacted by Cell 4B operations during the eight-quarter baseline sampling period.

Preoperational environmental monitoring was described in Sections 2.5, 2.4 and 2.9 of the 1992 License Renewal Application. Evidence of NRC approval is contained in License Condition 9.3. In addition, the Division will include a new condition in the Permit, requiring that a minimum of three additional downgradient groundwater monitoring wells be installed in conjunction with the construction of Cell 4B. Two compliance monitoring wells (MW-33 and MW-34) will be

installed as described in new Permit condition I.H.6. A condition has also been added to the Permit to require that a plan for approval be submitted to the Executive Secretary for installation of the third compliance monitoring well (MW-35). After approval, the location of the third well (MW-35) will be determined after consideration of hydrogeologic information acquired through installation and development of wells MW-33 and MW-34 and other related field investigations (Permit Part I.H.6). The condition also requires that a monitoring well As-Built report for Wells MW-33 and MW-34, and for Well MW-35, be submitted within 45 calendar days of completing well installations to document said well construction for Executive Secretary approval (Permit Part I.H.6).

**FINDING:**

The Division will incorporate new Permit conditions (Permit Parts I.E.1(b)(3), I.H.6, and I.H.7) requiring that a minimum of three additional downgradient groundwater monitoring wells be installed, with two of these wells required to be installed prior to placement of tailings or wastewater in Tailings Cell 4B, and that within 45 calendar days of completing well installation, a monitoring well As-Built report be submitted for these two wells to document said well construction for Executive Secretary approval, and that a background groundwater quality report be submitted to the Division after completion of 8 quarters of sampling and analysis in these wells. The conditions will also require that a plan for installing the third new groundwater monitoring well be submitted to the Division before Cell 4B is placed into service. These Permit changes, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Licensee has submitted, indicate that the requirements of UAC R313-24-4 ,that invokes requirements contained in 10CFR40, Appendix A, Criterion 7, will yet be satisfied, by complying with the Permit conditions, as they involve Cell 4B.



## **10CFR40, APPENDIX A, CRITERION 8: EFFLUENT CONTROL DURING OPERATIONS**

### **REGULATORY BASIS:**

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

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

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

*apply, operators shall develop written operating procedures specifying the methods of control which will be utilized.*

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

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

### **SAFETY EVALUATION:**

This topic deals primarily with mill operations generally and the mill's tailings system as a whole and not specifically to Cell 4B. Refer to Section 5.0 of the 2007 License Renewal Application and Section 4.0 of the 1992 License Renewal Application for a description of the mill's emission and dust control procedures. Evidence of NRC approval of such procedures is contained in License Condition 9.3.

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 8 will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 8A: DAILY INSPECTIONS**

### **REGULATORY BASIS:**

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

### **SAFETY EVALUATION:**

Refer to the evaluation presented under 10CFR40.26(C)(2): General License, (refer to pages 16 and 17, above).

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 8A will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 9: FINANCIAL SURETY ARRANGEMENTS**

### **REGULATORY BASIS:**

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

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

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

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

*(a) Surety bonds;*

*(b) Cash deposits;*

*(c) Certificates of deposits;*

*(d) Deposits of government securities;*

*(e) Irrevocable letters or lines of credit; and*

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

## **SAFETY EVALUATION:**

As required by License Condition 9.5, the mill has deposited a surety bond with the Executive Secretary, consistent with UAC R313-24-4 (10 CFR Part 40, Appendix A, Criteria 9 and 10), adequate to cover the estimated costs, accomplished by a third party, for decommissioning and decontamination of the mill and mill site; reclamation of the mill's tailings or waste disposal areas; and the long-term surveillance fee.

The amount of the surety bond is currently \$15,807,429, was approved by the Executive Secretary on December 9, 2009, and represents site conditions without Cell 4B. Annual updates to the surety amount, required by UAC R313-24-4 (10 CFR Part 40, Appendix A, Criteria 9 and 10) are submitted for Executive Secretary for approval by March 4 of each year.

Prior to operation of Cell 4B, and after approval of the revised Reclamation Plan, the reclamation cost estimate will be updated to reflect the eventual closure of Cell 4B. Thereafter, the surety bond will be updated accordingly. The proposed License contains new requirements at Conditions 9.5 and 9.11 to this effect. Further, changes in Condition 9.5 now prohibit the Licensee from operating the facility without prior submittal of evidence of appropriate changes to the surety amount, and Executive Secretary approval thereof.

In addition, the current surety amount (\$15,807,429) does not include costs related to groundwater restoration that might be required at the time of closure. Given that a chloroform contaminant plume is now known to exist at the facility, and was caused by pre-construction and

initial site operations related to 11e.(2) tailings disposal, it is appropriate for the Licensee to include an allowance for chloroform groundwater remediation in the annual surety report to include any activities and costs needed to meet the Criterion 9 requirements, including:

*“... 1) decontamination and decommissioning of ... the milling site to levels which allow unrestricted use of these areas ...”* and

*“ ... The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs.”*

As a result, it is the intent of the Division to require the Licensee to include a cost allowance for chloroform groundwater remediation during the review process for the 2010 annual surety report.

Refer also to evaluation under UAC R313-24-3D: Environmental Analysis - Long-Term Impacts, as stated on Pages 13 through 15 above.

**FINDING:**

The Division will require, through a new License Condition (License Condition 9.11), that the Licensee submit a revised Reclamation Plan, and revised Specifications for Reclamation for Cell 4B, and obtain approval thereof, before Cell 4B is put into service. In addition, adequate information for determining financial surety requirements for all tailings management cells, including Cells 4A and 4B, and any new features or facilities that are constructed in conjunction with operation of Cells 4A and 4B will also be required. Said revised Reclamation Plan and Specifications and surety for Cell 4B shall be approved by Executive Secretary before disposal of any tailings or wastewater in Cell 4B. The updated Reclamation Plan will revise both the NRC- approved version of the Reclamation Plan (Revision 3.0) for Cells 1, 2, and 3, and the version approved by the Division in August, 2008, referred to as Revision 3.1 (see UDRC 2008c).

The new License Condition combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 9 will yet be satisfied, as they involve Cell 4B.

## **10CFR40, APPENDIX A, CRITERION 10: COSTS OF LONG-TERM SURVEILLANCE**

### **REGULATORY BASIS:**

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

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

### **SAFETY EVALUATION:**

The Long Term Surveillance Fund is specific to the entire site and is not designated for individual features of the site. There will be no increase in the calculated amount of the fund from the addition of Cell 4B.

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R313-24-4 that invokes the requirements contained in 10CFR40, Appendix A, Criterion 10 have been satisfied, as they involve Cell 4B.



### **UAC R317-6-6.3: GROUND WATER DISCHARGE PERMIT APPLICATION**

#### **REGULATORY BASIS:**

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

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

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

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

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

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

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

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

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

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

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

- 1. ground water monitoring to determine ground water flow direction and gradient, background quality at the site, and the quality of ground water at the compliance monitoring point;*
- 2. installation, use and maintenance of monitoring devices;*
- 3. description of the compliance monitoring area defined by the compliance monitoring points including the dimensions and hydrologic and geologic data used to determine the dimensions;*
- 4. monitoring of the vadose zone;*
- 5. measures to prevent ground water contamination after the cessation of operation, including post-operational monitoring;*
- 6. monitoring well construction and ground water sampling which conform where applicable to the Handbook of Suggested Practices for Design and Installation of Ground-Water Monitoring Wells (EPA/600/4-89/034, March 1991), ASTM Standards on Ground Water and Vadose Investigations (1996), Practical Guide for Ground Water Sampling EPA/600/2-85/104, (November 1985) and RCRA Ground Water Monitoring Technical Enforcement Guidance Document (1986), unless otherwise specified by the Executive Secretary;*
- 7. description and justification of parameters to be monitored;*
- 8. quality assurance and control provisions for monitoring data.*

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

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

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

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

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

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

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

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

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

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

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

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

*Q. Other information required by the Executive Secretary.*

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

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

## **SAFETY EVALUATION:**

As outlined above, ground water quality protection issues at uranium mills are managed by the Division under the authority of the Utah Ground Water Quality Protection Regulations (UAC R317-6) and the corresponding Permit. The original Permit was issued by the Division on March 8, 2005, and has been modified several times since; the most recent being January 20, 2010. During these Permit actions, the Permittee has submitted a substantial amount of additional hydrogeology and groundwater quality information, and additional requirements have been implemented at the facility. These actions have improved site performance standards for new construction and enhanced monitoring and reporting criteria. As a result, the Division believes improved measures are in place for protection of local groundwater quality. Despite these improvements, the Licensee was asked to provide additional geologic, hydrogeologic, and groundwater related information during review of the Cell 4B application. A brief discussion of that information follows.

The Licensee provided a Colorado Plateau geologic map and a map showing the geology of the Mill site and surrounding areas found in the November 24, 2009 Reclamation Plan submittal (DUSA 2009b) (Figures 1.6.1 and 1.6.2, respectively). A figure showing the generalized stratigraphy of the mill site was included as Figure 6 of the 2008 ER and Figure 1.5-1 of the November 24, 2009 Reclamation Plan submittal.

The Licensee provided a report, Site Hydrogeology and Estimation of Groundwater Travel Times in the Perched Zone White Mesa Uranium Mill Site Near Blanding, Utah, as Appendix B to the November 24, 2009 Reclamation Plan submittal (DUSA 2009b), which includes updated site information on site hydrology and hydrogeology.

In the Round 1 response, the Licensee assured that during the Cell 4B construction process that the existing groundwater compliance monitoring wells would be preserved, because each groundwater monitoring well at the mill site near Cell 4B would be protected by concrete bollards that surround the well. Each post is a four inch metal pipe filled with concrete that is sunk three feet into the ground and that protrudes three feet above the ground. Each post and the monitoring well casing is painted red for easy visual identification. The Licensee states that if a monitoring well is damaged, given the above protections, the Executive Secretary would be notified, and the well would be repaired in accordance with a plan that would be submitted to the Executive Secretary for approval and approved prior to commencement of repair.

The Licensee furnished well boring logs for wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-11, MW-12, MW-14, MW-15, MW-16, MW-17, MW-18, and MW-19, as Appendix A to the Hydrological Evaluation of White Mesa Uranium Mill, July 1994, prepared by Titan Environmental Corporation (the "1994 Titan Report").

The Licensee also provided lithologic and core logs for wells MW-3A, MW-23, MW-24, MW-25, MW-27, MW-28, MW-29, MW-30 and MW-31 as Appendix A to the Report: Perched Monitoring Well Installation and Testing at the White Mesa Uranium Mill April Through June 2005, August 3, 2005, prepared by Hydro Geo Chem, Inc.

Also provided by the Licensee are the lithologic and core logs for wells MW-20, MW-21 and MW-22 in a June 21, 2001 letter report from Hydro Geo Chem, Inc. (Hydro Geo Chem), which is attachment A to Denison's June 22, 2001 letter to the Executive Secretary in response to the Executive Secretary's request for additional site hydrology information. Lithologic and core logs for wells TW4-4 and TW4-5 are included in an October 4, 2000 report prepared by Hydro Geo Chem, which has previously been submitted to the Executive Secretary.

The Applicant included geologic cross sections depicting the three-dimensional configuration of the (geologic) contact between the Brushy Basin and the Burro Canyon formations representing the area beneath and downgradient of the Cell 4B footprint (DUSA 2010b). The cross sections depict the approximate configuration of the perched water zone in the cross sections. The Applicant has also provided boring logs for Boring #19, MW-3A, MW-16, and MW-23, along with angled subsurface boring logs for GH-94-1, GH-94-2A, and GH-94-3. The Applicant concluded that there was not sufficient data on the locations of, and angles of completion of, the angled borings to allow them to be precisely placed on a map and therefore these were not used in developing the cross sections.

In their response to Round 1 Interrogatories submitted relative to the Cell 4B Environmental Report (DUSA 2009c), the Licensee also provided a letter, dated November 10, 2009, from Hydro Geo Chem which indicated that the reported sub-horizontal, limonite-stained features interpreted in the 1978 ER (D&M, 1978) as bedding plane fractures may not be actual fractures but may represent structurally weaker zones along bedding planes that appear as partings in core samples.

Hydro Geo Chem concluded, in the above-referenced report, that examination of core samples collected during drilling of angle borings beneath tailings Cells 3 and 4A indicate that where fractures were present in cores, they were cemented with gypsum. They indicated that open fractures significant enough to impact groundwater movement in the perched zone were not identified in that investigation. Hydro Geo Chem also concluded that no fractures were reported in cores from MW-3A, MW-16, or MW-23, the existing wells adjacent to or at the location of proposed Cell 4B. Hydro Geo Chem concluded that this makes it even less likely that potentially undetected fractures could significantly affect subsurface fluid flow in the vicinity of proposed Cell 4B, and that, should the sub-horizontal features reported in the 1978 ER actually represent fractures, their sub-horizontal nature would prevent them from acting as vertical conduits from the tailing cell to the perched groundwater.

A Hydro Geo Chem letter report dated February 8, 2010 (an attachment to DUSA 2010a) also provided additional information recommending the installation of Cell 4B monitoring wells MW-33 and MW-34. These wells would be screened across the perched zone, and therefore, their installation would provide data to better define the apparent ridge-like feature identified in the top of the Brushy Basin, near MW-16. In meetings with the Division on February 18, 2010, the Applicant agreed to install three new wells, including a third monitoring well, MW-35, adjacent to the western edge of Cell 4B. The installation of MW-35 is intended to aid in further defining the potential groundwater migration patterns downgradient of proposed Cell 4B. The Division has decided this third well is required.

The Licensee also provided information stating the design of Cell 4B and Cell 4A will be similar and will be constructed with dual synthetic liners, a leak detection system between the synthetic liners and a geosynthetic clay liner beneath the lowest synthetic liner. This liner system will be overlain by a slimes drain system. The Licensee concluded that the cells are therefore designed without any present, and therefore, no assumed future potential, points of discharge for effluents or leachate from the cells.

#### **FINDING:**

The Division will incorporate a new Permit condition requiring that a minimum of three additional downgradient groundwater monitoring wells be installed near Cell 4B. Two of these new wells (MW-33 and MW-34) must be installed and approved prior to use of Cell 4B (see new Part I.H.6). The new Permit condition also requires that the Licensee submit a plan for installation of the third well (MW-35) prior to placement of tailings and wastewater in Cell 4B. For additional details see the Permit and attending Statement of Basis.

A condition will also be included in the forthcoming Permit to require the Licensee to conduct an additional hydrogeologic investigation in the area to the west of the Cell 4B footprint area,

extending to, and including existing seeps (e.g. Cottonwood Seep and Westwater Seep) and a spring (e.g. Ruin Spring) located west and southwest of the tailings management cells, and submission by the Licensee of a report describing results of those hydrogeologic investigations prior to placing Cell 4B into service (see new Part I.H.10). The investigation will be conducted to verify the relationship of the (geologic) contact between the Brushy Basin and the Burro Canyon formations to the seeps and springs. The Division believes this geologic contact may have significant impact on local groundwater flow directions, and location of potential points of exposure of the public to possible groundwater contamination.

The changes to the Permit, combined with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R317-6-6.3 will yet be satisfied, as they involve Cell 4B.



## **UAC R317-6-6.4: ISSUANCE OF DISCHARGE PERMIT**

### **REGULATORY BASIS:**

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

*“A. The Executive Secretary may issue a ground water discharge permit for a new facility if the Executive Secretary determines, after reviewing the information provided under R317-6-6.3, that:*

- 1. the applicant demonstrates that the applicable class TDS limits, ground water quality standards protection levels, and permit limits established under R317-6-6.4E will be met;*
- 2. the monitoring plan, sampling and reporting requirements are adequate to determine compliance with applicable requirements;*
- 3. the applicant is using best available technology to minimize the discharge of any pollutant; and*
- 4. there is no impairment of present and future beneficial uses of the ground water.”*

### **SAFETY EVALUATION:**

The Licensee provided information stating that the construction and operation of Cell 4B would not create any new issues of concern over and above those considered and accepted for existing licensed facilities at the mill. The physical, chemical and radiological make up of the tailings is not expected to be significantly different from that of existing tailings or from the assumptions in the previously issued Permit. Cell 4B will have a double liner/leak detection/slimes drain system similar to that of Cell 4A that is designed not to release tailings solutions to the environment and that the Division has already approved. The Licensee indicated that any releases at Cell 4B will be detected by the LDS and groundwater monitoring programs and remediated before there could be any impact on the public.

The Licensee also provided information in a Hydro Geo Chem letter dated February 12, 2010, discussing the inferred distribution of conglomeratic zones within the Dakota Formation, and their inferred vertical and aerial extent of the elevated portion of the contact surface of the Burro Canyon / Brushy Basin Formations on geologic cross sections that span the Cell 4B footprint area.

Refer also to the evaluation under UAC R317-6-6.3: Ground Water Discharge Permit Application, presented above.

### **FINDING:**

The Division believes that the proposed engineering design and construction specifications for Cell 4B, along with the proposed Permit changes to address operational monitoring /



maintenance, and groundwater monitoring satisfy the requirements of UAC R317-6-6.4(A). For additional information on these findings, please see the related Statement of Basis.

The Division will incorporate a new Permit condition requiring that a minimum of three additional downgradient groundwater monitoring wells be installed in conjunction with the construction of Cell 4B (see new Part I.H.6). For a further discussion of this provision, see R317-6-6.3, Ground Water Discharge Permit Application, above.

A new condition will also be included in the Permit to require the Licensee to conduct an additional hydrogeologic investigation in the area to the west of the Cell 4B footprint area, extending to, and including existing seeps (Cottonwood Seep and Westwater Seep) and a spring (Ruin Spring) located west and southwest of the tailings management cells, and submission by the Licensee of a report describing results of those hydrogeologic investigations prior to placing Cell 4B into service (see new Part I.H.10). The investigation will be conducted to verify the relationship of the (geologic) contact between the Brushy Basin and the Burro Canyon formations to the seeps and springs.

The changes to the Permit, in combination with the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that the requirements of UAC R317-6-6.4 will yet be satisfied, as they involve Cell 4B.

## **UAC R317-6-6.9: PERMIT COMPLIANCE MONITORING**

### **REGULATORY BASIS:**

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

#### *“A. Ground Water Monitoring*

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

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

#### *B. Performance Monitoring*

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

### **SAFETY EVALUATION:**

The Licensee has provided updated site information on site hydrology (HGCI 2009), a copy of which is included as Appendix B to the November 24, 2009 Reclamation Plan submittal (DUSA 2009b). The HGCI 2009 report provides information demonstrating that the proposed groundwater monitoring system, including the three new monitoring wells (MW-33, MW-34, and MW-35) proposed to be installed downgradient of Cell 4B, together with existing wells MW-14 and MW-15, and other downgradient monitoring wells, are sufficient in number, are properly located, and are properly designed to provide reasonable assurance of providing timely, reliable, and representative data for detecting potential future releases from the tailings management cells, including Cell 4B.

With regards to requirements for monitoring BAT performance, certain other changes have been made to the Permit to require revision of the existing Cell 4A Monitoring, Operations and Maintenance Plan to address needs for Cell 4B. Refer also to the evaluation under UAC R317-6-6.3: Ground Water Discharge Permit Application.

### **FINDING:**

The Division will incorporate a new Permit provision requiring that a minimum of three additional downgradient groundwater monitoring wells be installed in connection with the

construction and use of Cell 4B (see new Part I.H.6). For a further discussion of this provision, see R317-6-6.3, Ground Water Discharge Permit Application, above.

A condition will also be included in the forthcoming Permit modification to require the Licensee to conduct an additional hydrogeologic investigation in the area to the west of the Cell 4B footprint area, extending to, and including existing seeps (Cottonwood Seep and Westwater Seep) and a spring (Ruin Spring) located west and southwest of the tailings management cells, and submission by the Licensee of a report describing results of those hydrogeologic investigations prior to placing Cell 4B into service (see new Part I.H.10). The investigation will be conducted to verify the relationship of the (geologic) contact between the Brushy Basin and the Burro Canyon formations to the seeps and springs.

The changes to the Permit, in combination with the information contained in the Cell 4B Environmental Report and other relevant documents the Licensee has submitted, indicate that the requirements of UAC R317-6-6.9 will yet be satisfied, by complying with Permit conditions, as they involve Cell 4B.

## **UAC R317-6-6.10: BACKGROUND WATER QUALITY DETERMINATION**

### **REGULATORY BASIS:**

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

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

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

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

### **SAFETY EVALUATION:**

The Executive Secretary's determinations regarding background groundwater quality for the site are set out in the 2009 Statement of Basis (UDRC 2009), and is based on previous work by both DUSA and the URS Corporation. These background reports were also considered in light of ground water geochemical and isotopic sampling and analysis performed by the University of Utah Department of Geology and Geophysics (Hurst 2008). Those documents and other documents considered by the Executive Secretary in determining background groundwater quality at the site are listed in the References section of the September, 2009 Statement of Basis (UDRC 2009).

New groundwater monitoring wells required to be installed in conjunction with the construction and use of Cell 4B have yet to be installed; therefore, background ground water quality in these wells has yet to be determined by the Executive Secretary. New conditions (Parts I.H.6 and I.H.7) have been added to the Permit to require the installation of these three wells and require submittal of a background report after 8 quarters of sampling and analysis of these new wells.

### **FINDING:**

The new provisions included in the Permit, and the information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted, indicate that

the requirements of UAC R313-24-4 (that invokes UAC R317-6-6.10) will yet be satisfied, as they involve Cell 4B.

## **UAC R317-6-6.12: SUBMISSION OF DATA**

### **REGULATORY BASIS:**

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

#### *“A. Laboratory Analyses*

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

#### *B. Field Analyses*

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

#### *C. Periodic Submission of Monitoring Reports*

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

### **SAFETY EVALUATION:**

These requirements are met by the Ground Water Quality Assurance Plan required under Part I.E.1(a) of the Permit. This plan was originally submitted to the Division on May 19, 2005 and has been revised and approved several times since; with the most recent approved version, Revision 5.0, approved on February 23, 2010. Section I.F.1 of the Permittee’s Ground Water Discharge Permit requires that groundwater monitoring reports be submitted to the Executive Secretary quarterly and that such reports include field data sheets and laboratory results.

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 (that invokes UAC R317-6-6.12) will yet be met, as they involve Cell 4B.

## **UAC R317-6-6.13: REPORTING OF MECHANICAL PROBLEMS OR DISCHARGE SYSTEM FAILURES**

### **REGULATORY BASIS:**

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

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

### **SAFETY EVALUATION:**

The Permit requires such notices to be given in the event of failure to maintain discharge minimization technology ("DMT") or BAT standards required under the Permit (Part I.G.3) and if the facility is otherwise out of compliance (Part I.G.4 and Part II.1). The Permit has been revised to incorporate Cell 4B into this set of requirements.

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 (that invokes UAC R317-6-6.13) will yet be satisfied, as far they involve Cell 4B.



## **UAC R317-6-6.14: CORRECTION OF ADVERSE EFFECTS**

### **REGULATORY BASIS:**

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

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

*B. The permittee, operator, or owner may be required to take corrective action as described in R317-6-6.5 if a pollutant concentration has exceeded a permit limit.”*

### **SAFETY EVALUATION:**

Pmt I.G.4 of the Permit specifies the actions that must be taken by the Licensee / Permittee in the event of a violation of a condition of the Permit. The Permit has been revised to incorporate Cell 4B into this set of requirements.

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Licensee has submitted, indicate that the requirements of UAC R313-24-4 (that invokes UAC R317-6-6.14) will yet be satisfied, as they involve Cell 4B.

## UAC R317-6-6.16: OUT-OF-COMPLIANCE STATUS

### REGULATORY BASIS:

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

#### *“A. Accelerated Monitoring for Probable Out-of-Compliance Status*

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

- 1. Notify the Executive Secretary in writing within 30 days of receipt of data;*
- 2. Immediately initiate monthly sampling if the value exceeds both the background concentration of the pollutant by two standard deviations and an applicable permit limit, unless the Executive Secretary determines that other periodic sampling is appropriate, for a period of two months or until the compliance status of the facility can be determined.*

#### *B. Violation of Permit Limits*

*Out-of-compliance status exists when:*

- 1. The value for two consecutive samples from a compliance monitoring point exceeds:*
  - a. one or more permit limits; and*
  - b. the background concentration for that pollutant by two standard deviations (the standard deviation and background (mean) being calculated using values for the ground water pollutant at that compliance monitoring point) unless the existing permit limit was derived from the background pollutant concentration plus two standard deviations; or*
- 2. The concentration value of any pollutant in two or more consecutive samples is statistically significantly higher than the applicable permit limit. The statistical significance shall be determined using the statistical methods described in Statistical Methods for Evaluating Ground Water Monitoring Data from Hazardous Waste Facilities, Vol. 53, No. 196 of the Federal Register, Oct. 11, 1988 and supplemental guidance in Guidance For Data Quality Assessment (EPA/600/R-96/084 January 1998).*

#### *C. Failure to Maintain Best Available Technology Required by Permit*

##### *1. Permittee to Provide Information*

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

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

**SAFETY EVALUATION:**

The determination of when the mill is out of compliance and the procedures to be followed once the facility is so determined are set out in Part I.G of the Permit, which incorporates the requirements of UAC R317-6-6.16, and has since original issuance of the Permit in March, 2005. See also the evaluation under UAC R317-6-6.13: Reporting of Mechanical Problems or Discharge System Failures, above. The Permit has been revised to incorporate Cell 4B into this set of requirements.

**FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Applicant has submitted indicate that the requirements of UAC R313-24-4 (that invokes UAC R317-6-6.16) will yet be satisfied, as they involve Cell 4B.

## **UAC R317-6-6.17: PROCEDURE WHEN A FACILITY IS OUT-OF-COMPLIANCE**

### **REGULATORY BASIS:**

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

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

- 1. The permittee shall notify the Executive Secretary of the out of compliance status within 24 hours after detection of that status, followed by a written notice within 5 days of the detection.*
- 2. The permittee shall initiate monthly sampling, unless the Executive Secretary determines that other periodic sampling is appropriate, until the facility is brought into compliance.*
- 3. The permittee shall prepare and submit within 30 days to the Executive Secretary a plan and time schedule for assessment of the source, extent and potential dispersion of the contamination, and an evaluation of potential remedial action to restore and maintain ground water quality and insure that permit limits will not be exceeded at the compliance monitoring point and best available technology will be reestablished.*
- 4. The Executive Secretary may require immediate implementation of the contingency plan submitted with the original ground water discharge permit in order to regain and maintain compliance with the permit limit standards at the compliance monitoring point or to reestablish best available technology as defined in the permit.*
- 5. Where it is infeasible to re-establish BAT as defined in the permit, the permittee may propose an alternative BAT for approval by the Executive Secretary.”*

### **SAFETY EVALUATION:**

The determination of when the mill is out of compliance and the procedures to be followed once the facility is so determined are set out in Part I.G of the Permit, which incorporates the requirements of UAC R317-6-6.17. The Permit has been revised to incorporate Cell 4B into this set of requirements.

### **FINDING:**

The information contained in the Cell 4B Environmental Report and other relevant documents the Licensee has submitted, indicate that the requirements of UAC R313-24-4 (that invokes UAC R317-6-6.17), will yet be satisfied, as they involve Cell 4B.

**REFERENCES:**

- Abrahamson 2007 Abrahamson, N.A. and Silva, W.J., *NGA Ground Motion Relations for the Geometric Mean Horizontal Component of Peak and Spectra Ground Motion Parameters*: Pacific Earthquake Engineering Research Center Report 2007.
- Brumbaugh 2005 Brumbaugh, D.S. *Active Faulting and Seismicity in a Prefractured Terrain*: Grand Canyon, Arizona. Bulletin of the Seismological Society of America 95: 1561-1566, 2005.
- Campbell 2002 Campbell, K.W., *Prediction of Strong Ground Motion Using The Hybrid Empirical Method: Example Application to Eastern North America*, Submitted to Bulletin of the Seismological Society of America, 2002.
- Campbell 2003 Campbell, K.W., and Bozorgnia, Y. (2003) *Updated near-Source Ground-Motion (Attenuation) Relations for the Horizontal and Vertical Components of Peak Ground Acceleration and Acceleration Response Spectra*. Bulletin of the Seismological Society of America 93(1): 314-331, 2003.
- Campbell 2007 Campbell, K.W. and Bozorgnia, Y. *NGA Ground Motion Relations for the Geometric Mean Horizontal Component of Peak and Spectra Ground Motion Parameters*. Pacific Earthquake Engineering Research Center Report 2007/02, 246 p, 2007.
- D&M 1978 Dames & Moore, "White Mesa Uranium Project, San Juan County, Utah" Environmental Report prepared for Energy Fuels Nuclear, Inc., January 30, 1978.
- DOE 1989 U.S. Department of Energy, *Technical Approach Document: Revision II, Uranium Mill Tailings Remedial Action Project*. Washington D.C., 1989.
- DUSA 2007a Denison Mines (USA) Corp., *Environmental Report in Support of the License Renewal Application, State of Utah Radioactive Materials License No. UT1900479*, February 28, 2007.
- DUSA 2007b Denison Mines (USA) Corp., *License Renewal Application; State of Utah Radioactive Materials License UT1900479*, February 28, 2007,
- DUSA 2008a Denison Mines (USA) Corp., *Environmental Report In Support of Construction Tailings Cell 4B, White Mesa Uranium Mill, Blanding, Utah*, April 30, 2008.
- DUSA 2008b Denison Mines (USA) Corp., *Denison Mines (DUSA) Corp.; State of Utah 11e.(2) Byproduct Material License No.UT1900479; White Mesa Mill, Blanding, Utah; License Condition Number 9.5 - Revised Surety Update*

- Cell 4A; Response to Request for Information, June 23, 2008, , July 25, 2008.*
- DUSA 2009a Denison Mines (USA) Corp., (Revised) Cell 4B Design Report, White Mesa Mill, Blanding, Utah. January 2009, included as an attachment to “*Cell 4B Lining System Design Report, Response to Division of Radiation Control (“DRC”) Request for Additional Information - Round 1 Interrogatory, Cell 4B Design*”, Letter dated January 9, 2009, from Harold R. Roberts to Dane Finerfrock, Division of Radiation Control. URL: [http://www.radiationcontrol.utah.gov/Uranium\\_Mills/IUC/cell4b/design4b.htm](http://www.radiationcontrol.utah.gov/Uranium_Mills/IUC/cell4b/design4b.htm)
- DUSA 2009b Denison Mines (USA) Corp., *Reclamation Plan, Rev. 4.0, White Mesa Mill, Blanding, Utah*, November 2009.
- DUSA 2009c Denison Mines (USA) Corp., *White Mesa Uranium Mill - [Response to] First Round of Interrogatories from Amendment Request and Environmental Report for Cell 4B*, December 23, 2009.
- DUSA 2009d Denison Mines (USA) Corp., (Revised) Cell 4B Design Report, White Mesa Mill, Blanding, Utah. August 2009, “*Cell 4B Lining System Design Report, Response to Division of Radiation Control (“DRC”) Request for Additional Information - Round 2 Interrogatory, Cell 4B Design*”, Letter dated August 7, 2009, from Harold R. Roberts to Dane Finerfrock, Division of Radiation Control. URL: [http://www.radiationcontrol.utah.gov/Uranium\\_Mills/IUC/cell4b/design4b.htm](http://www.radiationcontrol.utah.gov/Uranium_Mills/IUC/cell4b/design4b.htm)
- DUSA 2009e Denison Mines (USA) Corp., *White Mesa Uranium Mill - Renewal Application; State of Utah Groundwater Discharge Permit No. UGW370004*, September 1, 2009.
- DUSA 2009f Denison Mines (USA) Corp., *Cell 4B Lining System Design Report, Response to DRC Request for Additional Information – Round 3 Interrogatory, Cell 4B Design*, September 11, 2009. URL: [http://www.radiationcontrol.utah.gov/Uranium\\_Mills/IUC/cell4b/design4b.htm](http://www.radiationcontrol.utah.gov/Uranium_Mills/IUC/cell4b/design4b.htm)
- DUSA 2010a Denison Mines (USA) Corp., *White Mesa Uranium Mill - Second Round of Interrogatories from Review of License Amendment Request and Environmental Report for Cell 4B*, February 8, 2010.
- DUSA 2010b Denison Mines (USA) Corp., *White Mesa Uranium Mill - Second Round of Interrogatories from Review of License Amendment Request and Environmental Report for Cell 4B [Supplemental Response to Rd 2 Interrogatories]*, February 12, 2010.

DUSA 2010c Denison Mines (USA) Corp., *White Mesa Uranium Mill - First Round of Interrogatories From Review of License Amendment Request and Environmental Report For Cell 4B - Supplemental Response*, January 22, 2010.

Frankel 1995 Frankel, A., *Mapping Seismic Hazard in the Central and Eastern United States*, Seismological Research Letters 66(4): 8-21, 1995

Frankel 1996 Frankel, A., Mueller, C., Barnard, T., Perkins, D., Leyendecker, E., Dickman, N., Hanson, S., and Hopper, M., *National Seismic Hazard Maps - Documentation June 1996*. USGS Open-File Report 96-532, 1996.

Geosyntec 2007 Geosyntec Consultants, Cell 4B Design Report White Mesa Mill, Blanding, Utah, December, 2007. URL: [http://www.radiationcontrol.utah.gov/Uranium\\_Mills/IUC/cell4b/design4b.htm](http://www.radiationcontrol.utah.gov/Uranium_Mills/IUC/cell4b/design4b.htm)

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

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

HGCI 2009 HydroGeoChem Inc, *Site Hydrogeology and Estimation of Groundwater Travel Times in the Perched Zone, White Mesa Uranium Mill Site Near Blanding, Utah*, August 27, 2009.

Hurst 2008 Hurst, T. Grant, and D. Kip Solomon, *Summary of Work Completed, Data Results, Interpretations and Recommendations for the July 2007 Sampling Event at the Denison Mines, USA, White Mesa Uranium Mill Near Blanding Utah*, University of Utah, May 2008

IUC 2000 International Uranium Corp., Reclamation Plan, Rev. 3, White Mesa Mill, Blanding, Utah. Source Material Reference No. SUA-1358. Docket No. 40-8681. Revision 3.0. July 2000.

Knight 1999 Knight and Piesold, *Probabilistic Seismic Hazard Assessment*. Memorandum to Harold R. Roberts, by Knight Piesold dated April 23, 1999.

MFG 2006 MFG, Inc., *White Mesa Uranium Facility Cell 4B Seismic Study, Blanding, Utah*. Letter Report to Harold R. Roberts, by MFG, Inc. dated November 27, 2006.



---

NRC 1994	U.S. Nuclear Regulatory Commission, <i>Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility</i> , NUREG-1200 Rev. 3, April 1994.
NRC 1979	U.S. Nuclear Regulatory Commission, <i>Final Environmental Statement Related to the Operation of White Mesa Uranium Project, Energy Fuels Nuclear, Inc.</i> , NUREG-0556, May 1979.
NRC 1997	U.S. Nuclear Regulatory Commission 1997, “Environmental Assessment for Renewal of Source Materials License No. SUA-1358”, prepared by USNRC in support of license renewal application, Docket No. 40-8681, February 1997.
NRC 2002	U.S. Nuclear Regulatory Commission, <i>Design of Erosion Protection for Long-Term Stabilization</i> . NUREG-1623. Final Report. T.L. Johnson September 2002. U.S. N.R.C., Washington DC, 1988.
NRC 2007	U.S. Nuclear Regulatory Commission NRC, <i>A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion</i> . Regulatory Guide 1.208. March 2007.
Senes 2008	Senes Consultants Limited, <i>Proposed Development of New Tailings Cell 4b for the White Mesa Uranium Mill</i> , April 2008.
SSHAC 1997	Senior Seismic Hazard Analysis Committee, <i>Recommendations for Probabilistic Seismic hazard Analysis-Guidance on Uncertainty and Use of Experts</i> : U.S. Nuclear Regulatory Commission NUREG/CR-6327, variously paginated, 1997
Tetra Tech 2010	Tetra Tech, <i>Technical Memorandum - White Mesa Uranium Facility, Seismic Study Update for a Proposal Cell, Blanding, Utah</i> , February 3, 2010, Attachment E to DUSA 2010a.
UDRC 1999	Division of Radiation Control, <i>Notice of Violation and Ground Water Corrective Action Order, Docket UGW20-01</i> , letter from William J. Sinclair (UDRC) to David Fridenlund [International Uranium Corporation (USA)], August 23, 1999.
UDRC 2008a	Utah Division or Radiation Control, <i>Cell 4A BAT Monitoring, Operations and Maintenance Plan, Denison, Rev. 1.3</i> , September 16, 2008, 13 pp.
UDRC 2008b	Utah Division or Radiation Control, <i>Final Modified Groundwater Quality Discharge Permit UGW370004 (Permit) and Public Participation Summary (PPS) for DUSA Tailings Cell 4A: Permit UGW370004</i> , March 14, 2008 (Permit signed March 17, 2008).
UDRC 2008c	Utah Division or Radiation Control, <i>July 25, 2008 DUSA 2008 Response to Request for Information; June 23, 2008 DRC Request for Information; Annual Surety Update for the White Mesa Mill and Tailings Management System, Radioactive Materials License No. UT1900479 Updated Surety</i>

---

*Estimate, Revised Reclamation Plan Approval and Request for Evidence of Surety*, August 4, 2008.

UDRC 2009 Utah Division of Radiation Control, *Statement of Basis for a Uranium Milling Facility South of Blanding, Utah*, September 2009.

UDRC 2010a Utah Division of Radiation Control, *Radioactive Materials License UT1900479*, 2010, in Preparation.

UDRC 2010b Utah Division of Radiation Control, *Groundwater Discharge Permit No. UGW370004*, Final Groundwater Discharge Permit issued to Denison Mines (USA) Corp., January 20, 2010.

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

URS 2009 URS Corporation, *Final Summary of Review and Recommendation for Acceptance of Denison Mines (USA) Corp.'s Revised Cell 4B Design Report and Responses to Rounds 1, 2 & 3 Interrogatories (UDRC.0088000.166)*, Memorandum from Jon Luellen and Robert Baird (URS) to Loren Morton (Utah Division of Radiation Control), November 5, 2009.

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

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

USGS 2002 U.S. Geological Survey, *Interactive Deaggregation*, 2002. URL: <http://earthquake.usgs.gov/research/hazmaps/interactive/index.php>, 2002.

USGS 2008 U.S. Geological Survey, *Earthquake Hazards Program: United States National Seismic Hazard Maps*. May 2008 and July 2009 Updates; URL: <http://earthquake.usgs.gov/hazards/products/conterminous/2008/>, 2008 and 2009

Wong 1989 Wong, I.G. and Humphrey, J.R., *Contemporary Seismicity, Faulting, and the State of Stress in the Colorado Plateau*: Geological Society of America Bulletin, v. 101, p. 1127-1146, 1989

Wong 1996 Wong, I.G., Olig, S.S., and Bott, J.D.J., *Earthquake potential and seismic hazards in the Paradox Basin, southeastern Utah*, in *Geology and Resources of the Paradox Basin*, 1996 Special Symposium, A.C. Huffman,

W.R. Lund, and L.H. Godwin (eds.), Utah Geological Association and  
Four Corners Geological Society Guidebook 25, p. 241-250, 1996.