UTAH DIVISION OF RADIATION CONTROL
DENISON MINES (USA) CORPORATION
WHITE MESA MILL
BLANDING, UTAH

CELL 4B DESIGN REPORT

INTERROGATORIES –ROUND ONE

TABLE OF CONTENTS

Section Page

Acronyms and Abbreviations ii

General Summary of Requested Items iii

INTERROGATORY DMC R313-24-4-01/01: DIKE INTEGRITY 1

INTERROGATORY DMC R313-24-4-02/01: SLIMES DRAIN SYSTEM AND SIDE SLOPE RISERS FOR SLIME DRAIN PIPE AND LEAK DETECTION PIPE 4

INTERROGATORY DMC R313-24-4-03/01: SPILLWAY CAPACITY DESIGN/CALCULATION AND SURFACE WATER RUNOFF 8

INTERROGATORY DMC R313-24-4-04/01: MONITORING WELL WMMW-16 10

INTERROGATORY DMC R313-24-4-05/01: SPLASH PADS 11

INTERROGATORY DMC R313-24-4-06/01: SUBGRADE PREPARATION AND EARTHWORK 13

INTERROGATORY DMC R313-24-4-07/01: CELL 4B AGGREGATES AND COMPATIBILITY OF MATERIALS 18

INTERROGATORY DMC R313-24-4-08/01: GCL, PRIMARY LINER, SECONDARY LINER, AND LEAK DETECTION SYSTEM 19

INTERROGATORY DMC R313-24-4-09/01: RADIATION SURVEY TO DEMONSTRATE ACCEPTABLE SUBGRADE CONDITIONS PRIOR TO LINER SYSTEM CONSTRUCTION 26

Acronyms and Abbreviations

ALARA	As Low As Reasonably Achievable
ASTM	American Society for Testing and Materials
BAT	Best Available Technology
CCL	Compacted Clay Liner
CFR	Code of Federal Regulations
CQAP	Construction Quality Assurance Plan
DMC	Dennison Mines (USA) Corp
DR	Design Report
DRC	Division of Radiation Control (Utah)
FML	Flexible Membrane Liner
GCL	Geosynthetic Clay Liner
GW	Groundwater
HDPE	High Density Polyethylene
LCRS	Leachate Collection and Removal System
LDS	Leak Detection System
PVC	Polyvinyl chloride
SDR	Standard Dimension Rations
TDS	Total Dissolved Solids
TEDE	Total Effective Dose Equivalent
TMP	Tailings Management Plan
TRDP	Tailings Reclamation and Decommissioning Plan
URCR	Utah Radiation Control Rules
UV	Ultra-violet

General Summary of Requested Items

Please refer to the interrogatories for the complete context of the item requests.

1. A revised slope stability evaluation that confirms the critical slopes and considers dynamic loading as well as other consistent slope and soil parameters.
2. Additional clarification on the berm perimeter access road.
3. Additional information and drawing additions/clarifications to clarify the side slope risers for slimes drain pipe and leak detection pipe, including incorporation of measures to preclude/minimize long-term degradation of PVC pipes resulting from long-term exposure to the atmosphere/direct sunlight/heat.
4. Additional information on the Emergency spillway.
5. Clarification of Cell 4B's drainage and relationship with site wide drainage.
6. Information regarding the location of, and plan for decommissioning of, monitoring well WMMW-16.
7. Additional information on the proposed splash pads and discharge to these pads.
8. Additions and clarifications to the Design Report, Earthwork and Subgrade Preparation Specifications and the Construction Quality Assurance Plan, including expansion of these documents to include applicable ASTM/BAT Standards.
9. Additional information demonstrating that the leak detection system and the slimes drain system have been designed to meet performance standards that are the same as or equivalent to applicable specific performance standards contained in the Groundwater Discharge Permit.
10. Clarifications on Construction Drawings, Technical Specifications, and Construction Quality Assurance Plan.
11. Additional information in the specifications for the drainage aggregate.
12. Additional justification for the effectiveness (hydraulic equivalency) of the GCL to a compacted clay liner during the active cell life and for achieving the minimum requirements contained in the Groundwater Discharge Permit over the design life of the cell given the acidic cell environment. This justification would include revision of the calculation for the flow through the GCL and CCL to incorporate degraded conditions in the GCL.
13. Justification for the longest flow path used in, and low factor of safety determined for, flow in the geonet (Action Leakage Rate calculation).
14. Demonstration that the slotted PVC pipe has the required strength.

15. Additional information demonstrating the means by which Denison will ensure that the Cell 4B subgrade is free of unacceptable levels of contamination prior to installing the liner system.

INTERROGATORY DMC R313-24-4-01/01: DIKE INTEGRITY

PRELIMINARY FINDING:

Refer to R313-24-4, 10 CFR 40 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.

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 4 (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.

INTERROGATORY STATEMENT:

Please provide a revised slope stability evaluation that identifies the critical Cell 4B slopes. The evaluation needs to consider Cell 4B interior slopes of the joint berms between Cells 3 and 4B and 4A and 4B, the potential conditions associated with these berms, and the impacts of Cell 3 and 4A on the berm stability. The parameters and conditions used in the evaluation need to be identified and their values justified. If they vary from the previous relevant evaluations (i.e., those provided in support of Cell 4A), the reasons for the difference need to be presented and justified. The evaluation also needs to address potential impacts from seismic concerns, ground motions resulting from blasting operations to remove bedrock, potential operational loading, and other conditions that may impact the stability of the berms (between Cell 3 and Cell 4B and between Cell 4A and 4B) during the proposed cut back work to obtain the desired 2H:1V slopes.

Please justify the use of factors of safety equal to 1.5 and 1.3.

Please provide more detail on the construction drawings and in the design report on the proposed construction of the access road. This detail should include the layout of the road, its materials and means of construction, surface water flow, erosion controls and infiltration controls to preclude adversely impacting the integrity of the Cell 4B liner system and berms. Additional detail should also demonstrate that the road is adequate to handle the proposed traffic loading .

BASIS FOR INTERROGATORY:

The slope stability analysis provided for Cell 4B includes an evaluation of slopes described as being "typical" for the cell. The slopes evaluated need to be ones defined as critical (most prone to failure), not typical, and the evaluation needs to include likely *conditions under which the slope will be subjected that will impact its stability. Based on the DRC's review of Cell 4B slope geometry, the interior slopes represented by cross sections A-A and B-B appear to be critical interior slopes. Revised analyses should answer such questions as:*

- *What about the interior slope of the berm between Cell 3 and 4B?*
- *What are the soil engineering properties (including degree of saturation) as well as other relative parameters that impact slope stability of this berm?*
- *What type of liner is in Cell 3, how effective is it?*
- *What are the properties of the material in Cell 3 and how have they impacted the stability of the joint berm?*
- *Will the cut back from 3H:1V of this berm result in unstable conditions?*

In addition, the evaluation provided for Cell 4B only considers the static condition. It needs to also include dynamic conditions such as seismic concerns and blasting done to remove the bedrock from the area for bottom of Cell 4B.

The slope stability analysis Denison Mines (USA) provided for the Cell 4A (MFG 2006) included a static and dynamic evaluation of the western berm of Cell 4A (which is the proposed eastern berm for Cell 4B) in the same location as Section A-A. This slope was identified as a critical slope for Cell 4A and was evaluated under likely critical conditions to be encountered for this slope as they relate to the use of Cell 4A. It also identified soil material properties for the berm that are different than the ones used for the Cell 4B evaluation. The Cell 4A evaluation identified the soil in the berm as a Compacted fine, silty sand (Phi = 30^o; c = 0 psf; and weight = 123 pcf), on top of a layer of Natural Sand (Phi = 28^o; c = 0 psf; and weight = 120 pcf) that is overlying bedrock.

The Cell 4B evaluation identified for the same berm has only one soil type over the bedrock; a sandy lean clay with an estimated weight of 125 pcf, Phi of 35^o and a cohesion (c) of 100 psf. Explanation and justification are required for omitting the Natural Sand layer and for using different values of Phi ($35^{o)}$ and c (100 psf).

It is recognized that the Phi of 35^o is based on the blow counts (N values) from sampling of soil in the bottom of Cell 4B. However, the use of this information for the in place berm material needs to be justified. The evaluation for Cell 4B assumed a value for c of 100 psf with no justification, whereas the evaluation for Cell 4A assumed c values of 0 for both soils identified in the berm. In addition, consolidated-drained triaxial tests were performed on samples taken from the bottom of Cell 4B. Why were these tests run? Why weren't values of Phi, c, and shear strength estimated for this soil using this data? Is this data applicable to the berms? Please explain and justify these differences.

Another condition that needs to be addressed from the standpoints of environmental protection and construction/worker safety is the cutback of the joint Cell 4A/4B and Cell 3/4B berms from 3H:1V to 2H:1V due to the activities in Cells 4A and 3. Are there any conditions that would impact the stability of the respective berm and result in an unstable slope and hazardous condition, either during the cut-back work or during operation? As *presented in the slope stability evaluation for Cell 4A, if the adjacent cell contains fluid (water), and it is allowed to flow into the respective joint cell berm, and saturate the berm soil (due to a liner failure), an unstable, and possible hazardous condition could result. Will there be any added live loads on the top of the berm or in the adjacent Cell 3 that could impact the stability of the slope? At a minimum, live loads from construction equipment need to be included. These conditions need to be addressed, and if needed, controls put in place to ensure the stability of the slope and worker safety. It is recognized that the redundancy of the double liner system in Cell 4A should prevent the flow of water into the berm. However, the condition of the liner in Cell 3 in not known, and there are some simple controls or monitoring options that could be put in place so as to ensure stability and safe working conditions One such option would be install piezometers into the berm to monitor liquid levels (if any) that could adversely impact the stability of the Cell 4B interior berm.*

Section 2.5 of the Design Report states that "surface water run-on is limited to the perimeter access road surrounding the Cell [Cell 4B]." How is the berm perimeter road designed such that erosion of the road does not occur and run off from the berm perimeter road does not excessively saturate and erode the outside slopes of Cell 4B, thus leading to failure of the berm surrounding Cell 4B?

How is the berm perimeter road designed such that surface water does not infiltrate the berm perimeter road material, enter the anchor trench, and allow water to drain down the inside slopes via the geonet and in between other components of the liner system?

The limits of the berm perimeter road are not clear on the Construction Drawings. Provide clarification for the limits of the berm perimeter road in relationship to liner completion at the top of the berm and how vehicle usage will not damage the liner completion. Provide details regarding locations where access to the berm perimeter road is gained by operational vehicles and methods by which operational vehicles have sufficient space to perform their functions without adverse impacts on the FML.

What materials are used to construct the berm perimeter road? What size and weight class of vehicle and frequency of vehicle traffic are used in the design of the berm perimeter road? What are the compaction requirements for construction of the berm perimeter road? Demonstrate that the berm perimeter road will adequately handle the vehicle traffic during operations such that failure of materials used to construct the road surface and subgrade does not occur effect the stability of the berm.

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

MFG Consulting Scientists and Engineers, June 7, 2006, Technical Memorandum to JoAnn Tischler, TetraTech EMI, Denver From Tom Chapel, White Mesa Stability Analysis.

INTERROGATORY DMC R313-24-4-02/01: SLIMES DRAIN SYSTEM AND SIDE SLOPE RISERS FOR SLIME DRAIN PIPE AND LEAK DETECTION PIPE

PRELIMINARY FINDING:

Refer to R317-6-6.4(A). The applicant must provide information that allows the Executive Secretary to determine the applicant is using best available technology to minimize the discharge of any pollutant.

Refer to R313-24-4, 10 CFR 40 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.

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 5A(1): Surface impoundments 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.

INTERROGATORY STATEMENT: ***Refer to the Design Report.*** *Please indicate in the Design Report (Section 3.4.1) that the slimes drain system has been designed to be compliant with the following performance standards which were also specified in Part 1.D.6 of the Groundwater Discharge Permit) for Cell 4A, which, at a minimum include:*

…"c. Slimes Drain Monthly and Annual Average Recovery Head Criteria – after the Permittee initiates pumping conditions in the slimes drain layer in Cell 4A, the Permittee will provide continuous declining fluid heads in the slimes drain layer, in a manner equivalent to the requirements found in Part I.D.3(b) [of the Groundwater Discharge Permit]." *Please demonstrate that the strength of the specified perforated PVC pipes will be sufficient to ensure that the pipes will perform satisfactorily given the Cell 4B design.*

Please modify the design of the PVC pipe used in the slimes drain access pipe on the sideslopes to include measures to protect against damage of the PVC pipe due to prolonged exposure to the atmosphere, including sunlight (e.g., UV radiation) or, alternatively, provide piping material that is resistant to damage from such long-term exposure conditions.

Refer to the Design Report and Design Calculation: Action Leakage Rate*. Please provide additional information to justify the selection of a maximum flow length (longest drainage path) of 730 feet (p. 3 of the calculation and Attachment B to the calculation).*

Refer to Construction Drawing 5, Section D/3. *The use of a textured HDPE splash pad needs to be considered. The textured HDPE provides for a friction surface and traction if there is s need to access this area, it would also provide for a more stable base for the discharge pipe.*

Construction Drawing 6, the call out for Section F/6 is shown on Plan Detail 9/3,4 as F/5. Please correct. Also on this drawing, please correct the depiction of the sand bags shown to be consistent with those on Construction Drawing 5, provide the detail to scale. In order to ensure the proper design and constructability of these pipes and sump systems, please provide these sections and details to scale. This is the same design used for Cell 4A (which also had the same sections NTS), and it is our understanding that there have been some complications associated with the actual construction of these sump systems.

Refer to Construction Drawing 6, Section I/6 and Drawing 7, Section 11/4*. Please provide revised construction drawings showing how all the components (i.e., GCL, HDPE membranes, geotextile, geonet, and aggregate) of the slimes drain and leak detection side slope are finished at the top of the side slope/berm and how do the slimes drain pipe and leak detection pipe penetrate these components? Additional detail is required in Drawings 6 and 7 to illustrate how these components are finished at the top of the side slope/berm in relationship with the slimes drain pipe and leak detection pipe penetrations. Demonstrate that the slimes drain pipe and leak detection pipe at the top of the side slope/berm will not allow water to seep around the liner components, including flow around the points where the pipes penetrate the liner components, such that water does not flow down the side slope into the sump below.*

Refer to Construction Drawing 7, Detail 11/4*. Please clarify why the cross-section shows the pipes exiting the ground surface at a slope which varies, given that the inside slope of the berm is reported to be 2:1? Demonstrate that the tie down straps and anchor bolts provide sufficient strength to prevent movement of the pipes. Demonstrate that the concrete header/foundation used to support the pipes provides sufficient strength without the use of rebar, as identified in Construction Drawing 7. Please provide additional detail how the concrete header/foundation will be constructed in relationship with the liner components (i.e., GCL, HDPE membranes, geotextile, geonet, and drainage aggregate) at the top of the side slope/berm.*

Refer to Construction Drawing 6, Section I/6. It provides details for sand bags and rope with 5' spacing placed on top of the slimes drain and leak detection system side slope. Is this currently being used successfully for Cell 4A? If so, demonstrate how the ropes will be secured around the sand bags such that rope does not become loose from the sand bag; demonstrate how the ropes are secured at the top of the berm; and demonstrate that the rope and will be resistant to UV light, weathering, low pH caused by the tailings, and other environmental operating conditions at Cell 4B.

Alternatively, other means might be considered to stabilize and protect the slimes drain and leak detection system side slope pipes and granular backfill and geosynthetic components. Such means might include providing granular/soil material ballast, sand-sized granular material—filled geosynthetic tubes, etc…, on the condition that their *acceptability is demonstrated through pipe loading calculations and their use otherwise demonstrated as being suitable under the expected operational and environmental conditions.*

For all Construction Drawings ensure that the following key components are identified, and drawn to scale:

- *Liner system component layer surface elevations.*
- *Slimes drain piping and sump invert elevations and horizontal coordinates at terminations, changes in direction or grade, and connection points (at fittings).*
- *Leak Detection System drain piping and sump invert elevations and horizontal coordinates at terminations, changes in direction or grade, and connection points (at fittings).*
- *Elevations and horizontal coordinates at all liner system changes in grade such at key transition locations including but not limited to from the cell bottom to the side slopes and top of berms and in the sump area.*

Please provide additional information/data demonstrating that components of the sideslope system for the slimes drain system and leak detection system riser pipes (including the tie down straps for the pipes onto the concrete header, the concrete header, and other components (e.g., ropes and sand bags) can operate in the low pH operating conditions and other operating environmental conditions.

Please provide the justification for not including cleanouts for both the slimes drain and the leak detection piping (refer to Sheet 4). Include the methods proposed to maintain these pipes so they function as designed.

BASIS FOR INTERROGATORY:

The completion of the side slope riser for the slimes drain pipe and leak detection pipe and the liner/sump components is important such that surface water does not enter at the top of the berm and migrate down into the liner system and increase the head on the primary and secondary liners. The design details for the tie down straps for the pipes onto the concrete header are limited, as well as the design of the concrete header. Other components (i.e., ropes and sand bags) of the side slope system for the riser pipes need to be confirmed that they can operate in the low pH operating conditions and other operating environmental conditions. All of these details for the side slope riser function together to ensure that the pipes and side slope liner system do not experience failure over the life of Cell 4B and unnecessary surface water does not enter the slime drains and liner leak detection system and contribute to the head on the primary and secondary liners.

The design of the slimes drain and leak detection system pipes and sump system is the same design used for Cell 4A (which also had the same sections NTS). The performance of this slimes drain needs to meet the standards which were also specified in Part 1.D.6 of the Groundwater Discharge Permit) for Cell 4A. In addition, it is our understanding *that there have been some complications associated with the actual construction of these sump systems. It is felt that these complications could be resolved by completing and depicting the design to scale. In order to ensure the proper design and constructability of these systems, please provide these sections and details to scale. It is also not clear how the value of the maximum flow path length for the leak detection system (LDS) was selected or how it reflects the actual LDS design.*

Pipe strength calculations were performed for non-perforated PVC pipes. The PVC pipes used in the design of the slime drains are perforated.

PVC pipe can suffer damage to UV radiation from sunlight, including a change in the pipe's surface color and a reduction in impact strength (Uni-Bell 1997). The slimes drain access pipe on the sideslopes is likely to be directly exposed to the atmosphere and sunlight for several years.

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

Uni-Bell PVC Pipe Association 1997. The Effects of Ultraviolet Aging on PVC Pipe. UNI-TR-5, 15 pp.

State of Utah Division of Water Quality 2008. "Groundwater Discharge Permit, Denison Mines (USA) Corp." Permit No. UGW370004. March 17, 2008.

INTERROGATORY DMC R313-24-4-03/01: SPILLWAY CAPACITY DESIGN/CALCULATION AND SURFACE WATER RUNOFF

PRELIMINARY FINDING:

Refer to R313-24-4, 10 CFR 40 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.

Refer to R313-24-4, 10 CFR 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.

Refer to R313-24-4, 10 CFR Appendix A, Criterion 4 (d): In addition to providing 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.

INTERROGATORY STATEMENT:

The spillway capacity design/calculation states that flow occurs serially from Cell 2, 3, 4A to 4B, and that these flows are based on the PMP. However, these flows need to also include the anticipated flow of tailings and solution from the mill operations. Please include the flows from the mill operation to these calculations and apply the results to design (as needed).

The discharge inlet/outlet elevations need to be identified on the Construction Drawings to identify how the flow occurs serially from Cell 2, 3, 4A, to 4B.

Please include a demonstration that if the operational requirements for freeboard in each cell are maintained (i.e., freeboard elevations maintained) the complete cell system has the capacity to contain stormwater from the PMP combined with the water and tailings from anticipated mill processing. The response to this request should include reference to the original determination of discharge from Cells 1, 2, 3, and 4A. It should also include a demonstration on where the overflow discharge from Cell 4B would go (if it occurred when all the other cells are full), and how the overflow water would be handled such that an uncontrolled release of tailings does not occur, or erosion and failure of the cells berms does not occur?

At the point of discharge from Cell 4A into Cell 4B from the emergency spillway, please demonstrate how the design has incorporated features to prevent damage from occurring to the liner system and slimes drain piping by debris which may be entrained with the discharge water.

Section 2.5 of the Design Report states that "surface water at the facility is diverted around the Cells including Cell 4B." Please provide a drawing(s) that show how surface *water runoff is diverted around Cell 4B, including runoff from adjacent cells which are either closed or in the process of being closed (i.e., placement of fill material as a cover), such that outside slopes of Cell 4B do not erode and lead to potential failure. Include the design components which allow the surface water to divert around Cell 4B. Also show the entire site surface water drainage flows, and explain how Cell 4B is incorporated into this overall facility drainage. This needs to include how contact stormwater that is or may be contaminated is discriminated from uncontaminated or non-contact stormwater. The relocation of the existing access road due to the construction of Cell 4B also needs to be considered.*

Refer to Construction Drawing 7, Section 10/3. Please clarity why there are two Sections labeled "K/7"?

Please clarify why Construction Drawing 7, Section 10/3 and Section K/7 identify the inside slope of Cell 4B as 3:1, when other portions of the Design Report states that the inside slope of Cell 4B is 2:1. Also clarify and justify why the Construction Drawing 7, Section 10/3 and Section K/7 identify the inside slope of Cell 4A as varies.

Resolve the conflict between Design Calculations for the Emergency Spillway (spillway width is 100 feet) and Construction Drawing 7, Section J/(width as 94 feet).

BASIS FOR INTERROGATORY:

It has been indicated that stormwater flow from Cell 4A and upstream cells into Cell 4B has been factored into the design. However, an adequate demonstration of the capacity of the entire facility cell system to handle the PMP combined with the process flows has not been provided. In addition, how the non-contact surface water is diverted around the cells and how this is integrated into the management of surface water flow for the site needs to be addressed.

Review of the drawings identified some inconsistencies that require clarification. They are listed in the Interrogatory Statement.

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

INTERROGATORY DMC R313-24-4-04/01: MONITORING WELL WMMW-16

PRELIMINARY FINDING:

Refer to R317-6-6.4(A). The applicant must provide information that allows the Executive Secretary to determine: "3. the applicant is using best available technology to minimize the discharge of any pollutant;…". DMC must provide information that site activities meet the requirements of Ground Water Discharge Permit, Permit No. UGW370004.

INTERROGATORY STATEMENT:

The Design Report states that "monitoring well WMMW-16 is currently within the proposed Cell 4B" yet the Construction Drawings do not show the location of WMMW-16. Please identify the location of WMMW-16 on the Construction Drawings. Please also provide a well construction diagram for WMMW-16. This diagram needs to be appended to Specification Section 02070, Well Abandonment), which is currently missing from that Section.

Please also submit a well plugging and abandonment (well decommissioning) plan for Well WMMW-16.

BASIS FOR INTERROGATORY:

The applicant needs to provide details regarding the location of, and construction of existing monitoring well WMMW-16 and provide a plan for plugging and abandonment (decommissioning) of this well. . It is DRC's understanding that this well (wellbore?) is dry; however, if not properly decommissioned/plugged, the well/wellbore could provide a vertical pathway for escape of contaminants from Cell 4B or otherwise interfere with Cell 4B construction work. The construction contractor needs to have sufficient information concerning the well's location and construction in order to effectively implement a plan for decommissioning of the well.

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

"Ground Water Discharge Permit; UGW370004", Department of Environmental Quality, Utah Water Quality Board, held by International Uranium (USA) Corporation, March 8, 2005.

INTERROGATORY DMC R313-24-4-05/01: SPLASH PADS

PRELIMINARY FINDING:

Refer to R313-24-4, R317-6-1.13: Best Available Technology means the application of design, equipment, work practice, operation standard or combination thereof at a facility to effect the maximum reduction of a pollutant achievable by available processes and methods taking into account energy, public health, environmental and economic impacts and other costs.

Refer to R313-24-4, R317-6-6.4(A)(3/112): 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.

INTERROGATORY STATEMENT:

The Design Report and Construction Drawing 5 identifies that approximately three splash pads will be constructed and the locations of the splash pads will be finalized in the field during construction, based on site operational needs. The placement of tailings into Cell 4B, without damaging the integrity and long term operational effectiveness of the liner system, is a major component of the design, construction, and operation of Cell 4B. What are the operational criteria which will determine the selection of the splash pads locations, and why would these criteria become apparent during construction, as opposed to during the design phase? It is anticipated that in order to properly distribute the tailings within the cell, more than three splash pads will be needed. For example, it is anticipated that more will be needed along the western berm. Please note that approval to utilize the cell will not be provided until the location and justification for the splash pads are provided to the DRC.

Construction Drawing 5, Section D/3 suggests that a pipe located at the upper portion of the splash pad will be the mechanism by which tailings will be placed into Cell 4B. Provide an overview how the tailings will be introduced and fed through the pipe (i.e., operations related to input of tailings into Cell 4B) such that the liner system is not damaged by movement/handling of the pipe. Demonstrate how the tailings will flow, settle, and enter Cell 4B at critical time periods over the operational life of Cell 4B and will not damage components (i.e., movement of sandbags, displacement of gravel and geotextiles) of slimes drain, strip drains, leak detection system, and liner system present in the bottom of Cell 4B.

Demonstrate that the dimension of the protective HDPE geomembrane (20' wide and 5' extension from the toe of the berm) will resist the influent pressure and scour flow rate of *the tailings (in all directions, width of the side slope and extension from the toe of the berm).*

Update the Project Technical Specifications to include the requirements for the construction of the protective HDPE geomembrane at splash pad locations and update the Construction Quality Assurance Plan to include procedures which will be followed to ensure that the protective HDPE geomembrane at splash pads is properly installed.

BASIS FOR INTERROGATORY:

Introduction and placement of tailings and byproducts into Cell 4B will be performed at the splash pads. The Design Report indicates that the splash pad locations will be determined during the construction of Cell 4B. It is not clear why splash pad locations are not known during the design phase of Cell 4B. Certain components of the splash pad design and construction quality assurance require clarification.

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

INTERROGATORY DMC R313-24-4-06/01: SUBGRADE PREPARATION AND EARTHWORK

PRELIMINARY FINDING:

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 5A(1): Surface impoundments must have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water, or surface water) during the active life of the facility, provided that impoundment closure includes removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate. For impoundments that will be closed with the liner material left in place, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility.

Refer to R313-24-4, 10 CFR 40 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.*

Refer to R313-24-4, 10 CFR 40 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.

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 4(d): A full self-sustaining vegetative cover must be established or rock cover employed to reduce wind and water erosion to negligible levels.

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 3: Where full below grade burial is not practicable, the size of retention structures, and steepness of slopes associated with exposed embankments must be minimized by excavation to the maximum extent reasonably achievable or appropriate given the geologic and hydrologic conditions at a site. In these cases, it must be demonstrated that an above grade disposal program will provide reasonably equivalent isolation of the tailings from natural erosional forces.

INTERROGATORY STATEMENT:

Demonstrate how the construction process for the earthwork movement of soil between Cell 4B and Cell 3 will not cause cross-contamination of impacted soil to clean areas.

Please note as presented in Interrogatory 09, it must be demonstrated that the levels of radiation (contamination) in Cell 4B subgrade are acceptable before a construction permit can be issued and the liner system installed.

Technical Specification Section 02200, Paragraph 3.05 and Construction Drawing No. 2 detail the requirements for stockpiling excavated soil. No limit is placed on the height of the stockpiled soil in the Technical Specifications. How does the height (i.e., weight) of the stockpiled soil affect slope stability of the cut (i.e., West Berm slope)? Demonstrate that soil stockpile slopes will be stable under foreseeable future conditions. How does stockpiling of soils (loading) just west of the West Berm and subsequent removal of that soil affect the performance of the West Berm?

Please provide technical specifications on how each of the cut slope surfaces will be completed (i.e., compacted,) to ensure strength and stability of the slopes for Cell 4B's operation.

Demonstrate how the outside slope of the south berm of Cell 4B and the upgradent portion of the west berm of Cell 4B will be completed to prevent excessive erosion and potential slope failure.

Provide specifications for drilling and ripping to support any blasting the Contractor might perform.

Demonstrate what level of blasting will be required to remove rock to the grades/elevations for Cell4B as indicated in the Drawings and how the blasting will effect the stability of the surrounding berms in place, effect the functionality of the surrounding berms which will be cut to serve as the side slopes for Cell 4B, and effect any other components of Cell 4B and adjacent Cells. Demonstrate the effect blasting will have on the effective permeability and speed of water travel through underlying material. The Design should demonstrate that removal of the rock by blasting does not compromise the design and functionality of Cell 4B and other Cells. The current design and Technical Specification Section 02200 places a requirement on the Contractor that blasting shall not cause damage. Please define "damage" both in terms of nearby dike stability, but also foundation permeability under Cell 4B.

Please provide detail what level of blasting is necessary to construct Cell 4B without causing damage and specific points of compliance the Contractor should be expected to meet such that damage is not caused.

Please define "Project Manager" as used in the Technical Specifications. Section 02200 of the Technical Specifications uses the term "Project Manager". The role of Project Manager is not defined in the Technical Specifications. .

Please revise Subsections 2.01 (A through C) and 3.02 (A through F) of Section 02220 (Subgrade Preparation) and Section 7.3.3 of the Construction Quality Assurance Plan to incorporate applicable requirements contained in ASTM D 6102-06, including, but not limited to the following:

- *The subgrade surface shall be firm and unyielding, with no abrupt elevation changes, voids and cracks, ice, or standing water*
- *The subgrade surface shall be smooth and free of vegetation, sharp-edged rock, stones, sticks, construction debris, and other foreign matter that could contact the GCL*
- *At a minimum, the subgrade surface shall be rolled with a smooth-drum compactor of sufficient weight to remove any excessive wheel ruts, footprints, or other abrupt grade changes.*

The provision in Paragraph 2.01B of the Technical Specification Section 02220 (Subgrade Preparation) stating that desiccation cracks less than or equal to ¼-inch in width in the subgrade prior to liner construction are acceptable is not supported and is apparently inconsistent with the requirements of ASTM D 6102-06. Please demonstrate that desiccation cracks of ¼ inch width or less are acceptable or remove this permissiblee crack width value from the specifications. The specifications should detail how any desiccation cracks observed in the subgrade will be remedied. A requirement that the subgrade surface be checked for cracks and such cracks be remedied should be included in specifications and/or in the Construction Quality Assurance Plan as applicable.

The provision in Technical Specification Section 02220 (Subgrade Preparation) Paragraph 2.01C stating that subgrade soil shall consist of on-site soils that are free of particles greater than 3 inches in longest dimension is apparently inconsistent with typical GCL and/or FML manufacturer's recommendations for subgrade soil used for GCL and FML installation applications (e.g., see GSE 2008, Section 4.5). Please demonstrate that such a large maximum particle dimension is acceptable or revise this requirement to be consistent with typical GCL / FML manufacturer's recommendations. Please also indicate that such soil shall be well graded material (to be consistent with additional typical GCL / FML manufacturer's recommendations for subgrade soil) or provide justification for not including this requirement in the specifications.

Please define "fill" as used in Subsection 2.01 of the Section 02200 (Earthwork) and "subgrade soil" as used in Subsection 2.01 (C) of Section 02220 (Subgrade Preparation) of the Technical Specifications and clearly distinguish between these two types of fill material. Subsection 2.01 of the Section 02200 (Earthwork) states that fill will consist of material free from rock larger than 6-inches. Subsection 2.01 (C) of Section 02220 (Subgrade Preparation) states that subgrade soil shall be free of particles greater than 3-inches in longest dimension. If "fill" is referring to the material that is suitable for use in constructing the berms, and "subgrade soil" is select fill material suitable for use in constructing/developing the subgrade surface, then define them as such.

Subsection 3.04 (D) of Section 02200 (Earthwork) of the specifications calls for the fill to be compacted in lifts no greater than 12-inches, to 90% of maximum density and to +/- 4% of optimum moisture content (per ASTM 1557). Subsections 3.03 (E) and 3.04 (C) of Section 02220 (Subgrade Preparation) call for fill to be compacted in lifts no greater than 8-inches, to 90% of maximum density and to +/- 3% of optimum moisture content *(per ASTM 1557). Due the critical nature of the fill placement for the slopes and the subgrade fill placement for the subgrade, the DRC judges that all the fill placed needs to be compacted in lifts no greater than 8-inches, to 90% of maximum density and to +/- 3% of optimum moisture content (per ASTM 1557). Please revise the specifications accordingly.*

Note that the compaction requirements cited in Section 3.3.4 of the design report are inconsistent with the Technical Specifications that call for 8-inch lifts and +/- 3% of optimum moisture. Please resolve this contradictory information.

BASIS FOR INTERROGATORY:

The Design Report details that the perimeter berms will be constructed in order to define the limits of the containment of Cell 4B and earthwork construction will be necessary to generate the necessary capacity to retain the tailings. Perimeter berms will be constructed by either cutting into existing soil, existing berms of adjacent Cells, or backfill and compaction of fill material. The Design Report lacks appropriate detail and requirements such that earthwork will not cause unfavorable interim and final conditions (i.e., cross-contamination by vehicular traffic from or near Cell 3, slope strength and stability, erosion of exposed surfaces of berms).

The Design Report and Construction Drawing 2 identify that movement of large quantities of soil will occur during the construction of Cell 4B as follows: excavation for Cell 4B; cutting into the existing berms of Cell 3 and Cell 4A; cutting into the existing soil along the west berm slope for Cell 4B; and construction of the south berm of Cell 4B. Based on Construction Drawing 2, movement of the soil generated by construction of Cell 4B will be placed in a stockpile area adjacent and up gradient of the west berm side slope and as a cover for the eastern portion of Cell 3, which has tailings and by-product materials.

The requirements specified in Subsection 2.01 of Section 02220 for the subgrade soil 3-inch maximum longest dimension particle size specified for the "subgrade soil" in Subsection 2.01(C) is larger than the maximum particle size recommended for subgrade select soil that is typically recommended by GCL manufacturers (e.g, GSE 2008, Section 4.5). Additionally, no requirement is included in Subsection 2.01 of Section 02220 that the subgrade soil be well-graded material. Typical GCL manufauturer's recommendations (e.g, GSE 2008) include a recommendation that subgrade soil (when used as fill for preparing the subgrade surface) contain no gravel greater than 2 inches and that such soil also be well-graded.

Particles of excessive size, if present in subgrade soil, could also roll over and become displaced during final adjustments of GCL panels placed over the subgrade (e.g., Richardson et al. 2002). This could lead to damage to GCL and/or the overlying geomembrane.

The specification of a maximum allowable ¼-inch-wide crack width for desiccation cracks in the subgrade foundation has not been technically justified.

Applicable requirements of ASTM D 6102-06 do not appear to have been included. These requirements apply to subgrade surfaces over which GCLs and FMLs are to be placed.

Justify the largest particle size allowed as a protection to the GCL. Also justify that the largest particle size allowed will not result in damage to the geomebrane liner overlying the GCL.

Technical Specification Section 02200, Paragraph 3.03 – "ROCK EXCAVATION" details the requirements for rock excavation. The specification places a general requirement on the Contractor to remove rock by ripping, drilling, or blasting. No requirement for ripping and drilling is provided in the Technical Specifications. Requirements for blasting are provided to the Contractor, and suggest that the rock will be removed by blasting, but no requirements are provided for requisite drilling and subsequent ripping to support blasting.

Some inconsistencies in the Technical Specifications were identified and have been addressed in the Interrogatory Statement.

REFERENCES:

ASTM D 6102-06. "Standard Guide for the Installation of Geosynthetic Clay Liners". ASTM International, West Conshohocken, PA. February 2006.

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

Richardson, G., Thiel, R., and Erickson, R. 2002. "GCL Design Series – Part 3: Installation and Durability". Designer's Forum, Geotechnical Fabrics Report, September 2002, p. 18-23.

INTERROGATORY DMC R313-24-4-07/01: CELL 4B AGGREGATES BACKFILL AND COMPATIBILITY OF MATERIALS

PRELIMINARY FINDING:

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 5A(2)(a): The liner must 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.

INTERROGATORY STATEMENT:

The Design Report states that the pH range for the tailings is between 1 and 2. The Design Report also states that the aggregate backfill materials and sand (in sand bags) shall have a carbonate content loss of no more than 10 percent by weight based on UDOT standard specifications. Please provide the basis for determining the requirement of the aggregate and sand. Demonstrate how much the specified aggregate and sand will deteriorate under a pH of 1 to 2 over the design life of Cell 4B, including the change in permeability of the aggregate and sand with time and how the change in permeability will effect the drainage of liquids in the slimes drain (both the header and strip drains) with time; and how the head on the primary liner and secondary liner is effected over time due to the change in aggregate and sand permeability.

On Construction Drawing 6, Section I/6, the side slope riser system for liquid removal from slimes drain and leak detection includes aggregate bedding. Demonstrate how the slope stability (i.e., resistance to sliding) of the aggregate is affected by the low pH environment. This is of particular concern if the risers and bedding are placed on a 2H:1V slope.

BASIS FOR INTERROGATORY:

The Design Report provides specifications and requirements for Cell 4B's liner and drainage components. However, the effects of the low pH on the aggregate backfill materials and other materials used in the cell containment system are not directly evaluated in the design, functionality, and operation of Cell 4B.

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

INTERROGATORY DMC R313-24-4-08/01: GCL, PRIMARY LINER, SECONDARY LINER, AND LEAK DETECTION SYSTEM

PRELIMINARY FINDING:

Refer to R313-24-4, 10 CFR 40 Appendix A, Criterion 5A(1): Surface impoundments must have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil, ground water, or surface water) during the active life of the facility, provided that impoundment closure includes removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate. For impoundments that will be closed with the liner material left in place, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility.

Refer to R313-24-4, 10 CFR 40 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.*

Refer to R313-24-4, R317-6-1.13: ***Best Available Technology [BAT]*** *means the application of design, equipment, work practice, operation standard or combination thereof at a facility to effect the maximum reduction of a pollutant achievable by available processes and methods taking into account energy, public health, environmental and economic impacts and other costs.*

Refer to R313-24-4, R317-6-6.4(A)(3/112): 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.*

INTERROGATORY STATEMENT:

Refer to the Design Report. *Please indicate and justify in the Design Report (Section 3.4.3) that the leak detection system has been designed to be compliant with the following performance standards (the same as or equivalent to those that were also specified Part 1.D.6 of the Groundwater Discharge Permi) for Cell 4A, which, at a minimum, included):*

a. "Leak Detection System (LDS) Maximum Allowable Daily Head – the fluid head in the LDS shall not exceed 1 foot above the lowest point in the lower membrane liner.

b. *LDS Maximum Allowable Daily Leak Rate - shall not exceed some specified number of gallons/day." [value used here should equal to the maximum flow rate to the Cell 4B sump as determined in the final (approved) Action Leakage Rate calculation for Cell 4A, , e.g., ≤ 24,160 gal/day]*

Refer to the Design Calculation: Comparison of Flow through a Compacted Clay Liner (CCL) and Geosynthetic Clay Liner (GCL). *In the definition of input variables for equation (4),* t_{LCL} *is 200 mils. Subsequent value for* t_{LCL} *is corrected to 300 mils, but in actual calculations 200 mils is used. Please clarify what is the correct value for* t_{LCL} *and how does the head and flow rate for the GCL change; and how does the change in head and flow rate compare with a compacted clay liner?*

Refer to the Design Report, Construction Quality Assurance Plan, and the Design Calculation: Action Leakage Rate*. Please demonstrate that a low factor of safety of 1.1 for flow in the geonet is acceptable, since long-term degradation of the installed geonet's flow capacity (e.g., through gradual partial degradation of the geonet core as a result of long-term exposure to the acidic solutions contained in the cell) could significantly lower this factor of safety, thus resulting in a higher head on the secondary liner. Also, the possibility exists that the geonet might become damaged during/following installation or the installation methods otherwise result a reduced geonet capacity. Possible means whereby the geonet might become damaged during or following installation or the installation methods otherwise result a reduced geonet capacity are described below. Please revise Section 13 (Geonet) of the Construction Quality Assurance Plan to include measures to minimize/preclude damage to the geonet so as to minimize the potential for reduced geonet function occurring as a result of geonet and primary liner installation activities.*

Refer to the Design Report and Design Calculation: Comparison of Flow through a Compacted Clay Liner (CCL) and Geosynthetic Clay Liner (GCL). *Please revise the calculation to include the use of (degraded) hydraulic conductivity values that are more representative of projected long-term in place GCL hydraulic properties. Please justify the selection of a long-term hydraulic conductivity value for the GCL for use in the equivalency analysis, including consideration of passage of an adequate number of pore-water volumes of acidic solutions into the GCL to reflect the disposal cell's long-term performance over the compliance period. The adverse effects of progressive exposure to acidic solutions on GCL hydraulic conductivity were demonstrated by the GCL field and laboratory tests for Cell 4A that were done using a CETCO Bentomat GL product that was used in the Cell 4A construction (Geosyntec Consultants 2007). The Cell 4B*

Technical Specifications, as currently written, allow the use of a GCL having a maximum index flux [maximum flux of the bentonite portion of the GCL] of 1 x 10^{-8} m^3/m^2 /second which, for a typical GCL thickness and for typical GCL testing conditions, can be considered to be equivalent to a GCL having a hydraulic conductivity value of 5 x 10^{-9} cm/sec (CETCO 2007). This hydraulic conductivity value is considerably lower than the hydraulic conductivity values reported for the GCL samples that were first pre-hydrated and then exposed to between 1 and 2 pore volumes of acidic permeate solution (9.0 x 10^{-9} to 4.5 x 10^{-8} cm/se, suggesting permeabilities about 8 to more than 50 times greater than the initial GCL hydraulic conductivity value for each sample).

This Design Calculation and the Design Report need to assess the sensitivity of the assumption of degraded GCL hydraulic conductivity values on the following:

- *The validity of the GCL hydraulic equivalency analysis*
- *The ability to comply with the requirements of R313-24-4, 10 CFR 40 Appendix A, Criteria 5A(1) and 5A(2).*
- *The ability to comply with the requirements of Part 1.D.8 of the Groundwater Discharge Permit.*

Based on the results of the revised GCL hydraulic equivalency analysis, Denison needs to determine the need, if any, for revising the Cell 4B secondary liner design and the Cell 4B Technical Specifications to incorporate use of an alternative GCL, possibly having a lower initial hydraulic conductivity value, or use of a combination of low-permeability materials (e.g., a GCL encapsulated between two HDPE geomembranes) to comprise the secondary liner system component. This component of the Cell 4B liner system needs to be constructed of materials that are hydraulically equivalent to, or hydraulically more effective than, a compacted clay liner, must prevent wastes from migrating into the liner during the active life of the facility in accordance with R313-24-4 and 10 CFR 40 Appendix A, Criteria 5A(1) and 5A(2) requirements, and must be adequate when evaluated in terms of both the initial and projected long-term performance characteristics of the material to meet the requirements of Part 1.D.8 of the Groundwater Discharge Permit.

Additional test data needs to be provided to support the use of any proposed alternative secondary liner materials to demonstrate that the alternative materials will meet the minimum project requirements (as driven by the revised GCL hydraulic equivalency results) and will achieve compliance with R313-24-4, 10 CFR 40 Appendix A, Criterion 5A(1). Supporting data should include information on the pre-hydration levels achieved in the tested GCL samples and data on initial and final hydraulic conductivity values obtained for all secondary liner materials/liner assemblages tested.

***Refer to the Cell 4B Technical Specifications**: Please modify Specification Section 02772 (GCL) to be consistent with the final design of the secondary liner component (revised as needed based on the final revised GCL hydraulic equivalency calculation results). If an alternative secondary liner component/system, such as an encapsulated GCL or an alternative type of GCL is proposed, please include a description of the procedures for pre-hydrating the GCL relative to the timing of placement of the bottom* *and top geomembranes or a description of the procedures for pre-hydrating the specific alternative GCL proposed. If such an alternative component/system is specified, please provide test data that demonstrates that its expected long-term hydraulic performance will meet project requirements.*

Refer to the Design Report and the Cell 4B Technical Specifications*: Please revise the Design Report and the technical specifications as needed to include a description of the measures that need to be taken during installation to ensure the GCL is properly hydrated prior to covering it with geomembrane material.*

Please provide additional justification to support the determination of the minimum hydration level that the GCL material should be brought to prior to placing the primary geomembrane. In particular, please provide additional information demonstrating that the minimum pre-hydration level specified for the GCL is sufficient for demonstrating the hydraulic equivalency of the GCL relative to a compacted clay liner. Based on hydraulic conductivity testing data for the GCL used in constructing Cell 4A, it would appear that minimum 75% pre-hydration level would be superior to a minimum 50% pre-hydration. Please revise the specification to require a 75% pre-hydration or provide a demonstration as to why a minimum 75% pre-hydration level should not be specified for the GCL. When specifying the optimum pre-hydration level for the GCL, please:

- *Refer to the Cell 4A GCL hydraulic conductivity testing data and use that and /or other available data for justifying the selection of the specified minimum pre-hydration level;*
- *Consider the specific type of GCL anticipated to be used in the cell;*
- *Consider the effects of pre-hydration on the shear strength and bearing capacity of the GCL, and the possible susceptibility for migration of bentonite to occur within the CGL during and following GCL placement (e.g, as a result of an additional amount of pre-hydration); and*
- *Consider other possible impacts of pre-hydrating the GCL to the modified specified minimum moisture content (e.g., effects on accessibility to the cell GCL surface for installing the geomembrane; effects on overall cell stability*

Refer to the Design Report and the Cell 4B Technical Specifications*: Please revise Subsection 2.02 of Section 02772 of the Technical Specifications (Geosynthetic Clay Liner), which calls for interface testing of the GCL to include a definition of the optimum moisture content that is to be used at the time of placement in the field.*

Refer to the Design Report, the Cell 4B Technical Specifications, and the Construction Quality Assurance Plan*: Please revise Section 02772 of the Technical Specifications (Geosynthetic Clay Liner) and Section 12 of the Construction Quality Assurance Plan as needed to include applicable requirements contained in ASTM D 6102 (“Standard Guide for Installation of Geosynthetic Clay Liners”).*

BASIS FOR INTERROGATORY:

The section on GCLs in the Design Report needs to include a discussion on the adverse impact of acidic solutions on GCL. Acidic solutions can increase the permeability of the GCL unless the GCL is properly hydrated. The discussion needs to include the results of the GCL field testing for Cell 4A that were done to evaluate the ability of the GCL to hydrate under the conditions at the site, and what measures need to be taken during installation to ensure the GCL is properly hydrated. Due to the concern over the impact of acid solutions on the GCL and the need to hydrate the GCL to mitigate this impact, the statement at the end of Section 3.4.4.2 of the Design Report: "Based on review of the above site-specific considerations, a GCL is considered superior to a CCL for use in the secondary composite liner system." is debatable. This is especially true given that the GCL hydraulic conductivity value used in the hydraulic equivalency calculation is the initial GCL hydraulic conductivity value of 5 x 10^{-9} *cm/sec, rather than a more realistic long-term (degraded) hydraulic conductivity value (reflecting the laboratory test results for the GCL samples that were pre-hydrated then subjected to the acidic permeate). The hydraulic equivalency of the GCL to a compacted clay liner, over the design life of Cell 4B, has not been demonstrated. The Design Report needs to be revised to make this demonstration or include a revised secondary liner system design that demonstrates that such equivalency will be achieved.. The design of the liner system, including the secondary liner, needs to be adequate to ensure that the closed cell performance requirements specified in Part 1.D.8 of the Groundwater Discharge Permit can be achieved.*

Subsection 2.02 of Section 02772 of the Technical Specifications calls for interface testing of the GCL. It states that this testing shall be performed on test specimens that are at the optimum moisture content. The optimum moisture content needs to be defined as the final moisture content needed to achieve the level of hydration that mitigates the impacts of the acidic solution. This level is currently defined in Subsection 3.03 (D) of Section 027772 as greater than 50 percent Additional justification needs to be provided to support the choice of the minimum hydration level for the GCL material as being sufficient for demonstrating the hydraulic equivalency (or superiority) of the GCL relative to a compacted clay liner: (1) over the active life of the facility and (2) relative to achieving compliance with the requirements contained in Part 1.D.8 of the Groundwater Discharge Permit requirements contained in Part 1.D.8 (following final closure of the cell).

Hydraulic conductivity testing data for the GCL used in constructing Cell 4A (Geosyntec Consultants 2007) indicate that, for GCL samples that had been pre-hydrated to moisture contents between 50% and 140% and then exposed to ½, 1, and 2 pore volumes of acidic permeate, hydration of the GCL to 75% gave better protection of the GCL against the deleterious effects of the acidic permeate than did pre-hydration of the GCL to the 50% level, at the 1 and 2 pore-volume acidic permeate exposure levels.

The Technical Specifications for the GCL (Section 02772) need to reference ASTM D 6102-06 which contains additional ***BAT*** *requirements which are applicable to the installation of the GCL.*

The calculated factor of safety for flow within the geonet (1.1) is lower than that achieved for the geonet in Cell 4A (1.34). Because the leak detection system is a critical design component in order to verify that the liner system is performing correctly, clarification is required for why the factor of safety determined for flow within the geonet in Cell 4B is acceptable. Also, as with the installation of the geonet for Cell 4A, DRC agreed that strict QA/QC methods would be employed to minimize potential impacts of improper installation on the performance of this drainage layer. The geonet material could become damaged through abrasion resulting from dragging of the geonet across a rough surface or an object on the surface, by wind uplift prior to covering of the geonet, by exposure to excessive heat (e.g., possibly leading to wrinkling and subsequent buckling of tied-off geonet panels or panel sections), dropped cigarettes, or possibly other factors. Section 13.6 of the Cell 4B Construction Quality Assurance Plan focuses on how the geonet should be handled and placed so as to minimize/preclude damage to other Cell 4B liner and leak detection components, but does not include QA/QC measures related to handling and placement of the geonet to minimize/preclude damage to the geonet itself.

REFERENCES:

ASTM D 6102. "Standard Guide for Installation of Geosynthetic Clay Liners". ASTM International, West Conshohocken, PA. February 2006. "Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.

CETCO 2005. Certified Properties, Bentomat ST Certified Properties" . CECTO Lining Technologies, May 2007.

Geosyntec Consultants 2007. "Geosynthetic Clay Liner Hydration Demonstration Letter Report, Denison Mines Corporation, White Mesa Mill, Cell 4A, Blanding, Utah". August 31, 2007.

GSE 2008. "Introduction to Sample Specification – Bentofix GCLs, Geosynthetic Clay Liner Installation Specification Guideline, Section 4.5. January 25, 2008.

Uni-Bell PVC Pipe Association 1997. The Effects of Ultraviolet Aging on PVC Pipe. UNI-TR-5, 15 pp.

State of Utah Division of Water Quality 2008. "Groundwater Discharge Permit, Denison Mines (USA) Corp." Permit No. UGW370004. March 17, 2008.

INTERROGATORY DMC R313-24-4-09/01: RADIATION SURVEY TO DEMONSTRATE ACCEPTABLE SUBGRADE CONDITIONS PRIOR TO LINER SYSTEM CONSTRUCTION

PRELIMINARY FINDING:

Refer to R313-24-1(3), R313-24-4, R313-15-501, R313-15-406, and 10 CFR 40 Appendix A, Criterion 5A(1); DRC rules require that a radiation survey be performed to demonstrate that the requirements of R313-15 are met, including the magnitude and extent of radiation levels and concentrations or quantities of radioactive material (see R313-15-501). DRC rules also require the applicant to describe "… how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment,…" (see R313-15-406). R313-24-4 and 10 CFR 40 Appendix A, Criterion 5A(1) require that for uranium tailings impoundments … the liner be designed, constructed, and installed to prevent migration of wastes out of the impoundment to adjacent subsurface soil at any time during the active life of the impoundment."

Refer to UAC R313-24-3(1) UAC R313-24-4, 10 CFR 40 Appendix A, Criterion 7.

INTERROGATORY STATEMENT:

Please provide an evaluation that demonstrates that the existing soil subgrade has radiation and contamination levels that are acceptable. One possible scenario to minimize contamination and meet Best Available Technology (BAT) requirements is to base the design of the liner system for Cell 4B on a clean and stable subgrade, i.e., one with background soil levels. Therefore, demonstration of the absence of wind-blown contamination from other nearby sources of uranium tailings at the proposed Cell 4B site is important before construction begins. Another scenario is to demonstrate that the levels of any soil contamination left under the new liner design will have no adverse impact on local groundwater quality or the environment. In either case, the applicant needs to demonstrate and justify that any soil concentration level proposed as a cleanup standard has both technical and regulatory justification. Consequently, it is imperative that this evaluation be submitted to the DRC and is approved prior to issuance of the Construction Permit. Also, if the implementation of the plan results in modifications to the proposed subgrade and liner system, the respective modifications will need to be submitted to the DRC for review and concurrence prior to liner construction.

BASIS FOR INTERROGATORY:

Prior to construction of Cell 4B, the applicant needs to demonstrate that the existing subgrade has radiation levels that are acceptable, i.e. equal to or lower than background soil levels. Any construction of the proposed disposal cell over soils that have been previously contaminated from other nearby disposal operations, without prior removal and containment, could lead to pollution of underlying soils and groundwater resources..

REFERENCES:

"Cell 4B Design Report, White Mesa Mill, Blanding, Utah" by GeoSyntec Consultants, December 2007. Prepared for International Uranium (USA) Corporation.