State of Utah

Department of Environmental Quality

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DIVISION OF RADIATION CONTROL
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File:
IUC
Cell 4A
Rnd 2
Interrog.

June 14, 2006

Mr. Harold Roberts
Vice President – Corporate Development
International Uranium (USA) Corporation
1050 Seventeenth Street, Suite 950
Denver, CO 80265

Re: IUC Tailings Cell 4A Re-Lining System Design; May 24, 26, and June 9, 2006 IUC Responses to May 17, 2006 DRC Round 1 Interrogatory: **DRC Request for Additional Information – Round 2 Interrogatory.**

Dear Mr. Roberts,

We have reviewed your May 24 and 26, 2006 responses to our May 17, 2006 Round 1 Interrogatory, referenced above. Our comments are given in the attached Round 2 Interrogatory, prepared by URS Corporation staff.

We note your May submittals did not include information regarding dike stability, which was provided later in your June 9, 2006 submittal. The tardy arrival of this information has jeopardized our agreed upon schedule. However, DRC review of the June 9, 2006 information is on-going, and findings will be provided you as a part of a future interrogatory.

From review of the May, 2006 submittals, we have found a number of information items that continue to be unresolved. The purpose of this letter is to bring these issues to your attention, so that the review can continue forward.

You will note that the number of open interrogatories in Round 2 remains unchanged from Round 1. You will also note that from the six original interrogatories there are 15 technical issues that need to be addressed. The most significant of these open issues, or critical path items, are briefly mentioned below:

1. Radiation Survey Report and Demonstration – this Round 1 issue continues to be unresolved, in that IUC has failed to provide the required report. While the review process can continue forward, we will be unable to issue a Construction Permit without resolution of the known contamination in the soils and subgrade below the former Cell 4A. This item is a critical path element for issuance of the permit.
2. Dike Seismic / Stability Considerations - we acknowledge receipt of your June 9, 2006 submittal, and our review of it will continue forward. In the meantime, we have carried forward this interrogatory into Round 2 as an open and unresolved matter. This issue is of some concern, in that it has the potential for significant impact to design and construction needs, and to the agreed upon review schedule.

The remaining 13 open technical issues, while important, appear to be much easier to resolve and address.

We look forward to your response and resolution of these matters. If a meeting would be of assistance in understanding and resolving the attached Round 2 Interrogatory and related open issues, please contact Dave Rupp of my staff to arrange.

Sincerely,

Loren B. Morton

LBM:dr

attachment

cc: Britt Quinby, URS

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File: IUC Cell 4A Re-lining Project

URS

UTAH DIVISION OF RADIATION CONTROL
CELL 4A LINING SYSTEM
INTERNATIONAL URANIUM (USA) CORPORATION
WHITE MESA MILL
BLANDING, UTAH

INTERROGATORIES – SECOND ROUND

TABLE OF CONTENTS

Acronyms and Abbreviations

ALARA	As Low As Reasonably Achievable
BAT	Best Available Technology
CFR	Code of Federal Regulations
CQAP	Construction Quality Assurance Plan
DR	Design Report
DRC	Division of Radiation Control (Utah)
FML	Flexible Membrane Liner
GCL	Geosynthetic Clay Liner
HDPE	High Density Polyethylene
LCRS	Leachate Collection and Removal System
SDR	Standard Dimension Ratios
TDS	Total Dissolved Solids
TEDE	Total Effective Dose Equivalent
TMP	Tailings Management Plan
TRDP	Tailings Reclamation and Decommissioning Plan
URCR	Utah Radiation Control Rules

Summary of Requested Items

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

1. A Radiation Survey Report to demonstrate that the existing subgrade for Cell 4A has radiation and contamination levels that are acceptable. This continues to be an issue that has been carried through from round 1 interrogatories.
2. A revised Construction Quality Assurance Plan that includes a clear and concise description of the lines of authority and communication as well as protocols for identifying and rectifying deficiencies in an upfront section.
3. A revised Construction Quality Assurance Plan that includes some corrections and/or clarifications on a few items. They are described in interrogatory R313-24-4-02/02.
4. The inclusion of a section in the Construction Quality Assurance Plan that addresses the concrete spillway.
5. A quantitative evaluation that addresses the long-term resistance of all the liner system components to the tailings cell solution, or the results of liner compatibility studies to demonstrate the long-term resistance of the liner materials.
6. Additional data and/or information that the GCL will be able to resist damage/degradation due to exposure to the leachate and freeze/thaw action. The response to round 1 was incomplete. Included should be data on the predicted levels of hydration for the GCL based on site-specific conditions, and the potential impact of freeze/thaw on the GCL in the exposed portion of the liner system (i.e., the portion of the liner above the cell fluid level during operations with no confining pressure)
7. Detailed procedures that cover installation of the cell liner and operation of the cell. They are requested as part of the design because they form a basis for the liner system design by specifying that no construction or operational loads will be placed on the liner. These procedures will be submitted to the DRC for review and concurrence prior to issuance of the Construction Permit.
8. An evaluation of the anticipated differential settlement of the liner along the bottom and side slopes under the final closed cell condition. The information provided by IUC in response to this request addresses only the potential settlement on the cell bottom, and not on the dike side slopes due the final surcharge of the tailings.
9. Additional information and/or analysis of the stability of the cell dikes. A revised analysis reflecting the critical cell slope conditions was provided June 9, 2006. This analysis is under review.
10. The basis for the 0.10g seismic loading used in the current dike stability analysis.

11. Revised GCL specifications that include a requirement that the GCL must incorporate a woven geotextile as one of its components and a specific requirement that states which side of the GCL shall be installed facing upward.
12. A Leachate Monitoring, Operations, Maintenance, and Reporting Plan that includes anticipated flow rates and maximum flow rates in the leachate collection layer (slimes collection layer). This is to include a demonstration that the tailings sands will settle out and function properly as a slimes drain layer without clogging and that the collection pipes are properly located and have the ability to remove the tailings solution in a reasonable time and manner. This plan shall also include the demonstration of the Action Leakage Rate and proposed response actions should the Action Leakage Rate be exceeded.
13. Additional information in support of the Action Leakage Rate calculation, including a computation of different Action Leakage Rates that correlate to the range of liquid levels that are anticipated in the cell during operation, and an appropriate factor of safety, as needed, to account for uncertainties associated with the manner of installation of the geonet in the cell.
14. A revised Project Specification for the geonet that reflects the actual thickness of the geonet assumed in the ALR calculation and will ensure proper joining of geonet panels or sections of panels in the cell, in accordance with the type of geonet to be employed.
15. Construction drawings must be provided. A construction permit cannot be issued until these drawings are reviewed by DRC.

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INTERROGATORY IUC R313-24-4-01/02: RADIATION SURVEY AND RELATED DEMONSTRATIONS

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 IUC 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 where wastes have migrated into the liner during the active life of the facility, that closure of said impoundment must include "...removal or decontamination of all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate."

Also refer to R317-6-6.4(A). IUC 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;...".

INTERROGATORY STATEMENT:

Round one of the interrogatories requested an evaluation that demonstrates that the existing soil subgrade has radiation and contamination levels that are acceptable. It is IUC's burden 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 approval prior to the issuance of the construction permit.

IUC's response indicated that they are finalizing the Final Cleanup Monitoring Plan and will submit the Plan under a separate cover. However, please note that a "Report" with the results of the evaluation that demonstrates that the existing subgrade for Cell 4A has radiation and contamination levels that are acceptable was requested (not a "Plan"). Please provide this report to the DRC for review and approval.

BASIS FOR INTERROGATORY:

It is clear that the former liner system in Cell 4A did not meet the requirements of 10 CFR 40 Appendix A, Criterion 5A(1), in that it did not "...prevent wastes from migrating into the liner during the active life of the facility." It is also clear that both waste residues in Cell 4A, the liner, contaminated subsoils, and structures and equipment contaminated with waste and leachate need to be removed (ibid.). Prior to the

installation of the new liner system, IUC needs to demonstrate that the existing subgrade has radiation levels that are acceptable. IUC has submitted the results of a preliminary radiation survey. However, the DRC raised questions in an October 18, 2005 letter and IUC has yet to provide a complete survey report. Please provide this report so that agreement can be reached as to the concentration and depth of contaminants in the cell subgrade that can be left under the new liner system.

IUC in their May 8, 2006 response to URS Completeness Review committed to provide the referenced plan under separate cove, and in the May 26, 2006 response to round 1 interrogatories IUC again stated that this plan will be provide under a separate cover. However, the timing of the submittal was not provided. Since the design and placement of the liner system is dependent on having a clean and stable subgrade, agreement and implementation of this plan is needed.

REFERENCES:

Letter from IUC to UDRC dated May 8, 2006; Re: Cell 4A Lining System Design Report, Response to URS Completeness Review,

October 18, 2005 DRC letter to IUC (request for additional information).

INTERROGATORY IUC R313-24-4-02/02: DOUBLE LINER 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 R317-3-1(1.7). 1.7. Construction Supervision. The applicant must demonstrate that adequate and competent inspection will be provided during construction. It is the responsibility of the applicant to provide frequent and comprehensive inspection of the project.

Refer to R317-3-10(4)(E). E. Construction Quality Control and Assurance. A construction quality control and assurance plan showing frequency and type of testing for materials used in construction shall be submitted with the design for review and approval. Results of such testing, gradation, compaction, field permeability, etc., shall be submitted to the executive secretary.

INTERROGATORY STATEMENT:

Additional clarification on the lines of authority and communication need be included in the CQAP. Protocols for identifying and rectifying deficiencies are included in the respective liner material sections, which are useful. However, a clear and concise description of the lines of authority and communication as well as the protocols for identifying and rectifying any deficiencies in one of the upfront sections (such as in Section 3) is needed.

Also, the following corrections or clarifications on the CQAP need to be addressed:

- *Correction of the section listing contained in Section 1.4. It presents 14 sections when the plan has only 13 sections.*
- *Section 2.8 states that "The CQA Consultant is a party, independent from the Contractor, Manufacturer, and Geosynthetic Installer, who is responsible for..." However, this should also state that the CQA Officer is independent from the Owner.*

- *Section 13.1, Survey Control, states in the first paragraph the "Survey control will be performed by the Construction Manager as needed." Shouldn't this be "by the Land Surveyor as needed"? This needs to be corrected or clarified.*
- *A section on the concrete spillway needs to be included.*

BASIS FOR INTERROGATORY:

The applicant proposes to use a double liner with leak detection in order to prevent migration of wastes out of the impoundment (Cell 4A Lining System Design Report [DR]). The liners will be constructed of 60 mil High-Density Polyethylene (HDPE). The applicant has provided a Design Report (Cell 4A Lining System) that contains an introduction (summary), design drawings, Construction Quality Assurance Plan, Technical Specifications, existing berm (dike) and clay liner construction documentation, and design calculations. The applicant indicates that the double liner with the leak detection system design is the Best Available Technology (BAT).

The initial review of the CQAP resulted in a request for clarification in round 1 interrogatories on specific issues relating to the lines of communication and protocols for identifying and rectifying deficiencies. Also, that the engineer of record be an independent party. IUC's response to this interrogatory provided clarification on certain responsibilities between the Construction Manager and the Geosynthetic Installer as they relate to acceptance of the geomembrane installation for the cell. However, no mention was made in the response of the respective lines of communication and protocols for other aspects of the liner system installation (i.e., GCL, earthwork, geonet, etc).

It is recognized that the sections of the technical specifications that address each component of the liner system do discuss the specific procedures for testing, acceptance, and retesting if needed, and the sections of the CQAP that address each component of the liner system include protocol for deficiencies and notification. However, a clear and concise description of the lines of authority and communication between the Owner, Construction Manager, CQA Officer, the Engineer of Record, and the Contractor as well as the protocols for identifying and rectifying any deficiencies in one of the upfront sections of the QCAP is needed.

Some edits or clarifications were also identified since the preparation of Round 1 Interrogatories that should be addressed. They are:

- *Section 1.4 of the CQAP presents the organization of the plan. However, it presents 14 sections when the plan has only 13 sections. It appears that Section 4 was removed or combined with another section and the listing in 1.4 was not revised. This should be corrected.*
- *As noted in IUC's response to round 1 interrogatories, Section 2.8 states that "The CQA Consultant is a party, independent from the Contractor, Manufacturer, and Geosynthetic Installer, who is responsible for..." However, this should also state that the CQA Officer is independent from the Owner.*

- *Section 13.1, Survey Control, states in the first paragraph the "Survey control will be performed by the Construction Manager as needed." Shouldn't this be "by the Land Surveyor as needed"? This needs to be clarified.*
- *The CQAP does not contain a section on the concrete spillway. This should be included.*

REFERENCES:

"Cell 4A Lining System Design Report for the White Mesa Mill, Blanding, Utah," by GeoSyntec Consultants, January 2006. Prepared for International Uranium (USA) Corporation.

INTERROGATORY IUC R313-24-4-03/02: LINER STRENGTH & COMPATIBILITY

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:

Please provide either a quantitative evaluation that addresses the long-term resistance of all the liner system components to the tailings cell solution, or perform liner compatibility studies to demonstrate the long-term resistance of the materials to the cell solution. Information provided to date includes inorganic data (no organic data) and the resistance of the liner to the acidic nature of the cell solution. This information is needed due to the potential impact specific organic constituents commonly associated with uranium mill tailings could have on the liner.

Due to the significance of hydration on the ability of the GCL to sustain a low hydraulic conductivity, IUC should provide data (e.g., a plot) indicating approximate predicted levels of hydration of the GCL expected to occur over time based on the GCL being in direct contact with the subgrade materials present at the site (based on their estimated moisture content, subgrade material type, and the specific characteristics of the geotextile backing of the GCL that will be placed against the subgrade). These levels of expected GCL hydration should be compared with the levels of hydration of the GCL specimens used by Ruhl and Daniel as well as compared to the levels of hydration (moistening) of the GCL specimens that were tested by Kolstad et a.l 2004 for conventional non-prehydrated GCLs tested against acidic liquids (the latter reference source was previously cited in the Round 1 Interrogatories). The results and conclusions should then be presented in a framework that demonstrates that the reported test data are applicable to the range of the expected site conditions.

A portion of the liner will remain exposed for an extended period of time (years). Therefore, please provide an evaluation of the GCL and its ability to perform under all anticipated conditions (including where it is exposed to freeze/thaw without cover or confining pressure).

To assist in the evaluation of the liner system design please provide detailed procedures that IUC will follow during installation of the cell liner system and operation of the cell during tailings placement that will limit the stress applied to the liner system to acceptable levels. This information is needed as part of the current submittal to ensure the design is compatible with the application. For liner installation these procedures must include provisions that no construction loads be placed on the side slope liner

system, and during operation they are to include tailings placement procedures that will also limit stress to the side slope liner. The respective detailed procedures for liner installation must be included as part of the project specifications (that are included with the current application). The respective detailed procedures covering the operation of the cell are also needed at this time to complete the review of the design and they must be included in the Cell 4A Operations and Maintenance Procedures and Plan, and Best Available Technology Monitoring Plan to be provided later.

As an alternative to providing the detailed procedures requested above, a justification for the liner system design that accounts for typical construction loads and potential loads due to tailings placement on the side slopes can be provided.

BASIS FOR INTERROGATORY:

To meet the regulatory requirements referenced for the cell liner system the liner system materials (HDPE, GCL, clay, geonet, fabric, granular material, piping, extraction and monitoring equipment, etc.) need to be compatible with leachate so as not to compromise the integrity if the system.

In IUC's May 8, 2006 response to the completeness review IUC provided supporting technical information on the compatibility of the liner system materials with the cell leachate (or tailing cell solution). The resistance of the liner system materials to an acidic environment was addressed, and the technical materials, "Chemical Resistance Guide, Harrington Industrial Plastics Inc.", and "Technical Note, Chemical resistance Chart, GSE" were provided. Both include information on the resistance of HDPE and other materials to a range of potential chemical contaminants. In response to this submittal, the DRC included in round 1 interrogatories a request for current site-specific information, test data, and/or studies on the current and anticipated chemical and physical characteristics of the leachate. This was done so that comparison could be performed of the constituents in (including the organic ones), and characteristics of, the cell solution to the respective technical data.

IUC responded to the round 1 interrogatory by providing inorganic test results of the tailing cell solution from September 4, 2003. Current results from 2005 and/or 2006 were not provided, nor were any results on organic constituents. Also, no discussion was included on the results being representative of anticipated chemical and physical characteristics of the tailings cell solution.

There is concern that organic compounds in the cell solution could have an adverse impact on the liner system. Common uranium mill chemical constituents associated with uranium tailings include but are not limited to:

- *Acetone*[2,3]
- *Benzene*[2]
- *2-Butanone (MEK)*[1,2]
- *Carbon Disulfide*[1]
- *Carbon Tetrachloride*[2]

- *Chloroform*[1,2,3]
- *Chloromethane*[2]
- *Di-n-butyl Phthalate*[3]
- *Diethyl Phthalate (Phthalic Acid)*[1]
- *1,2-Dichloroethane (Ethylene Dichloride)*[1]
- *Dichloromethane*[2]
- *Methyl Isobutyl Ketone*[4]
- *Naphthalene*[1,2,3]
- *Phenol*[3]
- *Tetrahydrofuran*[2]
- *Toluene*[2,3]
- *Xylenes(total)*[2]

For example, according to the "Chemical Resistance Guide" by Harrington Industrial Plastics Inc., HDPE is shown as unsuitable for use with carbon disulfide, chloroform, and MEK, and PVC (i.e., the collection pipes) is unsuitable for all 6 compounds listed. According to the "Technical Note, Chemical resistance Chart" by GSE, HDPE has a low to unsatisfactory resistance to carbon disulfide, and unsatisfactory resistance to chloroform (MEK is not listed). It is recognized that the degree of resistance included in these references is based on significant concentrations of the respective constituent. However, data on the presences and concentration of these or other organic compounds in the cell solution has not been provided, nor has information, studies, data, etc. on the potential resistance of the liner materials to the respective organic constituent (and at the respective concentration).

IUC needs to provide either a quantitative evaluation that addresses the long-term resistance of all the liner system components to the tailings cell solution, or perform liner compatibility studies to demonstrate this long-term resistance.

In response to the ability of the GCL to maintain integrity, IUC provided an explanation and references that conclude that the hydrated GCL will provide a lower hydraulic conductivity when exposed to acidic solutions as compared to unhydrated GCLs. However, no supporting data or demonstration was provided to show that the proposed GCL would adequately hydrate under the anticipated site soil subgrade conditions.

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[1] From Draft NUREG 1724

2 From State of Utah Ground Water Discharge Permit No. UGW370004

3 From 1999 IUC Groundwater Information Report

4 From March 7, 2005 IUC Request to Amend Radioactive Material License

Due to the significance of hydration on the ability of the GCL to sustain a low hydraulic conductivity, IUC should provide data (e.g., a plot) indicating approximate predicted levels of hydration of the GCL expected to occur over time based on the GCL being in direct contact with the subgrade materials present at the site (based on their estimated moisture content and subgrade material type). These levels of expected GCL hydration should be compared with the levels of hydration of the GCL specimens used by Ruhl and Daniel as well as compared to the levels of hydration (moistening) of the GCL specimens that were tested by Kolstad et al 2004 for conventional non-prehydrated GCLs tested against acidic liquids (the latter reference source was previously cited in the Round 1 Interrogatories).

Also included in round 1 interrogatory was a discussion on the concern of freeze/thaw action on the GCL under little to no confining pressure:

> *"Other potential impacts to the GCL could result from exposure to multiple freeze/thaw cycles and from inadvertent and undetected damage during installation. Portions of the liner system will be exposed above the liquid/tailings level in the cell for an extended period of time. During this time the liner system will be not be covered (have very little to no confining pressure) and be exposed to multiple freeze/thaw cycles. As indicated in the literature cited above, GCLs subjected to freeze/thaw cycles under little to no confining pressures (no cover) could heave such that the hydraulic conductivity will increase. Assurance is needed that this action will not result in an unacceptable increase in the performance of the GCL (i.e., in a hydraulic conductivity greater than 1.0x 10^{-7} cm/sec). Inadvertent damage of a GCL during installation could result in a breach of this layer that is more detrimental to the performance of the liner system than inadvertent damage to a 12-inch thick layer of clay. Therefore, the evaluation of the GCL and its ability to perform under the all anticipated conditions an important aspect of ensuring liner system performance."*

This provided the basis for a request for more information on the GCL's ability to resist freeze/thaw. In response IUC included reference to a recent article (Podgornery, 2006) on the long-term impact of freeze/thaw on the GCL. However, the referenced article provides an evaluation for the condition where the GCL has a confining pressure such as with a liner or cover that has 5 to 15 feet of liquid over it. As stated above, the concern is over the portion of the liner that is exposed, and not covered by the solution/tailings during operation. Since there will be a portion of the liner that will remain exposed for an extended period of time (years), the evaluation of the GCL and its ability to perform under all anticipated conditions (including where it is exposed without confining pressure) needs to be provided.

Also included in this interrogatory was the following request:

> *"Please provide detailed procedures that IUC will follow during installation of the cell liner system and operation of the cell during tailings placement that will limit the stress applied to the liner system to acceptable levels. For liner installation these procedures shall include provisions that no construction loads be placed on the side slope liner system, and during operation they are to include*

tailings placement procedures that will also limit stress to the side slope liner. The respective detailed procedures for liner installation shall be included as part of the project construction specifications. The respective detailed procedures covering the operation of the cell shall be included in the Cell 4A Operations and Maintenance Procedures and Plan, and Best Available Technology Monitoring Plan.

As an alternative to providing the detailed procedures requested (in the paragraph) above, a justification for the liner system design that accounts for typical construction loads and potential loads due to tailings placement on the side slopes can be provided."

This request was not addressed in IUCs response to this interrogatory. No procedures were provided. This information is needed as part of the current submittal to ensure the design is compatible with the application. For liner installation these procedures must include provisions that no construction loads be placed on the side slope liner system, and during operation they are to include tailings placement procedures that will also limit stress to the side slope liner. The respective detailed procedures for liner installation must be included as part of the project specifications (that are included with the current application). The respective detailed procedures covering the operation of the cell are also needed at this time to complete the review of the design, and they must be included in the Cell 4A Operations and Maintenance Procedures and Plan, and Best Available Technology Monitoring Plan to be provided later.

REFERENCES:

"Cell 4A Lining System Design Report for the White Mesa Mill, Blanding, Utah," by GeoSyntec Consultants, January 2006. Prepared for International Uranium (USA) Corporation.

IUC, March 7, 2005 Request to Amend Radioactive Material License, White Mesa Mill and Environmental Report.

IUC May 1999, Groundwater Information Report for White Mesa Uranium Mill.

Ruhl, J., and Daniel, D. 1997. "Geosynthetic Clay Liners Permeated with Chemical Solutions and Leachates", Journal of Geotechnical and Geoenvironmental Engineering, Vol. 123, No. 4, pp. 369-381.

State of Utah Ground Water Discharge Permit No. UGW370004.

Smith R.D.1987, U.S. Nuclear Regulatory Commission, Sampling of Uranium Mill Tailings Impoundments for Hazardous Constituents, Memorandum, Februarey9, 1987, Division of Waste Management.

U.S. Nuclear Regulatory Commission, Standard Review Plan for Review of DOE Plans for Achieving Regulatory Compliance at Sites With Contaminated Ground Water Under Title I of the Uranium Mill Tailings Radiation Control Act, Draft Report for Comment, NUREG-1724, June 2000.

INTERROGATORY IUC R313-24-4-04/02: LINER SETTLEMENT

PRELIMINARY FINDING:

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

INTERROGATORY STATEMENT:

Please estimate, quantify, and justify the maximum total settlement, differential settlement, and distortion allowed in the cover, on the bottom and sideslopes under the liner system at the time of final closure. Demonstrate that allowable settlement, differential settlement, and distortion resulting from the anticipated loads during operation will not damage the final liner system. Please provide justification of the design criteria used that includes consideration of engineering properties of site-specific soils.

BASIS FOR INTERROGATORY:

The license application has not provided for review a complete evaluation of potential differential settlement on the bottom verses side slopes of the liner due to anticipated loads during operations and after final closure.

IUC's response included reference to the slope stability analysis provided as part of the response to the completeness review (attachment G to this response). This referenced analysis addressed the potential settlement under the berms (due to the weight of the berms), and the response discussed potential settlement under the cell. Differential settlement of the liner along the side slopes due to the surcharge of the tailings on the berms verses settlement (or lack therc of) at the cell base is not addressed. There is mention that the dike has been in place for over 16 years with only minor settlement, and this settlement is monitored. Please provide the resultant data generated from this monitoring, and note that the evaluation requested is to consider the added surcharge of the tailings on the cell berms (or dikes).

REFERENCES:

"Cell 4A Lining System Design Report for the White Mesa Mill, Blanding, Utah," by GeoSyntec Consultants, January 2006. Prepared for International Uranium (USA) Corporation.

INTERROGATORY IUC R313-24-4-05/02: 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.

INTERROGATORY STATEMENT:

Please provide evidence that the current extent of erosion, subsidence, biointrusion or other forces have not altered the dike, originally constructed in 1989, so that long-term structural integrity maybe ensured. State the extent to which erosion, subsidence, biointrusion, or other forces have altered the dike since it was originally constructed. State inspections, maintenance and/or repairs conducted to date including documentation developed, such as logs, data, and inspection reports.

Please confirm that slope stability analysis represents the most critical slope conditions for the proposed Cell 4A dike, (i.e., under the assumption of partial or total liner failure, and when the cell is full of liquid to capacity). If not, please provide a revised analysis that does evaluate the most critical slope conditions. Also, please provide the basis for the 0.10g seismic loading.

In response to this request a revised dike stability analysis was recently received from IUC (June 9, 2006), and is currently undergoing review.

BASIS FOR INTERROGATORY:

Appendix D of the design report presents documents from the original construction of the dike on the west and south sides of Cell 4A. However, this information is inadequate to conduct a detailed review of the license and to meet the regulatory requirements. Information is needed as to how the dike has been maintained or will be re-constructed to meet the requirements for structural integrity during the active life of the impoundment.

IUC's May 8, 2006 response to URS Completeness Review did provide an evaluation of the stability of the original Cell 4A dikes. This evaluation considered two slopes and used a seismic loading of 0.10g. The indication was that the slopes evaluated were 3H:1V, and they are the highest. However, the design report does indicate the presence of a 2H:1V slope on the west side of Cell 4A. Due to the presence of the 2H:1V slope, it is uncertain if the slopes evaluated are the most critical. Also, the basis for the 0.10g seismic loading was not included.

In response to this request a revised dike stability analysis was recently received from IUC (June 9, 2006), and is currently undergoing review.

REFERENCES:

"Cell 4A Lining System Design Report for the White Mesa Mill, Blanding, Utah," by GeoSyntec Consultants, January 2006. Prepared for International Uranium (USA) Corporation.

INTERROGATORY IUC R313-24-4-06/02: BEST AVAILABLE TECHNOLOGY

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:

Please provide a revised Specification Section 02772 to include a requirement that the GCL must incorporate a woven geotextile as at least one component of the GCL. Please also include, in the revised Specification Section, a specific requirement, as applicable, to indicate which side of the GCL is to be installed upward (i.e., in contact with the lower geomembrane).

Please provide a Leachate Monitoring, Operations, Maintenance, and Reporting Plan that includes an estimate of the anticipated flow rates and maximum capacity in the leachate collection system (slimes collection layer). This estimate should include a calculation that:

- *Estimates the flow rate of the tailings cell solution through the tailings and into the collection pipes.*
- *A demonstration that the sand fraction will settle out and provide an adequate slimes drainage layer, this sand drainage layer is properly designed so that tailings fines will not filter into it and result in the clogging of the sand layer (restricting flow in this drainage layer), and that the proposed collection pipe layout is adequate to collect and remove the leachate solution.*

The Leachate Monitoring, Operations, Maintenance, and reporting Plan should also include proposed response actions to take if the Action Leakage Rate is exceeded.

Please provide the following information to support the determination of an appropriate Action Leakage Rate for the Cell 4A lining system. This information should be included as part of the Leachate Monitoring, Operations, Maintenance, and Reporting Plan.

1. *A revised Action Leakage Rate (ALR) Calculation or revised Project Specifications for the geonet (leak detection layer) to ensure that the geonet thickness used in the ALR calculation is also required in the Project Specifications, and that an appropriate factor of safety is included, as needed, in the ALR calculation to account for uncertainties associated with the manner of geonet installation within Cell 4A.*
2. *A compilation (or graphical representation) of different ALR values that would be appropriate for different heights of liquid in Cell 4A to cover the range of liquid levels that are anticipated to occur in Cell 4A during cell operations.*
3. *A revised Project Specification for the geonet and a revised Construction Quality Assurance Plan as required to ensure that the requirements for adjoining the geonet panels or pieces of geonet together in the field address differences in flow capacity of the selected geonet in directions other than the machine direction of the geonet, as applicable based on the geonet type selected for final use.*

Further review of the design calculations revealed some inconsistencies that should be addressed. Please provide the following revisions or additional information so that the design calculations are consistent:

1. *A revised Pipe Strength Calculation that provides a consistent value for the PVC pipe ring deflection (page 5 of 6, contains a different value than that calculated on page 3 of 6). It appears that the calculation was revised and the ring deflection indicated in the narrative on page 5 of 6 was not updated*
2. *A revised Emergency Spillway Concrete Pavement Calculation that provides a consistent value for the slab bending moment due to the applied wheel load (page 3 of 5 contains two inconsistent values for this parameter compared with Attachment C). What about consideration of a significantly heavier piece of equipment traveling over the spillway such as may occur during construction or future cell development? All of the information contained on the final page of this calculation (drawing sheet 7 of 7) is not visible due to the fact that the original measured 11" x 17" and was copied as letter size; please provide a legible reproduction. Also, the date on this drawing (November 2005) is not consistent with the date of the latest revision to the Size D drawings (dated January 2006).*
3. *A revised Spillway Capacity Calculation that provides a formal list of references utilized in the document. The calculation should also include additional documentation of assumptions in regard to the size and flows off/from Cells 2 and 3.*

In response to the request to have complete horizontal and vertical control included on the project drawings, IUC responded that construction level drawings will be prepared that include horizontal and vertical control. IUC must submit Construction level drawings to the DRC for review prior to the issuance of a construction permit.

BASIS FOR INTERROGATORY:

For waste cell liner systems as proposed for Cell 4A, the State of Utah considers BAT to be a double liner with leachate collection/detection systems. For Cell 4A, this means, at a minimum:

- *Leachate collection layer and removal system above a primary liner consisting of appropriately designed collection pipes, granular filter bed, and sump type extraction system. The leachate collection system shall have the ability to remove liquid from the cell in practical and timely manner.*
- *Primary HDPE Liner that is at least sixty (60)-mil thick.*
- *A rapid reporting leak detection layer and removal system between the primary and secondary liner consisting of appropriately designed collection pipes, geonet and/or granular filter bed, and sump type extraction system. The leachate detection system shall operate so as to maintain a minimal head on the secondary liner with a maximum allowable head of one (1) foot under anticipated impacts from siltation and clogging, rib layover and creep of synthetic components of the system, overburden pressures, etc.*
- *A composite secondary liner that consists of a HDPE liner that is at least sixty (60)-mil thick over at least twelve (12) inches of compacted clay with a maximum permeability of 1 x 10^{-7} centimeters per second.*
- *Bedding layer and/or appropriately prepared and clean subgrade.*
- *Maximum side slopes of 3-horizontal to 1-vertical*
- *Leachate Monitoring, Operations, Maintenance and Reporting Plan (that addressees both the leachate collection and detection system)*
- *Ground Water Monitoring system (per the facility Ground Water Quality Discharge Permit)*
- *Ground Water Monitoring Plan (per the facility Ground Water Quality Discharge Permit)*
- *Liner Maintenance and Inspection Plan*

The Round 1 Interrogatory included the following request:

> *"Please provide additional information to demonstrate, for the anticipated site conditions, that the proposed width of longitudinal GCL panel overlap (12 inches) is adequate to prevent the possibility of separation gaps occurring between individual GCL panels after field placement of the GCL panels."*

IUC's provided the following in their May 26, 2006 response:

> "Current industry standard of practice is to install adjacent geosynthetic clay liner (GCL) panels on side slopes with a minimum 6-inch overlap. When the liner system is to remain exposed, the industry is moving towards a 12-inch overlap, as

recommended by Thiel, et. al., 2005. In addition, for the following reasons, the amount of GCL separation is not expected to be greater than 12 inches:

- The GCL to be used in the Cell 4A project will have a woven geotextile component that will minimize the potential for tension developed necking in the GCL.
- A white surfaced geomembrane will be installed to limit temperature changes within the exposed liner system components.
- Two geomembrane layers and one geonet layer installed overlying the GCL will provide some temperature insulation for the underlying GCL.
- The side slopes are not considered steep (greater than 2H:1V) and will therefore have less tension developed necking in the GCL."

The first bulleted item in the response states that the GCL will incorporate a woven geotextile component that will minimize the potential for tension-developed necking in the GCL. However, Section 02772, Geosynthetic Clay Liner, of the Project Specifications does not include any specific requirements regarding the type(s) of geotextile backing required for the GCL. The specifications should be revised to reflect these requirements. Also, the third bullet states that a 2H:1V is not considered steep. However, when compared to the BAT requirement of 3H:1V maximum slope and slopes typical for waste cell structures, 2H:1V are considered steep.

Also included in round 1 interrogatory was the following request:

> *"Please provide a Leachate Monitoring, Operations, Maintenance, and Reporting Plan that includes an estimation of anticipated flow rates and maximum capacity in both the leachate collection and detection systems."*

IUC's response did not include a Leachate Monitoring, Operations, Maintenance, and Reporting Plan and indicates that the respective flow rate information is included in the evaluation of the Action Leakage Rate (reference IUC's May 24, 2006 submittal). However, only the flow in the leak detection system is included as part of this evaluation. Also, IUC's response included the following in response to a request for clarification on the slime drain layout included in the drawings:

> "The slimes drain system is installed in a manner that provides drainage of the low point of the cell and is design to aid in dewatering of the slimes fraction of the tailings solids. The tailings will be placed into the Cell along the north, northwest and northeast sides of the Cell. The sand fraction will settle out first near the point of discharge and the finer grained material will eventually settle in the pool area of the Cell. The sand fraction of the tailings solids will drain faster than the slimes fraction, therefore extending the drain in to those areas will provide little or no additional benefit. The slimes drain layout proposed for Cell 4A is approximately three (3) times larger than the systems installed in the other cells."

The estimate of the anticipated flow rates and maximum capacity in the slimes collection layer needs to be provided. IUC's response should include a calculation that estimates the flow rate of the tailings cell solution through the tailings and into the collection pipes,

and an assurance that the sand fraction will settle out and provide an adequate drainage layer. This is of specific concern since drainage media such as sand used for drainage layers need to be designed (sized or a filter applied) so that the overlying fines (slimes) do not infiltrate and clog the sand. The design of the collection pipe also needs to be justified.

The Action Leakage Rate, which is defined as the maximum design flow rate that the leak detection system can rapidly remove without the fluid head on the liner exceeding one (1) foot, needs to be determined. IUC provided the calculation of the Action Leakage Rate in their May 24, 2006 response. However, the review of this calculation revealed the following concerns:

1. *There is an inconsistency in the thickness of the geonet (leak detection layer) assumed for the Action Leakage Rate determination (300 mils) and the specified thickness of the geonet as indicated in Table 02773-1 of the Project Specification (Appendix C of the Cell 4A Lining System Design Report). This discrepancy needs to be resolved by either revising the ALR calculation to include a 200-mil geonet thickness or by revising the Project Specifications to specify a 300-mil geonet thickness.*
2. *It is our understanding that during some periods of cell operation, the volume of process liquids stored in Cell 4A will be less than 37 feet in height. During such time periods, the flow (leakage) rates to the leak detection system will be less than when the full 37 feet of liquid head would be present. In other words, the calculated action leakage rate is a function of fluid head, and a fluid head less than 37 feet will have a lower action leakage rate. Therefore, since the action leakage rate is a function of the fluid head, and the head on the liner in the cell will vary with time and facilities operations, a correlation of fluid head to action leakage rate needs to be developed and used so that the appropriate action leakage rate is used and the function of the liner properly monitored.*
3. *The 300-mil geonet thickness used in the ALR calculation appears to imply use of a tri-planar geonet while the 200-mil geonet thickness specified in Section 02773 of the Project Specifications (Appendix C) appears to imply use of a bi-planar geonet. Test data (e.g., GSE, undated) indicate significant differences in flow capacities for biplanar and triplanar geonets depending on flow directions within the geonet that differ from the machine direction. Geonet panel installation orientations and geonet panel overlap/connection configurations implemented in the field may therefore affect flow capacities depending on whether they include adjoining of panels or pieces in such a way that would lead to flows not parallel to the machine (roll) direction of the individual geonet panel/pieces. The Specifications and Construction Quality Assurance Plan should be revised as needed to reflect appropriate procedures for installing and adjoining geonet panels and geonet pieces based on the final selected geonet type to ensure constancy with design assumptions. Please also include, as appropriate, an appropriate specific factor of safety in the ALR calculation to account for*

uncertainties relating to the final manner (e.g., direction) of installation of portions of the geonet in selected areas of Cell 4A.

Further review revealed some inconsistencies in the project calculations. These were not included in the Round 1 Interrogatories however; they should be addressed and revised final calculations produced. They include:

1. *The Pipe Strength Calculation that contains an inconsistent value for the PVC pipe ring deflection (page 5 of 6, contains a different value than that calculated on page 3 of 6). It appears that the calculation was revised and the ring deflection indicated in the narrative on page 5 of 6 was not updated*
2. *The Emergency Spillway Concrete Pavement Calculation has an inconsistent value for the slab bending moment due to the applied wheel load (page 3 of 5 contains two inconsistent values for this parameter compared with Attachment C). Is the equipment load the maximum load anticipated during construction and operation? All of the information contained on the final page of this calculation (drawing sheet 7 of 7) is not visible due to the fact that the original measured 11" x 17" and was copied as letter size. Also, the date on this drawing (November 2005) is not consistent with the date of the latest revision to the Size D drawings (dated January 2006).*
3. *No formal list of references used was provided with the Spillway Capacity Calculation. The calculation should also include additional documentation of assumptions in regard to the size and flows off/from Cells 2 and 3.*

REFERENCES:

"Cell 4A Lining System Design Report for the White Mesa Mill, Blanding, Utah," by GeoSyntec Consultants, January 2006. Prepared for International Uranium (USA) Corporation.

GSE. Technical Note: "Installation of Geosynthetic Drainage Products". Undated. Available at:

http://www.gseworld.com/Literature/TechnicalNotes/PDF/TN025installationgeo.pdf

Thiel, R., Criley, K., and Bryk 2005. "Practical Guidelines for Specifying GCL Overlaps", Geotechnical Fabrics Report, October/November 2005. St. Paul, MN.

40 CFR 264.301.