INTERNATIONAL URANIUM (USA) CORPORATION

August 29, 2006

VIA E-MAIL AND OVERNIGHT DELIVERY

Mr. Dane L. Finerfrock
Director
Division of Radiation Control
Department of Environmental Quality
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Re: Cell 4A Lining System Design Report, Response to DRC Request for Additional Information – Round 4 Interrogatory, Cell 4A Design.

Dear Mr. Finerfrock:

We are responding to your July 20, 2006 letter, requesting additional information following on the Cell 4A Lining System Design. These responses confirm the telephone discussions with DRC representative on August 2, 2006.

For ease of review, the Division of Radiation Control's ("DRC's") questions are repeated below in italics with International Uranium (USA) Corporation's ("IUSA's") responses following each question.

1. *Radiation Survey Report and Demonstration*

   IUSA is finalizing the revisions to the Final Cleanup Monitoring Plan and will submit the Plan under separate cover.

2. *Revised Construction Quality Assurance (CQA) Plan – include 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.*

   A revised CQA Plan is presented in Attachment A.

3. *CQA Plan, Technical Specifications, Drawings – perform concrete strength testing in field by collecting one set of compressive strength cylinders.*

   A revised CQA Plan is presented in Attachment A. Technical specifications and drawings remain unchanged.

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4. *CQA Plan, Technical Specifications, Drawings – provide aggregate, subgrade, and anchor trench compaction criteria.*

   Revised Technical Specifications are presented in Attachment B. As agreed with DRC, aggregate placed over liner material will not be compacted or tested for compaction. Sub base material will not be needed under the concrete spillway. CQA Plan and Drawings remain unchanged.

5. *CQA Plan – correct reference to Table 1A in section 7.2.1.*

   A revised CQA Plan is presented in Attachment A.

6. *GCL Chemical Resistance – provide methods for GCL hydration.*

   The GCL manufacturer, CETCO, does not typically recommend hydrating (i.e. spraying with water) GCLs during installation as the GCL will hydrate by absorbing water from adjacent soils soon after installation. However, if the time the GCL is to be exposed to the subgrade prior to service is short, CETCO recommends, in a telephone conversation between Greg Corcoran of GeoSyntec Consultants and Laurie Tockey of CETCO on 21 August 2006, that the GCL be hydrated to 50% moisture content.

   Based on this advice, the GCL will be hydrated to 50% moisture content shortly after installation and prior to installation of the overlying geomembrane. The GCL will be sprayed with water at a rate of approximately 1,000 gallons per acre to achieve an increase of 25% moisture content in the GCL (GCL is anticipated to be delivered at approximately 25% moisture content, variations will be adjusted in the field to accommodate changes in delivered GCL moisture content). In addition, the subgrade will be moisture conditioned prior to installation of the GCL. Moisture conditioning will be performed at a rate that will not make the subgrade unacceptably soft or unworkable for deployment of the GCL. The CQA Plan and Technical Specifications have been updated and are presented in Appendices A and B, respectively.

   To demonstrate the effectiveness of the GCL hydration process, a small piece of GCL will be installed over on-site soils and beneath a piece of geomembrane secured on all four sides. Samples will be collected from the GCL to measure the moisture content of the GCL after a period of 2, 4, 6, and 8 weeks.

7. *GCL Freeze Thaw – provide evaluation of ability to withstand freeze thaw conditions without confining pressure.*

   The liner system that will remain exposed during the winter, and therefore subject to freezing, will not be covered with waste materials. When additional waste material is added to the Cell, the increase in the surface elevation will change very gradually. As the surface elevation increases, the exposed liner system will become covered and will then be insulated from the freezing effects and be subjected to a confining stress. Once insulated, the liner system components will thaw and the bentonite component of the GCL will self heal under the applied confining stress.

Furthermore, the GCL will not likely be exposed to waste materials due to the following conditions:

- The head on the primary geomembrane portion of the side slope that may experience the freeze/thaw will be very small;
- The primary geomembrane combined with the secondary geomembrane provide two levels of protection of the GCL; and
- The leak detection system underlying the primary geomembrane will not allow head to develop on the secondary geomembrane, which will preclude potential migration through the secondary geomembrane into the GCL.

According to Podgornery, et. al. (Podgornery, 2006), long-term exposure of GCLs to freeze thaw cycles resulted in no appreciable increases in the hydraulic conductivity. Podgornery, et. al. tested the GCL by submitting samples of GCL to freeze thaw cycles under no normal or confining stresses. The samples were then tested, under low normal or confining stresses, to determine the hydraulic conductivity of the GCL after a specific number of freeze thaw cycles. This methodology models the exposed side slope liner case for this project as the GCL will be subjected to no normal stress during freeze thaw cycles and will then be subjected to a normal stress prior during potential permeation.

Furthermore, the dike was constructed of on-site soils that are generally classified as clayey sands and silts. Site materials (ore storage pad area) have been tested for hydraulic conductivity and found to have laboratory hydraulic conductivities of between 1.2 x 10^{-6} cm/sec and 3.5 x 10^{-8} cm/sec with a statistical mean of 2 x 10^{-7} cm/sec (Hydro Geo Chem, 2002). These soils will act as an additional liner system, further minimizing the potential for liquids to migrate from within Cell 4A, through 2 geomembrane layers, a GCL layer, and more than 10 feet of on site soils with hydraulic conductivity less than 1 x 10^{-6} cm/sec.

In contrast, compacted clay liner materials subjected to freezing will develop ice lenses that, upon thawing, will leave voids in the soil matrix thereby increasing the permeability of the clay liner. La Plante, et. al. show that clay soils exposed to more than 20 freeze/thaw cycles can exhibit a permeability increase of more than one order of magnitude (LaPlante, 1992). To correct the problem, the clay soil would potentially need to be reworked and re-compacted. Therefore, a GCL is less susceptible to damage from freeze/thaw cycles and more protective of the environment.

8. *<u>Liner System Installation</u> – Provide information regarding use of ATVs during installation of geosynthetic materials.*

The liner system installer will utilize low ground pressure equipment that will place a localized normal stress of less than 6 psi (loaded equipment) on the liner system components. The contact surface will be comprised of a rubber tire or rubber track. This equipment will operate on the floor and not on the side slopes, except for the northeast corner.

According to Henning (Henning, 2002), the human foot can exhibit pressures in the heal of approximately 20 psi and in the fore foot of approximately 7.7 psi. Henning presents higher foot pressure values for humans running in athletic shoes.

Based on the human foot pressures, the proposed low ground pressure equipment will have less of an impact on the liner system components than the personnel working on the geosynthetic materials during installation.

9. *Dike Stability, Seismic Loading and Routine Maintenance and Monitoring*

– clarify sideslope inconsistency on slope stability evaluation models

Side slope condition shown on the calculation package titled "Settlement Evaluation of Berms" has been changed to reflect the correct 3H:1V outer side slope condition. Attachment C presents the revised calculation package.

-Seismic Loading

IUSA previously submitted the original Cell 4A Design documents providing a Seismic Risk Analysis for the dike design of Cell 4A. A copy of the Seismic Risk Analysis was included as Attachment I in the May 26 response to the 1st Round Interrogatories. Section 1.3.4, "Potential Earthquake Hazards to Project" of this submittal details the justification for the 0.10 g seismic loading.

IUSA also reviewed two additional references detailing a probabilistic seismic analysis for the region surrounding the Moab Title II tailings site ("Wong"). IUSA finds nothing in the Wong analysis specific to the Moab site to contradict the conclusions and basis for the design parameters presented in the Cell 4A Design documents. The Wong analysis for the Moab site lists peak horizontal accelerations of 0.05, 0.07, 0.14 and 0.18g based on return periods of 500, 1000, 5000 and 10,000 years respectively. Wong recommended the seismic design criteria for the Moab site to be based on a return period of 10,000 years. This recommendation is stated to be very conservative based on the fact that the Moab site is located adjacent to the Colorado River and could cause a release into a major water source. The Moab site was considered to be a higher risk than other Title II sites.

40 CFR 192.02 and Appendix A requires 1,000 return periods, which would have resulted in a peak horizontal acceleration of 0.07g for the Moab site. Because of the proximity of the Moab site to the Colorado River the more conservative assumption is warranted. The White Mesa Cell 4A Design risk analysis looked at potential fault

systems close to the actual site. Various studies cited in the report recommend peak horizontal ground accelerations ranging from 0.04 to 0.07g based on return periods of 50 to 1000 years. This is not inconsistent with the values for the Moab site assuming the more realistic return periods. The original Cell 4A Design Report used a more conservative value for peak horizontal accelerations of 0.10g for design basis.

IUSA also reviewed the 1994 study titled "Seismic Hazard Analysis of Title II Reclamation Plans" prepared by Lawrence Livermore National Laboratory ("LLNL") for the U.S. Nuclear Regulatory Commission. The abstract of the LLNL study states in part:

> "In its effort to evaluate the risk associated with those piles, the NRC sponsored the Lawrence Livermore National Laboratory to perform a simplified seismic hazard analysis for all the sites. The emphasis of the study was to review the geology, seismicity and tectonics of the regions, to establish the bases for the selection of the design criteria, when they existed, and to determine whether the perception of the seismic hazard had changed since the last analyses were performed. For example, newly discovered active faults running close to a site could have an important impact on the perception of the hazard at a specific site.
>
> LLNL reviewed all the available literature, interviewed local experts geology, seismicity and ground motion estimation and developed an estimate of the current design criteria for each site. The adequacy of the as built design criteria were then determined on a site by site basis."

The section of the LLNL study specific to the White Mesa Mill site made the following comments on the seismic potential of the site:

> "The nearest Quaternary fault to the White Mesa site is the Shay Graben Fault System which is 40 km north of the site. There are other faults 60 km west of the site, the Bright Angel Fault System (Hecker 1993), which may be Quaternary. However, the individual faults in the Bright Angel Fault System are shorter than the Shay Graben Fault System, thus the Mu [largest possible earthquake] for the system is smaller than for the Shay Graben. This possible ground motion at the White Mesa site is much lower for earthquakes on the Bright Angel Fault System from the largest events postulated to occur on the Shay Graben Fault System."
>
> "As discussed in the deterministic analysis for the Rio Algom site, the Mu for the Shay Graben Fault System is 6.9 with a more likely value of 6.5. The 1-sigma estimate for PGA [peak ground acceleration] for a M-6.5 earthquake located on the Shay Graben Fault System at the site is 0.12g with a median estimate of 0.07g. To account for the less likely 6.9 earthquake we use the median estimate for PGA which is 0.08."

The LLNL study concluded, in part:

> "There appear to be no faults in the vicinity of the site which could introduce surface rupture through the site and tailings piles. Our estimate for the range of appropriate PGA to use is 0.05 to 0.12g."

As with the Wong reports, there also appears to be nothing the LLNL study to suggest that the 0.10 g ground acceleration used for the White Mesa design is not appropriate or that further study is warranted.

-Routine Maintenance and Monitoring

Trained personnel inspect the White Mesa tailings system on a once per day basis. Any abnormal occurrences or changes in the system are immediately reported to Mill management and maintenance personnel. The inspectors are trained to look for events involving the routine placement of tailings material as well as events that could affect the integrity of the tailings cell dikes. The daily inspection reports are summarized on a monthly basis and reviewed by the Mill Manager. On an annual basis a Utah Registered Professional Engineer evaluates the tailings area, operations and inspection reports. The results of this evaluation are presented to Mill management with recommendations for maintenance or modifications to operating or inspection procedures. A copy of the annual evaluation is also submitted to the DRC. As a part of the annual evaluation, a Utah Registered Land Surveyor checks control points that have been installed on the crests of the Cell 3 and Cell 4A dikes to ensure that there has been no abnormal settlement or displacement of the dike structures. This survey information is reviewed as a part of the annual evaluation and compared to the previous surveys. The routine inspections, as well as the annual evaluations, have ensured that there has been no alternation or change to the dike structures that have adversely affect the dikes since originally constructed. A copy of the most recent annual evaluation has been sent under separate cover to the DRC's design consultant.

10. <u>Slimes Drain System Operation</u>

The initial loading of tailing sands into Cell 4A will occur in the southwest corner overlying the slimes drain system piping. This initial loading will occur through three separate points where discharge piping will be located. The tailings slurry will be processed through a cyclone or classifier system to split the larger sand fraction from the slimes portion of the slurry. The sand portion will be discharge over the slimes drain piping network to aid in establishing a filter blanket over the drain pipes. The slimes fraction will be discharged to Cell 3 or to an area in Cell 4A along the north or east sides. The sand discharge points are illustrated in Figure 1 and depict a covering of at least 2 feet of sands overlying the slimes drain system piping. Subsequent to the initial loading, tailing sands will be discharged through six separate points along the northern and eastern perimeter berms. These points are illustrated on Figure 2 and depict the discharge of the sands into Cell 4A such that the finer tailings fraction (slimes) will accumulate in the southwest corner over the initial loading of the coarser tailings sands.

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11. *<u>Action Leakage Rate</u> – additional information, 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. Data used in this analysis, along with calculations and listing of data generated/used as the basis of the plot must be provided.*

    Attachment D presents a graphical representation of the varying factor of safety values and calculations for the Action Leakage Rates (ALRs) associated with different head conditions in Cell 4A.

12. *<u>Geonet Specification Revision</u> – Address design considerations for the geonet including direction of placement of the geonet, possible damage to geonet material occurring during installation or temperature affects, possibility of partial intrusion of geomembrane into geonet and its affects, and the uncertainty with respect to adequacy and appropriateness of intrusion assumptions.*

    The Technical Specifications have been updated to include a requirement that the geonet be placed perpendicular to the contour interval (direction of flow) and the transmissivity testing is to be conducted with the geonet placed between two layers of 60-mil HDPE geomembrane. Attachment B presents the revised Technical Specifications.

13. *<u>Design Calculation Inconsistencies and Revisions</u> – including a revised pipe strength calculation with updated values, a revised emergency spillway concrete pavement calculation that provides a consistent value for the slab bending moment due to the applied wheel load and calculation that considers the future use of a heavier piece of equipment. Spillway calculation should provide a formal list of references, additional documentation of assumptions.*

    Attachment E presents the revised calculation packages. The size and flows used for the spillway design calculation were taken from the January 1990 White Mesa Mill Drainage Report submitted to the U. S. Nuclear Regulatory Commission by Umetco Minerals Corporation. In the Drainage Report, the Probable Maximum Precipitation/ Probable Maximum Flood ("PMP/PMF") was determined using NOAA's Hydrometeorological Report 49, Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages.

If you have any additional questions please feel free to contact me at (303) 389-4160.

Very truly yours,

Harold R. Roberts
Vice President - Operations

cc: Ron F. Hochstein, IUSA
Steve D. Landau, IUSA
Greg T. Corcoran, GeoSyntec

References

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