November 6, 2008

Mr. Wayne W. Heili
President
Lost Creek ISR, LLC
5880 Enterprise Drive, Suite 200
Casper, WY 82609

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION – NEW LICENSE APPLICATION REQUEST – LOST CREEK ISR, LLC'S LOST CREEK IN SITU RECOVERY FACILITY, SWEETWATER COUNTY, WY (TAC J00559)

Dear Mr. Heili:

By letter dated March 31, 2008, Lost Creek ISR, LLC (LCI) resubmitted a source material license application for the Lost Creek in situ leach (ISL) uranium project in Sweetwater County, Wyoming, to U.S. Nuclear Regulatory Commission (NRC) staff. By letter dated June 10, 2008, the staff informed you that we completed our acceptance review of your application and found it acceptable for technical review. NRC staff has now completed a detailed review of the Technical Report supporting your application. Our review has identified deficiencies in the Technical Report that require additional information to complete our review.

During the technical review, the staff identified issues related to hydrogeology and radiation protection. Regarding hydrogeology, the staff requested additional information necessary to understand subsurface conditions and the manner in which the existing aquifers would respond to ISL operations. The staff also identified issues regarding radiation protection, including the need for more information on monitoring and the calculation of doses to members of the public and employees.

The request for additional information (RAI) is included in the enclosure. Within 30 days, please either provide the information requested or a schedule for submitting the requested information. Please note that untimely responses to this RAI could delay completion of the safety review. We are available to meet with you to discuss the requested information in more detail and provide any guidance you might need to respond to this RAI.

If you have any questions concerning this letter, please contact me, either by telephone at (301) 415-7182, or by e-mail at stephen.cohen@nrc.gov.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Sincerely,

**/RA/**

Stephen J. Cohen, Project Manager
Uranium Recovery Licensing Branch
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Docket No. 40-9068

Enclosure: Request for Additional Information

cc: John Cash, LCI
Mark Thiesse, WDEQ
Mark Newman, BLM
Melissa Bautz, WDEQ
Jon Kaminsky, BLM

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| Date | 11/06/08 | 11/06/08 | 11/06/08 | 11/06/08 |

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**U.S. Nuclear Regulatory Commission Request for Additional Information**
**Lost Creek ISR, LLC, Lost Creek In Situ Recovery Facility**
**Application for a U.S. Nuclear Regulatory Commission Source Materials License**

By letter dated March 31, 2008, Lost Creek ISR, LLC (LCI) resubmitted a Source Materials License application to the U.S. Nuclear Regulatory Commission (NRC) staff for the Lost Creek ISR Project, a proposed in situ leach (ISL) uranium recovery facility. NRC staff has completed its technical review of this application and offers the following Request for Additional Information (RAI). Individual information requests are organized by the section in which the subject matter is found in the application. A basis for requesting the information is provided for each section of the RAI.

## Section 2.5 Meteorology, Climatology and Air Quality

LCI has not provided sufficient information regarding the meteorological characteristics of the site to enable the staff to fully understand this topic and to support other reviews dependent on that understanding, such as dose to members of the public. Specifically, please provide the following information:

1. Section 2.5.5.2.
    a. Section 2.5.4 ("Winds") and Figure 2.5-3 indicate that the most prevalent winds are from the west-northwest. Section 7.2.1.2 ("Exposures from Air Pathways") indicates that the SEB1 boundary location has the highest calculated total effective dose equivalent. In addition, the proposed mine unit abuts the permit boundary in the SEB1 area. However, there has been no preoperational radon sampling in this area. Identify and provide justification for using the downwind radon monitoring location that excludes these areas.
    b. Information regarding instrumentation used to collect radon gas measurements.
    c. Information regarding instrumentation used for gamma air sampling.
    d. Information obtained regarding radon equilibrium ratios as a result of environmental sampling.
2. A description of onsite meteorological instrumentation.
3. Any effects of nearby water bodies identified in Figure 2.5-1 on meteorological measurements.
4. Information regarding total evaporation by month.
5. Information regarding annual average mixing layer heights.
6. Information regarding average inversion height.
7. Wind stability class in tabular format.

## 2.6 Geology and Soils

The analysis of the geology in the proposed license areas is currently insufficient to determine the relationship and isolation of the extraction layer from the overlying and underlying aquifers especially across the fault. Please provide:

1. The land surface elevation in mean sea level (msl) on all of the cross sections and the distance in feet between wells.
2. Maps of the top elevation in msl for the following layers: The FG horizon, the Lost Creek Shale (LCS), the HJ horizon, the Sage Brush Shale (SBS), and the KM horizon. Include the location of the fault on all maps to enable reviewers to assess the change in elevation of these layers across the fault.
3. A discussion of the true thickness of the overlying and underlying shales where isopach maps indicate they are less than ten feet thick, especially within the mine units. Large sections exist of less than 10 foot thickness in the SBS and several areas in the LCS in the proposed mine units.
4. Evidence or further explanation of why LCI has confidence that the 560 abandoned exploration holes drilled prior to 2000, shown in Attachment 2.6.2, were sealed and surface plugged in compliance with the State of Wyoming Regulations in effect at the time of drilling
5. Please provide an analysis of the short term stability of the storage ponds. Guidance regarding this type of analysis can be found in Regulatory Guide 3.11, “Design, Construction, and Inspection of Embankment Retention Systems for Uranium Recovery Facilities.”

## Section 2.7.1 Surface Water

The analysis of the surface water hydrology and quality in the proposed license areas is currently insufficient to determine the potential for floods to disrupt the operation of the facility. Provide the following:

1. Maps showing areas inundated during major flood events within each proposed license area.
2. A discussion of the potential for flooding of the area around the central processing plant and the provisions to protect critical equipment and components.
3. Peak flow estimates at recurrence intervals for all drainages within the license area near or crossing the planned wellfields noted on topographic maps.
4. Provisions for erosion and wellhead protection against the effects of flooding from all drainages in the license area which pass near or through planned wellfields, or explain why protection is not necessary. All berms, culverts, rock riprap, drainage, or diversion channels are suggested to follow a design which meets the requirements of 10 CFR Part 40, Appendix A.

**Section 2.7.2 Groundwater Occurrence**

The analysis of the groundwater hydrology and water quality in the proposed license area is currently insufficient to interpret the impact of operations on groundwater flow and quality in and around the license area. Please provide the following:

1. Potentiometric contours in msl and groundwater flow direction and gradient for the FG horizon, HJ horizon, and KM horizon across the entire license area, in addition to the fault region provided previously.
2. Cross-sections showing water levels in msl for the overlying (DE and FG horizon), ore zone (HJ horizon) and underlying aquifers (KM horizon) in the proposed permit area (Figures 2.6-1b-e).
3. A surface map showing the names and locations of the sands that act as the surficial aquifer (highest occurrence of groundwater) and contours of their water levels in feet below ground surface (bgs) across the proposed permit area.
4. Tables identifying the existing or planned locations, rates and total withdrawal of any domestic or stock wells within a five mile radius of the license area. This distance was selected based on predicted drawdowns of 146 ft at 2 miles and 114 ft at 3 miles ( page 3-14). Provide a notation for the type of water use for all wells.
5. A correction for the location of monitoring well HJMP 110 on Figure 2.7-9 and clarify other well locations on this map for readability. Also a correction for the township/range numbers on cross section 2.6-1b and c in the small inset maps.
6. A column indicating the dates for the 1982 pumping tests and the 2006 pumping tests in Table 2.7-9.
7. All pumping test data and the drawdown/recovery plots for the three 2006 long term tests in the HJ horizon and information on screens and well completion for the pumping well and observation wells used for each test.
8. Redraw the axes in Figures 6-2, 6-6, 6-8 and 6-10 in Attachment 2-7 as they are switched.
9. In Table 3-1 in the pumping test report (Attachment 2.7), please provide the top of screen and bottom of screen in msl and indicate if each well was completed across the entire aquifer (FG. HJ, KM) horizon or one or more particular sands of each horizon (e.g., UHJ, MHJ, etc). Also provide the perpendicular distance of each well from the fault. For example:

| WELL NAME | FAULT LOCATION | FAULT DISTANCE | TOS | BOS | AQUIFER |
|---|---|---|---|---|---|
| LC19M | North | 200 ft | 6700ft | 6800 ft | All 25 ft of LHJ, bottom 10 ft MHJ, 0 ft of UHJ |

10. An explanation of how a pumping test conducted on specific layers of the heterogeneous HJ horizon can be used to determine a representative transmissivity of the entire HJ horizon which is about 120 ft thick. According to an analysis of Table 3-1 in Attachment 2.7, the completion intervals of the pumping and observation wells in the LC19M pumping test were of different lengths (20-57 ft) and across different sands (UHJ, MHJ, LHJ).
11. The manner in which LCI has and will account for the difference in the well completion locations in the HJ horizon across the fault on the pumping test analysis for the determination of connectivity in the DE, FG, HJ and KM horizons . For example, please explain how an observation well located in the HJ horizon on the south side of the fault was used to determine connectivity from the pumping well in a much higher HJ horizon on the north side of the fault. As shown in cross section HH, if the pumping well is screened in MHJ and UHJ on the north side and the observation well is screened in the entire HJ horizon on the south side, the observation well may not fully respond since the HJ horizon is thrown down on the south side and separated by the LCS from the MHJ and UHJ on the north side. In this particular case the adjacent aquifer across the fault from the MHJ and UHJ is the overlying FG, and this appears to be where the observation response was detected in LC 25M south of the fault for the LC19M test.
12. An assurance that the analysis of the long term pumping test data at LC19M was performed to provide a transmissivity which was not affected by the influence of the fault. This information is important because the drawdown curves provided for the test do not clearly show the time and impact of intercepting a sealing fault. The sealing nature of the fault is evident on the recovery plots.
13. An explanation of how the range of 60-70 ft2/day transmissivity for the HJ horizon was determined as a value which does not reflect the impact of the fault (page 2.7-26).
14. An explanation of how LCI will evaluate and address the drawdown response of the overlying and underlying wells on pumping tests which indicate there is a connection between these aquifers and the mining zone through the confining shales. The drawdowns at LC 18M (FG sand above the pumping well) and at UKMP-102 (KM sand very far from the pumping well) are of concern as the shales may be poorly confining.
15. A calculation of potential leakage across the LCS and SBS to the HJ horizon during operations since they are thin (less than 10 ft ) in many portions of the license area and the pumping tests showed they were not sufficiently confining to prevent a drawdown response in the overlying and underlying aquifers.

**Section 2.7.3 Groundwater Quality**

The analysis of the groundwater quality in the proposed license area is currently insufficient to interpret the impact of ISR recovery operations on water quality in and around the license area. Please provide an explanation of why the number, location, and completion intervals of wells selected for preoperational groundwater quality monitoring in all the horizons provide adequate coverage and are representative of the license area. Most wells are concentrated in and near the ore body and are not completely penetrating of each targeted horizon.

## 2.9 Background Radiological Characteristics

The analysis of background radiological characteristics is currently insufficient. Background radiological characterization is necessary to determine whether LCI's future operations will affect human health and the environment. Please provide the following information:

1. On page 2.9-1 of the Technical Report, LCI states: "Passive air samplers were used to measure natural gamma and Rn-222 at multiple locations within and outside of the Permit Area; and these results are presented in Section 2.5.2 of this report." However, Section 2.5.2 describes precipitation for the permit area. Provide the appropriate reference for these results.
2. Radon flux measurements consistent with Regulatory Guide 4.14 or justification for not submitting them.
3. Regarding preoperational vegetation sampling for radionuclides, LCI states: "The Project will not produce particulate emissions because the end-product is yellowcake slurry. Therefore, there will be no radiological impact on vegetation; and baseline characterization of vegetation radiological characteristics was not conducted."

   LCI has not sufficiently demonstrated compliance with 10 CFR 40.31(h) regarding the requirements and objectives in 10 CFR 40, Appendix A. Criterion 7 of Appendix A states: "At least one full year prior to any major site construction, a preoperational monitoring program must be conducted to provide complete baseline data on a milling site and its environs." Baseline data is used not only to measure the effectiveness of effluent control systems and procedures during normal milling operations, but also to assess the impacts of unusual releases due to spills, accidents, etc. In addition, LCI recognizes in its pathway analysis (Section 7.2.1.2 and Figure 7.2-1) that radon-222 releases can lead to radionuclide foliar deposition and uptakes by vegetation.

   LCI has not provided sufficient regulatory or technical justification to relieve them from the requirement of 10 CFR 40, Appendix A, Criterion 7. Please submit vegetation sampling in accordance with 10 CFR 40, Appendix A, Criterion 7, for NRC review prior to any major site construction.
4. Preoperational radionuclide air particulate samples are not discussed. LCI has not provided sufficient regulatory or technical justification to relieve them from the requirement of 10 CFR 40 Appendix A, Criterion 7. Please submit radionuclide air particulate sampling in accordance with 10 CFR 40, Appendix A, Criterion 7, for NRC review prior to any major site construction.
5. Preoperational surface water sampling is not discussed. However, in Section 7.3.2 of its Technical Report, LCI identifies "drainages within and downstream of the Permit Area." Regarding preoperational sediment sampling for radionuclides, LCI states, "Because there is no perennial surface water in the Permit Area, sediment sampling was not conducted." The Lost Creek site contains drainages that may periodically contain surface water. Furthermore, spills could impact sediments, and consequently, surface water or runoff quality exiting the site.

Therefore, LCI has not provided sufficient regulatory or technical justification to relieve them from the requirement of 10 CFR 40 Appendix A, Criterion 7. To comply with 10 CFR 40 Appendix A, Criterion 7, provide:

a. A more detailed evaluation of potentially impacted surface waters and results from any necessary preoperational surface water sampling for NRC review prior to any major site construction.

b. Results of any preoperational sediment samples related to 5.a above for NRC review prior to any major site construction.

6. The application does not discuss preoperational food and fish samples. Please provide a justification for not addressing this data.

7. Background gamma radiation survey and soils sampling:

a. Considering that LCI has stated "There is an unexpected degree of variability in gamma exposure rates in the Permit Area" and that increased exposure rates were detected over ore bodies and at Permit Area boundaries, it is not clear why only ten correlation grids were chosen and how these ten correlation grids accurately represent the Permit Area as a whole. Demonstrate and provide justification that the ten correlation grid samples are representative of the Permit Area as a whole.

b. Estimates in the literature (e.g., Faw and Shultis, 1993) indicate that the average concentration of K-40 in soils is 12 pCi/g. Considering that the method proposed to characterize Lost Creek depends on exposure rate correlated to radium concentrations, how is the presence and variation of K-40 and other naturally occurring radionuclides taken into consideration in the proposed methodology?

c. Considering that the main product from Lost Creek is uranium in slurry form, and that uranium is not well correlated to radium on the Lost Creek site, demonstrate that the proposed preoperational soil sampling methodology is sufficient to allow LCI to clean up land as a result of spills and accidents, including on proposed transport routes, and meet the requirements of 10 CFR 40, Appendix A, Criterion 6(6), for decommissioning for radionuclides other than radium.

d. LCI states: "Within each grid, ten soil sub-samples were collected to a depth of six inches (15 centimeters) then composited into a single sample." Demonstrate that the subsurface (greater than 15 cm below the surface) is properly characterized so as to be able to comply with 10 CFR 40 Appendix A, Criteria 6 (6).

e. In discussing the cross-calibration of the sodium iodide (NaI) detector with a High-Pressure Ionization Chamber (HPIC), LCI states: "NaI detectors were cross-calibrated in the field at each site against an HPIC. Results were consistent with cross-calibrations at other uranium sites as well as with the literature in terms of the energy dependence of NaI detectors (Ludlum, 2006; Schiager, 1972)." Regarding the Schiager reference, please address the following:

The Schiager paper describes a process where the NaI detector was calibrated with a radium point source which was then used to measure exposure from radium. The NaI detectors used in the Lost Creek evaluation were calibrated with cesium-137 (Cs-137) then used to measure exposure from radium. Explain why Cs-137 was

chosen as the calibration source and the relevance of the Schiager paper to the Lost Creek survey cross-calibration.

f. The intent of the Schiager paper is to demonstrate that the exposure rate over a uranium mill tailings pile can be estimated if there is a known uniform concentration of radium in the tailings. The technique proposed in the Lost Creek analysis attempts to correlate known exposure rates with unknown radium concentrations that may or may not be uniform outside of the correlation grids. Aside from the references noted, are there other outside references that establish this type of relationship?

g. LCI states: "Each 1,076-square-foot (100$m^2$) soil sampling grid was also, scanned to determine the average gamma exposure rate over the same area, following methods described in Johnson et al. (2006)." The Johnson reference indicates that the site was scanned with a "shielded sodium iodide detector." Verify if a shielded sodium iodide detector was used to survey Lost Creek and if so provide details on the shielding, including its purpose and how it alters the unshielded energy response.

h. For all linear regression analyses presented (Figures 2.9-7 – 2.9-9, 2.9-11 and 2.9-14), provide calculations and results of testing the null hypothesis (i.e., that no correlation exists).

i. For Figures 2.9-7 – 2.9-9, 2.9-11 and 2.9-14, provide the paired X and Y coordinate data points and where these are located in the application.

j. For the relevant dates that data was used for correlation, provide the quality control charts titled "Lost Creek: Check Source QC chart for ATV Instruments" or indicate where these can be found in the application.

**Section 3.2 Mine Unit Process, Instrumentation and Control**

LCI has not provided sufficient information regarding the ISR mine unit operation and instrumentation and control to enable the staff to fully understand this topic and to support other reviews dependent on that understanding. Specifically, the following information should be provided:

1. A clarification and explanation for how selective completion of the mine unit monitoring well ring in specific sands in the HJ horizon will be sufficient to capture horizontal excursions outside the extraction zone. For example, if the monitoring ring well is only completed in the MHJ sand in the belief it is the only sand present at the location, an excursion may migrate through the LHJ or UHJ without detection. Furthermore, please justify the use of 500 feet for the monitoring well ring spacing.
2. A monitoring strategy (number, location of wells) for detecting excursions into the FG sand when it is juxtaposed across the fault from the HJ extraction zone (figures 2.6-1 c-e).
3. A monitoring strategy (number, location of wells) for detecting excursions into the KM sand when it is juxtaposed across the fault from the HJ extraction zone (figures 2.6-1 c-e).

4. A description of which sands will be used to provide water for well drilling and completions and the total volume anticipated to be withdrawn. An evaluation of whether the water use in these sands will impact water levels in the overlying extraction or underlying aquifers.
5. Standard industry practice for MIT tests requires less than a 10 percent pressure drop of 20 minutes. Please justify the use of the standard of less than 5 percent pressure drop over 10 minutes.
6. Methods for timely detection and cleanup of leaks in the wellfield at wellheads and in surface and buried lines in the wellfield.
7. Descriptions of the process and wellfield instrumentation, controls and radiation safety monitoring instrumentation, including their minimum specifications and operating characteristics. LCI provides only a general commitment to have instrumentation and controls to monitor production, injection, and waste flows, and to have instrumentation to alarm for system failures. The descriptions of the process and wellfield instrumentation and controls and radiation safety monitoring instrumentation need to be more detailed and specific, including their minimum specifications and operating characteristics (alarms, interlocks, etc.). The descriptions should focus on how the instrumentation and controls are adequate to identify quickly and remedy all potential processing problems that can increase exposures to radiological and chemical hazards.
8. Revised drawdown calculations for the extraction zone which include the impact of the fault as opposed to the infinite aquifer assumption during full capacity operation (6000 gpm) with groundwater sweep (original no-fault calculations on page 3-14 estimate 146 ft and 114 ft drawdown at 2 and 3 miles respectively). Please account for the fact that the fault, if it is sealing as described, will separate the extraction area into two zones. The consumptive use will exacerbate the drawdown in the presence of a sealing fault and change the impact of the drawdown on both sides of the fault. One may use an analytical model and account for the influence of the fault through superposition of image wells across the fault to estimate the drawdown.
9. A potentiometric contour map showing the calculated drawdown for full capacity consumptive water use over a five mile radius and the wells within this radius which may be impacted.
10. A comprehensive explanation of how LCI will operate the mine units in the HJ horizon to address the potentially large drawdowns that will occur near the fault when the operation is up to full capacity.
11. A statement that LCI will submit all wellfield hydrologic packages to NRC for review and approval before extraction begins, as LCI does not have a record of performance with NRC.
12. Section 4.1.2 of the application discusses the ventilation systems that are planned for the facility. Please provide details on the type, size, and location of the ventilation systems.
13. Please discuss radiation safety monitoring devices and other process safety controls that will be used within the central processing plant. The discussion should focus on the availability and reliability of these systems. This should include a discussion of controls that are used to minimize or eliminate the hazards presented by radioactive materials or chemicals that may impact radiological safety.

14. Please provide details regarding the quantities and storage locations of chemicals that will be used at the facility. This should include a list of federal, state, and local regulations that LCI intends to use to ensure that chemicals that have the potential to impact radiological safety are handled in a safe and appropriate manner. Also, please provide a discussion of the operating conditions (temperature, pressures, and flow rates) that will exist during operation of the central processing plant for both radioactive and non-radioactive materials that may have an impact on radiological safety.

### 3.3 Plant Processes, Instrumentation and Control

LCI did not provide sufficient information to assess the plant processes, instrumentation, and controls of the proposed facility. Such information is necessary to determine if LCI will be operating its central plant safely. Please provide the following information requested below.

1. Section 3.3 indicates that LCI plans to accept loaded ion exchange resins from other satellite facilities operated by LCI and/or other third party facilities. Please provide a discussion related to shipping and handling of third party resins, including potential impacts of shipping and transportation. Furthermore, such third parties must be identified in the license. Therefore, the parties must be identified in this license application or subsequent license amendment applications.
2. Section 3.2.7.1 provides information on the operation and shutdown mechanisms that will be used if a piping failure occurs. Please provide similar discussion related to backup systems or other controls within the central processing plant. The discussion should also address the actions that will occur at the facility (central processing plant, wellfields, and header houses) in the event of a power failure or other potential disruptions in operations.
3. Please provide the following information regarding the deep disposal wells:
    a. maximum number of disposal wells to be installed at the Lost Creek facility.
    b. information regarding the instrumentation and controls that are planned for the deep disposal wells.
    c. basis for reaching a conclusion on the number of deep wells that will be needed for liquid waste disposal

## Section 4.0 Effluent Control Systems

LCI did not provide sufficient information to assess the effluent control systems for the proposed facility. Information regarding the workplace ventilation, radiation monitoring, effluent composition, liquid and solid wastes is necessary to allow the staff to assess the manner in which LCI is protecting public health and the environment. Please provide the following information requested below.

## Section 4.1 Gaseous Emissions and Airborne Particulates

1. Details regarding the Continuous Working Level (CWL) monitor system regarding calibration frequency and methods.
2. LCI has established an administrative action level for radon-222 at 25% of the derived air concentration (DAC) limit, per regulatory guides 8.30 and 8.31. However, LCI has not established the equivalent for uranium. Provide information regarding the administrative action level for uranium based on its DAC.
3. On page 4-2 of the Technical Report LCI states: "Airborne particulates may also include minor amounts of salt and soda ash releases during deliveries to the Plant…" However, NUREG/CR-6733, *A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees*, estimates that soda ash releases from facilities using baghouse dust collection systems that are over 99 percent efficient are typically 2 tons/yr. Provide an analysis of soda ash release during operations.
4. Regarding accident scenarios involving yellowcake slurry, LCI states: "Given that the slurry storage tanks will be positioned a considerable distance from exterior walls and within a bermed area it is highly unlikely that a ruptured vessel of yellowcake slurry could reach the outdoor environment." Provide an analysis of the volume of bermed area compared to the largest yellowcake slurry vessel.
5. Regarding potential accident scenarios involving yellowcake slurry on site, LCI refers to analyses of accidents discussed in NUREG/CR-6733. The discussion in NUREG/CR-6733 is focused on uranium oxide, $U_3O_8$. According to Section 3.3.3 of the Technical Report, "Hydrogen peroxide will then be added to the eluate to effect precipitation of the uranium as uranyl peroxide. Caustic soda solution will then be added to elevate the pH, which promotes growth of uranyl peroxide crystals and makes the slurry safer to handle in the subsequent process steps."

   Various references (e.g., R.F. Leininger, J.P. Hunt, and D.E. Koshland, Jr., "Composition and Thermal Decomposition of Uranyl Peroxide," Chemistry of Uranium, USAEC, TID-5290, Book 2 (1958)) describe this precipitate as $UO_4*nH_2O$, where the typical value of n is 2. Since the values of density, solubility class (thus dose) and other physical parameters depend on the molecular formula, provide a justification for utilizing an accident scenario for uranium oxide and applying it to uranyl peroxide.
6. Redundant Exhaust Fans:
   a. Provide a comparison of the capacity of the redundant exhaust fans to the primary exhaust fans.
   b. Will redundant exhaust fans be connected to the same power supply as the primary exhaust fans?

## Section 4.2 Liquid Wastes

LCI needs to provide the following additional information related to the liquid effluents at the proposed facility:

1. Provide information on the expected chemical and radiological composition of the liquid waste stream to be disposed of in the deep wells.
2. Provide additional information related to releases on site. The discussion should address the following issues: the health and safety impacts of a spill, inspection practices, inspection frequencies, measures planned to contain spills on or below the ground surface within wellfields or near evaporation ponds, details of the planned fluid detection system, procedures for determining if a radiation work permit will be needed to address a release, notification, and recordkeeping efforts related to spills.
3. The proposed storage ponds need to meet the applicable requirements of 10 CFR Part 40, Appendix A. LCI needs to provide the following additional information to allow for NRC staff to compare the proposed pond design to the applicable requirements of 10 CFR Part 40, Appendix A:
    a. The results of the geotechnical investigation for the proposed pond location, including discussion of soil classification, grain size analysis, compaction, and density requirements. The results of the geotechnical investigation should also discuss the liquefaction potential of the soils that will be used to construct the storage pond embankments.
    b. Evaluations of both slope stability and settlement demonstrating that the pond will remain stable and that the liner system will not be compromised. The slope stability analysis should consider the critical section of the proposed embankment under the anticipated loading conditions. The settlement analysis should reflect the foundation soil conditions, liner system, and anticipated loading conditions.
    c. An analysis of the required freeboard in the storage ponds. The storage ponds should have adequate freeboard to allow for transfer of liquids between the ponds in the event of a leak and prevent overtopping of the storage ponds by wave run-up or significant rainfall events. Note that wave run-up is dependent on the open area of the pond, the anticipated wind speeds, and the anticipated wind direction at the site.
    d. Detailed discussion of the components of the liner system. The discussion should include: the required subgrade preparation techniques, the material and thickness for the impermeable liner, the anticipated liner seaming techniques, the permeability of the sand used in the leak detection layer, and chemical compatibility between the liner material and the liquids stored in the ponds.
    e. A discussion of how the pond areas will be decommissioned and reclaimed.
    f. A set of detailed drawings showing the planned location of the storage ponds, cross section of the liner system, and construction details.
    g. A set of construction specifications for the storage ponds. This should include a quality assurance plan for soil and liner installation.
    h. The results of the preoperational monitoring program to provide a determination of the baseline groundwater quality data in the vicinity of the storage ponds.
    i. A detection monitoring program to identify if the storage ponds are leaking. This program should include: the frequency for monitoring the leak detection system,

justification for the selection of indicator parameters for sampling liquids found in the leak detection layer and surrounding groundwater monitoring wells, action levels for obtaining chemical samples of liquids in the leak detection system, notifications to be made upon leak identification, and follow up actions after a leak has been identified. Note that the indicator parameters selected should allow for a clear distinction to be made between the liquids contained in the pond and groundwater.

j. A discussion of the location of the ponds and the measures that will be taken to protect the ponds from surface water run on. This may require a review of the upstream catchment area and any diversion channels or slope protection around the embankments.

k. A discussion of any anticipated maintenance activities that may be required over the life of the storage ponds.

4. A demonstration that well completion, development and pumping test water originating from the extraction zone will have a minimal potential radiological impact on health and safety.

5. The basis for reaching a conclusion on the number of deep wells needed for liquid waste disposal and a description of the location, target formation depth, design, and capacity of deep disposal wells.

6. A discussion of how LCI will evaluate the impact to the surficial aquifer from a surface spill.

7. Information regarding the ability of the sump system to handle the volume of the largest hazardous materials source.

**Section 4.3 Solid Wastes**

Provide a commitment to develop an agreement for off-site disposal of 11e.(2) byproduct material disposal at an NRC or Agreement State licensed facility. The agreement should include commitments to notify NRC within 7 days if it is terminated and to submit a new agreement for NRC approval within 90 days of expiration or termination.

**Section 5.1 Corporate Organization and Administration**

LCI has not provided sufficient information regarding the corporate organization and administration in Section 5.1 for the staff to fully understand this topic. Specifically, please address the following issues:

1. Figure 5.1-1 identifies the position of Manager Environmental Health and Safety (EHS) and Regulatory affairs and the position of Radiation Safety Officer (RSO). However, Section 5.1.5 of the application provides the details of the Site Supervisor EHS/RSO. This position is not identified on Figure 5.1-1, and it is not clear if the EHS and RSO responsibilities at the site level will be fulfilled by one or two people. Please reconcile this inconsistency between section 5.1.5 and Figure 5.1-1.

2. Based on the staff's review of Section 5.1, it is not clear who is responsible for construction of the facility. Please identify the department that is responsible for construction of the

facility and details on the integration of construction activities with overall plant management.

3. The description of the Lost Creek organization does not specify which personnel will be on-site and which personnel are in corporate level positions. LCI needs to show its aspect of the site organization, including the role of the different organizations within the management chain (i.e., Ur-Energy USA, Inc.). The site level management text should discuss the independence of the Mine Manager, RSO, and SERP for raising significant safety issues to senior management. Also, please discuss and show the integration among groups that support construction, operation, and maintenance of the facility.

**Section 5.2 Management Control Program**

Providing the information presented below will allow NRC staff to ensure that the proper information is being reported and cultural resources will be protected. Lost Creek needs to provide a commitment to administer a cultural resources inventory before engaging in any development activity not previously assessed by NRC, and that any disturbances associated with such development will be completed in compliance with the National Historic Preservation Act, the Archeological Resources Protection Act, and their implementing regulations. In addition, LCI needs to commit to cease any work resulting in the discovery of previously unknown cultural artifacts to ensure that no unapproved disturbance occurs.

**Section 5.7.1 Effluent Control Techniques**

LCI did not provide sufficient information regarding effluent controls for the proposed facility. This information is necessary for the NRC staff to assess the ability of LCI to control and monitor emissions, protect worker health, and collect the necessary data to calculate doses to the public. Please provide the following information:

1. In regards to 10 CFR 20.1301/1302, provide an analysis of the maximum expected dose to members of the public in restricted areas and other areas within the permit area. This analysis should include contractors receiving a public dose while in restricted areas and other areas within the permit area.
2. Provide information on the testing, maintenance, and inspection of the ventilation equipment, including frequencies and minimum performance specifications. Where applicable, compare proposed testing, maintenance, and inspection to the manufacturers' recommendations.
3. Regarding the release of pregnant lixiviant, LCI states: "NUREG/CR-6733 considers two conservative scenarios involving the release of pregnant lixiviant and loaded resin. In both scenarios, the authors determined that the spills would have no significant external radiological risks. The risks from associated radon releases are discussed in Section 5.7.1.1. All process and effluent liquids will be contained within pipelines, tanks, and storage ponds that are inaccessible to members of the public."

   NUREG/CR-6733, *A Baseline Risk-Informed, Performance-Based Approach for In Situ Leach Uranium Extraction Licensees,* is for guidance only. However, it does state that these

types of spills cannot be discounted from risk assessment on the basis of probability and concludes that effluent levels and internal doses can be significant due to spills of pregnant lixiviant. LCI must analyze the risk regarding the release of pregnant lixiviant.

Please provide a site-specific analysis for a spill of pregnant lixiviant in the field, including:

a. mitigation against occurrence;

b. spill response;

c. remediation, including checks for undetected leaks; and

d. a detailed pathway analysis (including an analysis of onsite and offsite surface water bodies, including drainages) of potential dose to members of the public.

**Section 5.7.2 External Radiation Exposure Monitoring Program**

LCI did not provide sufficient information regarding the external radiation exposure monitoring program for the proposed facility. This information is necessary for the NRC staff to determine whether or not LCI's proposed program adequately protects worker and public health. Please provide the following information:

1. Details of survey equipment calibration methods
2. Regarding beta radiation surveys, LCI states: "If beta surveys are necessary, the RSO shall develop a monitoring program detailing frequency, acceptable equipment, calibration, methodology, and location in accordance with NRC Regulatory Guide 8.30 Appendix C. Instrumentation for monitoring beta radiation will be a Ludlum Model 44-9 pancake probe with a Model 3 meter (or equivalent)." However, Regulatory Guide 8.30, Appendix C, discusses a GM probe with an open/close window configuration while LC proposes to use a pancake probe.

   Assuming that beta monitoring will be required at some point during plant operations, provide information on the beta monitoring program detailing frequency of surveys, acceptable equipment, calibration methodology, and location for the type of detector proposed.
3. To what energies will survey equipment be calibrated?
4. The suggested sodium iodide survey meters for direct gamma exposure measurements are energy dependent detectors. What correction factors, if any, will be applied to determine the dose rate for the Lost Creek facility?
5. Discuss expected external exposure rates throughout the Plant and wellfield.

**Section 5.7.3 In-Plant Airborne Radiation Monitoring Program**

LCI has not provided sufficient information regarding the airborne radiation monitoring program. Information regarding the air sampling program and administrative action levels is necessary to determine if the airborne radiation program is protective of worker health. Please provide the following information:

1. Regarding the lower limit of detection (LLD) of uranium particulate air sample analyses from Section 5.7.3.1, LCI states: "The quantity of air sampled and the method for analysis should allow a lower limit of detection (LLD) of at least 1 x $10^{-11}$ microcuries per milliliter (µCi/mL) as per Regulatory Guide 8.30 (NRC, 2002)."

   The generally acceptable value of LLD will be 10 percent of the applicable limit. The applicable limit will depend on the appropriate DAC which will be driven by the solubility classification of the material in question. In this case, LCI should reevaluate the LLD in light of its response to the questions regarding solubility classification and dose calculation in Section 5.7.4. Provide an LLD(s) that is representative of particulate uranium throughout the plant.

**Section 5.7.4 Worker Dose Calculations**

LCI does not provide sufficient information regarding the exposure calculation methods. This information is important as it provides a basis for determining compliance with worker and public dose limits. Please provide the following information:

1. LCI states: "Alternatively, the annual doses may be calculated directly using monitoring data and established dose conversion factors (DCFs) from Federal Guidance No. 11 (EPA, 1988), or the dose coefficients (DCs) from ICRP Report No. 68 (ICRP, 1994 and ICRP, 2001)." However, 10 CFR Part 20 does not permit the use of the revised and updated internal dosimetry models without an approved exemption request (see 10 CFR 20.1204(c)).

   Please clarify that all internal doses will be calculated using data that is based on ICRP Publication 30.

2. Equation 1 is used to calculate the intake of radionuclides:

   Equation 1: Calculation of Long-Lived Radionuclide Intake Using Monitoring Data

   (Note: Doses from inhalation of airborne particulate matter will be calculated only when the measured concentration exceeds ten percent of the DAC.)

$$I_r = \sum_{i=1}^{i=n} (BR)(C_r)(H)(10^6\ ml/m^3)/PF$$

   Where BR = breathing rate (cubic meters per hour [m3/h]).

   The values in 10 CFR 20, Appendix B are predicated on a standard breathing rate. Clarify what breathing rate will be used to determine the intake of radionuclides in Equation 1.

3. Regarding "H" in the above Equation 1 (number of hours of exposure), LCI states: "Exposure times will be estimated using worker time studies or using recorded time spent on the task for which a RWP was issued." Provide details on how worker time studies will arrive at an exposure time.

4. Regarding air sample analyses, LCI states: "In general, the in-Plant air particulate samples will be analyzed for gross alpha but assumed to be primarily, if not all, due to natural uranium." This assumption needs to be justified in order to correctly calculate the dose (e.g., no thorium or radium in the air sample). Please address 10 CFR20.1204(g) regarding mixtures of radionuclides and provide a technical justification for using a gross alpha count and attributing all dose to natural uranium.
5. LCI states: "The DAC for Class D uranium ($5 \times 10^{-10}$ µCi/mL) will be used if this dose calculation method is employed as per NRC Regulatory Guide 8.30." However, Regulatory Guide 8.30 does not specifically address the solubility of uranyl peroxide or other forms of uranium. Please provide a technical basis for the use of "Class D" uranium throughout the plant. This discussion should address all forms of uranium that may be encountered during routine and off-normal circumstances including maintenance.
6. The proposed DAC value ($5 \times 10^{-10}$ µCi/mL) is relevant for calculating the non-stochastic dose to the bone surface. Please justify the use of the proposed DAC for calculating the committed effective dose equivalent (CEDE).
7. LCI states: "The dose to the fetus from internally deposited radionuclides must be determined if the intake is likely to exceed one percent of the ALI (0.02 microCuries [µCi])." The referenced ALI appears to be the stochastic ALI for class "D" natural uranium.

   Based on LCI's response to previous RAIs regarding the DAC proposed in Section 5.7.4, it needs to reevaluate the trigger for determining the dose to the fetus of a declared pregnant worker. If the proposed DAC changes, please provide a revised trigger for calculating the dose to the fetus based on the new DAC value.

**Section 5.7.5 Bioassay Program**

LCI does not provide sufficient information regarding the bioassay program. This information is important as it provides a basis for determining compliance with worker dose limits. Please provide the following information:

1. LCI states: "Bioassays will also be performed if there is any reason to suspect that an inhalation exposure has resulted from exposure to an average yellowcake concentration equal to or exceeding ten percent of the DAC for soluble uranium (5 x 10-11 µCi/mL) for a 40-hour workweek." Based on LCI's response to questions on the DAC in Section 5.7.4, it needs to reevaluate the trigger for bioassays. If the proposed DAC changes, please provide a revised trigger for performing bioassays.

**Section 5.7.6 Contamination Control Program**

LCI does not provide sufficient information regarding the contamination control program. This information allows the staff to assess whether or not LCI has established administrative and technical controls to detect and control releases. Please provide the following information:

1. Regarding removable contamination, LCI states: "Alternatively, total contamination surveys may be performed. If the total contamination level exceeds the removable contamination

limit, the removable contamination level will be determined using smears." Specify the "removable contamination limit" that will be used at Lost Creek.

2. Please describe how contamination on the interior of pipes, drain lines, duct work, and similar items will be determined prior to release.
3. For releasing potentially contaminated items from the facility, discuss specifically what contamination limits will be used. In your discussion, address the following issues:
   a. Items potentially exposed to pregnant lixiviant. If proposing the limits for natural uranium, demonstrate that radium is in equilibrium with the uranium and explain why the separate radium limit in Table 1 of NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" should not apply.
   b. Items potentially exposed to barren lixiviant after ion exchange. If proposing the limits for natural uranium, explain why the separate radium limit in Table 1 of NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material" should not apply.

### 5.7.7 Airborne Effluent and Environmental Monitoring Program

LCI does not provide sufficient information regarding the airborne effluent and environmental monitoring. This information allows the staff to assess whether or not LCI has established the proper programs to estimate worker and public doses. Please provide the following information:

1. LCI has not proposed an effluent monitoring program that would satisfy the requirements of 10 CFR 40.65. The report specified in 10 CFR 40.65 requires that the licensee "… must specify the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents…." Provide a description of your proposed stack effluent monitoring program, including radon.
2. Regarding operational environmental monitoring, LCI states: "Because there will be no significant release of airborne particulate during operations and there are no credible accident scenarios that could result in a significant release of material, LCI does not propose to perform routine air particulate, soil, vegetation, or surface water sampling during operations." Both pregnant lixiviant field spills and transportation accidents have been shown to have the ability to result in a significant release of licensed material. In addition, radon daughters from operations can accumulate in soil, vegetation, and surface water.

   Please reevaluate the operational environmental monitoring program for Lost Creek and submit a program to adequately monitor the release of licensed material and verify the effectiveness of in-plant measures used for controlling the release of radioactive materials.

### Section 5.7.8 Groundwater and Surface Water Monitoring Programs

The groundwater and surface water monitoring programs have not been sufficiently described to determine if they will detect an excursion from the ISL operations in an effective and timely manner. Provide the following information:

1. A description of the sampling procedures for all monitoring and private wells to ensure sampling is consistent for all wells during operations.
2. An explanation of how UCLs will be set for each of the individual sands in the HJ horizon as they are mined in succession.
3. An excursion correction strategy for correcting excursions into the FG sand where it is offset across the fault from the extraction zone. (Figures 2.6-1c-e)
4. An excursion correction strategy for correcting excursions into the KM sand where it is offset across the fault from the extraction zone. (Figures 2.6-1c-e)

### Section 5.7.9 Quality Assurance Program for Radiological Monitoring Programs

LCI has stated that it will implement a quality assurance program but has not provided any details of that program. This information is necessary to ensure that the quality of the data collected is acceptable for estimating doses to employees and members of the public. Please provide:

1. A comprehensive description of a quality assurance program applicable to all radiological, non-radiological, effluent, and environmental monitoring programs.
2. A statement that survey and calibration records will be kept for 3 years and will reflect updated 10 CFR Part 20 requirements that LCI maintain records used to demonstrate compliance and evaluate dose, intake, and releases to the environment until license termination.

### Section 6.2 Plans and Schedules for Groundwater Quality Restoration

The plans and schedules for groundwater quality restoration have not been sufficiently described to determine if they will achieve the required goals of restoration. Considering the timeliness in decommissioning requirements of 10 CFR 40.42, the schedule provided by LCI constitutes an alternate restoration schedule and is an important component of the restoration discussion. Provide the following information:

1. LCI should state that it is requesting an alternate schedule and should acknowledge that changes to the restoration schedule must be requested through a license amendment application.
2. A statement that LCI will return the groundwater quality to the standards listed in Criterion 5B(5) of 10 CFR Part 40, Appendix A, and a revised pore volume estimate to meet these standards as necessary.
3. A technical basis for LCI's ability to meet the standards in Criterion 5B(5) of 10 CFR Part 40, Appendix A, through restoration.

4. A description of the expected water quality in the mine unit at the beginning of restoration.
5. An explanation of the timeline for restoration of nine months for sweep, nine months of RO, and one month for homogenization considering the low conductivity of the HJ horizon and the described stacked sand restoration approach.
6. A description of how stability will be monitored in the stacked sands of the HJ horizon (LHJ, MHJ and UHJ) as they are sequentially restored (e.g., six months for each with individual monitoring wells, six months after all are restored with completely penetrating monitoring wells, etc).
7. An estimate of porosity for each mine unit and an explanation of how this value is to be determined. (A valid justification for this number (e.g., wireline logs, core measurements) is needed as this value is critical for pore volume calculations)
8. A justification for the method to estimate well field pore volume and the assumed 20 percent vertical and horizontal flare ( No technical details are provided for estimating the well field pore volume and the associated horizontal and vertical flare.) Also please explain why a 10 percent vertical and 10 percent horizontal flare estimate was used in the surety calculations, when each flare was stated to be 20 percent.
9. A comprehensive discussion and justification for the estimate of six pore volumes (1 sweep, 5 RO) for restoration of MU1, which appears very low, using a basis of comparable field experience.
10. If LCI retains the estimate of six pore volumes for restoration, provide a substantial justification using analytical methods or numerical modeling. These estimates should also take into account unique issues presented by the sequential stacked sand restoration approach and address any difference in pore volumes needed if biological reductants are used.
11. A description of the criteria that will be used to determine when well fields will be taken out of production and started in restoration to meet the regulatory requirements of timeliness of decommissioning as outlined in 10 CFR 40.42.
12. A statement that NRC will be informed when a transition from production to restoration occurs in a mine unit.
13. A description of the biological reduction method(s) to be used to achieve restoration for targeted constituents in the proposed wellfield extraction zone including: the efficacy of the chosen method; additives and rates; how progress will be monitored; estimates of pore volumes required when using biological reductants; and how the stability of water quality in zones treated with biological reductants will be monitored and established.
14. A detailed description about the comprehensive safety plan regarding any reductant use.
15. An estimate, with supporting analysis, of how much waste water would be produced during restoration and the ability of the disposal wells to handle the rates and volumes.
16. A description of how waste fluids will be handled if any or all of the disposal wells became inoperable.

17. A justification for the selection of a six month stability monitoring time period to determine restoration success. Additionally, the criteria which will be used to establish that the water quality in the restored zone is stable.

### 6.2 Plans for Reclaiming Disturbed Lands

1. The discussion of reclamation of surface features does not appear to adequately describe the techniques that will be used during decommissioning. Please provide discussion that addresses the following issues: (i) the techniques used to conduct the pre-reclamation surveys; (ii) the cleanup criteria that will be followed; (iii) the analysis techniques that will be used to compare the pre-reclamation survey to the pre-operation survey to identify contaminated areas; and (iv) discussion of the areas on the site that are may become contaminated, such as header houses, areas adjacent to well heads, the area near the storage ponds, etc.
2. Please provide a commitment in the license application that Lost Creek will submit a decommissioning plan for NRC staff's review and approval at least 12 months before planned commencement of decommissioning.
3. Please provide discussion of decommissioning of non-radiological hazardous constituents as required by 10 CFR Part 40, Appendix A, Criterion 6 (7).
4. Please discuss the quality control program that will be followed during decommissioning.

### Section 6.3 Mine Unit Reclamation

Please discuss how on-site disposal of non-contaminated materials is consistent with the requirements of 10 CFR Part 40, Appendix A, Criterion 2. Note that disposal of waste materials on Bureau of Land Management or State-owned land may require separate approvals.

Please discuss the process of contamination surveys on large equipment or pieces with unique construction. If the equipment cannot be surveyed, it should be presumed to be contaminated in excess of the release limits.

### Section 6.5 Post-Reclamation and Decommissioning Radiological Surveys

LCI does not provide a discussion of methodologies for conducting post-reclamation and decommissioning radiological surveys. Provide a description of procedures for conducting these surveys, including:

1. How the cleanup criteria for radium in soils as provided in 10 CFR Part 40, Appendix A, Criterion 6(6), will be met.
2. Acceptable cleanup criteria for uranium in soil, such as those in Appendix E of NUREG–1569, Standard Review Plan for In-Situ Leach Uranium Extraction License Applications.
3. Assurance that the survey method for verification of soil cleanup is designed to provide 95 percent confidence that the survey units meet the cleanup guidelines.

4. A discussion of the soil cleanup program. The discussion should include: the areas planned to be surveyed (such as wellfield surfaces, areas around structures in process and storage areas, on-site transportation routes, historical spill areas, and areas near deep disposal wells); details of the pre-reclamation radiological survey, particularly, specifics on how it and the baseline survey will be used to identify potential contamination areas; details on how the final radiological soil conditions after cleanup will be measured and documented .
5. Provide a discussion of plans for decommissioning non-radiological hazardous constituents as required by 10 CFR Part 40, Appendix A, Criterion 6 (7).

## 6.8 Financial Assurance

During its review, the staff determined that the information regarding financial assurance was insufficient to determine if LCI appropriately estimated the surety amount. A proper surety amount is necessary to ensure that the LCI facility can be property restored and decommissioned in the event LCI becomes insolvent. Please provide the following information:

1. The current financial assurance information indicates the estimate is provided in current dollars, but does not indicate if this is 2007 or 2008 dollars. Please indicate the year that the costs are referenced to. The estimate should be adjusted for inflation at the time of license issuance and should include an adjustment for annual inflation in future years.
2. Please identify the financial assurance funding mechanism (i.e., surety bond, cash deposit, certificate of deposit, deposit of government securities, etc.) that will be used for the Lost Creek project.
3. LCI needs to provide indication in Section 6.8 that it will 1) automatically extend the existing surety amount if the NRC has not approved the extension at least 30 days prior to the expiration date; 2) revise the surety arrangement within 3 months of NRC approval of a revised closure (decommissioning) plan, if estimated costs exceed the amount of the existing financial surety; and 3) provide NRC a copy of the State's surety review and the final surety arrangement.
4. The following items in the Financial Assurance estimate in Table 6.8-1 of the application need to be discussed, explained, or calculated further:
    a. Page 9 provides an estimate of the total amount of water to be disposed of via the deep disposal well. Please provide additional details on the planned deep disposal well capacity to verify that this amount of liquid can be disposed of while maintaining enough deep disposal well capacity for the wellfield production bleed.
    b. The timeline provided in Table 6.8-1 indicates that the time required for groundwater restoration is approximately 25 months (7 months for groundwater sweep, 9 months for reverse osmosis, and 9 months for stabilization). The NRC staff is not aware of any approved ISL wellfield groundwater restoration activities that have been completed in this timeframe. Please provide justification for this restoration timeframe, or revise the table to reflect an alternate timeframe. Note that the restoration timeframe should take the available required number of pore volumes for restoration as well as the deep disposal well capacity. The restoration timeframe may impact costs related to electrical power, monitoring and sampling, and labor.

5. Worksheet 7, Page 25 of 35, provides an estimate of potential costs related to surface reclamation in the mine units. The cost estimate indicates that there will be no surface spills requiring cleanup in the mine unit. Please provide justification for this assumption, or revise the spill cleanup portion based on a likely occurrence of spills.
6. The financial assurance cost estimate does not appear to include operational costs that would need to be continued during restoration. Items such as sampling and testing of the monitoring wells and mechanical integrity testing (MIT) of all the wells will need to be continued during groundwater restoration. Please discuss where these costs are included in Table 6.8-1 or revise the financial assurance estimate to include these costs.

## 7.2 Radiological Effects

LCI did not provide sufficient information regarding radiological effects. Information regarding dose to members of the public and meteorological data are important for assessing LCI's ability to operate the proposed facilities safely. Please provide the following information:

1. Attachment 7.2-1 data appears to conflict with data in Section 7.2. For example, data in Figure 7.2-3 and Table 7.2-1 in Section 7.2 indicate a maximum dose to a receptor at SEB1 of 3.01 mrem while Figure 3 and Table 6 of Attachment 7.2-1 indicate a maximum dose to a receptor at NB of 136 mrem. Review all data in Section 7.2 and Attachment 7.2-1 and provide an explanation for the differences.
2. Typographical errors:

   Proofread, and revise as applicable, typographical errors relating to figures and tables including the following:

   a. On page 7-15, LCI refers to Table 7.3-1. The correct reference appears to be Table 7.2-1.
   b. LCI states: "Most mine units are upwind of the SEBI location. Calculated receptor doses for the plant are shown in Figure 7.2-4." However, Figure 7.2-4 shows doses to workers.
   c. LCI states: "Moving the plant to the alternate location (Plant 2 in Figure 7.2-3) …" However, Figure 7.2-3 shows dose at the preferred plant site.

## Section 7.4 Effects of Accidents

This section describes the environmental effects of various accident scenarios. However, LCI needs to provide information regarding the systems and procedures that it will use to prevent accidents at the facility or minimize the effects of such accidents on worker and public health. The requested information is described in Section 7.5. of Regulatory Guide 3.46.

1. Regarding a pipeline failure event, LC states: "If the volume and/or concentration of the solutions released in such an accident did constitute an environmental concern, the area would be surveyed and the contaminated soils would be removed and disposed of according to NRC and/or state regulations." Please define what constitutes an "environmental concern" in regards to spills of pregnant and barren lixiviant.

2. What is the minimum leakage rate that will be detectable with installed instrumentation?

3. Provide verification that the accident response program includes notification to NRC in compliance with the requirements of 10 CFR 20.2202 and 20.2203.

4. Please provide a description of how a facility wide power outage would be handled and resolved in the main plant, mine unit, pond, and disposal well operations.