U.S. Nuclear Regulatory Commission
Technical Report – Request for Additional Information
AUC, LLC
License Application Request
Proposed Reno Creek Project
Campbell County, Wyoming

List of Acronyms

ACLs	Alternate concentration limits
ALARA	as low as is reasonably achievable
AUC	AUC, LLC (the applicant)
BPT	Best practical technology
CBM	Coal bed methane
CFR	Code of Federal Regulations
CPP	Central Processing Plant
D&D	Decontamination and Decommissioning
DDW	Deep disposal well
EPA	U.S. Environmental Protection Agency
ER	Environmental Report, AUC License Application Request for the Reno Creek Project
GEIS	Generic Environmental Impact Statement for In Situ Leach Uranium Milling Facilities (NUREG-1910)
GW#	Groundwater well number
GWS	Groundwater sweep
ISR	In situ recovery
MARSSIM	Multi-Agency Radiation Site Survey and Investigation Manual (NUREG-1575)
MIT	Mechanical integrity test
NRC	U.S. Nuclear Regulatory Commission
PMF	Probable maximum flood
PMP	Probable maximum precipitation
PU	Production unit
PZA	Production zone aquifer
PZM#	Production zone monitoring well number
QAP	Quality assurance plan
R&D	Research and development
RAI	request for additional information
RSO	Radiation Safety Officer
RST	Radiation Safety Technician
RTVs	Restoration target values
SER	Safety Evaluation Report
SERP	Safety and Environmental Review Panel
SOP	Standard Operating Procedure
SRP	NUREG-1569, Standard Review Plan for In Situ Leach uranium Extraction License Applications (June, 2003)
TR	Technical Report, AUC License Application Request for the Reno Creek Project
UCLs	Upper control limits
WDEQ	Wyoming Department of Environmental Quality
WDEQ/LQD	Wyoming Department of Environmental Quality/Land Quality Division

SECTION 1 – PROPOSED ACTIVITIES

Request for Additional Information (RAI)-1

Section 1.2 (Project History) of the Technical Report (TR) states:

> "In 2004 Strathmore staked and filed new mining claims in the area acquiring over 16,000 acres of prospective lands including the proposed Reno Creek Project. In May 2007, Strathmore entered into a joint venture partnership with American Uranium Corporation Inc. of Nevada, to bring the Reno Creek property to a full-scale ISR operation. Strathmore and American Uranium subsequently sold the Reno Creek Project (the subject of this license application) and the nearby Pine Tree Trend Properties located approximately seven to eight miles to the west and northwest respectively of the Proposed Project, including its corporate owner AUC LLC, to AUC Holdings. Table 1-1 outlines all information known regarding the proposed property ownership and joint ventures."

Basis:
The applicant's discussion of ownership is unclear. The above discussion refers to the filing of mining claims, the acquisition of over 16,000 acres of lands (including the Reno Creek project), and the selling of properties. This makes it difficult to understand if the transactions relate to surface ownership, mineral ownership, or other ownership. Also, Table 1-1 (Proposed Project Area Historical Ownership) shows AUC, LLC (AUC, the applicant) as the current company (corporate entity) and AUC Holdings as the partnership name, but the table does not identify the entity with ownership of the proposed project area. The NRC NUREG-1569, Standard Review Plan (SRP) for In Situ Leach Uranium Extraction License Applications, Section 1.3 states that the application summary of proposed activities includes descriptions of specific items (e.g., including corporate entities involved, location of the proposed facilities, and land ownership) sufficient to provide a basic understanding of the proposed activities and the likely consequences of any health, safety, and environmental impact.

RAI:

- Revise text describing the nature of these transactions to clarify surface land ownership, mineral ownership, or other ownership. Please be specific as to which ownership is by the applicant (AUC) and any corporate-related body (e.g., AUC Holdings).
- Revise Table 1-1 to identify entity with ownership of the proposed project area and the type of ownership (e.g., mineral, surface land, or other ownership).

RAI-2

In Section 1.9 of the TR, the applicant refers to the proposed project schedule in Figure 1-3, which indicates that decommissioning activities start in year 14 following the completion of restoration activities for Production Unit (PU) 12A. Elsewhere, in this section, the applicant states that decontamination and decommissioning (D&D) and reclamation activities for PUs will likely commence after receiving U.S. Nuclear Regulatory Commission (NRC) and Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) approval of successful groundwater restoration in each PU. In Section 1.7 of the TR, the applicant contemplates a phased, iterative approach, in which AUC will sequentially construct and operate a series of up to 12 PUs.

Basis:
The above information regarding the start of D&D activities appears contradictory and inconsistent with the requirements for timely decommissioning in Title 10 of the Code of Federal Regulations (CFR) 40.42. Also, the applicant does not commit to initiating decommissioning activities at a particular time. Figure 1-3, indicates that decommissioning activities start in year 14, and elsewhere the applicant indicates that D&D and reclamation activities for PUs will "likely" commence after receiving NRC and WDEQ approval of successful groundwater restoration in each PU. Deferring the start of decommissioning activities until year 14 is inconsistent with the requirements in 10 CFR 40.42(d) without first obtaining approval of licensee's request to delay or postpone initiation of the decommissioning process in accordance with 10 CFR 40.42(e). Based on Figure 1-3, under a phased decommissioning approach, decommissioning activities could conceptually start in year 6 (after the successful restoration of PU 1), and final decommissioning would conceptually occur in year 15 following the D&D of PU 12A, Central Processing Plant (CPP), Deep Disposal Wells (DDWs). For additional information, see the NRC rule "Timeliness in Decommissioning of Material Facilities" (59 Federal Register 36026-36040, July 15, 1994), and NRC Administrative Letter 96-05: Compliance with the Rule "Timeliness in Decommissioning of Material Facilities". The effect of the final rule is to require the uranium recovery licensees to notify the NRC within 60 days when they have permanently ceased operations or have not conducted operations for 24 months (Section 40.42(d)) and to submit an updated decommissioning plan within 12 months of this notification or license expiration.

RAI:

- Revise the discussion in this section to clarify AUC's approach for initiating decommissioning activities following NRC and WDEQ approval of successful groundwater restoration in each PU. Include a commitment as to when decommissioning activities will be implemented. If AUC commits to implement a phased decommissioning approach, revise Figure 1-3 to show how the approach affects the start of all remaining decommissioning activities.
- If AUC plans to pursue some other decommissioning approach, describe the approach including how the approach complies with the requirements for timely decommissioning in 10 CFR 40.42.

RAI-3

In Section 1.9 (Proposed Operating Schedule) of the TR, the applicant states:

> "Once groundwater restoration, D&D, and reclamation activities conclude and AUC has met the requirements of 10 CFR 20, Subpart E, the site will be released for unrestricted use."

Basis:
The above statement incorrectly cites 10 CFR Part 20 Subpart E as the regulatory standard for the clean-up and release for the proposed Reno Creek Project. This statement is also inconsistent with other correct statements in the application that discuss the remediation of disturbed areas to meet the requirements of 10 CFR Part 40, Appendix A, Criterion 6(6). The general provisions in 10 CFR Part 20 Subpart E, at 10 CFR 20.1401, specifically state that criteria in this part "… do not apply to uranium and thorium recovery facilities already subject to appendix A to 10 CFR part 40 or the uranium solution extraction facilities."

RAI:
Revise the discussion in this section, and related sections, to cite the applicable regulatory standard for remediating disturbed areas at the Proposed Reno Creek Project.

SECTION 2 – SITE CHARACTERIZATION

RAI-4

Section 2.1 (Site Location and Layout) and Table 2.1-1 (Surface and Mineral Ownership Distribution) of the TR indicates that the proposed project consists of 157 Federal unpatented lode mining claims (encompassing 2,873 acres or 47.4% of Proposed Project Property), one private mineral lease (encompassing 2,544 acres or 42% of Proposed Project Property), and one State of Wyoming mineral lease (encompassing 651 acres or 10.6% of Proposed Project Property).

Basis:
The application discussion of mineral ownership of proposed project property is unclear. This section does not identify the entity that currently holds the mineral ownership for the above areas of the Proposed Reno Creek Project. SRP, Section 1.3 states that the application summary of proposed activities includes descriptions of specific items (e.g., including corporate entities involved, location of the proposed facilities, and land ownership) sufficient to provide a basic understanding of the proposed activities and the likely consequences of any health, safety, and environmental impact.

RAI:

- Clarify whether the applicant or AUC Holdings currently owns/holds the above mining claims/mineral leases. If the applicant or AUC Holdings does not currently own/hold all of these mining claims/mineral leases, revise the text and associated figures (e.g. Figure 2.1-2) to clarify the fraction of these mining claims/mineral leases currently owned/held by the applicant or AUC Holdings, and address any potential impacts of proposed project activities on adjacent in-situ recovery (ISR) mining claims/mineral leases.
- In Table 2.1-1, correct or clarify why the total proposed project acreage for surface ownership (6,057 acres) and mineral ownership (4,793 acres) are different. Also, correct or clarify why there is a difference in acreage for State surface ownership (640 acres) and State mineral ownership (651 acres).

RAI-5

TR Section 2, Figure 2.1-3, provides mapping of the proposed wellfields areas but does not provide mapping that demonstrates the ore trends including the oxidation and reductions zones, stacking of the ore bodies, or vertical depiction of the ore body.

Basis:
The application fails to include adequate information on the ore body.

Section 2.7.3 of the SRP states:

> "If zones of distinct water quality characteristics are identified, they are delineated and referenced on a topographic map. For example, since uranium rollfront deposits are

formed at the interface between chemically oxidizing and reducing environments, water quality characteristics may differ significantly across the rollfront."

RAI:
Please provide mapping (including depicting the ore body on the cross-sections) that demonstrates the ore trends including the oxidation and reductions zones.

RAI-6

Section 2.1 (Site Location and Layout) of the TR, states:

> "Controlled areas will be fenced to limit access to project associated operations and is estimated to encompass 481 acres or approximately 8 percent of the Proposed Project Area. Anticipated controlled areas include all fenced areas around the CPP, wellfields, backup pond, and DDWs. "

Basis:
The application description of controlled areas does not include monitoring wells around planned production units. The application refers to the 10 CFR Part 20 definition of a controlled area as an area outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason. The applicant should clarify if monitoring wells are controlled areas which will be fenced to limit access to project associated operations.

RAI:
Clarify in text and related maps if monitoring wells will be fenced and included as controlled areas. If monitoring wells are not considered controlled areas, please provide a justification for not including monitoring wells as controlled areas.

RAI-7

In TR Section 2.1 on Figure 2.1-3, the applicant proposes to construct wellfields that bisect by a publicly used paved road.

Basis:
The application does not discuss procedures to implement operations at that setting that will ensure safe operations (accidents, security, access, engineering.)

Section 3.2.2 of the SRP states:

> "Staff should determine whether the hazards associated with the storage and processing of the radioactive materials and those hazardous materials with the potential to impact radiological safety, have been sufficiently addressed in the process design for the recovery plant, satellite processing facilities, well fields, and chemical storage facilities."

RAI:
Please describe how operations in areas which are bisected by the publicly used paved road will be conducted to ensure safety. Include a description of any controls that will be used.

RAI-8

Section 2.2.1 (Current Land Use) of the TR states:

> "There is currently one residence (the Taffner homestead) located within the Proposed Project boundary, and the Taffner homestead is currently located where the proposed CPP will be located. AUC will acquire the Taffner property prior to construction and it will not thereafter be used as a residence. The domestic water well located at the Taffner residence will be plugged in accordance with all WDEQ Rules and Regulations and will not be used for consumption once construction begins."

Basis:
The applicant acknowledges that this residence is not compatible with licensed activities and the discussion presumes that AUC will satisfy the above commitment. As such, the application does not address the health and safety implications associated with the co-location of the residence and the proposed CPP. AUC's commitment to acquire the Taffner property and plug the domestic water well prior to construction will be conditioned in the issuance of any NRC license.

RAI:
Describe how and when AUC will verify to the NRC implementation of its plans regarding the Taffner property.

RAI-9

In Section 2.5 of the TR, the applicant describes the nearest mountain ranges and the distance (60-100 miles), and concludes that due to these large distances, neither the Antelope site nor the proposed project site experiences weather effects from the three mountain ranges. In section 2.2.1, the applicant describes the Pumpkin Buttes at a distance of 7.5-14 miles from the proposed site.

Basis:
NRC staff cannot determine from the information in the TR if the Pumpkin Buttes have an impact on local weather patterns. SRP Acceptance Criteria 2.5.3(2) states that the applicant should assess the impact of terrain and nearby bodies of water on local meteorology. NRC staff considers buttes as tall natural structures/objects located in relatively flat or rolling hill terrain that may have an impact on local weather patterns. NRC staff has determined that the applicant failed to describe the impact (or lack of impact) of the Pumpkin Buttes, (which are much closer to the site than the nearest mountain ranges) on the terrain and how it may (or may not) affect local meteorology at the proposed site.

RAI:
Provide a technical assessment that demonstrates how the Pumpkin Buttes affect (or does not affect) the local meteorology (i.e., wind direction and wind speed). The applicant can provide actual research, computer simulation models, or relevant scientific literature search to support its conclusions.

RAI-10

The application states that the mineralization occurs along multiple oxidation-reduction fronts in various interbedded sandstones within the "production zone aquifer" (TR Section 2.6.2.6 page 2.6-15); uranium "intercepts" are variable in thickness ranging from one to 30 feet (TR Section 3.1.1 page 3-3) and the financial surety calculations indicate an average screen thickness (ore body) of 12 feet (Table 2.2 on Attachment 1-3 of Addendum 6-A); the ore body closely resembles roll-front deposits discussed in NUREG-1910 Generic Environmental Impact Statement for In Situ Leach Uranium Milling Facilities (GEIS), which indicate stacked or multiple horizons in a specific sandstone host; in areas in which [sandstones] in the production zone aquifer (PZA) are bifurcated by a thick mudstone, uranium mineralization can be found both above and below the mudstone lens; and, more frequently, the uranium mineralization is found in the lower half of the PZA (TR Section 2.6.2.2.1 page 2.6-9).

Basis:
On Figure 2.6A-27, the application presented a cross-sectional view of a typical roll front; however, the application did not include cross-sectional views of the ore body within the production zone aquifer throughout the project area (e.g., Figures 2.6A-18 through -23).

Historically, applications for a source material license contain depictions of the ore bodies' trends in both horizontal and vertical dimensions, in addition to the general information on the "production zone". This information is utilized by staff to determine adequacy of the pre-operation data (pumping test and water quality) for the proposed operations. For example, the vertical distribution of ore bodies will influence staff's evaluation of the suitability of the screened horizon for the perimeter ring wells. For this application, the vertical aspect of the ore bodies is significant with respect to the available water column for operations in areas in which the PZA is not fully saturated.

Section 2.6.1 of the SRP states:

> "An isopach map of the intended zone of injection or production and associated confining beds should be evaluated. All conclusions regarding the lateral continuity and vertical thickness of the mineralized zone(s), surrounding lithologic units, and confining zones, as based on lithologic logs from core and drill cuttings, geophysical data, remote-sensing measurements, and the results of other appropriate investigations should be reviewed." Emphasis added.

RAI:
Please depict the vertical location of the mineralized horizon(s) on the cross sections provided in the application. If multiple mineralize zones are identified, please provide map views of the distribution of the individual mineralized zones.

RAI-11

In TR Addendum 2.6-A, the mapping of the potential wellfields (e.g., Figure 2.6A-11) depicts a linear edge to several wellfields that coincide with section lines. During a NRC site visit in September 2013, the applicant acknowledged mineral claims other than those of the applicant exist within the proposed license area boundary. The linear edges in the application figures in general coincide with the general description of the boundary between mineral claims of the applicant and others.

Basis:
The application is deficient in that it does not include any description of the extent of mineral claims owned or not owned by the applicant, agreements with the other mineral owners, or techniques or limitations on performing operations near those areas.

Section 2.6.1 of the SRP states:

> "Data on the geochemistry of the ore zone and the geologic zones immediately surrounding the mineralized zone that will or could be affected by injected lixiviant should be evaluated. Information on unique minerals (including those that might be affected by fluid movement associated with the proposed project, such as bentonite) or paleontologic deposits of particular scientific interest, should also be reviewed. The staff should examine descriptions of any effects that planned operations at the site might have on the future availability of other mineral resources."

RAI:
Please provide information on the areas in the proposed license area for which the applicant does not have complete control in the subsurface. In those areas, please provide agreements to either monitor or perform corrective actions to ensure that the migration of regulated materials will not occur or be properly mitigated.

RAI-12

In TR Section 2.7.1.5 (page 2.7-9), the applicant asserts that "surface-[water] runoff will be directed away" from the plant and associated infrastructure (e.g. backup storage pond)." The foundation of support for the design of diversion channels as recommended by Regulatory Guide 3.11, Revision 3, "Design, Construction, and Inspection of Embankment Retention Systems at Uranium Recovery Facilities", is not discussed.

Basis:
The application does not provide an adequate evaluation of the surface-water flow to the surface impoundment.

Section 2.7.1 of the SRP states the application includes:

> "Descriptions of surface-water features in the site area including type, size, pertinent hydrological or morphological characteristics, and proximity to in situ leach processing plants, well fields, evaporation ponds, or other facilities that might be negatively affected by surface erosion or flooding."

Furthermore, Section 4.2.3 of the SRP states:

> "The design, installation, and operation of surface impoundments at the site used to manage 11e.(2) byproduct material meet relevant guidance provided in Regulatory Guide 3.11, Section 1 (NRC, 1977). ... [t]he surface impoundment must have sufficient capacity and must be designed, constructed, maintained, and operated to prevent overtopping resulting from (i) normal or abnormal operations, overfilling, wind and wave actions, rainfall, or run-on;"

Section 2.2.1 of Regulatory Guide 3.11 states:

> "If impoundments are designed to contain only direct precipitation that falls into the reservoir area, a single occurrence of the 6 hour probable maximum precipitation (PMP) may be used to determine storage capacity and freeboard requirements. If the tailings retention system has some external drainage area, and hydraulic structures (such as diversion channels) are needed to safely divert the probable maximum flood (PMF), the peak PMF inflows and runoff used to design such structures should be determined in accordance with the suggested flood design criteria in NUREG-1623, "Design of Erosion Protection for Long-Term Stabilization," (Ref. 2)."

Staff has interpreted the "tailings retention system" reference in Regulatory Guide 3.11 to include all surface impoundments used for storage of byproduct material including liquid byproduct material.

RAI:
Please provide the analysis of the surface-water run-on to the proposed surface impoundment which is proposed for the drainage channel surrounding the "backup pond".

RAI-13

On page 23 in TR Addendum 2.7-D of the application, the applicant reports:

> "Based on field reports by AUC, it was concluded that well UM3 was irreparably damaged during well completion. After the UM3 well casing was cemented and allowed to cure, the underlying unit was under-reamed to total depth. During the under-reaming, the two blades were bent while reaming through a four to five feet thick hard carbonate layer immediately above the underlying unit. After reaching total depth, the damaged under-reaming blades could not be retracted into the bit. Withdrawal of the bit resulted in gouging and distortion of the inside of the well casing. The well was completed, but as the results of the step test conducted at PZM3 show, the intended underlying unit completion interval was compromised and had direct communication with the PZA. Based on these data, the well was properly plugged and abandoned and replaced with well UM3R."

In Section 3.1.3.3 of the application (page 3-12), the applicant states:

> "Any well with evidence of suspected subsurface damage will require an MIT prior to the well being returned to service."

Basis:
Identifying a problem with the integrity of monitoring well UM3 during a step test without evidence of prior testing is inconsistent with the applicant's commitment in Section 3.1.3 to perform tests on wells with suspected damage.

Section 5.2.2 of the SRP states:

> "The reviewer should determine that the proposed management control program and administrative procedures are sufficient to assure that any activities affecting health, safety, and the environment, including compliance with any license commitments or conditions, will be conducted in accordance with written operating procedures."

RAI:
Please describe how commitments made in Section 3.1.3 will be implemented during operations. Also, please verify that information provided in the application is accurate regarding the integrity of damaged wells (e.g., UM3): Refer to Tables 2.7B-8, 2.7B12 (Addendum (2.7-B) and 3 (Addendum 2.7-C); Figures 2.7A-8 and 2.7B-9.

RAI-14

TR Addendum 2.7-C of the application documents results of a groundwater numeric model used by the applicant for the basis of its proposed design for the wellfield operations. Staff has several comments and questions on the groundwater numeric model which, for convenience, are grouped into three categories as follows: (1) existing model design/simulations; (2) model setup; and (3) model predictions.

(1) Existing Model Design/Simulations

The supplemental data dated July 19, 2013 (ADAMS Accession No ML13213A064) included the electronic version of the ground water modeling input and output files. For the RegionalSS and Life-of-Mine Simulations, an error in a water mass balance budget for many stress periods exceed 1.0 percent. Generally, the conventional industry standard for an error is 0.1 to 0.5 percent, but it is reported that errors of 1.0 percent may be acceptable (Hill, 2007).

(2) Model Setup

(a) On Figure 11 in Addendum 2.7-C, the application reports that the groundwater numeric model consists of 24 zones of hydraulic conductivity values with values varying between 0.1 and 6 feet per day. Of the 24 zones, 23 zones approximate a "circular-like" zone centered about the various locations of pumping tests and generally limited to the proposed license area. The modeled area outside of the proposed license area is one zone with a hydraulic conductivity of 1.0 foot per day.

The geometry of the circular-like zones is likely an artifact of using pilot point calibration techniques. However, use of this calibration technique with the large number of zones needs to be addressed in light of the fact that the calibration "targets" consisted of only 12 head values. Furthermore, the modeling report did not include any sensitivity analysis on the hydraulic conductivity values, in particular, the single zone surrounding the license area.

(b) The discussions on sensitivity of the groundwater numeric model to storage terms are limited in Addendum 2.7-C of the application. The application states that calibration for two transient simulations (based on drawdown in the partially

saturated cells) was more sensitive to specific yield (page 12 of Addendum 2.7-C); however, other than reporting the "calibrated" values the report did not elaborate model sensitivity to specific yield values.

(c) Based on information in Addendum 2.7-C, the groundwater numeric model is based on strata orientation with a uniform northwesterly dip (Page 5). As a result, the general head boundary conditions assigned to cells along the southeastern perimeter model had to be assigned relatively high heads. The high heads result in a "source" component to the groundwater model. The application states that the general head boundaries in that area reflect recharge directly to the ore zone based on the mapped distribution of outcrops of the Felix Coal seam (Page 6). While staff acknowledges that the applicant's model assigns a low contribution to that source and that the Felix Coal seam outcrops are as reported by the applicant (Page 11), staff's concern is that general head boundaries in that area may be an artificial source of water in the model. For example, the area of recharge is actually located within another surface water watershed and the outcrops of the coal seam correlate with incised slope surface forming distant stream channels. As such, direct recharge to the ore zone may not be occurring to the extent of the applicant's conceptual model nor migrate to the location of the proposed license area.

(d) The applicant's model is a one-layer model (Page 11) which limits its predictive capabilities to a 2-dimensional flow regime (i.e., horizontal flow). The application states that a single layer is reasonable because the upper and lower layer represents no-flow boundaries consistent with the applicant's conceptual model for the upper and lower confining units. However, vertical anisotropy to the aquifer, as inferred by the application, cannot be incorporated into a one-layer model and vertical anisotropy would affect specific model predictions (as discussed below under Section (3)).

(e) The transient stress periods for the Life-of-Mine Simulation consist of withdrawals that are based on a "preliminary production unit operational schedule" and the "maximum proposed production …during year seven". While staff acknowledges that the withdrawals reflect proposed production unit constraints, the application did not provide a simulation which took into account the maximum impact of operations (e.g., 3 percent bleed at the maximum 11,000 gpm for the life of the operations).

(3) Model Predictions

(a) Life-of-Mine Simulation - The application predicts drawdown for various stress periods during the life-of-mine simulation. The model simulation predicted the worst case of 35 feet of drawdown during stress period 7 (year 7 of operations) in the area of the aquifer which is only partial saturated with 80 feet of available water column under static conditions (Page 17).

(i) The model predictions are based on rectangular model cells; the predictive results do not take into account radial drawdown in the vicinity of a relatively thin diameter well (thin compared to the dimension of the model cell) or inefficiency of a well. The applicant reports that from the pumping tests, well efficiencies on the order of 10 percent may be expected.

(ii) The model is based on wells screened throughout the entire saturated thickness of the aquifer. However, the production wells may be focused on only a portion of the ore aquifer and thus the available water column after the 35 feet of drawdown may be significantly less than 55 feet (80 minus 35 feet).

(b) Flare Simulation - The application determined based on the model results horizontal flare factors of 1.14 or 1.15 for the fully and partially saturated areas of the aquifer, respectively, and concluded that those values are less than those used in other ISR applications (Page 20); the applicant adopted higher values in the surety calculations (similar to those used by other applicants (e.g., 1.20). In addition, the application states that although not simulated in the model, the vertical flare should be less than the horizontal flare due to the anisotropy.

Being a single layer, the model cannot incorporate any anisotropy in the aquifer. Furthermore, because the model incorporates a "fully penetrating" well by design, the model cannot predict flare for a partial penetrating well, which will be the case for all production (injection and recovery) wells.

(c) Excursion Recovery - The application reports that model predictions support the applicant's proposed spacing of the perimeter ring monitoring wells and that the modeling demonstrates timely corrective action should an excursion be observed (Page 19). The duration of the stress period used to demonstrate that the well spacing is adequate was 2 years.

Basis:
Based on the information provided in the application, staff is unable to substantiate the applicant's conclusions nor can staff conclude that the applicant's conceptual model is appropriate for the specific setting. As a result, staff developed three specific RAI comments on the applicant's model.

Section 2.7.1 of the SRP states:

> "Characterization of the hydrology at in situ leach uranium extraction facilities must be sufficient to establish potential effects of in situ leach operations on the adjacent surface-water and ground-water resources and the potential effects of surface-water flooding on the in situ leach facility."

Section 2.7.2 of the SRP further states:

> "Examine pumping tests, analyses, and/or other measurement techniques used to determine the hydrologic properties of the local aquifers and aquitards that affect or may be affected by the proposed in situ leach activities."

Section 6.1.2 of the SRP provides guidance on the evaluation of groundwater numerical models:

> "If numerical ground-water flow or transport modeling is used to support or develop the ground-water restoration plans, examine the descriptions of features, physical phenomena, and the geological, hydrological, and geochemical aspects of the modeled aquifers. The staff should verify that the descriptions are adequate and that the

conditions and assumptions used in the modeling are realistic or reasonably conservative and supported by the body of data presented in the descriptions."

"Evaluate the sufficiency of data used to support model input parameter values. Data sources may include a combination of techniques such as laboratory experiments, aquifer hydraulic testing and water level measurements in wells, geochemical analyses, or other site-specific field measurements."

"Evaluate the technical bases for parameter ranges, probability distributions, or bounding values. The reviewer should determine whether the parameter values are derived from either site-specific data, or an analysis to show assumed parameter values bound data uncertainty in a manner that is not overly optimistic."

"Evaluate whether there are aspects of the model where additional data could provide new information that could invalidate the modeling results and significantly affect the ground-water restoration plan. For example, if constant head boundary conditions are used in a numerical ground-water flow model, could additional wells or sampling during a different season result in a significantly different interpretation of model boundary conditions? If so, is a different interpretation of boundary conditions likely to significantly alter model results used to develop or support the restoration plan?"

"Examine the initial conditions and boundary conditions used in any numerical modeling for consistency with available data. The staff should also consider the potential importance of temporal and spatial variations in boundary conditions and source terms used to support the ground-water restoration plan."

"Evaluate the applicant's assessment of uncertainty and variability in model parameters. The reviewer should determine whether uncertainty in both temporal and spatial parameter variability is incorporated into or bounded by parameter values."

RAI:

(1) Please provide a discussion of the potential uncertainty of the model for stress periods that did not achieve the 1.0 percent threshold.

(2) (a) Please provide an analysis of the model sensitivity to the distribution and number of hydraulic conductivity values used in the model.
(b) Please provide a discussion and sensitivity analysis of the storage coefficient on the model predictive results.
(c) Please provide a discussion on the impact of the boundary conditions in the southeastern perimeter on the long-term model predictions.
(d) Please comment on the limitations and impacts of a single layer model on the predictive results with respect to the field vertical anisotropy to the aquifer.
(e) Please provide a simulation evaluating the impact under the maximum operating conditions requested by this application.

(3) (a) Please provide an evaluation of available water column at a specific well taking into account radial flow to the well, well inefficiency, anticipated well completion elevation in the partially saturated portions of the aquifer.
(b) Please provide further clarification on the limitation of the flare calculations.

(c) Please provide further evaluation of the spacing for the perimeter ring monitoring taking into account the limited flare predicted for the application.

RAI-15

In TR Section 2.7.1, the narrative in the application states that the surface water sampling locations consist of stock ponds or in drainages where ponding occurs (Section 2.7.1.9 page 2.7-13). The application states that, in general, surface water in the ponds exhibit typical saline characteristics of [coal bed methane] surface discharge during the summer and fall months and changes during the spring months due to dilution from snow melt or heavy precipitation (Page 2.7-13). The application states that there are significant differences among the various sampling locations with surface water quality at several locations and proffers various source characteristics (Page 2.7-15). For example, the application notes three locations as being dilute, at one location having a composition similar to rainwater. At the other end of the spectrum, several surface water samples being comparable with CBM discharges indicating a chemistry strongly influenced by CBM discharges, CBM discharge waters characterized by relatively high [total dissolved solids], dominantly sodium-bicarbonate water, and the fact that several surface water sampling locations are close to CBM discharges (Page 2.7-16).

The application (Page 2.7-16) also states another potential end member for the surface water quality is a calcium magnesium sulfate rich water, which differs from CBM discharged water in that coal bed methane (CBM) discharges have low sulfate levels, but does not provide any source characterization (i.e., groundwater discharge, surface water runoff). The application states that surface water at one location (SW9) appears to be CBM type water that has undergone some dilution and possible interaction with minerals in the soil and that a lixiviant spill could be distinguished from CBM discharges by concentrations of sulfate (high in lixiviant (aquifer) and low in CBM discharges) and barium (high in CBM discharges and low in the lixiviant (aquifer)).

Basis:
The conceptual surface water model presented in the application lacks specificity. For example, it fails to denote which surface water sampling locations are impacted by a permitted CBM discharge, which locations are not impacted but are located close to permitted CBM effluent discharge, and which locations that saline conditions characteristics of CBM discharge are not located close to a permitted CBM discharge.

Section 2.7.1 of the SRP states:

> "Review surface-water data, including maps that identify nearby lakes, rivers, surface drainage areas, or other surface-water bodies; stream flow data; and the applicant's assessment of the likely consequences of surface-water contamination from in situ leach operations. Verify that the applicant has generally characterized perennial surface-water bodies, such that an assessment of impacts from operations can be made."

RAI:
While staff acknowledges that the surface water features are ephemeral and thus difficult to characterize, the description provided in the application is too generalized to provide adequate background. Please provide the following information:

For each surface water sampling location, indicate: (1) whether an active CBM discharge is occurring, (2) whether the surface-water body is used for livestock water and, if so, is it supplemented with groundwater, (3) duration and maximum depth of the water in the surface-water body, (4) which of the "end" members (precipitation, CBM discharge, sulfate-rich) are a dominant component, and (5) whether or not reaction with soils are likely occurring.

RAI-16

In TR Addendum 2.7B, Figure 2.7B-60, the application plots data for wells PZM-1, 3, 5, 9 &19 on a piper diagram but the tabulated data are not provided. Similarly, several wells (e.g., PZM-4,11,12 & 13) were used to monitor water levels during pumping tests but the application did not include any water quality data for those wells.

Basis:
The applicant failed to include complete data or a rationale for not including the data.

Section 2.7.2 of the SRP states:

> "Verify that a sufficient number of baseline ground-water samples are collected to provide meaningful statistics, that samples are spaced in time sufficiently to capture temporal variations, and that the chemical constituents and water quality parameters evaluated are sufficient to establish pre-operational water quality, including classes of use."

Section 2.7.3 of the SRP states:

> "All significant borehole data should be included in an appendix. Staff should verify that, an adequate number of boreholes is used to support the assertion of hydrogeologic unit continuity, if shown as such in the cross sections."

RAI:
Please provide rationale for not sampling several wells (PZM-4,11,12 & 13) or not providing the data for several wells (e.g., wells PZM-1,3,5,9 &19), even though data from those wells were included in the piper diagrams.

RAI-17

In TR Addendum 2.7B, Figure 2.7B-65, the application includes a piper diagram for the historical groundwater quality (previous R&D and application) but did not provide any tabulated data for staff to verify.

Basis:
Same as RAI 16.

RAI:
Please provide a summary table of historical groundwater quality used to construct the piper diagram (Figure 2.7B-65).

RAI-18

In TR Addendum 2.7B, the application did not include well completion details for well UM3R in Table 2.7B-1.

Basis:
Same as RAI 16

RAI:
Please provide well completion details for well UM3R in Table 2.7B-1.

RAI-19

Section 2.7 of the TR includes: (1) a summary of water quality at nearby, privately owned, livestock and domestic water supply wells (Table 2.7B-38); (2) a summary of wells sampled (2.7B-37); (3) a summary of groundwater rights within a two-mile buffer (Table 2.7B-18); and (4), a narrative description of water supply wells located within (i) the project (15 groundwater rights including 6 rights cancel, 8 rights for livestock use and 1 right for domestic use), (ii) two miles of the project (29 rights including stock, domestic, miscellaneous and industrial usage), and (ii) three miles of the project (69 rights without any further delineation). The reported summary of water quality is for 14 locations, 6 locations within the project and 9 locations outside of the project. The reported summary of sampling locations includes 15 locations. The applicant did not provide any discussion of the water quality of the sampled wells in Section 2.7 of the application.

In Section 2.9.8, the applicant summarizes recommendations in Regulatory Guide 4.14 for a monitoring program that consists of one well upgradient and three wells downgradient of the tailings area. The applicant further states that because no tailings impoundments are proposed, the Regulatory Guidance 4.14, Revision 1, "Radiological Effluent and Environmental Monitoring at Uranium Mills", recommendations “ha[ve] been interpreted and adapted by AUC.” The applicant then summarizes the detected levels of various radionuclides in Tables 2.9-16 through Table 2.9-21, and the baseline radiological sampling locations in Figure 2.9-1. The reported radiological analytical parameters consist of Radium-226, Polonium-210, Thorium-230, Lead-210, uranium and Radon-222. Based on tables in Section 2.9, the number of samples reportedly analyzed for the baseline radiological program varied from 6 to 17 locations and only during the fall of 2010. For Radium-226, the locations include 3 privately owned wells, 9 on-site monitoring wells, 5 locations with the Sample Name not depicted on Figure 2.9-1 or discussed in the narrative.

In Appendix 2.9-A, the applicant includes a sampling and analysis plan which includes groundwater sampling and analysis. Based on the plan, its objective is to describe programs and procedures for obtaining baseline radiological data. For groundwater sampling, the plan notes recommendations of Regulatory Guide 4.14 to monitor existing domestic, livestock or irrigation wells within two kilometers of the tailings area, and one well upgradient and three wells downgradient of the tailings area. The plan states that the baseline monitoring included wells within a two-kilometer radius of the project boundary and then provides a confusing discussion on the details. For one sentence, “[w]hile there are six wells within the two km sample requirement, these resources will likely be analyzed in the baseline study”, staff is interpreting the meaning of this sentence that the six wells refer to those reported in the application for six locations (GW2, GW3, GW6, GW10, GW12 & GW14) and not a commitment for additional six

wells. For the next sentence, "[i]n addition to wells within two km outside the Proposed Project area, there are 14 baseline stock/domestic wells sampled", staff is interpreting the meaning of this sentence as the 14 privately owned wells (both inside and outside of the project) as reported in Table 2.7B-38. Finally, the application includes the following sentence "[i]nside of the Proposed Project area, seven monitoring well clusters with a total of 39 wells have been installed for characterizing the up-gradient and down-gradient flow from the locations of the proposed CPP and backup pond", which the staff is interpreting refers to the wells sampled for site characterization in Section 2.7. The plan also states that the analytical parameters consist of uranium (dissolved), Radium-226, gross alpha and gross beta.

In Section 5.7.8.1 of the application, the applicant states that the all private wells used for drinking water, livestock watering or crop irrigation within two kilometers of the wellfield area boundary will be sampled for baseline values and during operations for parameters identified in Regulatory Guide 4.14 Table 2. The applicant does not provide a listing of wells that meet that criterion or a figure showing the extent of the area.

Basis:
The presentation of data for the pre-operational and operational groundwater monitoring program is unclear and appears to be inaccurate due to: (1) errors in the tables listed below; (2) conflicting information among various sections of the application; (3) lack of commitments regarding implementation of the environmental monitoring program.

Staff has identified the following issues:

Summary of Errors

Table 2.7B-37

- GW8 is listed but the summary data and location are not shown elsewhere.
- For GW15, the location lists Range 72 but figure 2.9-1 depicts it in Range 74. Furthermore, Permit P18852P is not listed in Table 2.7B-18.
- No location is listed for GW12, GW-14 and GW17; however, the sampling locations were deduced from Figure 2.9-1.

Tables 2.9-16 through -21

- The table number is incorrect for several tables (e.g., Table 2.9-16 is listed as Table 2.9-1)
- The table lists the sample names PZM5-PT1, PZM5b, TAF1, TAF2 & PRI1, but the locations are not shown on any figure or descriptions in the application.

Conflicting Information
As noted in the above summary, the application includes conflicting information in various sections of the application, which, as presently constructed, would not lead to a staff sufficiency finding. For example, the analytical parameters in Appendix 2.9-A lists uranium (dissolved), Radium-226, gross alpha and gross beta whereas Tables 2.9-16 through 2.9-21 list Radium-226 (dissolved and suspended), Polonium-210 (dissolved and suspended), Thorium-230 (dissolved and suspended), Lead-210 (dissolved and suspended), uranium (natural) (dissolved and suspended), and radon (not specified as dissolved), or Regulatory Guide 4.14 Table 2, which the applicant commits to in Section 5.7.8.1 of the application, lists dissolved and suspended natural uranium, Radium-226, Thorium-230, Lead-210 and Polonium-210 (staff notes that the

dissolved and suspended components are applicable to each radionuclide). The other conflicting information is that the number of wells identified to be sampled differs among various sections of the application.

Lack of Commitment

While the applicant commits to an operational monitoring program that includes the nearby private wells in Section 5.7.8.1, staff is unsure which wells currently are within two kilometers of the proposed project area fulfills that requirement). Furthermore, staff requires applicant's commitments that all wells meeting the established criteria (i.e., within two kilometers of the proposed project area) are sampled as part of the preoperational monitoring prior to the start of operations.

Inadequate Program

The applicant stated its effluent and environmental program is based on its evaluation of guidance in Regulatory Guide 4.14. However, the applicant inappropriately combines two types of programs listed in Regulatory Guide 4.14 as a single environmental monitoring program. The first program identified consists of one well upgradient and three wells downgradient of the tailings impoundment. It is defined as a specific groundwater protection detection program designed to monitor a leak from the regulated surface impoundment. This program as identified in Regulatory Guide 4.14 has been superseded by 10 CFR Part 40 Appendix A Criterion 5 (promulgated after Regulatory Guide 4.14). Furthermore, though these regulations discuss "tailings impoundments", staff applies them to all surface impoundments that are designed to contain solid or liquid byproduct material for ISR purposes.

The second program identified by the applicant is the operational environmental monitoring program which includes the nearby privately owned wells. Based on the recently issued licenses, staff adapts or modifies the recommendations in Regulatory Guide 4.14 of the "2 kilometer of the tailings disposal area" to "2 kilometers of the well perimeter ring" for ISR facilities. The applicant will have to clearly commit to a similar environmental monitoring program.

RAI:

a. Please correct errors noted above in the tables and text.
b. Please correct inconsistencies noted above in the various sections of the application.
c. Please provide a map depicting the 2-kilometer area (or other proposed area with justification for staff's consideration) for the environmental monitoring program, including all wells that are or could be a water supply, livestock domestic water supply or irrigation well regardless of the state permit use status.
d. Please provide a summary table of wells sampled for the pre-operational (baseline) environmental monitoring program. If a well was not sampled and located within the distance criteria, please provide the rationale or justification for not sampling the well.
e. Please provide a description and location of all samples included in the pre-operational environmental monitoring program.
f. If GW7, GW12 and GW14 are not groundwater use permit numbers identified as P110428W, P165695W or P188488P, respectively, please provide the rationale or justification why those wells are not included in the pre-operational environmental monitoring program.
g. Please provide rationale for including only a selected number of wells in the pre-operational environmental monitoring program and only one sampling event for each location.

h. Please provide a commitment that, if all wells in the pre-operational monitoring program have not been sampled, they will be sampled prior to operations.
i. Please provide a summary table of pre-operational environmental monitoring program parameters and rationale for modification from those parameters recommended in Regulatory Guide 4.14 for staff's consideration.
j. Please provide a commitment to perform reviews on an annual basis for new wells that may be installed in the future in the area of the environmental monitoring.
k. Please provide a rationale or justification for continued use of monitoring wells or stock wells (specifically wells for groundwater use permits P2883P and P33284W) if those wells are located in the within an area of influence of a wellfield and the screened horizon spans over more of the ore zone aquifer than the targeted horizon.
l. Please provide design details for and a commitment to install a groundwater protection monitoring program compliant with Criterion 7A of Appendix A, 10 CFR Part 40, for the surface impoundment (backup ponds)

RAI-20

In Section 2.9 of the TR, the applicant stated that the locations of the air particulate and air radon monitoring stations are located in Figure 2.9-1 of the Technical Report (AUC, 2012).

Basis:
NRC staff noted that the locations of the pre-operational soil (and direct radiation measurements) are not collected around the center of the mill operations (or central processing facility) in Figure 2.9-1. The location of the central processing facility is considered to be the origin of the coordinates and the bases for the location of air particulate, air radon, soil, and direct radiation measurements. Regulatory Guide 4.14, Table 1, recommend surface and subsurface soil samples taken at various intervals from the center of the milling area. Also, SRP Acceptance Criteria 2.9.2(1), which references Regulatory Guide 4.14, Section 1.1, states that three locations at or near the site boundaries in different sectors that have the highest predicted concentrations of airborne particulates, and preoperational sampling should be the same as operational locations. This guidance affects air particulate, air radon, soil, and direct radiation pathways for both pre-operational and operational programs.

NRC staff reviewed Figure 2.9-1 and determined that the pre-operational soil sampling locations are not conducted from the center of the central processing facility. Thus the proposed air particulate, air radon, soil, and direct radiation measurements are not in the proper sampling locations. The central processing facility, as shown in Figure 2.9-1, is located at a different location. NRC staff has determined that the origin of the location of the central processing facility in Figure 2.9-1 impacts the location of the air particulate sampling locations shown in Figure 2.9-1, as well as air radon, soil, and direct radiation during operations. The applicant needs to conduct pre-operational soil sampling from the origin of the location of the central processing facility, as shown in Figure 2.9-1, and develop air particulate sampling locations, based on wind rose data collected during pre-operations from this point of origin.
Pre-operational soil samples need to be collected at various intervals from the center of the milling area consistent with Regulatory Guide 4.14 or if the applicant proposes other locations, the applicant must provide its rationale for staff's consideration.

RAI:
Describe and commit to a soil sampling regimen consistent with Regulatory Guide 4.14 for surface and subsurface soils, or propose an alternative method with rationale for Staff's consideration. Commit to 12 consecutive months of pre-operational air particulate, air radon, soil, and direct radiation data collection regimen consistent with Regulatory Guide 4.14, prior to operations, or propose an alternative data collection regimen with rationale for staff's consideration.

RAI-21

In Section 2.9 of the TR, the applicant stated that it conducted pre-operational continuous air sampling and filters were collected weekly initially, but extended filter replacement collection to a monthly frequency in 2011. The applicant indicated that the change in filter replacement was due to cost efficiency and safety for personnel working in sometimes harsh site conditions. The applicant indicated that the filter size was increased to four inches from 47 millimeters and provided a technical basis in Addendum 2.9-C.

Basis:
The applicant has not adequately demonstrated that the changing of the sampling frequency from weekly to monthly will not adversely impact accuracy of results due to dust loading. Regulatory Guide 4.14 states that the sample collection frequency should be a weekly filter change or more frequently as required by dust loading. NRC has determined that dust loading can adversely affect the activity on the filter as certain radioactive particles (i.e., alpha and beta) on the filter can be absorbed by the dust prior to reaching the detector. If dust loading is present on an air filter, the amount of dust should be accounted for to correct for the true activity on the filter. NRC staff reviewed TR Addendum 2.9-C and determined that the applicant did not provide any data or discuss the impact (or lack of impact) of dust loading on a 47 millimeter filter collected over one week versus dust loading on a 4 inch (101.6 millimeter) filter collected over one month. More specifically, the applicant did not discuss the type of analysis when evaluating the dust loading on the filter. A stand-alone statement by itself indicating that a 4 inch filter over a 30 day collection period compared to a 47 millimeter filter with a collection period of one week is not sufficient to demonstrate the benefits of using a 4 inch filter paper over a 30-day period.

RAI:
Provide additional information regarding merits of using a large filter at a longer frequency using dust loading data or a similar study performed by another entity, and its relation to accuracy of the analytical counting method that will be used to determine filter activity. Furthermore, explain how the dust loading on the filter at the proposed sampling frequency impacts counting efficiency and accuracy of results.

RAI-22

In TR Section 2.9.8.1, the applicant proposes and used the "low-flow" sampling methodology during collection of background groundwater samples for the pre-operational monitoring program. The applicant further states that the wells were sampled (for the pre-operational monitoring program) using "EPA-approved" low-flow procedures, including use of a low-flow purge rate of 0.1 liters per minute and in-line monitoring of stabilization parameters. Although not directly stated, in Section 5.7.8 of the application, the applicant suggests that low-flow

purging techniques may be used for sampling of groundwater for the subsequent groundwater protection detection monitoring program(s).

Basis:
The applicant fails to include references for the "EPA-approved" procedures. Staff cannot make assumptions about the reference documents to which the applicant is referring (e.g., EPA Regional Offices' Standard Operating Procedure (e.g., EPA Region 1 SOP-GW-001) as the application does not include a proper reference. The applicant provides a SOP-5 "Ground Water Sampling (Low-Flow)" in Appendix 2.9-A of the application. Although the applicant provides general concepts in its Standard Operating Procedures (SOP) that are consistent with guidance in the above referenced EPA SOP, the applicant is silent on how several applicable implementation procedures (e.g., low stress), including that low-flow sampling, may not be appropriate for low-yielding wells, and that more appropriate sampling procedures for low-yielding wells other than the "low-flow" methodology are found in other guidance documents (e.g., EPA 542-S-02-001) and should be used as applicable.

In addition, groundwater sampling methodologies at existing ISR facilities are not the "low-flow" method but hybrid methods consisting of purging one or more well volumes followed by stabilization of selected parameters. However, the applicant has applied its proposed methodology to the pre-operation site characterization monitoring program for the application. Based upon staff's review of the ground water quality reported for various sampling locations in the application, staff identified a significant variability in field-measured pH and temperature levels for the groundwater, which indicates insufficient well completion and/or sampling methodologies.

Section 2.7.3 of the SRP states:

> "The applicant should show that water samples were collected by acceptable sampling procedures, such as American Society for Testing and Materials D4448 (American Society for Testing and Materials, 1992)."

RAI:
Based on the above, please provide clarifications for the following:

(a) Please provide well completion report and/or boring log for all monitoring wells. If the completion report and/or boring log does not document well completion activity, please provide that information in a separate submittal.
(b) Please justify the use of "low-flow" sampling methodology for a low-yielding well especially for: (1) purge volumes approximately equal the volume of water removed from the well; and (2) effects on trace metal levels (in particular uranium) at well UM3R where the first sampling event used non-low-flow techniques and the last three events used low-flow techniques.
(c) Please comment on the significant variability of reported field-measured pH levels at several wells with emphasis on suitability of the sample as representative of the aquifer.
(d) Please comment on the variability of reported temperatures for all samples, which appear to correlate with the ambient temperatures at the time of sampling with emphasis on the suitability of the sample as representative of the aquifer.
(e) Please provide the methodology for wells sampled for the pre-operational monitoring program but were not sampled using low flow techniques.

RAI-23

In Section 2.9.10 of the TR, the applicant stated that vegetation grab samples were collected at sampling locations as identified in Figure 2.9-1 of the TR and the results are provided in Table 2.9-24 of the TR.

Basis:
The applicant did not provide vegetation samples and results at least three times in three different sectors during the grazing season. Regulatory Guide 4.14 recommends that forage vegetation should be sampled at least three times during the grazing season in grazing areas in three different sectors that will have the highest predicted air particulate concentrations due to milling operations.

RAI:
The applicant needs to collect vegetation samples at least three times during the grazing season in grazing areas in three different sectors that will have the highest predicted air particulate concentrations due to operations or provide a rationale for an alternative sampling regime for the staff's consideration.

RAI-24

In Section 2.9.10 of the TR, the applicant stated that vegetation grab samples were collected at sampling location as identified in Figure 2.9-1 of the TR and the results are provided in Table 2.9-24 of the TR.

Basis:
NRC staff reviewed the vegetation sampling locations (RC-RAD-1, RC-RAD-2, and RC-RAD-3) in Figure 2.9-1 of the TR and determined that these vegetation sampling locations are not in three different sectors that will have the highest predicted air particulate concentrations during operations. Regulatory Guide 4.14 states that forage vegetation should be sampled at least three times during the grazing season in grazing areas in three different sectors that will have the highest predicted air particulate concentrations due to milling operations.

RAI:
The applicant needs to demonstrate that the vegetation sampling locations (RC-RAD-1, RC-RAD-2, and RC-RAD-3) are located in three different sectors, or collect vegetation samples in three different sectors that will have the highest predicted air particulate concentrations due to operations or describe and justify an alternate sampling regimen for staff's consideration. The applicant should provide maps with sectors to differentiate the different sectors and sampling locations.

RAI-25

In Section 2.2.1 of the TR, the applicant stated that within the proposed project area, existing land uses include: oil and gas production, CBM production, transportation, livestock grazing, and wildlife habitat.

Basis:
The applicant did not provide any discussion or data for the collection of food samples, including livestock. Regulatory Guide 4.14 states that at least three samples should be collected at time of harvest or slaughter or removal of animals from grazing for each type of crop (including vegetable gardens) or livestock raised within three kilometers of the mill site.

RAI:
Provide an adequate technical justification for not collecting food samples (i.e., crop, livestock, etc.) during the harvest or slaughter within 3 kilometers of the proposed site, or commit to collect three samples once during the harvest or slaughter for each type of crop or livestock as indicated above prior to construction of the site, or propose an alternate sampling regime with rationale for staff's consideration.

RAI-26

In Section 2.9.9 of the TR, the applicant stated that surface water sampling at four sampling locations (SW 3, SW 11, SW 16, and SW 18) are shown in Figure 2.9-1 of the TR, and Table 2.9-22 and Table 2.9-23 of the TR. The applicant stated that the surface water sampling included perennial streams, and ephemeral stream drainage channels where surface waters are present at least part of the year.

Basis:
The applicant did not collect monthly surface water sampling at four sampling locations. Regulatory Guide 4.14 states that samples should be collected at least monthly from streams, rivers, any other surface waters or drainage systems crossing the site boundary, and any offsite surface waters that may be subject to drainage from potentially contaminated areas or from a tailings impoundment failure. Any stream beds that are dry part of the year should be sampled when water is flowing. Samples should be collected at the site boundary or at a location immediately downstream of the area of potential influence. NRC staff reviewed the surface water sampling results provided by the applicant in Table 2.9-22 and Table 2.9-23 and noted that the results reflected only the month of September 2010. NRC staff determined that the collection of surface water samples for the month of September 2010 does not constitute monthly surface water samples, nor did the applicant provide sufficient information for not collecting monthly surface water samples (i.e., stream beds were dry except for the month of September). NRC staff also reviewed Figure 2.5-9 in the TR and noted that sufficient precipitation occurred during month 5. Figure 2.5-9 does not provide any key or legend that suggests or infers that month 5 is September.

RAI:
Provide monthly surface water samples consistent with Regulatory Guide 4.14 or provide justification for only collecting surface water samples during the month of September for staff's consideration. Clarify figures by use of legend or description. Specifically, define the measure of month 5.

RAI-27

In Section 2.9 of the TR, the applicant references Figure 2.9-1 for the Baseline Radiological Sampling Location. In Figure 2.9-1, the applicant identified the Proposed Reno Creek Project Boundary in the legend. In the applicant's Glossary on page G-4, the applicant defines the

Proposed Project Area as the area proposed for construction, operation, groundwater restoration, and decommissioning of an ISR uranium recovery facility.

Basis:
The applicant needs to define the site boundary consistent with 10 Part CFR Part 20. According to 10 CFR 20.1003, the Site Boundary is defined as that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee. During the review, NRC staff noted that a public road runs through the Proposed Reno Creek Project Boundary. This leads to the question, does the applicant have control over that public road and lands that are not controlled areas as defined by 10 CFR 20.1003. NRC staff cannot determine from the applicant's definition of the Proposed Reno Creek Project Boundary if it is the same as the site boundary or if the Proposed Reno Creek Project Boundary definition is different from the NRC 10 CFR Part 20.1003 definition of site boundary.

RAI:
Clearly define the site boundary and controlled area using 10 CFR 20.1003. Explain any difference between the site boundary and the proposed Reno Creek Project Boundary. Identify the controlled area within the site boundary.

SECTION 3 – DESCRIPTION OF PROPOSED FACILITY

RAI-28

In TR Section 3.0, Figure 3-1 depicts a conceptual facility layout for the central processing plant and backup pond. The applicant supplemented the information with preliminary construction drawings submitted in the supplement data (ML13213A064).

Basis:
The supplemental data differs from the conceptual layout in the initial application submittal. Specifically, the plant location, backup pond location and outbound truck drive path have been modified. Please correct (update) the appropriate information in the application.

Section 3.2.3 of the SRP states:

> "The application provides diagrams showing the proposed (or existing) plant/facilities layout in adequate detail."

RAI:
Please revise the TR to incorporate the proposed changes in the supplemental data submittal.

RAI-29

In TR Section 3.1.1 (page 3-3), the application states:

> "..for purposes of this License Application, recoverable ore resources of on the order of 15.7 million pounds of uranium ...[b]ased on AUC analysis ... ore body closely resembles the roll-front deposits assessed previously by NRC in the ... ISR GEIS".

Basis:
The wording in the application is deficient in stating the estimated ore reservoirs in the proposed license area. Relevant information to evaluate the AUC analysis, such as distribution and characteristics of the ore bodies, was not provided.

Section 1.1 of the SRP states:

> "The staff should review the corporate entities involved; the location of the proposed activities; land ownership; ore-body locations and estimated uranium (U_3O_8) content."

Section 3.1.3 of the SRP states:

> "The description is sufficiently detailed to identify the mineralized zone(s), their areal distribution, and their approximate thickness. If more than one mineralized zone is to be leached, each zone should be defined separately. The estimated U_3O_8 grade should be specified."

RAI:
Please provide mapping that demonstrates the ore trends including the oxidation and reduction zones.

Also see RAI-5.

RAI-30

In TR Section 3.1.7, flow diagrams (Figures 3-6 and 3-7) show the restoration circuit which includes 50 gallons per minute attributed to the groundwater sweep (GWS). In Section 6.1.4, the application states that not all stages of groundwater restoration will be used if deemed unnecessary by AUC.

Basis:
The flow diagrams do not reflect times at which groundwater sweep is not performed.

Section 3,1,3 of the SRP states:

> "Proposed plant material balances and flow rates should be acceptably described."

RAI:
Please discuss the impact to the water balance when the groundwater sweep component is not performed.

RAI-31

In the Supplemental data (ML13219A203) on Sheet C-3.0 "GRADING: INDEX", the amount of cut and fill required for earthwork preparation of the plant area may exceed 70,000 cubic yards. Section 6.2.3, of the TR states "no construction activities are planned that will require major re-contouring. Due to the fact that there will be no <u>significant</u> changes to the topography of the

land during operations, a final contour map will not be necessary, and the post-ISR contours will reflect the pre-operation contours".

Basis:
The application fails to provide the rationale to explain why moving 70,000 cubic yards of material is not significant and explain how the proposed compaction methods will ensure a suitable foundation for the plant.

Section 3.1.3 of the SRP states:

> "Staff should determine whether the hazards associated with the storage and processing of the radioactive materials and those hazardous materials with the potential to impact radiological safety, have been sufficiently addressed in the process design for the recovery plant, satellite processing facilities, well fields, and chemical storage facilities."

Section 6.2.2 of the SRP states:

> "The staff should determine whether the described approaches for reclaiming temporary diversion ditches and impoundments, reestablishing surface drainage patterns disrupted by the proposed activities, and returning the ground surface and structures for post-operational use are consistent with regulatory guidance and are sufficient to satisfy the requirements of 10 CFR Part 40, Appendix A, Criterion 6(6), and 10 CFR 40.42. The staff should ensure that the licensee intends to restore topography and vegetation to a state that is similar to pre-operational conditions. The staff should review the pre-reclamation survey plan to ensure that it provides adequate coverage to designate contaminated areas for cleanup. Particular attention should be focused on sampling temporary diversion ditches and surface impoundments, well field surfaces, process and storage areas, transportation routes, and operational air monitoring locations. These areas are expected to have higher levels of contamination than surrounding areas. The staff should also ensure that plans exist for the disposal of contaminated soils at an existing licensed byproduct material disposal facility, consistent with 10 CFR Part 40, Appendix A, Criterion 2."

RAI:

(1) Please explain how the proposed compaction methods to be used will minimize any future subsidence.
(2) Please clarify the significance to the movement of 70,000 cubic yards in terms of changes to the pre-construction topography. Furthermore, should the post-ISR contours be returned to pre-operational contours, describe how those soils that need to be relocated for the post-operational contours are monitored to meet the bench-mark dose limits.

RAI-32

In the Supplemental data (ML13219A203) on Sheet C-3.4 "GRADING: BACKUP POND DETAILS", the details indicate clean granular material only in the leak detection sump and a "geotextile drain material" installed in the slopes and floor of the pond.

Basis:
The limitation of the proposed granular material to the sump differs from previously acceptable designs and the term “geotextile drain material” is too vague for staff to determine if the material is suitable to meet the intended use (e.g., permeability).

Regulatory Guide 3.11 recommends highly permeable soil or geosynthetic material.

RAI:
Please provide a more-in-depth description on the geosynthetic material to be used in the design for the surface impoundments.

RAI-33

In the Supplemental data (ML13219A203) on Sheet C-3.4 “GRADING: BACKUP POND DETAILS”, the details indicate 2.0 feet of freeboard. The information lacks backup calculations on the suitability of the freeboard.

Basis:
The lack of calculations to support the calculation of needed freeboard is not acceptable.

Section 4.2.2 of the SRP states:

> “The staff should also ensure that appropriate freeboard requirements are established, and that appropriate monitoring programs and reporting procedures are in place.”

RAI:
Please provide justification for the 2.0 feet of freeboard.

RAI-34

TR Section 3.1.8 proposes a single surface impoundment as a “backup storage pond to temporarily store waste water as needed,” especially if a deep disposal well is down for maintenance.

TR Section 4.3.5 states “[t]he backup storage pond is designed specifically as a redundancy system to the DDWs, which are the primary liquid 11e.(2) byproduct disposal option. Therefore, some of the requirements for tailings impoundments do not apply to the design of the backup storage pond. The primary difference is the limited use of the backup pond during the life of the facility. Control of potential windblown particulate releases from the dried fringe areas of the pond that has been temporarily in use will be managed via clean water wash down to remove residues, temporary application of commercially available dust suppression/stabilization sprays, or other means**.”**

Basis:
The application lacks details on a corrective action plan for a loss of integrity of the primary liner at the surface impoundment, routine maintenance of the liner during which no fluids are stored within the impoundment (e.g., prohibit movement of the liner due to the wind). Generally, ISR facilities have multiple surface impoundments which served a redundancy function (i.e., should the integrity of the liner of one pond fail the contents of the failed pond can be transferred to the

other impoundment). Furthermore, the surface impoundments at many ISR facilities maintain liquids at a minimum depth to help hold the liner in place. The proposed usage by the applicant differs from that at most facilities. Furthermore, though the application states that the use of the pond will be limited, NRC staff evaluates such ponds as if they will be used on a routine basis.

Section 4.2.2 of the SRP states:

> "Verify that surface impoundments rely on standard engineering design to ensure proper containment performance, including appropriate leak detection systems."

RAI:
Please provide a description of controls and contingencies that will be implemented should the liner develops a leak and procedures for routine maintenance.

RAI-35

In the Supplemental data (ML13219A203) on Sheet CD-9.2 "DRAINAGE DETAILS", the details indicate a 1.5-foot minimum depth to the "west interceptor ditch" surrounding the backup pond. On Sheet C-9.3 "STORM DRAINAGE: WEST INTERCEPTOR DITCH" in the supplemental information, the maximum elevation of the base on the drainage ditch is reported at 5166.841 (no units).

Basis:
At the scale of the mapping, it is difficult to ascertain the elevations of the berms surrounding the ditch. Furthermore, the application did not contain calculations to justify the 1.5-foot minimum depth meets the design criterion.

Section 2.2.1 of Regulatory Guide 3.11 states:

> "If the tailings retention system has some external drainage area, and hydraulic structures (such as diversion channels) are needed to safely divert the probable maximum flood (PMF), the peak PMF inflows and runoff used to design such structures should be determined in accordance with the suggested flood design criteria in NUREG-1623, "Design of Erosion Protection for Long-Term Stabilization".

RAI:
Please provide a detailed description of how a 1.5-foot minimum depth of the "west interceptor ditch" surrounding the backup pond will be maintained. Provide calculations that demonstrate the minimum channel depth is sufficient to prevent run-on from the probable maximum flooding from areas upstream on the ponds.

RAI-36

In TR Section 3.1.4.1 (page 3-14), the application states:

> "AUC will use the SERP process to allow usage of the oxidant at the Proposed Project if the oxidant is not included in this application."

Basis:
The application mischaracterizes use of the Safety and Environmental Review Panel (SERP) process in the proposed operations which is the fundamental process for a "Risk-Informed Performance-Based License" such as one sought by the applicant. The SERP process should provide the means for appropriately documenting changes (whether or not an amendment is sought) and identify whether or not an amendment from NRC is required for a change in the technical licensing basis or to the facility from that described in the application.

Section 5.2.4 of the SRP states:

> "Procedures governing the functioning of the Safety and Environmental Review Panel ensure that approvals of any changes in the facility, the operating procedures, or the conduct of tests or experiments are appropriately documented and reported. These changes, tests, or experiments may be effected without obtaining a license amendment pursuant to 10 CFR 40.44, so long as the change, test, or experiment does not
>
> (a) Create a possibility for an accident of a different type than previously evaluated in the license application (as updated).
> (b) Create a possibility for a malfunction of a structure, system, or control with a different result than previously evaluated in the license application (as updated).
> (c) Result in a departure from the method of evaluation described in the license application (as updated) used in establishing the final safety evaluation report or the environmental assessment or technical evaluation reports or other analyses and evaluations for license amendments."

RAI:
Please revise this statement to correctly characterize implementation of the SERP process.

SECTION 4 - EFFLUENT CONTROL SYSTEMS

RAI-37

In Section 4.2 of the TR, the applicant stated that the forced air ventilation system will be designed for a maximum of six air changes per hour.

Basis:
The applicant did not provide any flow rate and structural volume to demonstrate that it will meet a maximum of six air changes per hour. Regulatory Guide 8.37,Section C.3.1 states that, when practical, releases of airborne radioactive effluents should be from monitored release points (e.g., monitored stacks, discharges, vents) to ensure that the magnitude of such effluents is known with a sufficient degree of confidence to estimate public exposure. The flow rate(s) from fan(s) is one of several parameters that can be used to calculate and compute potential releases of radioactive material, including radon. NRC staff has determined that the applicant did not provide flow rate(s) from fan(s) and the volume of air inside the structure to validate the statement that the force air ventilation system will be designed for a maximum of six air changes per hour.

RAI:
Provide calculations that show the technical basis for the selection of six as the number of max air charges needed per hour? Clarify where the maximum of six air changes per hour applies (e.g., single room, area, or the entire facility). Include the volumetric flow rate that supports the conclusion of maximum of six air changes per hour.

RAI-38

In Section 4 of the TR, the applicant discussed deep well disposal but the applicant did not address land applications.

Basis:
The applicant should demonstrate if they plan to use land applications or make a statement that they will not use land applications. SRP Acceptance Criteria 4.2.3(1) states that common liquid effluents generated from the process bleed, process solutions, wash-down water, well development water, pumping test water, and restoration waters are properly controlled. Acceptable control methods include diversion of liquid wastes to surface impoundments, deep well injection, and land application/irrigation and solid effluents can be considered either as contaminated or as non-contaminated. For land applications, the applicant should comply with 10 CFR Parts 20 and 40. NRC staff cannot determine from the applicant's technical report if the applicant plans, or does not plan, to use the land application/irrigation methods at the site.

RAI:
Provide a statement on whether land application/irrigation will be used. If land application/irrigation is used, then provide a detailed explanation of the land application/irrigation process and methods that will be used to include identity of the property area and approximately acreage, the potential use of the land, the annual volume of liquids discharged or deposited onto the land, maximum possible flow rate. Also, include that applicant's plan to demonstrate compliance with 10 CFR 20.1301,10 CFR 20.1302, 10 CFR 20.2002, and 10 CFR 20.2007 will be achieved.

In addition, if the applicant plans to use land application/irrigation then:

- Describe the area where the use of land application will be applied (clearly, identify whether this land is on property controlled by the licensee or on private/public property not controlled by the licensee).
- Define how much surface area does the applicant plan to use.
- Describe the purpose of the land application (i.e., use for industrial, commercial, recreational, agriculture, other).
- Describe the source of the water for land application.
- Estimate how much will be used on a daily, weekly, monthly, and annual basis.
- Describe the process to determine if the source of the water is suitable for land application (what regulatory criteria does the applicant plan to use to determine that the water is permissible for discharge for land application…i.e., 10 CFR 20 Appendix B, Table 2).
- Identify the radionuclides (and non-radiological chemical elements) that will be discharged to the land application.

RAI-39

In Section 4.3 of the TR, the applicant stated that prior to commencement of pond construction, the applicant will submit to the NRC a backup storage pond design plan based on the site specific geotechnical investigation. The components of the backup storage pond design plan are outlined in Section 4.3 of the TR. SRP Acceptance Criteria 4.2.3(2) through Acceptance Criteria 4.2.3(4), and Acceptance Criteria 4.2.3(8) collectively address, in one manner or another, that the design and the operations of the on-site evaporation system are conducted to mitigate liquid waste from reaching the subsurface below the bottom of the on-site evaporation system, consistent with Regulatory Guide 3.11 (NRC, 1977).

Basis:
NRC staff has determined that the above acceptance criteria are implicit and prudent to provide all necessary information to NRC during the review of the application.

RAI:
Provide the backup storage pond design components, as outlined in Section 4.3 of the TR, in the license application; not prior to commencement of pond construction.

RAI-40

In Section 4.3 of the TR, the applicant identified a backup storage pond and a future additional backup pond in Figure 3-1 of the TR.

Basis:
The applicant did not provide any design plans or discuss the construction of the backup storage pond consistent with Regulatory Guide 3.11. SRP Acceptance Criteria 4.2.3(3) states that the design, installation, and operation of surface impoundments at the site used to manage 11e.(2) byproduct material meet relevant guidance provided in Regulatory Guide 3.11, Section 1.

RAI:
Provide detailed information on the design as well as drawings and pertinent analysis of the future additional backup storage pond. Include a description of the construction method(s), testing criteria, and quality assurance program that applies to this structure, as well as the planned mode of operation and associated inspection and maintenance programs.

RAI-41

In Section 4.2.2 of the TR, the applicant indicates that the predominant airborne releases are Radon-222 from point and non-point sources. The applicant also indicates that the radon releases from the central processing building would occur from periodic tank ventilation during venting and backwashing operations, and from the normal building ventilation system, which will exhaust building air at various points in the structure and as such, no discrete monitoring locations would be available to make representative measurements of Radon-222 concentrations or air flow rates to estimate semi-annual emissions of Radon-222. The applicant indicates that because of these factors, the methods used to estimate Radon-222 emissions in Section 7.4 of this document will be used to estimate the semi-annual Radon-222 emissions from the facility as required in 10 CFR 40.65.

Basis:
NRC staff has determined that estimation of emission from the facility during operations is not acceptable. Regulatory Guide 8.37, Section 3 identifies surveys and effluent monitoring for airborne radioactive effluent monitoring, liquid effluent monitoring (if applicable), and unmonitored effluents. Regulatory Guide 4.14, C2, also discusses stack sampling to comply with 10 CFR 40.65. The stack monitoring is not confined only to the yellowcake dryer and packaging area, but other areas of the plant. NRC staff has determined that surveys and monitoring of the effluent provides a sufficient and reliable method for quantifying the amount of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during operations.

RAI:
Revise the text to describe the methods and protocols for surveying and monitoring the major potential effluent pathways in accordance with 10 CFR 40.65. Describe in the application how the results will be quantified for each principle radionuclide released to unrestricted areas in liquid and in gaseous effluents during operations. Define the effluent release design objectives for the proposed facility. Also, define areas of the project which are designated as unrestricted areas for the purpose of 10 CFR 40.65.

SECTION 5 – OPERATIONS

RAI-42

In Section 5.3 and Section 5.7 of the TR, the applicant stated that a qualified designee will be trained to perform daily inspections, such as weekends and/or holidays, perform contamination surveys, and that an individual can qualify for a daily walkthrough inspection if specific training is received from the Radiation Safety Officer (RSO), and the training is documented in the individual's training records and is available for NRC inspection. This training will include all procedures in the standard operating procedure (SOP) for the daily inspection and any significant radiological hazards, the individual will immediately report the findings to the RSO.

Basis:
The applicant did not demonstrate that the qualified designee met the minimum qualification and experience for radiation safety staff consistent with Regulatory Guide 8.31, nor did the applicant require that the designee pass this training. SRP Acceptance Criteria 5.4.3(1) states that the personnel meet minimum qualifications and experience for radiation safety staff that are consistent with Regulatory Guide 8.31, Section 2.4 (NRC, 2002). NRC staff finds the designee's qualifications, as described by the applicant, are less than the training and experience of an RSO or Radiation Safety Technician (RST) recommended by Regulatory Guide 8.31. In addition, NRC staff finds that the applicant has not defined the qualifications of "selected individuals" or "qualified designee" in sufficient detail, nor are these qualifications consistent with qualifications of personnel as suggested in Regulatory Guide 8.31 (NRC, 2002) or with the "Inspection and Enforcement Circular 81-07, Control of Radioactively Contaminated Material" (NRC, 1981), which recommends that only qualified radiation safety individuals perform surveys releasing radioactive contamination to unrestricted areas.

RAI:
Define the radiation safety staff qualifications and the qualifications of the “selected individuals” or “qualified designee” consistent with Regulatory Guide 8.31, or propose alternative qualifications with rationale and justification for NRC consideration. Provide a detailed description of the types of contamination surveys the selected individuals or qualified designee will conduct.

RAI-43

In Section 5.5 of the TR, the applicant stated that the training program will be administered in keeping with standard radiological protection guidelines and the guidance provided by Regulatory Guides 8.13, 8.29, and 8.31. Regulatory Guide 8.29 is designed to provide worker training about health risks from occupational exposure.

Basis:
The applicant did not include in its application the training on health risks from occupational exposure. SRP Acceptance Criteria 5.5.3(3) states that the radiation safety training program is consistent with Regulatory Guide 8.29 and this guide provides a basis for training employees on the risks from radiation exposure in the work place. Regulatory Guide 8.29 differs from Regulatory Guide 8.13, which covers radiation doses to prenatal/fetal, and Regulatory Guide 8.31, which covers basic radiation safety training. NRC staff has determined that the applicant adequately discussed the basic radiation safety training program and the instructions for prenatal radiation exposure as identified in Regulatory Guides 8.13 and 8.31, but did not address the risks from radiation exposure in the work place as described in Regulatory Guide 8.29. NRC staff determined that the topics identified in the TR reflect the training topics identified in Regulatory Guide 8.31. More specifically, NRC staff could not determine if the material, as described in Regulatory Guide 8.29, is addressed in the radiation safety training program.

RAI:
Provide a detailed description of AUC’s training on the risks from radiation exposure in the work place and its relationship to the basic radiation safety training. Describe who is required to have this training and how often. Provide the technical basis for this type of training.

RAI-44

Section 5.6 of the TR describes the controlled areas, restricted areas, and unrestricted areas of the Proposed Project. This section states that all entrances to the proposed NRC licensed facility and all controlled areas will be conspicuously posted with the words ANY AREA WITHIN THIS FACILITY MAY CONTAIN RADIOACTIVE MATERIAL, in order to be exempted from the requirements of 10 CFR 20.1902(e) for areas within the facility. Section 5.6.1 of the TR also states that the facility area will be enclosed using typical eight-foot security chain link fence equipped with a locking gate at the main entrance.

Basis:
The area that represents the proposed NRC licensed facility should be clarified. Based on the above statements, the proposed licensed facility is the area bounded by the eight-foot security chain link fence around the CPP area. However, this boundary does not include other areas where licensed activities are conducted (e.g., such as, wellfields, monitoring wells, and header houses).

RAI:
Clearly define the facility boundaries. Clarify if the facility boundary differs from the licensed areas.

RAI-45

In Section 5.7.2 of the TR, the applicant stated that general area surveys (i.e., air radon, air particulate, and gamma surveys) are identified in Figure 5-2 of the TR.

Basis:
NRC staff reviewed the general area surveys identified in Figure 5-2 of the TR and noted that the applicant did not address the conduct of general area surveys in the yellowcake drying and packaging area. SRP Acceptance Criteria 5.7.2.3(9) states that the monitoring program is sufficient to detect and control gamma radiation from uranium decay products in areas where large volumes of uranium may be present (e.g. processing tanks, yellowcake storage areas) and is consistent with Regulatory Guide 8.30.

RAI:
Provide a technical basis for not establishing general area surveys in the drying and packaging area or include in the application a commitment that general area surveys in the yellowcake drying and packaging area will be conducted. If such surveys will be conducted, then reflect the locations of such surveys in Figure 5-2.

RAI-46

In TR Section 5, Figure 5-1, the applicant shows the detector model, radiation detected, type and characterization.

Basis:
The applicant did not provide the lower limit of detection for the radiation detectors. SRP Acceptance Criteria 5.7.2.3(4) states that monitoring equipment has a lower limit of detection that allows measurement of ten percent of the applicable limits. NRC staff has determined that the lower limit of detection is an important method when measuring true activity or concentrations of surface contamination or volumetric concentrations that is very small and just above background. NRC staff needs the applicant to demonstrate, a priori, (by calculation) that the radiation detector in question can detect (or measure) ten percent of the applicable limits (i.e., 10% of 1000 dpm/100 cm^2 is 100 dpm/100 cm^2). Thus NRC staff is seeking to determine if such equipment can detect quantities sufficiently below the regulatory limit. NRC staff reviewed the application and did not find any lower limit of detection values for the radiation detectors as identified in Table 5-1. NRC staff has determined that the applicant did not estimate the lower limits of detection for the radiation detectors, as listed in Table 5-1, to determine if the measurement will meet ten percent of the applicable limits.

RAI:
Provide in the application, for each type of radiation detector AUC plans on using at the proposed project, and an estimate (a priori) of the lower limit of detection using the equation identified in Regulatory Guide 8.30. Determine and provide the lower limit of detection values, based on detector parameters, capable of detecting ten percent of the applicable limit.

RAI-47

In Section 5.7.3 of the TR, the applicant stated that the primary source for airborne uranium particulates will occur during packaging operations and these operations will be confined to the enclosed drying room which will be under negative pressure during operation. In conjunction with this statement, the applicant also stated in Section 5.7 of the TR that the sampling locations are selected to characterize various locations in the process (e.g. lixiviant, precipitation, and drying/packaging areas).

Basis:
The applicant did not depict in a drawing of the facility layout the airborne uranium particulates sample collection locations that will be used during the packaging operation. SRP Acceptance criteria 5.7.3.3(1) states that the applicant provides one or more drawings that depict the facility layout and the location of samplers for airborne radiation. NRC staff reviewed Figure 5-2 and determined that the applicant placed four air particulate and nine air radon monitoring locations within the central processing plant. However, in reviewing Figure 5-2, NRC staff did not find any airborne uranium particulate monitoring station in the drying/packaging area which the applicant deemed as the primary source for airborne uranium particulate. NRC staff determined that the applicant did not address or explain why the primary source for airborne uranium particulates is not monitored for airborne uranium particulates.

RAI:
Provide a technical basis or justification for not conducting airborne particulate sampling at the primary source for airborne uranium particulates, or commit to conducting airborne particulate sampling at the primary source for airborne uranium particulates and depict the location of this type of sampling on the facility layout drawing. NOTE: This RAI is slightly different than RAI-45. This RAI focuses only on the airborne particulate. RAI-45 focuses on general radiation surveys, which can also include airborne particulate.

RAI-48

In Section 5.7.3 of the TR, the applicant stated that it plans to estimate radionuclide air concentrations, with the initial air particulate samples obtained following plant startup. The sample will be composited according to the sampler location as shown in Figure 5-2 of the TR. Samples submitted to a contract laboratory for radioisotope analysis will be analyzed for natural uranium, Thorium-230, and Radium-226 and the results will be used in the sum of fractions rule to ensure the appropriate use of the Derived Air Concentrations (DAC) from 10 CFR 20 Appendix B, Table 1. This includes the DAC for Class W natural uranium, which is 3.0 E-10 uCi/ml. The applicant stated that the laboratory results of the initial radio-isotopic analysis confirm that natural uranium is the primary radionuclide of concern in the air particulate samples and that other uranium decay products may be disregarded, measurement of airborne uranium will be performed by gross alpha counting of the air filters using an alpha particle detector system, such as the Ludlum Model 43-1 or similar coupled to an appropriate scaler.

Basis:
The applicant needs to conduct isotopic analysis in addition to an initial analysis to comply with 10 CFR 20, Subpart C. Acceptance Criteria 5.7.3.3(3) states that planned surveys of airborne radiation are consistent with the guidance in Regulatory Guide 8.30 and specifically 10 CFR 20, Subpart C. NRC staff has determined that the applicant needs to estimate radionuclide air concentration on a more frequent basis other than an initial sample at startup. NRC staff has determined that an initial sample (depending on when the air samples are collected after startup) may not be representative of the mixture of radionuclides in air over a longer time period (i.e., one year or two years). NRC staff has determined that the radionuclide air concentration will change with time or buildup until it reaches an equilibrium state, assuming that there is no change to the operation over time. NRC staff has determined that the applicant needs to conduct radionuclide air concentrations semi-annually for the first year and annually thereafter to check the type and amount of radionuclides. The mixture of radionuclides needs to include, uranium, uranium progeny, radon (Radon-222), and radon progeny.

RAI:
In the application, commit to conduct isotopic analyses of radionuclides in air concentrations semi-annually for the first year, and annually thereafter to ensure that the mixture of radionuclides in air is in compliance with 10 CFR 20.1204(g).

RAI 49

In Section 5.7.6 of the TR, the applicant stated that since any beta-gamma contamination at an ISR (or uranium mill) should be associated with alpha emitting nuclides, no special monitoring or survey for beta-gamma emitters are required and the lack of detectable alpha contamination assures no beta-gamma contamination.

Basis:
The applicant needs to monitor for beta-gamma emitters consistent with 10 CFR 20 Subpart F. Acceptance Criteria 5.7.6.3(3), Acceptance Criteria 5.7.6.3(8) and Acceptance Criteria 5.7.6.3(9), in general, states that the action levels for surface contamination are set in accordance with Regulatory Guide 8.30 and Table 5.7.7.3-1 of NUREG-1569. Footnote a in Table 5.7.6.3-1 states that where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently. NRC staff has determined that aged yellowcake as well as both uranium and radon progeny, remain in certain areas of the facility from spills and maintenance activities. Further, Radon-222 is also a radioactive constituent in groundwater and ISR lixiviant, and is produced from the decay of Radium-226 in the plant. Radon-222, a radioactive gas with a 3.8 day half-life, decays to several solid particles that tend to be electrically charged, produce no alpha decay (Lead-214 and Bismuth-214) and can deposit on surfaces or attach to dust particles. The short-lived progeny decay to Lead-210 a beta-emitter and does not produce alpha emission, can build-up in buildings, if the ventilation is not adequate to ensure complete air exchange or an inadequate contamination control program where potential contaminants are allowed to migrate.

RAI:
In the application, commit to developing and implementing a survey program for beta-gamma contamination for personnel exiting from restricted areas that will meet the requirements of 10 CFR Part 20, Subpart F.

RAI-50

In Section 5.7.7 of the TR, the applicant identified the different environmental pathways that will be monitored consistent with Regulatory Guide 4.14 (Section C.2, Regulatory Position, Pre-operational Monitoring) and the applicant further stated that the potential air particulate releases from the CPP processes will be monitored in a manner to that employed for baseline determination of air particulate concentrations.

Basis:
The applicant did not address: 1) how they will monitor and measure the effluent from the yellowcake dryer and packaging stack and other stacks as described in Section C.2 and, 2) how emission controls will be used to ensure facility releases to the environment are as low as is reasonably achievable (ALARA) and consistent with 10 CFR 40 Appendix A, Criterion 8. Regulatory Guide 1.21 "Measuring, Evaluating, and Reporting Radioactive Material and Liquid and Gases and Solid Waste," Rev 2 (06/2009) and Regulatory Guide 4.1 "Radiological Environmental Monitoring for Nuclear Power Plants" Rev 2 (06/2009) defines effluent as the liquid or gaseous waste containing plant-related, licensed radioactive material, emitted at the boundary of the facility (e.g., buildings, end-of-pipe, stack, or container) as described in the final safety analysis report. Although these guides are prepared for nuclear power plants, NRC staff has determined that the definition for effluents is applicable to any materials facility that release gaseous or liquid waste containing plant-related, licensed radioactive material. Regulatory Guide 8.37 provides guidance on designing an acceptable program for establishing and maintaining ALARA levels for gaseous and liquid effluents at material facilities.

RAI:
Identify all potential effluent release points at the facility, commit to measure and quantify the amount of radioactive materials released from major potential release points (and estimate smaller potential release points), identify what controls are used to ensure that facility releases to the environment are ALARA consistent with 10 CFR 40, Appendix A, Criterion 8.

RAI-51

In Section 5.7.7 of the TR, the applicant stated that during operations, the applicant will conduct sediment sampling on an annual basis and discrete grab samples of sediment will be collected at the same baseline surface water sampling location as discussed in Section 3.4.1 of the Environmental Report. The applicant further stated in Section 5.7.7 of the TR that all sediment samples will be collected to a depth of five centimeter for consistency with the baseline sediment sampling surveys, then analyzed for natural uranium, Radium-226, Lead-210 and gross alpha.

Basis:
The applicant did not analyze for Thorium-230. SRP Acceptance Criteria 5.7.7.3(1) states that the proposed airborne effluent and environmental monitoring program is consistent with Regulatory Guide 4.14, Section 1.1 and 2.1, and ALARA requirements as described in Regulatory Guide 8.37. Regulatory Guide 4.14 recommends that the type of analysis include natural uranium, Thorium-230, Radium-226, and Lead-210. NRC staff has determined that the applicant plans to analyze for natural uranium, Radium-226, Lead-210, gross alpha, but not Thorium-230.

RAI:
Provide adequate justification for not including Thorium-230 in the sediment sampling regimen, or include Thorium-230 analysis for sediment sampling.

RAI-52

In Section 5.7.8.2 of the TR, the application references surface water sampling reported in Section 2.7 and 2.9, and that the operational monitoring program consist of "all pre-operational surface water locations." In Section 2.9, the applicant proposes that the operational surface water environmental monitoring program consists of only 4 of the 12 surface water bodies sampled for the site characterization and only a single sampling event.

Basis:
The proposed operational (and pre-operational) monitoring program represents a departure of the sampling parameters and frequency of monitoring of surface water impoundments recommended in in Regulatory Guide 4.14 and the application does not include justification for departures from such a program.

Section 5.7.8.3 of the SRP states:

> "The reviewer should ensure that pre-operational water quality sampling locations for applicable surface-waters are indicated in the application. The pre-operational data should be collected on a seasonal basis for a minimum of 1 year before in situ leach operations. Procedures for monitoring surface-water quality during operations should be discussed in the application: this discussion must include a monitoring schedule, monitor locations, and a list of sampled constituents. The applicant may be exempted from monitoring during operations if the site characterization demonstrates that no significant flow of ground water to surface water occurs near the site (e.g., if surface-water bodies are perched and ephemeral)."

RAI:
Please see RAI 26.

RAI-53

In Section 5.7.8.1.2 of the TR, the application states that the "Production Unit" is the basic unit for establishing baseline water quality, performing the groundwater protection monitoring program and completing the restoration activities. Chapter 1 of the application states that 12 Production Units are planned for the license area. The schedule on Figure 1-3 suggests 15 production units, 1 through 12, 4A, 7A and 12A.

Basis:
The application is inconsistent in the description on the number of the wellfield primary units.

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility

> is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Resolve discrepancies between Figure 1-3 and Section 5.7.8.12 of the TR regarding the number of planned Production Units for the license area.

RAI-54

In Section 5.7.8.1.2 of the TR, the application states "AUC proposes to adapt the statistical principles", "…use the Unified Guidance to evaluate baseline groundwater data .... [establish] restoration target values (RTVs)" and "statistically sound treatment of Outliers and Non-Detects". While these are generalized goals of a groundwater detection monitoring program, the statement lacks any specific commitments. For example, what is the proposed confidence level (e.g., 95%) for the "statistically sound treatment" of outliers.

Basis:
The application provides no specificity to the procedures for establishing groundwater protection standards required by to 10 CFR Part 40 Appendix A Criterion 5B(5).

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Provide example calculations on the method AUC will adapt for a Production Unit to establish standards required by Criterion 5B(5). For clarity, the applicant should define RTV in terms of NRC regulatory language.

RAI-55

In Section 5.7.8.1.3 of the TR, the application states "AUC will adapt the statistical principles ... to determine the UCLs". The applicant did not define the statistical principles (e.g., well-by-well basis, a wellfield average basis, or combination thereof).

Basis:
The application provides no specificity to the procedures for establishing upper control limits (UCLs) for the wellfield excursion monitoring program.

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Please provide specific statistical principles to be used for the method AUC will adapt for determining a Production Unit UCLs.

RAI-56

In Section 5.7.8.1.3 of the TR, the application proposes a perimeter ring well spacing of 500 feet in the fully saturated aquifer and 400 feet in the partially saturated aquifer based on the numerical model results.

Basis:
As discussed in RAI-14, staff requests additional clarification on the numeric model used and requests justification for the 500-foot spacing from the production area to the perimeter moinitoring well ring.

RAI:
See RAI-14

RAI-57

In TR Section 5.7.8.1.4, the application states that the Production Unit Hydrologic Data Package is reviewed by SERP and AUC will provide a copy to NRC for "review only".

Basis:
It has been NRC's policy to require new licensees, by license condition, to submit the first package to NRC staff for review and verification and subsequent packages for NRC review. The SERP review process will be required for all packages to establish the groundwater protection standards required by Criterion 5B(5).

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Please provide a commitment to submit the first wellfield package for NRC staff review and verification and subsequent packages for NRC review.

RAI-58

In Section 5.7.8.1.6 of the TR, the application did not provide commitments for providing NRC a quarterly report on the status of wells on excursion status.

Basis:
All licenses have a license condition that NRC will be provided a quarterly report.

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to

> reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Please provide a commitment to provide a quarterly report to NRC on the status of wells on excursion status.

RAI-59

In Section 5.7.8.1.6 of the TR, the application states that "[i]f neither the second or third sampling data do not exceed the UCLS, then ... the well is removed from excursion status."

Basis:
Grammatically, the sentence is a double negative. Technically, the sentence is inaccurate - a well is placed on (not removed from) excursion status only after the initial data are verified by the second or third sampling result.

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Please revise the sentence accordingly.

RAI-60

In Section 5.7.8.1.6 of the TR, the applicant states:

> "In compliance with NUREG-1569, Section 5.7.8.3 (Criterion 5), AUC will consider corrective action complete when all excursion indicators are below their respective UCLs, or if only one excursion indicator exceeds its respective UCL by less than 20 percent."

Basis:
The application states incorrectly, by incomplete references to guidance in the SRP, the procedures for termination of excursion status for a well.

The application fails to address the subsequent sentence in the referenced criterion of the SRP:

> "Stability in the excursion indicator concentrations must be demonstrated by measurements over a suitable time period before the corrective action measures can be discontinued."

Staff has required demonstration of stability for all prior licenses.

RAI:
Please revise the narrative to include stability monitoring before termination of the corrective action measures (and excursion status).

RAI-61

In Section 5.7.8 of the TR, the application reiterates text from the SRP Criterion (30) in SRP Section 5.7.8.3 regarding actions should an excursion status exceed the 60 days.

Basis:
The application fails to clearly state that the applicant will follow the stated text.

Section 1.2 of the SRP states:

> "The reviewer should determine whether the application provides a sufficiently comprehensive summary of the nature of the facilities, equipment, and procedures to be used in the proposed in situ leach activity including the name and location. Reviewers should keep in mind that the development and initial licensing of an in situ leach facility is not based on comprehensive information. This is because in situ leach facilities obtain enough information to generally locate the ore body and to understand the natural systems involved. More detailed information is developed as each area is brought into production. Therefore, reviewers should verify that sufficient information is presented to reach only the conclusion necessary for initial licensing. However, reviewers should not expect that information needed to fully describe each aspect of a full operation will be available in the initial application. For license renewals and amendment applications, Appendix A to this standard review plan provides guidance for examining facility operations and the approach that should be used in evaluating amendments and renewal applications."

RAI:
Please revise the text to indicate the applicant's commitment following an excursion status exceeding 60 days.

RAI-62

In Section 5.7.9 of the TR, AUC commits to preparing a Quality Assurance Plan (QAP) and provides goals and objectives for preparation of that QAP. AUC commits to developing

applicable SOPs before a preoperational inspection and initiation of operations “as required by the standard license condition in SER Appendix A”.

Basis:
The information presented in the application QAP is insufficient.

First, many of the terms used in the descriptions by the applicant are vague and too generalized. For example, the term “applicable SOPs” does not specify which SOPs will be developed and may be subject to interpretation. Furthermore, because the Safety Evaluation Report (SER) has not been completed and thus a standard license condition does not exist, the staff has difficulty in reconciling statements in the application. While it is true that safety evaluation reports for prior projects have included such a standard license condition, the license condition was developed after staff having a reasonable assurance that that specific applicant could complete the QAP after review of information provided in the application. In the case of AUC, the applicant’s argument is that a QAP will be developed similar to past applicants due to a license condition and provided minimum information for staff to evaluation.

RAI:
Please provide a description of specific information to be included in a QAP for staff to review.

SECTION 6 – GROUNDWATER QUALITY RESTORATION SURFACE RECLAMATION AND FACILITY DECOMMISSIONIN

RAI-63

In Section 6.1.1 of the TR, the application incorporates the following termionology: “Groundwater will be restored”; “consistent with the groundwater protection standards“; “using BPT and ALARA”; “Commission approved baseline conditions or Restoration Target Values (RTV)”; and, “approved RTV within the range of statistical variability”.

Basis:
The terminology may be confusing and is at times often vague leading to staff’s interpreting the meaning of the applicant. For example:

“Groundwater will be restored” - This statement alone does not define the extent of the area for which groundwater is to be restored. Staff would need to assume that the applicant refers to groundwater at a specific production unit as a groundwater production standard would be defined on that basis.

“Consistent with the groundwater protection standards“ - The applicant will be required to meet not be consistent with the groundwater protection standards.

“Using BPT and ALARA” - BPT (best practicable technology) is not defined in NRC regulations and importantly, using ALARA is a requirement of Criterion 5B(6) only if alternate concentration limits (ACLs) (Criterion 5B5c) are to be used.

“Commission approved baseline conditions or Restoration Target Values (RTV)” - As written, the phrase can be interpreted as one standard or another (i.e., commission-approved background concentrate or an RTV). However, the applicant will be required to meet the commission-approved background concentration. (Note: Criterion 5B(5) of 10 CFR Part 40

Appendix A uses the term “background” in defining the “Commission-approved background concentration” for the groundwater protection detection monitoring program required under Criterion 7(A), whereas Criterion 7 of 10 CFR Part 40 Appendix A uses the term “baseline” for data collected during the pre-operational monitoring program. On the other hand, the SRP uses the terms in reverse. Consequently, in the past, industry and staff have used the terms “baseline” and “background” interchangeably).

“Approved RTV within the range of statistical variability” - The applicant needs to clarify this phrase. The commission-approved background concentration should be developed using the background values and incorporates estimated spatial variability in the data prior to operations. As written, one can interpret that the applicable standard will be the RTV plus some factor for statistical variability after the restoration is complete.

RAI:
Please revise the narrative in the application accordingly.

RAI-64

In Section 6.1 of the TR, the application states:

> “The groundwater baseline water quality data will be determined from data collected from wells completed in the PZA.”

Basis:
The application is unclear as to the completion interval of wells used to establish the groundwater protection standards for a wellfield.

Wells used to establish the commission-approved background concentration will be limited to the ore zone within the PZA aquifer undergoing the principal activities, i.e., lixiviant injection, and not throughout the entire aquifer as defined as the “PZA aquifer” by the applicant. Staff will require that wells screened in the PZA aquifer outside of the ore zone be abandoned prior to operations or the applicant will have to increase the surety calculations to denote the fact that the wells provide a conduit for lixiviant migration through the entire PZA aquifer.

RAI:
Please revise the application to reflect the completion interval for wells to be used for the baseline monitoring.

RAI-65

In Section 6.1.2 of the TR, the application states:

> “Specific restoration values will be established prior to uranium recovery in each Production Unit by computing specific restoration values for specific constituents.”

Basis:
This sentence appears to be circular reasoning and does not add value.

RAI:
Please clarify the meaning and intent of the sentence.

RAI-66

In Section 6.1.3 of the TR, the application states:

> "In the event that unforeseen conditions such as inclement weather, mechanical failure, or other factors that may result in placing an employee at risk or potentially damaging the surrounding environment occur, notification to NRC and the WDEQ will be made if any of the wells cannot be monitored within 65 days of the last sampling event."

In Section 5.7.8.1.5, the application states:

> ''AUC requests that in the event of certain situations such as inclement weather, mechanical failure, or other factors that may result in placing an employee at risk or potentially damaging the surrounding environment, NRC allow a delay in sampling of no more than five days. In these situations, AUC will document the cause and the duration of any delays.''

Basis:
The application requests a 65-day extension for a sampling requirement during restoration without providing a basis for that request.

RAI:
Please provide an example of unforeseen condition that would delay a sampling requirement for 65 days.

RAI-67

In Section 6.1.5 of the TR, the applicant proposes to sample groundwater in the perimeter ring monitoring wells only for the excursion parameters during the stability monitoring period.

Basis:
This statement is contrary to policy of NRC to demonstrate compliance with the groundwater protection standards should a well exhibit extended time on excursion status during operations or restoration. Staff will require a commitment that the applicant provides confirmatory sampling of the monitoring wells that were on excursion status during the life of the wells for the full suite of chemical parameters to demonstrate adherence to the groundwater protection standards, or provide justification for not analyzing the full suite.

RAI:
Please revise the text in the application to document the commitment to performing confirmatory sampling.

RAI-68

In Section 6.1.6 of the TR, and on Figure 1-3, the applicant expects the combination of active restoration, stability monitoring and surface reclamation and decommissioning of the wellfields to exceed 24 months, and furthermore, by the application, requests NRC approval for an alternate schedule in accordance with 10 CFR 40.42(i).

Basis:
The application incorrectly asks for NRC approval of the proposed schedule as an alternate schedule in accordance with 10 CFR 40.42(i).

While the applicant is correct that a request for an alternate schedule would be required for a wellfield, staff differentiates groundwater restoration of a specific wellfield as decommissioning of one outdoor area, from the decommissioning and reclamation of the wellfield surface features including abandonment of the wells. The applicant's proposed schedule for restoration of a specific production unit is less than 24 months (see Figure 1-3); thus, it is premature to request NRC's approval of an alternate schedule. In the event that the restoration may be delayed beyond 24 months or beyond the commission-approved schedule in this proposal (even an alternate schedule), the applicant would be required to request an alternate schedule to justify and evaluate the impacts of the delay in accordance with provisions in 10 CFR 40.42.

RAI:
Please revise the text accordingly.

RAI-69

In Section 6.2 of the TR, the applicant stated that they will submit a standard Production Unit (PU) decommissioning plan specific to PU1 for approval at least 12 months prior to the completion of groundwater restoration in accordance with NRC requirements. The applicant further stated in Section 6.2 of the TR that decommissioning will not begin in a Production Unit until final approval of groundwater restoration has been received from the NRC and the WDEQ.

Basis:
The applicant did not commit to having a decommissioning plan (which includes the reclamation plan) approval at least 12 months before the planned commencement of reclamation of a well field or licensed area. SRP Acceptance Criteria 6.2.3(7) states that the applicant commits to providing final (detailed) reclamation plans for land (soil) to the NRC for review and approval at least 12 months before the planned commencement of reclamation of a well field or licensed area. The final decommissioning plan includes a description of the areas to be reclaimed, a description of planned reclamation activities, a description of methods to be used to ensure protection of workers and the environment against radiation hazards.

RAI:
In the application, explain how the reclamation plan differs from the decommissioning plan or include the reclamation plan within the decommissioning plan. Only make reference to the decommissioning plan. The decommissioning plan must be submitted to the NRC for approval when the licensee has decided to permanently cease principal activities at the entire site or in any separate bullding or outdoor area.

RAI-70

In Section 6.2 of the TR, the applicant discusses the plans and schedules for reclaiming disturbed lands.

Basis:
The applicant did not discuss acceptable methods for sampling during decommissioning. SRP Acceptance Criteria 6.2.3(2) states that survey areas should include diversion ditches, surface impoundments, well field surfaces and structures in process and storage areas, on-site transportation routes for contaminated material and equipment, and other areas likely to be contaminated. A sampling grid of 100 m^2 (for soil) should be used and a statistical basis for sample size should be provided. Acceptable methods for sampling are provided in NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." MARSSIM is a document that provides detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate with a dose or risk based regulation. MARSSIM focuses on the demonstration of compliance during the final status survey following scoping, characterization, and any necessary remedial actions.

RAI:
Commit to address, within the decommissioning plan, a separate final status survey plan. The final status survey plan should provide a detailed survey plan that includes the planning, implementing, and evaluating radiological surveys that will demonstrate how the licensee will meet compliance (radium benchmark dose) during the final status survey consistent with MARSSIM or equivalent.

RAI-71

In Section 6.2 of the TR, the applicant stated that, prior to reclamation, the applicant will identify the disposition of all non-radiological components and hazardous materials, including all structures and equipment.

Basis:
The applicant needs to commit to addressing the non-radiological hazardous materials in the decommissioning plan. NRC staff determined that the applicant did not commit to addressing the non-radiological hazardous materials in the decommissioning plan. SRP Acceptance Criteria 6.2.3(8) states that the decommissioning plan addresses the non-radiological hazardous constituents associated with the wastes according to 10 CFR Part 40, Appendix A, Criterion 6(7). Any unusual or extenuating circumstances related to such constituents should be discussed in the reclamation plan or decommissioning plan in relation to protection of public health and the environment and should be evaluated by staff.

RAI:
In the application, commit to addressing the non-radiological hazardous constituents associated with the wastes in accordance with 10 CFR 40, Appendix A, Criterion 6(7) in the decommissioning plan.

RAI-72

In Section 6.2 of the TR, the applicant stated that structures and equipment that may be decontaminated to regulatory standards will be demolished, and disposed of at a permitted non-hazardous materials disposal facility (e.g., a local landfill).

Basis:
The applicant did not identify as to what regulatory standards that structures and equipment may be decontaminated. SRP Acceptance Criteria 6.2.3(8) states that the decommissioning plan addresses the non-radiological hazardous constituents associated with the wastes according to 10 CFR Part 40, Appendix A, Criterion 6(7). Any unusual or extenuating circumstances related to such constituents should be discussed in the reclamation plan or decommissioning plan in relation to protection of public health and the environment and should be evaluated by staff. NRC staff has determined that the applicant needs to consider the non-radiological hazardous material as described in 10 CFR 40. It is not clear from the applicant's statement as to whether the applicant is decontaminating structures and equipment for radiological and/or non-radiological purposes and what regulatory standards will be used for decontamination.

RAI:
In the application, identify the regulatory standards that will be used for radiological and/or non-radiological components that will be decontaminated prior to demolition and disposal to a permitted non-hazardous materials disposal facility (e.g., local landfill).

RAI-73

TR Addendum 6A, Section 1.3 (Radiological Surveys) explains that following removal of all structures and re-grading of the site to approximate original contours, and before topsoil is spread on the re-graded area, a gamma survey and soil sampling will be conducted as described in Section 6.4 of the TR. Soils will be cleaned up in accordance with the requirements of 10 CFR Part 40, Appendix A, Criterion 6(6) including consideration of ALARA goals and the chemical toxicity of uranium. The proposed limits and ALARA goals for cleanup of soils are summarized in Section 6.4 of the TR. Any areas that do not meet these limits will be remediated by removing contaminated soils to an appropriately licensed site and the area re-graded. The process will be repeated until all sites meet the ALARA goals for cleanup. The preliminary unit costs and areas subject to these surveys are provided in the Attachment RAP-2(E).

Basis:
Staff could not locate Attachment RAP-2(E) in the application.

RAI:
Revise this section by either incorporating Attachment RAP-2(E), or referring to the correct location of this information in the application.

RAI-74

In Section 4 and Section 5 of the TR, the applicant discusses the release of radon from the facility. The applicant discussed methods to control the release (Section 4.1), the monitoring of radon progeny for in-plant air monitoring (Section 5.3), and the monitoring of environmental

radon in air (Section 5.7). In Section 5.7.7 of the TR, the applicant did not identify or discuss an air radon concentration limit. In Addendum 7A, pg. 7A-21, Summary, last paragraph, the applicant states the following:

"In summary, all doses calculated for the boundary locations, permanent residences in the vicinity of the project or visiting members of the public are small fractions of the 100 mrem/yr limit specified in 10 CFR 20.1301."

Basis:
The NRC staff determined that the applicant did not discuss how it will evaluate the radiation dose from radon progeny to members of the public during operations. During the review of the application, NRC staff reviewed all applicable sections of the application. In Addendum 7A, the applicant computed radiation doses at multiple receptor points using the software computer program MILDOS. MILDOS determined the dose at the various receptor points using the radon progeny limit of 1.0×10^{-10} uC/ml. This method is to be used as a predictive tool prior to construction. The applicant must address how it will evaluate the member(s) of the public likely to receive the highest exposures from licensed operations on an ongoing basis throughout its operational lifetime.

Staff observes that the use of predictive modeling, such as Regulatory Guide 3.59, and the MILDOS-AREA computer code, has never been explicitly approved for demonstrating compliance with radiation protection standards during operations. On the contrary, Regulatory Guide 3.59 is for use when environmental monitoring data is not yet available and it directs applicants and licensees where to look for separate guidance on compliance with radiation protection standards.

10 CFR 20 Appendix B, Table 2, identifies two air concentration limits for Radon-222 to members of the public. One limit is for radon without daughters and the other limit is for radon with daughters. The NRC staff has determined that the application did not address which air concentration limit for Radon-222 that the applicant will use for meeting 10 CFR 20.1301 and 10 CFR 20.1302 during operations. In September 2011, NRC staff published interim guidance for comment on radon and compliance with 10 CFR 20.1301 (ML112720481). In this guidance, it states that compliance with 10 CFR 20.1301/1302 must account for radon *progeny* during operations. This point is supported by the National Council on Radiation Protection and Measurement (NCRP) Report No. 97 that states, "The short-lived Radon-222 daughters, Po-218, Pb-214, Bi-214, and Po-214, when inhaled, are the radionuclides that deliver the alpha radiation dose to the bronchial tissues that is implicated in radiogenic lung cancer." The NRC staff has determined that the radon with daughters limit accounts for the large fraction of the radiation dose produced by radon and radon progeny. The Statements of Consideration (SOC) for NRC's 1991 revision of 10 CFR Part 20 (56 FR 23360, 23374; May 21, 1991) states that uranium recovery facilities *must* consider the dose from radon progeny.

RAI:
The applicant needs to identify the air concentration limit for Radon-222 that it will use to determine compliance with 10 CFR 20.1301 and 10 CFR 20.1302 during operations. In addition to the air concentration limit for Radon-222, the applicant then needs to: (a) provide an explanation and identify how radon (radon-222) progeny will be factored into analyzing potential public dose from operations consistent with 10 CFR Part 20, Appendix B, Table 2, (b) provide an explanation of how, in accordance with 10 CFR 40.65, the quantity of the principal radionuclides from all point and diffuse sources will be accounted for, and verified by, surveys

and/or monitoring (c) discuss how it will employ this method to demonstrate compliance during operations, including if it intends to differentiate the radon concentration from the plant and the radon concentration from background, and (d) evaluate and provide a description of the member(s) of the public likely to receive the highest exposures from licensed operations consistent with 10 CFR 20.1302.

ADMINISTRATIVE

1. Several references in the application have clerical and other errors and omissions (for specific references, see "RAI" heading below).

Staff is required to verify that information presented in an application is accurate and complete in order to derive a finding of reasonable assurance in the safety evaluation.

Citations in the SRP guiding staff's review of references include the following:

- in Section 2.1.4, "review and to verify the general aspects of the submitted materials … [r]eferences are cited appropriately";
- in Section 2.2.2, "Data sources should be referenced";
- in Section 2.6.2, "to determine if [the discussion of regional geology and stratigraphy] is adequately referenced"; and
- in Section 2.7.3, "methods or standards used to analyze pumping test data should be described and referenced".

The above guidance is provided to ensure the applicant provides a clear demonstration how requirements and objectives in 10 CFR Part 40 Appendix A are met pursuant to 10 CFR 40.31(h).

Please revise or clarify the source for the following references in the application:

- The reference to Hotchkiss and Levings (1986) on page 2.7-20, 2.7-23, the applicant uses an incorrect date of 1985 and on figures in Addendum 2.7B, the applicant uses an incorrect date of 1983.

- Please include references for the source of information in the first two paragraphs of Section 2.6.1.1 (page 2.6-2)

- Please correct the reference to (Sharp et al., 1964) on Page 2.6-3 in the reference list. If the authors are listed correctly in the reference list, then the date of the document is listed incorrectly.

- Please confirm that reference to (Feathers, 1981) on page 2.7-20 is correct (at the minimum should be (Feathers et al., 1981).

- On page 3-3, please verify that the page (i.e., p.3-29) referenced to the GEIS is correct.

2. On the bottom of page 2.6-2, please clarify how the outcrop geologic mapping supports this statement: "The Tullock Member of the Fort Union marks the first evidence of basin downwarp and synorogenic filling (outcrop geology shown on Figure 2.6A-1)."

3. In paragraph 1 in Section 2.6.2.1 (page 2.6-5), please clarify how Figure 2.6A-2 confirms the northwesterly dip at the proposed project area.

4. Page number for Tables in Section 2.5 should include the prefix "2.5"

5. The first paragraph in Section 2.7.1.1 (page 2.7-1) ends with the following two sentences: "All drainages within the Proposed Project area are ephemeral in nature. However, CBM wells contribute co-produced water to these drainages." Please clarify these statements. Does the CBM contribution make the streams perennial?

6. The first paragraph in Section 2.7.1.2 (page 2.7.-3) states that all streams within the two-mile buffer have a Classification of 3B and references the GEIS. This statement is incorrect. The Upper Belle Fourche River has a Classification of 2ABww. Furthermore, the proper reference should be to the State of Wyoming and not the GEIS.

7. The second sentence in the first paragraph under Heading Caballo Creek starts with the phrase "Caballo Creek is". To avoid confusion, the phrase should be "The Caballo Creek gaging station is".

8. The first sentence in the first paragraph under Heading Coal Creek contains several grammatical errors.

9. The second sentence in the first paragraph in Section 2.7.1.3 (page 2.7.-5) begins with the phrase "According to NUREG-1910". While correct, the placement of the sentences in that paragraph suggests that NUREG-1910 specifically discusses drainages within the proposed project, which is incorrect. NUREG-1910 contains generic information on the various districts. It is incumbent upon an applicant to describe the site conditions based on site-specific information and then to conclude that it is consistent or not consistent with the generic information in NUREG-1910.

10. Under the Upper Belle Fourche Basin heading (page 2.7-5), the application describes Mud Spring Creek watershed. However, the Mud Spring Creek Watershed and its sub-watersheds are not clearly delineated on any figure.

11. In the first paragraph under Section 2.7.1.4, the application states "…were determined by the NRC Regulatory Guide 3.8". By using the passive tense, one could infer that the runoff for the site was determined by the regulatory guide. The reference should state that the analysis by the applicant was consistent with methods in the regulatory guide.

12. In the first paragraph under Section 2.7.1.4.1 (page 2.7-6), the application states that the "HEC-HMS is also listed as an approved program in both NUREG-1623 and WDEQ guidelines." NUREG-1623 discusses only HEC-1 and HEC-2 programs.

13. The first sentence in the first paragraph under Section 2.7.1.5 contains grammatical errors.

14. The last sentence in the first paragraph under Section 2.7.1.5.2 states "Figure 2.7A-5 provides cross-section views for each of the 49 cross-sections"; however, Figure 2.7A-5 includes only 12 cross-sections. Furthermore, locations of the 49 cross-sections are not depicted on any figure.

15. The first paragraph under Section 2.7.1.7 references Figure 2.7A-7 to depict small water bodies within the Project Area. The scale on Figure 2.7A-7 is too small to delineate the water bodies. Do the water bodies depicted on Figure 2.7A-9 represent all those in the Project Area?

16. In the second paragraph on Page 2.7-15, the application states that the "permits can be found"; however, the phrase should state "pertinent information for the permits can be found".

17. On Figure 2.7A-8, the datum reference is NAD 1983 and it should be NAD 27.

18. In Section 3.1, the applicant proposes to include wells with diameters down to 2 inches. Please elaborate when the use of 2-inch diameter wells will be used.

19. Section 3.2.1.1, the application references "^{226}Rn" in several paragraphs. However, ^{226}Rn is not a naturally occurring isotope for radon and it is likely a typographical error for ^{222}Rn.

20. The applicant provides a summary of the former Reno Creek R&D operations in Addendum 1-A. Figure 1A-1 depicts the location of the former operations; however the locations of various wells depicted on that figure are inconsistent with Rocky Mountain Energy Company "Pilot Plan Site Plan" on page Addendum 1A-64 or with the coordinates listed on Table 1A-1.

21. The narrative in the application states that sampling was performed at 21 sites. Table 2.7A-14 lists 22 water sampling locations including a sample collected from ID SW20 on 6/23/2011 and "n/a" for other events. Table 2.7A-13 lists sample results from all ID's on Table 2.7A-14 except SW20.