Uranerz Energy Corporation Nichols Ranch ISR Project
Responses to the NRC Request for Additional Information Dated 11-Sept-08

Section 2.0 Site Characterization

Section 2.5 Meteorology

The applicant has not provided sufficient information regarding the meteorological characteristics of the site in Section 2.5 to enable the staff to fully understand this topic and to support other reviews dependent on that understanding such as, dose to members of the public. Specifically, please provide the following information:

a. Section 2.5.2, pg. TR-26. Provide maximum, minimum, and average monthly temperatures. The applicant provides a brief narrative of the temperature data; however, the actual data is not included.

Response:

Maximum, minimum, and average month temperature data for the region and project area is presented in the revised Section 2.5.2.1 of the attached Technical Report.

b. Section 2.5.3, pg. TR-26. Provide maximum, minimum, and average monthly. The applicant provides a brief narrative of the precipitation data; however, the actual data is not included.

Response:

Maximum, minimum, and average month precipitation for the region and project area is presented in the revised Section 2.5.2.2 of the attached Technical Report.

c. Section 2.5.4, pg. TR-26 and TR-27

i. Provide average monthly wind speed data and identify the maximum, minimum, and average monthly wind speed.

Response:

Maximum, minimum, and average month wind speed data for the project area is presented in the revised Section 2.5.3.3 of the attached Technical Report.

ii. The applicant provides a wind rose for January (1961-1990) but does not show any additional wind roses for other months. Provide average monthly wind rose data (for each month), along with the average annual wind rose data.

Response:

Average annual and monthly wind rose data for the project area is presented in the revised Section 2.5.3.3 of the attached Technical Report.

iii. See comment 7.3(b).

Response:

A discussion on regional meteorological stations and the appropriateness of the use of Antelope meteorological station is presented in the revised Sections 2.5.1 and 2.5.3.3 of the attached Technical Report. The MILDOS analysis was reran using data from the Antelope station and the joint frequency distribution data for the Antelope station are discussed in Section 2.5.3.3 and presented in Addendum 7C.

d. General Comment(s) for Section 2.5

i. Provide seasonal diurnal data for a 24-hour period.

Response:

Seasonal diurnal data is presented in the revised Section 2.5.2.1 of the attached Technical Report.

ii. Provide information on the height of the meteorological instruments used to generate the data in this application and provide the average mixing layer or inversion height data. This information is important to assess doses to individual members of the public.

Response:

Information regarding the height of the meteorological instruments is found in the revised Section 2.5.2.9 of the attached Technical Report.

iii. It is noted in Figure 1-3, Hank Unit Contour Map, that several buttes are located within the vicinity of the Hank unit. In light of this observation, the applicant does not provide any information about the effects of nearby water bodies or terrain on meteorological measurements. Please provide such information for both the Nichols Ranch Unit and the Hank Unit.

Response:

The effects of local terrain on meteorological measurements are discussed in the revised Section 2.5.3.4 of the attached Technical Report.

Section 2.6 Geology and Seismology

The geologic descriptions provided in the application are insufficient to fully interpret the geology of the license area. This information is important for understanding the degree and extent of production zone confinement and the adequacy of the hydraulic testing and proposed monitoring networks. Provide the following:

a. Isopachs for the "B sand", overlying shale, "A sand," underlying shale, and "1 sand" for the Nichols Ranch Unit.

Response:

Isopach maps for the B sand, overlying shale, A sand, underlying shale, and 1 sand for the Nichols Ranch Unit were submitted in a revised Volume Va, Appendix D5 as Exhibits D5-13 through D5-17 in August 2008. Section 2.6 of the Technical Report has been updated to reference this information.

b. Cross-section for the west limb of the Nichols Ranch Unit.

Response:

Several new cross sections for the Nichols Ranch Unit were included in the Volume Va, Appendix D5 revisions that were sent to the NRC in August 2008. These new cross sections are found in Exhibits D5-10 through D5-12 in Appendix D5, Volume Va. Section 2.6 of the Technical Report has been updated to reference this information.

c. Isopachs for the "G sand", overlying shale, "F sand", underlying shale, and "B sand" for the Hank Unit.

Response:

Isopach maps for the G sand, overlying shale, F sand, underlying shale, and B sand for the Nichols Ranch Unit were submitted in a revised Volume Va, Appendix D5 as Exhibits D5-18 through D5-22 in August 2008. Section 2.6 of the Technical Report has been updated to reference this information.

d. Surface geological maps in Nichols Ranch and Hank units clearly showing areas of alluvium.

Response:

A surface and sub-surface geological map, Exhibits D5a and D5b of Volume V, Appendix D5, were submitted to the NRC in August 2008. Section 2.6.1 of the Technical Report was revised to include this information.

e. Explain how a porosity of 0.05 was determined for the "A sand" and "F sand" at the Nichols Ranch and Hank units.

Response:

The effective porosity (specific yield) of 0.05 for the A Sand and the F Sand was determined from experience with similar sandstone aquifers. An unconfined multi-well pump test in the F Sand is being conducted to better define the specific yield for the F Sand. This pump test's results should yield a better effective porosity to be used in the calculations of the ground-water velocities for the A and F Sands.

Section 2.7 Hydrology

Section 2.7.1 Surface Water

The analysis of the surface water hydrology and quality in the proposed license areas is currently insufficient to determine the potential for floods to disrupt the operation of the facility or to interpret the impact of operations on surface water quality. Please provide the following:

a. Maps at appropriate scale clearly showing the location, size and shape of surface water features within each proposed license area.

Response:

Figure 2-15 along with new Exhibits 2-2 and 2-3 show the location, size, and shape of surface water features within each proposed license area.

b. Maps showing areas inundated during major flood events within each proposed license area.

Response:

Figures 2-15a and 2-15b (located in Chapter 2, Technical Report) and Figures D6-1a and D6-1b (located in Volume VIa in Appendix D6) have been added to show the areas of inundated areas for the 25-year flood for the Nichols Ranch unit and Hank units respectively. Figure 2-15a shows a large area where the Cottonwood Creek would be flooded during the 25-year event. The tributaries in the permit area would only be flooded in a narrow band inside the incised channels. Figure 2-15b shows that all of the streams in the 25-year flood area for the Hank unit would be in a narrow band inside the incised channels in this permit area. Text has been added and edited in Section 2.7 of Chapter 2 of the Technical Report and on pages D6-2 and D6-2a of Appendix D6 in Volume VI.

c. A discussion of the potential for flooding of the area around the central plant facility and the provisions to protect critical equipment and components.

Response:

The upgradient area of the plant will contain a ditch and berm which will have the conveyance to drain the 25-year flood around the plant facility.

d. Name, physically describe, and provide peak flow estimates at recurrence intervals for all drainages within the Nichols Ranch Unit near or crossing the planned wellfields noted on topographic maps. One such drainage is marked by sediment sampling points SD 2, 3, and 4. A second drainage is marked by SD 1 and 6.

Response:

The sub-basin drainages at the Nichols Ranch unit are presented on updated Figure 2-15 and Table 2-9 and Figure D6-1 (located in Appendix D6, Volume VIa) and Table D6-1 (located in Appendix D6, Volume VI). Table 2-12 and Table D6-1 presents the peak discharges for these drainages. Drainage NDA-2 contains the sediment sampling points SD-2, SD-3 and SD-4 and the peak discharge in the 25-year peak discharge will be used to design any feature along this drainage. The use of the peak discharge at the confluence of these tributaries will be a conservative number when applied to crossings further upstream of the confluence. Drainage area in NDA-5 presents the information for the sediment sampling points SD-1 and SD-6.

e. Provisions for erosion and wellhead protection against the effects of flooding from all drainages

in the Nichols Ranch Unit that flow near or through planned wellfields or an explanation why protection is not necessary. All berms, culverts, rock riprap, drainage or diversion channels must be designed to meet the requirements of 10 CFR Part 40, Appendix A.

Response:

As a general rule, installation of injection, production, and monitoring wells in drainages will be avoided. If an injection, production, and/or monitoring well has to be constructed in a drainage, appropriate erosion protection controls will be used to minimize the impact to the drainage. Protection controls that could be used, but not limited to, are: grading and contouring, placement of hay bales, culvert installation, rocked low water crossings, placement of water contour bars, and designated traffic routes. The drainage bottoms will be restricted to the work activities that are needed to construct and maintain the wells. If the wells are placed in a location in the drainage where runoff and/or flooding has the potential to impact the well, measures will be taken to protect the well and wellhead. Barriers surrounding the well such as cement blocks, protective steel casing around the wellheads, or other measures to protect the wells from damage will be utilized. Additionally, if a new road or any access roads have to cross an ephemeral drainage, efforts will be made to cross the drainage at right angles to minimize erosion with the appropriate sized culverts installed. Rocked low water crossings or culverts in combination with a low water crossing will be designed to pass a 25-year peak runoff event. The minimum culvert size of 18" will be used in diverting drainage from roads or for crossing small drainages. In the event that drainage has to be crossed, but cannot be crossed at a right angle or along elevation contours, appropriate measures for erosion control will be examined and implemented. All measures will use the best management practices (rock, riprap, etc.) in accordance to WDEQ-LQD Rules and Regulations, Chapter 3 or those stated in 10 CFR Part 40.

Section 2.7.1.2 in Volume I of the Technical Report was revised to include this information.

f. Name, physically describe, and provide peak flow estimates at recurrence intervals for all drainages within the Hank Unit near or crossing the planned wellfields noted on topographic maps. These drainages are denoted by sediment sampling points SD 8, SD 10, SD 11, SD 12, SD 14, SD 15, SD 18, and SD 19.

Response:

The Figures 2-15 and D6-1 (located in Appendix D6, Volume VIa) also presents the sub basin drainage areas for the Hank unit. The results for sub-basin HDA-2 cover the sediment sampling points SD-8. Table 2-12 and Table D6-1 present the flow characteristics for the 25-year peak flow for the Hank unit drainage basins also.

g. Provisions for erosion and wellhead protection against the effects of flooding from all drainages in Hank Unit that flow near or through planned wellfields or explain why protection is not necessary. All berms, culverts, rock riprap, drainage or diversion

channels are suggested to follow a design which meets the requirements of 10 CFR Part 40, Appendix A.

Response:

The 25-year flood is proposed to be used to design all berms, rock riprap and drainage channels for the Nichols and Hank units. The conveyance of the 25-year flood will be a

combination of culvert and low water crossing where culverts are used.

h. Maps which show the existing or planned National Pollution Discharge Elimination System (NPDES) permit Coal Bed Methane (CBM) water discharge points to surface water features or drainages in or surrounding each license area within a five-mile radius. *(Radius revised to one-mile radius per discussion between Uranerz and NRC on October 22, 2008.)*

Response:

Permitted Wyoming Pollution Discharge Elimination System (WYPDES) facilities within the Hank Unit permit boundary and a one-mile radius of the permit boundary are depticted on Exhibit 2-2 and detailed in Table 2-12a. Discharge monitoring reports (DMRs) submitted through June 30, 2008 indicate no discharge to the outfalls listed in Table 2-12a. Permitted WYPDES facilities within the Nichols Ranch Unit permit boundary and a one-mile radius of the permit boundary are depicted on Exhibit 2-3 and detailed in Table 2-12b. There are currently five permits active in the area; however, discharge has only occurred at five out of the seventeen permitted outfalls. These outfalls are denoted on the map and shaded in Table 2-12b.

Table 2-12a--Outfalls Inside and Within a One-Mile Radius of the Hank Unit License Boundary.

Permit #	Permit Operator	Permit Name	Outfall Within 1-mi of Permit Boundary	Associated Reservoir(s) and WSEO Permit Number
WY0056171	Yates Petroleum Corporation	All Day POD, Cottonwood Creek	002	Ox Bar (P18329S)
WYG2900001*	Bill Barrett Corporation	Willow Creek Permit	001	Reservoir 16-1 (Not Permitted) and Davis Reservoir (P4479R)
WY0056774	Yates Petroleum Corporation	All Day POD, Dry Willow Creek	001	South Dry Willow #1 (P18282S)
			002	South Dry Willow #2 (P18283S)
			003	Westside (P18496S)

*Outfall and reservoirs beyond 1-mile radius but upstream of Permit Boundary

Table 2-12b--Outfalls Inside and Within a One-Mile Radius of the Nichols Ranch Unit License Boundary.

Permit #	Permit Operator	Permit Name	Outfall Within 1-mi of Permit Boundary	Associated Reservoir(s) and WSEO Permit Number
WY0051161	Williams Production RMT Company	T-Chair Unit	001	NA
WY0051241	Williams Production RMT Company	Bullwhacker Creek-Dry Fork Land	001	NA - Outfall not constructed
WY0054411	Williams Production RMT Company	East Bullwhacker Creek	002	Johnson 24-12-4377 Reservoir (P16121S)
			003	Johnson 23-19-4376 Reservoir (P17383S)
			004	Johnson 34-19-4376 Reservoir (P17384S)
			012	Johnson 11-29-4376 Reservoir (P17386S)
			018	Johnson 24-12-4377 Reservoir (P16121S)
WY0055824	Yates Petroleum Corporation	Blade POD CBM Facility	013	Stepanek (Pending)
			014	William (Pending)
			022	Ill Prepared (Pending)
			023	Backwards (Pending)
			024	Bull Pasture #2 (P18278S)
			025	Bull Pasture #1 (P18277S)
WY0056502	Yates Petroleum Corporation	Rolling Pin Spatula State	001	Bull Pasture #3 (P18653S)
			002	Bull Pasture #4 (P18733S)
			003	Dune (P18794S)
			004	Thumper (P18691S)
			005	Tex (P18615S)
			006	Zink (P187325)

*Shading indicates outfalls that have received discharge water, per Wyoming Department of Environmental Quality discharge monitoring reports (DMRs)

i. Tables of existing or planned volumes and water quality standards for each identified NPDES permit CBM produced water discharge point within a five mile radius of each license area.

Response:

Effluent limitations for Yates Petroleum Corporation and Bill Barrett Corporation's WYPDES facilities near the Hank Unit are detailed in Table 2-12c. Notice that watershed based permits such as Bill Barrett Corporations permit on Willow Creek lacks a maximum flow; these permits are written such that the permittee is required to contain all produced waters during operating conditions. Yates' pending permit in the Willow Creek watershed will likely have similar language. Table 2-9d provides the WYPDES effluent limitations for William's T-Chair Unit (WY0051161), Bullwhacker Creek Unit (WY0051241), and East Bullwhacker

Creek (WY0054411) as well as Yates' Blade POD CBM Facility (WY0055824) and Rolling Pin Spatula State Project (WY0056502).

Table 2-12c--WYPDES Effluent Limitations for Permits within One Mile of the Hank Unit Project

Operator, Project, Permit and Outfall	Effluent Characteristic	Daily Maximum
Yates Petroleum Corporation All Day POD, Cottonwood Creek WY0056171 Outfalls 001, 002 and 003	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	2,800
	Sodium Adsorption Ratio, unitless	17
	Total Recoverable Arsenic, ug/L	8.4
	Total Recoverable Barium, ug/L	1,800
	Total Flow, MGD	1.52
Bill Barrett Corporation Willow Creek CBM Facility WYG290001 Outfall 001*	Chlorides, mg/L	230
	Dissolved Iron, ug/L	1,000
	Dissolved Cadmium, ug/L	4
	Dissolved Lead, ug/L	4
	Dissolved Copper, ug/L	10
	Dissolved Zinc, ug/L	90
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	1,330
	Sodium Adsorption Ratio, unitless	7
	Sulfates, mg/L	3,000
	Total Arsenic, ug/L	7
	Total Barium, ug/L	1,800
	Total Dissolved Solids, mg/L	887
	Total Flow, MGD	N/A
Yates Petroleum Corporation All Day POD Willow Creek WY0056774 Outfalls 001, 002 and 003	N/A Permit Pending--Likely very similar to BBC's Watershed Based WYPDES Permit Detailed Above	N/A Permit Pending—Likely very similar to BBC's Permit Limits Detailed Above

*Outfall and reservoirs beyond 1-mile radius but upstream of Permit Boundary

Table 2-12d--WYPDES Effluent Limitations for Permits in or near the Nichols Ranch Project

Operator, Project, Permit and Outfall	Effluent Characteristic	Daily Maximum
Williams Production RMT Company T-Chair Unit WY0051161 Outfall 001	Chlorides, mg/L	46
	Dissolved Iron, ug/L	1,000
	Dissolved Manganese, ug/L	646
	pH, s.u.	6.5 - 8.5
	Specific Conductance, umhos/cm	7,500
	Sulfates, mg/L	3,000
	Total Arsenic, ug/L	7
	Total Barium, ug/L	1,800
	Total Dissolved Solids, mg/L	5,000
	Total Petroleum Hydrocarbons, mg/L	10
	Total Radium 226, pCi/L	1
	Total Flow, MGD	0.057
Williams Production RMT Company Bullwhacker Creek WY0051241 Outfall 001	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	7,500
	Total Arsenic, ug/L	8.4
	Total Barium, ug/L	1,800
	Total Flow, MGD	N/A
Williams Production RMT Company East Bullwhacker Creek WY0054411 Outfalls 002 and 018	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	7,500
	Total Recoverable Arsenic, ug/L	8.4
	Total Recoverable Barium, ug/L	1,800
	Total Flow, MGD	N/A
Williams Production RMT Company East Bullwhacker Creek WY0054411 Outfalls 003-004 and 012	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	3,570
	Total Recoverable Arsenic, ug/L	8.4
	Total Recoverable Barium, ug/L	1,800
	Total Flow, MGD	N/A
Yates Petroleum Corporation Blade POD CBM Facility WY0055824 Outfalls 001-025	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	2,800
	Sodium Adsorption Ratio, unitless	17
	Total Recoverable Arsenic, ug/L	8.4
	Total Recoverable Barium, ug/L	1,800
	Total Flow, MGD	1.66

Table 2-12d--WYPDES Effluent Limitations for Permits in or near the Nichols Ranch Project (Continued)

Yates Petroleum Corporation Rolling Pin Spatula State WY0056502 Outfalls 001-004, 006	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH	6.5 - 9.0
	Specific Conductance, umhos/cm	2,800
	Sodium Adsorption Ratio, unitless	17
	Total Recoverable Arsenic, ug/L	8.4
	Total Recoverable Barium, ug/L	1,800
	Total Flow, MGD	N/A
Yates Petroleum Corporation Rolling Pin Spatula State WY0056502 Outfall 005	Chlorides, mg/L	150
	Dissolved Iron, ug/L	1,000
	pH, s.u.	6.5 - 9.0
	Specific Conductance, umhos/cm	7,500
	Total Recoverable Arsenic, ug/L	8.4
	Total Recoverable Barium, ug/L	1,800
	Total Flow, MGD	N/A

j. A discussion of how CBM produced water discharge to surface water or drainages may or may not impact the surface water quality at Nichols Ranch or the Hank Unit.

Response:

With the exception of WY0051161, the WYPDES permits detailed previously are total containment. Any water discharged from WY0051161 would flow out of the Nichols Ranch License Boundary in less than a quarter mile. Additionally, permit WY0051161 is due to expire on March 31, 2009. Currently WDEQ requires that discharges be contained in non-discharging impoundments and that end of pipe effluent concentrations meet downstream irrigation standards. The permitted irrigation right on Cottonwood Creek is depicted on Exhibit 2-3.

For the remainder of the permits, discharge can only occur to non-discharging impoundments not directly to the ephemeral channels. Discharge from the impoundments is permitted only during significant runoff events, where the produced water is diluted by natural runoff. Any discharge beyond overtopping during heavy precipitation constitutes a violation of the permits. Based on the permit requirements and the necessity to maintain available freeboard in the impoundments, Uranerz believes that the CBNG produced water will not impact the surface water quality at either project.

k. Maps which show the existing or planned NPDES permit CBM produced water surface impoundments in or surrounding each license area within a ~~five~~ (one) mile radius.

Response:

Both proposed and constructed impoundments that have or may receive CBNG produced water are depicted on Exhibit 2-2 and Exhibit 2-3 and in Tables 2-12a and 2-12b. These data were derived from the WYPDES permits and Wyoming State Engineer's Office (WSEO) on-line database.

l. Tables of existing or planned NPDES permit volumes and water quality standards for each CBM produced water impoundment within a ~~five~~ (one) mile radius of each license area.

Response:

Effluent limits are detailed in Tables 2-12c and 2-12d above. The limits depict the end-of-pipe maximum concentrations for the selected parameters. None of the permits require containment unit sampling or the monitoring of the water quality directly from the impoundments.

m. A discussion of how CBM produced water infiltration from impoundments may or may not impact the surficial aquifer water quality at Nichols Ranch or the Hank Unit.

Response:

Anecdotal evidence provided by the WDEQ-WQD for surface water facilities permitted to receive CBNG produced water provides few instances in which water infiltrating from the facilities has impacted groundwater resources. Groundwater quality has been adversely affected and class of use has changed at only 16 out of 109 permitted impoundments due to infiltration from overlying reservoirs/infiltration pits. In these rare instances, the class of use has typically changed due to increases in the concentrations of selenium, TDS or sulfate. These data represent nearly four years of data collection from 259 monitor wells installed at sites across the Powder River Basin. In addition, no sites have been impacted where the groundwater resources were at the depths of the surficial aquifers at the Nichols Ranch and Hank Units. Based on the few sites that have received CBNG produced water and the limited duration of these discharges, it is exceedingly unlikely that the baseline water quality measured in the surficial aquifers has been compromised in any manner. Further, per WDEQ regulations, all containment reservoirs permitted after August 1, 2004 require groundwater monitoring that includes baseline characterization and quarterly monitoring of the down gradient well of a three-well network. Although groundwater impacts are unlikely in-place monitoring will detect impacts to the surficial aquifers.

n. A separate map for each unit showing the exact locations of the surface water sampling sites given in Table D6A.1-1. The table provides coordinates which appear to indicate none of the surface water samples were located within any of the license areas.

Response:

The updated Figure 2-15 (or Figure D6-1 located in Appendix D6, Volume VIa) shows the location of the sampling sites for the Nichols Ranch and Hank units. The sampling sites in the Cottonwood drainage are collected for information relative to the Nichols Ranch Unit while the sites in the Dry Willow drainage are monitored with respect to the Hank Unit. The downstream location on Cottonwood Creek is downstream of the permit boundary for the Nichols Ranch Unit because it is downstream of the western most of the sub-basins in the Nichols Ranch permit unit which enters Cottonwood Creek ¼ mile downstream of the permit boundary in Cottonwood Creek. The downstream sampling location on Dry Willow Creek is just downstream of the permit boundary for the Hank

Unit and is appropriate for monitoring this location for surface runoff from Dry Willow Creek.

o. Recent surface water samples from all sites within the Nichols Ranch and Hank Unit to provide baseline values. All surface water quality values provided in the application are based on 1978 and 1979 samples outside the license areas.

Response:

Surface water samples for the Nichols Ranch and Hank Unit were not available prior to submission of the Nichols Ranch ISR Project because of the lack of surface water, precipitation, and run off events. However, surface water samples were obtained in June 2008 for all three surface water samplers that are being monitored for the Nichols Ranch and Hank license areas. The results obtained from the surface water samplers were incorporated into Table D6A.1-1 in Volume VI, Appendix D6. A revised Table D6A.1-1 was sent to the NRC in August 2008. Section 2.7.1.3 of the Technical Report was also updated to reflect the new surface water samples.

The surface water data were collected prior to any known discharges from CBM in this area and therefore should be representative of baseline conditions.

Section 2.7.2 Groundwater Hydrology

The analysis of the groundwater hydrology and quality in the proposed license areas is currently insufficient to interpret the impact of operations on groundwater flow and quality. This requested information will allow the staff to assess the applicant's ability to control its subsurface process fluids and the applicant's monitoring program. Please provide the following:

a. A map of "F sand" water level contours at the Hank Unit alone with the same scale and contour level used in Figure 2-19 for the "A sand" at the Nichols Ranch Unit. The current scale of the "F sand" water level contour map on Figure 2-20 is too large to interpret the groundwater flow field at the Hank Unit.

Response:

Figure D6-6B (located in Appendix D6, Volume VIa) and Figure 2-20b (located in Chapter 2, Technical Report) was added to present the water-level elevation contours for the F Sand at the Hank Unit alone.

b. A notation for the type of water use for all wells in Tables 2-10 and 2-11 (stock, drilling water, etc.). Also identify all artesian wells (water level above ground surface) in and surrounding the Nichols Ranch and Hank units in the tables.

Response:

Tables 2-13 and 2-14 (formally Tables 2-10 and 2-11) have been revised to indicate the wells that are artesian and the use of the wells. (This information is also available in Addendum D6G located in Appendix D6, Volume VI.)

c. A clarification of specific well conditions at the Hank Unit (Table 2-11), specifically: multiple screens or completions in North Dry Willow and others; a description of

Connie #2; a definition of the "X aquifer."

Response:

Table 2-14 (formally Table 2-11) and Table D6-3 located in Volume VI, Appendix D6 have been corrected to present the multiple aquifer completions instead of the X under the aquifer wells. North Dry Willow well was completed in the F, C, B, A and 1 aquifers while the Paden #1 well is completed in the C, B, and A Sands. The Connie #2 well is completed in the F Sand.

d. Corrected time series plots of aquifer water levels at the Nichols Ranch and Hank units to reflect corrected water levels (Figures D6D1-1.-1-3 and D6D2-1-2-4).

Response:

The water-level graphs in Volume VI, Appendix D6, Addendum D6D have been corrected to reflect the correct water-level elevations. These water level figures and tables have also been updated for recent water levels.

e. Cross-sections showing the water levels in the overlying, ore zone, and underlying aquifers at the Nichols Ranch Unit (Sands 1, A, B, F).

Response:

The Nichols Ranch cross-sections Exhibits D5-1, D5-2 and D5-10 through D5-12 present the water-level elevations for the 1, A, B and F Sands. These Exhibits are located in Volume V and Va, Appendix D5 – Geology.

f. Cross-sections that show water levels for the alluvium, "G sand" and "F sand" at Nichols Ranch Unit to clearly identify the surficial aquifer. The applicant has identified the "F sand" as the overlying and surficial aquifer at Nichols Ranch Unit. It is not clear if the "F sand" aquifer is the only sand acting as the surficial aquifer across this unit. The "G sand" is also present across this license area and its saturation is not addressed. In addition, alluvium deposits are present across this unit and one alluvium well, URNZQ-4, has water at a depth of 9.5 ft bgs. Based on this information, the sands which act as the surficial aquifer may vary across the permit area and be the "F sand", "G sand" or alluvium.

Response:

The water levels have been added to the Nichols Ranch unit cross-sections (See Exhibits D5-1, D5-2, D5-5, D5-10 through D5-12) located in Volumes V and Va, Appendix D5. No new water levels for the Cottonwood alluvium have been added to Exhibit D5-1 and D5-10. These water levels in Cottonwood alluvium would be slightly less than 10 feet below the land surface between drill hole CCI-81 and U06-98 on Exhibit D5-1 and between drill holes U07N-204 and U07D-66 on Exhibit D5-10. The water levels for the F Sand have been added to the Nichols Ranch unit cross-sections. Water levels for the G Sand have not been added but this sand probably contains water only in the northern portion of the wellfield where the G Sand is not near the land surface.

g. A surface map showing the names and locations of the sands that act as the surficial

aquifer and contours of their water levels in feet below ground surface across the proposed Nichols Ranch Unit.

Response:

A map of surficial aquifers for the Nichols Ranch unit is presented in Figure 2-21a and Figure D6-7a (located in Appendix D6, Volume VIa). This figure shows a pattern for the Cottonwood alluvial aquifer where the water levels in all this area are expected to be less than 10 feet. The Cottonwood alluvium therefore is the surficial aquifer south of the Nichols Ranch wellfield area. The F Sand is the surficial aquifer in the southern portion of the wellfield. The depth to water in the F Sand is presented on Figure 2-21a and Figure D6-7a. The G Sand is likely to be the surficial aquifer in the northern portion of the Nichols Ranch wellfield area in areas where this sand is adequately developed. The estimated depths to water for the G Sand are presented in Figure 2-21a and Figure D6-7a and the G Sand is potentially the surficial aquifer north of the hundred foot depth line for the G Sand. Two additional wells, one in the F Sand and one in the G Sand, are proposed to be added at Nichols Ranch Unit to better define the surficial aquifers in this area. Figure 2-21a and Figure D6-7a show the locations of the two proposed wells.

h. A description and discussion of the vertical hydraulic gradients across aquitards at Nichols Ranch Unit.

Response:

The vertical gradient across the aquitards that are indicated by the heads in two adjacent sands yield gradients of a few tenths of a foot/ft. The head in the aquitard is generally governed by the head of the adjacent sand with the higher head. The head in the aquitard is likely to only be slightly less than the head in the adjacent sand with the higher head. Therefore, the actual gradient in the aquitard is likely to be less than 0.1 ft/ft.

i. Cross-sections showing the water levels in the overlying, ore zone, and underlying aquifers at the Hank Unit (C, F, G). Specifically note where the Hank "F sand" aquifer is unconfined.

Response:

The water levels for the G, F, C and B Sands have been added to the Hank unit cross-sections. (See exhibit D5-3 through D5-9). The F Sand aquifer is unconfined where the water level is at the top of the F Sand or below its top. These cross-sections show that some portions of the F Sand are confined with a few tens of feet of head above the top of the sand.

j. Cross-sections with water levels for the "G sand", "H sand", and any alluvium at the Hank Unit to identify those sands that act as the surficial aquifer and the locations, thereof.

Response:

The water levels for the G and H sands have been added to cross-sections, Exhibits D5-3 through D5-9. The water levels for the alluvium in the Hank unit area have not been added to the cross-sections because the wells in the alluvium in this area are

all dry.

k. A surface map showing the names and locations of the sands that act as the surficial aquifer and contours of their water levels in feet below ground surface across the proposed Hank Unit permit area.

Response:

The H sand is the uppermost sand in the Hank unit that should contain water in most locations near the wellfield. The Willow and Dry Willow alluvial material is not expected to contain water except during short periods of time after runoff events. The BLM alluvial monitoring wells in Dry Willow Creek have been dry for several years and the monitoring well BR-U in Willow Creek has recently been dry.

Figure 2-21b and Figure D6-7b present the depth to water for the H sand aquifer in the Hank unit area. This map shows that the depth to water near the wellfield is generally greater than 100 feet. Two additional H Sand wells are proposed to be added to better define the depth to water on the downgradient side of the Hank wellfield.

l. A description and discussion of the vertical hydraulic gradients across aquitards at Hank Unit. Substantial variation in water levels exists across aquitards. For example, the reported Hank Unit "H sand" ground water levels are 150 ft higher than "G sand" at URZ1 HH-7).

Response:

The heads in the adjacent aquifers at the Hank unit indicate large vertical hydraulic gradients across the aquitards as much as 1 ft/ft. Experience with head measurements in the Powder River Basin aquitards has shown that the head within the aquitard is fairly similar to the overlying aquifer head until the last few feet of the bottom of the aquitard. Therefore, the average vertical hydraulic gradient in the aquitard is much less than the indicated gradient by the two adjacent aquifer heads. The vertical hydraulic gradients in the aquitards would be expected to be near 0.1 ft/ft. The gradient within the overlying aquitard was measured at the North Butte SS2 site which is one mile north of the Hank permit. The gradient through the overlying aquitard was defined by aquitard well SS2FBCAQ and the overlying aquifer well SS2U to be 0.11 ft/ft. The indicated gradient from the two adjacent aquifers was much greater at 0.71 ft/ft.

m. Information regarding past, current and future operations for DW-4L and an estimate of the volume of water produced from this well to date.

Response:

DW-4L was initially installed by Cleveland Cliffs Iron Company in 1980. The well was part of many 3 well clusters that Cleveland Cliffs installed when they were exploring the Pumpkin Buttes Mining District. When Cleveland Cliffs left the area, the well was turned over to the land owner for their use, but the land owner has not used the well since it was acquired from Cleveland Cliffs. Since the summer of 2006 this well has been intermittently used by Uranerz for monitoring and baselining regional groundwater and supplying drilling water for exploration activities. Over the past two years, approximately 1.2 million gallons or 3.68 acre-ft of water has been pumped from DW-4L. The amount

of water pumped from the well has had no affect on any other wells in the area and has not affected water levels in the "A Sand" at Nichols Ranch. Future use of this well will continue as regional monitoring well and potential source of drilling water for exploration activities.

Section 2.7.2.3.1 of the Technical Report has been revised to include this information.

n. A discussion of any potential effects of the pumping activity at DW-4L on the water level elevations in the "A sand" at the Nichols Ranch Unit.

Response:

The production of well DW-4L for drilling water has not significantly affected the water levels of the A Sand at the Nichols Ranch unit. Water levels in late 2007 and early 2008 have been gradually rising in this area. Therefore, no detectable water level decline has been observed from the production of well DW-4L.

o. Tables identifying the existing or planned locations, rates and total withdrawal of pumping wells associated with CBM operations in the A, B, F or 1 sand within a five mile radius of the Nichols Ranch Unit. Estimate how these well operations may affect water levels in these sands within this radius.

Response:

Tables D6H.1-1 in Addendum 6H of Appendix D6, VolumeVI presents the CBM information for CBM wells in and within a 3 mile radius of the Nichols Ranch Unit respectively. All of the CBM wells in this area are completed significantly below the ore sands and adjacent aquifers. Section D6.2.3.3 of Appendix D6, Volume VI presents the potential affects from the CBM water production on the ore sands. Uranerz does not expect any drawdowns in the ore sands from the CBM operations. The only potential for drawdowns from the CBM operations to the ore sands is through an artificial completion in this area.

p. Tables identifying the existing or planned locations, rates and total withdrawal of pumping wells associated with CBM operations in the B, C, F, G or H sand within a five-mile radius of the Hank Unit license area. Estimate how these well operations may affect water levels in these sands within this radius.

Response:

Tables D6H.2-1 in Addendum 6H of Appendix D6, Volume VI presents the CBM information for CBM wells in and within a 3 mile radius of the Hank Unit respectively. All of the CBM wells in this area are completed significantly below the ore sands and adjacent aquifers. Section D6.2.3.3 of Appendix D6, Volume VI presents the potential affects from the CBM water production on the ore sands. Uranerz does not expect any drawdowns in the ore sands from the CBM operations. The only potential for drawdowns from the CBM operations to the ore sands is through an artificial completion in this area.

q. A demonstration that hydraulic conductivity determined from the drawdown portion of a

single pumping well test is accurate. Hydraulic conductivity determined from the drawdown portion of a single pumping well test would likely be subject to large errors due to wellbore pumping head loss.

Response:

The USGS WTAQ program was used to compute the skin effect in a pumping well on the slope of the drawdown curve. Typical aquifer properties were used for the A Sand at the Nichols Unit. A vertical hydraulic conductivity of 1/10 of the horizontal value, 0.5 feet/day, aquifer thickness of 90 feet and a storage coefficient of 3.2E-4 were used to calculate the slope of the drawdown line for different skin effects. Wellbore skin values of 2.0, 0.5 and 0 were used for evaluating the effects of the reduced permeability at the wellbore. The early time slopes of these 3 curves were identical and equal to the slope of the transmissivity for these aquifer values. The difference was that the amount of drawdown increased as the wellbore skin parameter was increased. This evaluation shows that an error should not exist from the wellbore skin effect for a single well pump test and that the straight line fit should be a function of the transmissivity of the aquifer. A comparison of the single well transmissivity values to the multi-well pump test values in Tables D6-4 and D6-5 also indicates that for the same well these single well tests and the multi-well test produce similar transmissivities.

r. An explanation of why the BR-G pump test should be considered representative of "F-sand" ore zone conditions. The BR-G pump test resulted in a transmissivity that was two orders of magnitude smaller than other "F-sand" tests at the Hank Unit.

Response:

The BR-G pump test is considered to be representative of the F Sand in its area. The F Sand transmitting ability at the BR-G site is significantly less, indicating that the permeability of the F Sand in this area is not representative of values measured in the ore zone.

s. An explanation of how future pump tests will be designed for the "F sand" in the Hank Unit to provide adequate hydrogeologic characterization of the wellfields considering the small drawdowns developed in the Hank Unit pump tests. These small drawdowns may make it difficult to demonstrate communication across the production zone with monitoring wells and isolation from the overlying and underlying aquifers.

Response:

Future multi-well pump tests in the F Sand at the Hank unit will be designed using the USGS WTAQ computer program for unconfined aquifers. The Hank wellfield pump test will require more multi-well pump tests than most wellfields due to its unconfined nature. Our initial evaluation of the pump test condition requirements for the Hank wellfield test using the WTAQ program indicates that the maximum distance to an observation well will likely be roughly 1,000 feet. A minimum of 3 multi-well tests will likely be required for the first Hank mine unit multi-well pump test.

t. A comprehensive explanation of how the applicant will operate the wellfields in the Hank Unit "F sand" to address the potential that these small drawdowns could affect the applicant's ability to control wellfield balancing and prevent, correct, and monitor excursions.

Response:

The unconfined nature of the F Sand at the Hank Unit will enable the drawdowns to exist only in the local area. These drawdowns as predicted will extend out several hundred feet from the edge of the wellfield. A 3 percent bleed as simulated should easily maintain the groundwater reversal on the down gradient side of the Hank wellfields. The localized cone of depression in the wellfield area and extending out a few hundred feet should make it easier to maintain the control in the wellfield.

u. A description regarding presence of sufficient head in the "F sand" at Hank Unit to prevent substantial dewatering of the sand during production and restoration operations, especially during the groundwater sweep phase of restoration.

Response:

The head in the F sand above the top of the ore is generally greater than 50 feet at the Hank Unit. This amount of head should enable the F Sand recovery wells to be operated adequately without excessive lowering of the water levels in the F Sand during the operation of the wellfield. The amount of bleed during ground-water sweep phase of restoration may have to be decreased because the ground-water bleed could be easily decreased to approximately 15 percent by re-injecting some of the ground-water sweep water after the uranium has been removed through an IX. This amount of bleed should enable the ground-water sweep phase of the restoration to be adequately effective.

v. A discussion and statement of what actions the applicant plans to take to mitigate the impact of large water level drawdowns from consumptive use in the "A sand" on water wells within a five mile radius of the Nichols Ranch unit. Uranerz pumping drawdown analysis, shown in Figure 7-1, indicates large water level drawdown created by planned consumptive use over a wide area surrounding Nichols Ranch.

Response:

Impacts to any wells that could be affected by consumptive use in the "A" Sand by Uranerz are addressed in surface use agreements between Uranerz and the surface owner of the land where the Nichols Ranch ISR Project is located. Although the details of the surface use agreement are confidential, Uranerz has agreed to work with the landowners if a well is affected by the "A" Sand drawdown. Potential actions could include installing pumps in artesian/flowing wells that stop flowing or drilling a new well for the landowner.

Section 7.2.3 of the Technical Report was revised to reflect this information.

w. A discussion of the implications to lixiviant composition and flow in the unconfined aquifer setting. Lixiviant composition and flow could be impacted by the unconfined aquifer setting (e.g. added oxygen may evolve out of solution to create a gas and liquid

phase in the ore body, which can lead to reduced permeability and preferential flow paths).

Response:

The injection of lixiviant into the F sand will not be in the upper portion of the aquifer or near the water table. A few tens of feet of water over the injection point should enable the added oxygen to stay in saturation. The head above the injection zone will be increased near injection wells; therefore, the injection of lixiviant into the unconfined aquifer should not create a problem.

Section 2.7.2.4. Groundwater Quality

The analysis of the groundwater quality in the proposed Nichols Ranch ISR Project is currently insufficient to interpret the impact of ISL recovery operations on water quality. The requested information will allow staff to assess the applicant's excursion monitoring program, the preoperational monitoring program, and the potential effects of CBM production on the applicant's operations:

a. The location, water quality, permitted volume and known volume of any CBM produced water to be discharged to surface drainages or impoundments within the license area and an estimate of how much will infiltrate to the overlying aquifer at Nichols Ranch Unit. The applicant has informed NRC staff that CBM discharge points will be located in the Nichols Ranch Unit.

Response:

CBM extraction has not yet begun in the Nichols Ranch Unit. CBM wells are being drilled and CBM infrastructure (pipelines, power, etc.) is being developed, but no surface discharge has occurred except in the far western edge of the license area. Maps supplied to Uranerz by a CBM producer do show the construction of one CBM reservoir being located in the Northeast part of the Nichols Ranch Unit license area. To date, no water has been discharged into this reservoir. Uranerz will continue to work with CBM producers in the area to monitor progress of CBM development and to keep informed when, if any, CBM water will be discharged to surface reservoirs within the license area.

The one proposed CBM reservoir that could lie within the Nichols Ranch Unit license area may be located in the Northeast portion of the Nichols Ranch Unit license area. The size of the proposed reservoir is 15.6 acre-ft.

There are currently two outfalls located within the Nichols Ranch Unit license boundary. The location of each outfall is summarized in Table 2-18.

Table 2-18—Outfalls Located Within Nichols Ranch Unit License Boundary.

Operator, Project, Permit	Outfall	Quarter Quarter	Section	Township	Range
Williams Production RMT Company T-Chair Unit WY0051161	001	NWSE	18	43N	76W

Yates Petroleum Corporation Rolling Pin Spatula State WY0056502	002	NENE	17	43N	76W

To date, only outfall 001 of permit WY0051161 has discharged to the surface within the license area at the Nichols Ranch Unit. This discharged occurred prior to the baselining of the Nichols Ranch Unit with no discharge observed by Uranerz since the 4th quarter of 2006. Discharge monitoring report (DMR) data for the outfall is provided in Table 2-19.

Table 2-19--Williams Production RMT Company (WY0051161) Average Water Quality and Discharge Rate.

Parameter	Unit	Permit Limit	Average Historical Data
Bicarbonate	mg/L		1,170
Chlorides	mg/L	46	7.5
Dissolved Calcium	me/L		9.0
Dissolved Iron	ug/L	1,000	682
Dissolved Magnesium	me/L		3.5
Dissolved Manganese	ug/L	646	33
Dissolved Sodium	me/L		14.8
pH	s.u.	6.5 - 8.5	7.4
Sodium Adsorption Ratio	calculated		6.1
Specific Conductance	micromhos/cm	7,500	2,390
Sulfates	mg/L	3,000	33
Total Alkalinity	mg/L as CaCO3		956
Total Arsenic	ug/L	7	1
Total Barium	ug/L	1,800	2,270
Total Flow (MGD)	MGD	0.057	0.018
Total Petroleum Hydrocarbons	mg/L	10	Non-Detect
Total Radium 226	pCi/L	1	0.9

Table 2-20 presents the estimated water quality of Yates Petroleum Corporation's WY0056502 Outfall 002. These data represent the water quality of an outfall targeting the same coal seam, located within six miles of outfall 002. The water quality analysis was included with the WYPDES permit application submitted to the WDEQ.

Table 2-20--Yates Petroleum Corporation (WY0056502) Estimated Water Quality and Discharge Rate.

Parameter	Unit	Permit Limit	Estimated Concentrations
Chlorides	mg/L	150	8
Dissolved Iron	ug/L	1,000	<30
pH	s.u.	6.5 – 9.0	8.09
Sodium Adsorption Ratio	calculated	17	11
Specific Conductance	micromhos/cm	2,800	1,840
Total Arsenic	ug/L	8.4	1.8
Total Barium	ug/L	1,800	1,280
Total Flow (MGD)	MGD	N/A	N/A

Typically, infiltration is most pronounced in the shallow, unconsolidated materials overlying the Wasatch Formation bedrock. Uranerz anticipates little to no infiltration through the claystones and siltstones that dominate the near surface bedrock stratigraphy. In addition, infiltration rates at CBNG impoundments tend to decrease during the first six months of operation as native clays swell and disperse as the soil SAR increases. The swelling and dispersion of the clays leads to soil sealing and a reduction in the hydraulic conductivity.

b. An assessment of CBM produced water discharge on baseline water quality in the surface water and overlying aquifers.

Response:

The impoundments and surface discharges in this area may infiltrate a few gallons per minute of water into the surficial aquifer in areas where the surface is very sandy. This water will likely take a very long time to affect the water quality in the F Sand or in the Cottonwood alluvium in this area. The location of impoundments upgradient of the F Sand monitoring well URZNF-3 are greater than 4,000 feet away and therefore the travel time is estimated to be greater than 100 years to reach well URZNF-3. It is doubtful that the water quality changes from the CBM discharges will be detected during the operation of the Nichols Ranch Unit. The most likely area to be affected is the Cottonwood alluvium and its natural water quality has a significantly higher TDS than the CBM discharge water. Therefore some decrease in concentration may possibly be observed in the Cottonwood Creek alluvial water. The CBM produce water has not been discharged into the area prior to defining baseline water quality in the surface water and overlying aquifers, therefore, CBM has not affected the baseline water quality.

c. Verification that both Hank and Nichols Ranch units have not been impacted by CBM produced water discharge. If this is not the case, provide an explanation of how the applicant can assess baseline surface water and surficial aquifer ground water quality when it is variably impacted by CBM discharge.

Response:

The Hank and Nichols Ranch units have not been impacted by CBM produced water discharges since there has not been any surface discharge in the Hank area and only one discharge to the surface has occurred in the western edge, down gradient location, of the Nichols Ranch Unit prior to any baselining activities. No effects in the near future are expected from the surface or surficial aquifer groundwater quality from the CBM discharges. At Hank, no surface discharge will occur since the CBM operator is taking the CBM produced water, transferring it to a large storage tank, then pumping it to a location some 35 plus miles from the Nichols Ranch ISR Project. Currently only one additional CBM reservoir is planned inside the Nichols Ranch Unit license area. This reservoir has not yet received any CBM produced water.

d. A rationale for the number and location of wells selected for preoperational groundwater quality monitoring for both the Nichols Ranch and Hank units. For comparison, Regulatory Guide 4.14, Revision 1, Radiological Effluent and Environmental Monitoring at Uranium Mills provides guidance for preoperational monitoring at conventional uranium mills. While Regulatory Guide 4.14, Revision 1, was developed only for

uranium mills, the regulatory objectives of Regulatory Guide 4.14, Revision 1, as well as some of the detailed guidance, are applicable to all types of uranium recovery facilities and The applicant should propose an appropriate preoperational monitoring program for the Nichols Ranch and Hank units with these objectives and guidelines in mind.

Response:

The selection of pre-operational groundwater monitoring for both Nichols Ranch and Hank units were done to develop adequate definition of the aquifers at both of these sites. Numerous additional wells will be added downgradient and upgradient of the wellfields during the wellfield baseline monitoring prior to any operation of an ISR wellfield. The baseline monitoring has been used to define the conditions of the groundwater systems and the wellfield monitoring will be used to further define the conditions in the immediate area of the wellfield prior to operations of each wellfield.

Section 2.7.3 Water Rights

Provide a list, or a reference where a list can be found in the application, of wells that will be abandoned or will be used as monitoring wells. On page TR-67, the applicant indicates that, "Those wells that are completed in the ore bearing sands will be abandoned...or will be used as monitoring wells if not completed in multiple sands."

Response:

A location of the wells described on page TR-67 can be found in Figure 2-18 of the Technical Report. The wells that may have to be abandoned or used as monitor wells are found in the last paragraph of page TR-67. The wells are identified as Paden #1 and North Dry Willow #1. A reference to where the wells can be located has been added to the text in 2.7.3.

Section 2.7.5 Exploration Drill Holes

NRC staff requests additional information regarding the exploration borings. Poorly abandoned exploration borings could provide vertical migration pathways causing vertical excursions. Please provide the following:

a. An estimate of the number of exploration drill holes abandoned prior to 1997, and an assessment of the impact that these borings could have on production zone confinement.

Response:

The number of exploration drill holes drilled prior to 1997 can be found in Tables D6I.1-2 and D6I.2-2 in Volume VI, Appendix D6, Addendum D6I. To the best of Uranerz's knowledge, a total of 321 exploration drill holes (103 Nichols Ranch, 218 Hank) were drilled in the Nichols Ranch Unit and Hank Unit license areas. Uranerz has not had any issues that would indicate that historic exploration holes are impacting the production zones of Nichols Ranch or Hank. If during wellfield pump tests or at any other time a historic drill hole is suspected of affecting the production zone, steps will be taken to locate the drill hole, re-enter it, and properly abandon the drill hole.

Section 2.7.5 was revised to include the above information.

b. Location where abandonment methods are defined. Table D6I.1-1 notes, "*see Section D6.5 of the text for a definition of the abandonment methods", however, Section D6.5 does not contain abandonment methods.

Response:

Section D6.5 of Volume VI, Appendix D6 was revised to define drill hole abandonment methods as noted in the tables in Volume VI, Appendix D6, Addendum D6I.

2.9 Background Radiological Characteristics

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

a. Section 2.9.1 .1, TR-77 and TR-78. The applicant did not provide air particulate results in the application. It appears that the applicant did not collect air particulate samples for three major reasons, as follows: 1) the recovery technique does not require the removal of overburden nor does it require the physical removal of the ore zone; 2) it is a wet process up to the stage of drying and packaging; and 3) modern dryers and packaging systems do not emit significant particulate discharges. The applicant does not define what is significant.

Regulatory Guide 4.14, Revision 1, April 1980 provides several objectives for radiological effluent and environmental monitoring at uranium mills. As previously noted, these objectives are applicable to uranium recovery facilities, including ISL facilities. The regulatory guide objectives are, as follows: 1) to estimate the maximum potential annual radiation dose to the public resulting from effluent releases, 2) to ascertain whether the regulatory requirements of the NRC (including 10 CFR part 20 does limits, release limits, and the "as low as is reasonably achievable" requirements of 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations") have been met, 3) to evaluate the performance of effluent controls, including stabilization of active and inactive tailings piles, 4) to evaluate the environmental impact of milling operations, both during operations and after decommissioning, and 5) to establish baseline data to aid in evaluation of decommissioning operations or decontamination following any unusual releases such as a tailings dam failure. Please provide a demonstration that air particulate sampling is not needed while meeting the regulatory objectives of Regulatory Guide 4.14, Revision 1.

Response:

Although Regulatory Guide 4.14 may still be relevant with regard to some aspects of baseline sampling, it, because of its age, was not written for modern in situ recovery operations. To illustrate, on page 4.14-1 of the Guide it is stated that "This guide describes programs acceptable to the NRC for measuring releases of radioactive materials to the environment from typical uranium mills." When the revised guide was written in 1980, a "typical mill" was a conventional mill, and therefore the guide speaks to features such as tailings piles, dams and ponds, as well as mills where ore is crushed

and processed. Because the guide is aimed at conventional mining, it does not take into consideration the fact that in situ recovery operations do not create large open pits with stacks of ore at the surface. Instead, the focus of the guide is on significant particulate-generating operations associated with conventional mining and processing. As discussed in the application, in situ recovery operations do not have significant levels of radiological particulates.

The lack of significant particulate-generating sources is acknowledged in U.S. Nuclear Regulatory Guide (NUREG-1569). To illustrate, Section 4.1.3 (3) under Acceptance Criteria, states "Aspects of design that can significantly limit airborne releases include closed production systems (i.e. no venting) and the use of vacuum dryers that eliminate airborne uranium particulate releases from the drying operation." The key phrase in this direct quote is "the use of vacuum dryers that eliminate airborne uranium particulate releases for the drying operation." In contrast, the qualitative terms such as "not significant" or "near zero" that are often used to describe the emissions efficiency of a vacuum dryer are not as absolute as the word "eliminate" which is used in the above referenced quote from NUREG-1569. Recognition that closed-loop ISR facilities equipped with rotary vacuum dryers is also recognized in MILDOS Area, a model used by NRC to evaluate potential radiological doses to members of the public. References to insignificant particulate emissions can also be found in NUREG/CR-6733 and NUREG-1910.

As described in the Application, Uranerz is proposing to build and operate a pressurized down-flow/closed-loop system that includes a rotary vacuum dryer. Until the drying phase is reached, the entire product recovery and waste fluid disposal process only includes solutions. For example, there are no particulate emissions from the saturated ore zone located deep underground nor are there any particulate emissions from fluids contained in wellfield surge tanks, pipelines, process pad vessels and waste disposal well storage tanks. Potential sources of particulate emissions can be associated with accidental spills, if left unremediated, or with operational practices that do not meet the principle of As Low as is Reasonably Achievable (ALARA); these potential sources are discussed below.

With respect to potential effects of accidental spills, discussions in the Application have documented that the most likely areas for spills to occur off the process pad are within a wellfield or between a wellfield and the process site. Spills of this nature would occur as a result of a pipeline leak or rupture. Uranerz's proposed corrective action plan would effectively eliminate a particulate emission source from developing as a result of an accidental spill. Briefly, the plan calls for delineating the spill area, conducting gamma surveys and collecting samples across the affected area. Areas of the spill site with gamma readings exceeding 3 times background will receive more intense sampling. Soils exhibiting a significant increase in radium-226 above background (e.g., 4 pCi/g) will be removed and disposed at a site licensed for 11e. (2) byproduct material. After removal, the area will be surveyed again to ensure that gamma readings have returned to pre-spill levels. By removing the contaminated soil in a timely manner, the potential dusting source (particulate emission site) will be eliminated.

Accidental spills on the process pad can be much more easily addressed. The process pad will be designed to fully contain any spill from process vessels, the waste disposal well storage tanks or pipelines located throughout the facility. Spills would be immediately cleaned up and the affected areas (pad, process equipment, etc.) would be

washed down to insure removal of contamination that if allowed to dry could produce a particulate source term. Again, by implementing good-housekeeping measures, having written protocols for addressing accidental spills, and conducting routine radiological surveys, the opportunity for creating an air particulate source term is remote.

Although from a design and engineering standpoint it can be reasonably demonstrated that in situ recovery operations equipped with vacuum dryers do not produce air particulate emissions, Uranerz can see the value in verifying this assertion by conducting air particulate monitoring during operations. Uranerz fully expects that the predicted near-zero air particulate emissions will be borne out in the operational monitoring program, and this operational proof will provide added assurance to regulators and to the public that ISR facilities do not emit significant radioactive particulates.

Presently, gamma and Rn-222 are being monitored at 4 locations at the Nichols Ranch site, and a fifth monitoring site is indicated on the new map titled Figure 2-25 Nichols Ranch Unit Gamma/Radon/Air Particulate Monitoring Locations in Chapter 2 of the Technical Report. Uranerz proposes to install air particulate samplers at 4 locations (upwind, downwind, nearest residence, and plant site) at the Nichols Ranch Unit. The samplers are expected to be in operation beginning late 1st Quarter 2009 or early 2nd Quarter 2009. Samples will be collected for two quarters and analyzed in accordance with Regulatory Guide 4.14 Revision 1. These samples will then be compared to other operations near the Nichols Ranch ISR Project that has collected baseline air particulate data (i.e. Cameco's North Butte Project, COGEMA Christensen Ranch, and Uranium One's Moore Ranch) to establish baseline air particulates. Similarly, air particulate monitors will be placed at 4 locations at the Hank site (Figure 2-26 Hank Gamma/Radon/Air Particulate Monitoring Locations Map in Chapter 2 of the Technical Report). The locations for the air particulate samplers will be the same as the Nichols Ranch Unit locations (upwind, downwind, nearest residence, and plant site).

b. Exhibit 5-1. Provide an explanation for why surface water samples were not collected or direct the NRC staff to the surface water results in the application. The applicant shows several surface water sampling locations on Exhibit 5-1 for the Nichols Ranch and Hank units but did not provide results for surface water samples for these units consistent with the guidance in Regulatory Guide 4.14, Revision 1, for surface water sampling.

Response:

Surface water self samplers were set up in 3 locations; two samplers in Cottonwood Creek and one sampler in Dry Willow Creek. Both Cottonwood Creek and Dry Willow Creek are ephemeral streams that may only contain water during runoff or major storm events. At the time the Nichols Ranch ISR Project license application was submitted, no surface water samples were collected at any of the three locations because there was no surface water present. In June 2008, surface water samples were collected. The results of the surface water samples are presented in Table D6A.1-1 located in Volume VI, Appendix D6, Addendum D6A. This revised table was submitted to the NRC in an August 2008 revision package.

c. Section 2.9.4, Flora and Fauna, Table 2-26 and Table 2.27.

i. Describe the type of vegetation sampled and demonstrate that the vegetation samples collected by the applicant, as suggested in Regulatory Guide 4.14, Revision

1. Regulatory Guide 4.14, Revision 1, Table 1 states that three vegetation samples should be collected near the site in different sectors that will have the highest predicted air particulate concentrations.

Response:

Vegetation types sampled consisted of sagebrush and grasses since the vegetation in the areas of the sample sites consists mainly of sagebrush shrubland and mix grassland communities. These communities are discussed in detailed in Volume VII, Appendix D8. Section 2.9.4.2 of the Technical Report was revised to reflect this information. The rationale for selecting the vegetation sampling sites is described in Sections 2.9.4.1 and 2.9.4.2.

To date, one set of vegetation samples has been collected and analyzed for the suggested constituents listed in Regulatory Guide 4.14. For the reasons described in this response regarding the differences between potential impacts from conventional mining vs. modern ISR operations, Uranerz does not believe that three sets of samples are needed from three sectors of highest predicted airborne concentrations. ISR operations do not generate significant airborne particulates and therefore potential impacts on vegetation from deposition are predicted to be insignificant. The sampling frequency and sampling location set out in Regulatory Guide 4.14 makes sense for particulate-generating conventional mining but may not be wholly applicable to ISR operations. Moreover, vegetation has been sampled extensively during the past 30 years at ISR operations and there is no documented instance of significant impact to vegetation. In spite of this excellent record, Uranerz proposes to sample vegetation as outlined in Regulatory Guide 4.14 during operations.

ii. Define the location "grazing area" as identified in the aforementioned tables.

Response:

The grazing areas described in the aforementioned tables were two locations, randomly selected, in each license area where vegetation samples were collected and analyzed for radionuclides. Since most of the area within the license area is used by livestock for grazing, the locations were deemed to be appropriate. Figures 2-25 and 2-26 display the locations where the vegetation samples were collected.

d. Section 2.9.3.3, Nichols Ranch Unit Results, Table 2-22. Regulatory Guide 4.14, Revision 1, Table 1 suggests that radon gas samples should be collected at five or more locations that are the same as the locations for air particulates. These locations would include three samples at or near the site boundaries, one sample at or close to the nearest residence or occupiable offsite structure(s) (if within 10 km of the site) and one sample at a control or background location remote from the site. For the Nichols Ranch Unit only four radon gas locations are identified. Please explain why a fifth location is not necessary.

Response:

As described in the response item under 2.9a, Regulatory Guide 4.14 was written many years ago to specifically address conventional mills. Because conventional mills

generate distinctly higher levels of air particulates, the number (5) and distribution of air particulate samplers given in Regulatory Guide 4.14 was in all likelihood adequate for the intended purpose. Since the guide called for radon monitors to be placed at the same locations as the particulate sampling stations, the number (5) and distribution of radon monitors obviously mirrored the particulate stations. Recognizing that a modern ISR facility is different then a typical conventional mill, the monitoring layout described in the Application is a modification of Regulatory Guide 4.14. In light of the significantly lower radiological impact of ISR operations as compared to old conventional mines/mills, deploying one fewer radon/gamma detectors seemed to be a reasonable departure from the guide. In any event, Uranerz will deploy a Rn-222 detector and gamma dosimeter at the fifth point at the Nichols Ranch Unit. **(Note: Table 2-28 has replaced Table 2-23)**

e. Section 2.9.3.3, Nichols Ranch Unit Results, Table 2-23.

i. Provide correct locations for background gamma exposure rates for those listed in Table 2-23 and shown in Exhibit D11-1. The locations identified in Table 2-23 are not consistent with the locations identified in Exhibit D1 1-1.

Response:

The site descriptions in Table 2-29 (formally Table 2-23) and those given on Exhibit D11-1 have been corrected for consistency. Revisions are attached.

ii. As suggested in Regulatory Guide 4.14, the integrated exposure measurements should be made at the sites chosen for air particulate samples. This should include, at a minimum, five locations. Only four locations were reported in the application.

Response:

Uranerz believes the previous responses given under 2.9a and 2.9d are responsive to this comment.

f. Section 2.9.3.4, Hank Unit Results, Table 2-25 dentify what "H" means in Table 2-25. Two results for the third quarter (7/07 to 10/07) were reported as "H" and "H" is unidentified in the table.

Response:

The designation "H" means "not read." Because Uranerz did not achieve 100% data recovery during the one year monitoring period, detectors have been deployed at the locations in the 4th quarter 2008 so that the minimum of one full year of baseline data will be obtained prior to any site development. Table 2-31 (formally Table 2-25) of Section 2.9 has been updated to include the new results for the two readings that were missing.

i. Describe in more detail the vendor product and measuring characteristics of the X-9 gamma dosimeter. In section 2.9.3 of the technical report, the X-9 gamma dosimeter is used to collect integrated gamma exposure.

Response:

A detailed testing report dated June 11, 2007 on the gamma dosimeters is attached to this response (see Attachment 2.9 ii).

Section 3.0 Description of the Facilities

The applicant does not provide sufficient information to assess all the necessary safety aspects of the proposed facilities for extracting and processing uranium. Additional information regarding the extracting process, emissions sources, process monitoring, and instrumentation is requested to allow staff to adequately understand and assess the applicant's proposed facilities. Please provide the following information:

In addition to the answers that Uranerz provides in the following sections, Figure 3-12 Production, Restoration, and Reclamation Schedule was updated.

Section 3.1 ISL Leaching Process and Equipment

The applicant has not provided sufficient information regarding the ISL leaching process and equipment to enable the staff to fully understand this topic and to support other reviews dependent on that understanding. Specifically, the following information should be provided:

a. The design, operation, and monitoring of the wellfield header houses where fluids will be injected and recovered from wellfields.

Response:

In Section 3.4.3 "Wellfield Injection and Recovery Patterns", Uranerz described header houses as small buildings that contain the manifolds that connect to the individual injection and recovery wells. In addition, Section 3.4.3 has been revised to include the following language. A copy of the revised Chapter 3 is attached to this document.

The Nichols Ranch Unit and Hank Unit wellfields will have header houses that contain manifolds with valves, piping, and instrumentation for injection and recovery wells. Each header house will contain up to 60 well accommodations. There are two possible designs for a typical header house, and they are shown in Figures 3-9A Header House Details (see map pocket) and 3-9B Header House Details Ground Level (see map pocket), and the details of the piping and instrumentation for the header house is shown in Figure 3-9C Header House Piping and Instrumentation (see map pocket).

The header houses will be metal buildings. There are two possible designs for the buildings and foundations. Depending on the terrain and logistics in the wellfield, one of the two designs will be used. Design A will have the metal building set on top of a concrete foundation. The concrete foundation will have grating which will allow access to the sub floor containing valves and hose runs. The maximum dimensions for the header houses will be up to 40 feet by 20 feet with a six inch concrete pad floor. The floor will slope to a sump with an automatic level control pump. The sump will pipe to the recovery line and will include check valves. Design B will have the metal building set on a pad. The inside of the building will be designed so that the main connection valves and hose runs are behind one of two walls that run the length of the header house. The walls will be three to four feet from the building edges, and thus allow for maintenance and operators to conduct their inspections and work on the ground level, and not in the sub floor area.

There are two separate solution trunk lines connecting the header houses. One of the trunk lines will take the recovery solutions from the header houses back to the processing plants, and the other trunk line will take injection fluid from the plants out to the header houses for injection into the wellfields. The actual number of header houses will depend on field placement of wells.
At each header house the individual injection and recovery flow and pressure readings can be monitored. Individual well flow readings will be recorded on a shift basis, and the overall wellfield flowrates will be balanced at least once per day. Alternately, flow and totallizer data will be transferred to the main or satellite plant and checked automatically. The recovery and injection trunk lines will have electronic pressure gauges and the information will be monitored from the Unit's control room. The control system will have high and low alarms for pressure and flow. If the pressure and/or flow is out of range the alarms will alert personnel to make adjustments, and certain ranges will signal automatic shutoffs or shutdowns.

b. A discussion of proposed Hank Unit "F" sand bleed and whether it will be sufficient to maintain an inward gradient in the unconfined aquifer conditions in the Hank Unit "F sand" production zone. The discussion should account for the reduced drawdown anticipated in the unconfined setting and for dewatering and mounding of fluids at the production/injection wells.

Response:

Figure 3-15 and 3-16 have been edited to add a location map for the first wellfield in the Nichols Ranch and Hank Units. The rows and column numbers for the output from the simulation were also added to these two Figures to enable the model output to relate to the model outputs easier.

The Hank unit simulation shows that an adequate gradient will be maintained with a 3% bleed rate for the Hank unit. The unconfined aquifer setting at the Hank unit causes the drawdowns to exist closer to the wellfield. The new bleed rate was increased to 3% to extend the gradient reversal out to 400-500 ft. The total magnitude of the drawdowns for the Hank unit will not be as large as those at the Nichols unit because the unconfined aquifer yields more water with smaller drawdowns. An additional simulation was conducted for the Hank unit to show that a small increase in the bleed rate from 3% to 3.2% significantly increases the rate of reversal.

Addendum 3A contains the simulations for the Hank drawdowns.

c. General locations for the underlying and overlying aquifer monitoring wells.

Response:

In Section 3.4.2 "Wellfield Areas", Uranerz describes the following: Vertical monitor wells for overlaying and underlying aquifers are installed accordingly for one monitor well for every 4 acres of wellfield area. The final locations of the vertical monitor wells will be submitted to the WDEQ/LQD in the Production Area Pump Test Document as described in Section 5.7.8. This is because the actual locations might need to be changed because of topography, access, etc.

Uranerz added two figures to Chapter 3. Figure 3-8A Nichols Ranch Unit Proposed Monitor Well Locations, shows the proposed monitor well locations for the Nichols Ranch Unit, and Figure 3-8B Hank Unit Proposed Monitor Well Locations, shows the proposed monitor well locations for the Hank Unit.

d. Methods for timely detection and remediation of leaks in the wellfield at wellheads and in surface and buried lines in the wellfield.

Response:

Uranerz briefly discusses wellfield leak detection in Section 3.5 "Plant Equipment, Instrumentation and Control". The title of Section 3.5 has been modified to say "Equipment, Instrumentation and Control" and includes the new language shown below. Please reference the new section, 3.6 Spills and Excursions. The NRC question 3.5.a addresses spills, inspections, and mitigation procedures. Uranerz references the answer to 3.5.a in conjunction with the answer to this 3.1.d question. A copy of the revised Chapter 3 is attached to this document.

The recovery and injection trunk lines will have electronic pressure gauges and the information will be monitored from the Unit's control room. The control system will have high and low alarms for pressure and flow. If the pressure and/or flow is out of range the alarms will alert personnel to make adjustments, and certain ranges will signal automatic shutoffs or shutdowns. The high and low flow alarms should be very effective in detecting significant piping failures. At each header house the individual injection and recovery flow and pressure readings will be monitored. Individual well flow readings will be recorded on a shift basis, and the overall wellfield flowrates will be balanced at least once per day. Alternately, flow and totallizer data will be transferred to the main or satellite plant and checked automatically.

e. A description of the number, location, design, and capacity of deep disposal wells.

Response:

Uranerz plans to use two Class I – Non Hazardous or Class V deep disposal wells. One of the deep disposal wells (DDW) will be located at the Nichols Ranch Unit and one will be located at the Hank Unit. Uranerz will likely permit two DDW for each unit, but will initially only install one at each Unit. The DDWs will be permitted through the Wyoming Department of Environmental Quality – Water Quality Division. Uranerz is expecting a 100 gpm flow into each of the DDW. As required, the disposal wells will be completed in approved formations. A typical deep disposal well design is depicted in Figure 3-8 (see map pocket). The exact locations will depend on field placement.

f. An explanation for how the applicant will handle waste fluids should the disposal wells become inoperable short term or long term.

Response:

Section 3.2.6 "Sources of Plant Liquid Effluents and Disposal Methods" was modified to include the following new language. A copy of the revised Chapter 3 is attached to this document.

Surge capacity is an important factor in maintaining balance within the main processing plant and the satellite plant. The Nichols Ranch main processing facility has four (4) large tanks with a capacity of over 17,000 gallons each. At a fill rate of forty two (42) gallons per minute (gpm), the surge capacity has approximately twenty four (24) hours. The Hank Ranch satellite facility has six (6) large tanks with a capacity of over 17,000 gallons each. At a fill rate of seventy seven (77) gallons per minute (gpm), the surge capacity has approximately twenty two (22) hours. The waste tanks are shown on Figure 3-3A Nichols Ranch Unit Process Flow Diagram Details and Figure 3-4A Hank Unit Process Flow Diagram Details. These two figures are attached to this document.

Uranerz has three possible solutions to manage surge capacity. One option would be to rent large capacity bladder tanks with secondary confinement. A second option would be to haul the solution over to the other site (Nichols to Hank or Hank to Nichols), and a third option would be to reduce production to minimize the waste tank fill rate, thus minimizing the volume of solution needed to be sent down the deep disposal well.

Section 3.2 Site Facilities Layout

f. Provide (in one location) a specific listing of each potential source of emissions or releases, a clear description (or location on the plant layout figure) of potential source locations, the planned monitoring associated with the potential release, and the preventive/mitigative controls for the potential release. In Chapter 3.0, The applicant addresses what general potential radioactive and chemical emissions or releases wouldexist at the Nichols Ranch and Hank sites, and, in Chapter 4.0, provides some detail on effluent controls.

Response:

The locations for potential sources for radiological emissions in the CPP are the IX columns, the elution circuit area, the precipitation circuit, rotary vacuum dryer room, and yellowcake storage room. In the IX column, elution, and precipitation area, radon could be present. In order to prevent radon build up, building ventilation systems and tank vents will be used. The dryer room and yellowcake storage area could have the potential for radiological airborne particulates if the yellowcake is released. To protect against the airborne release of air particulates, ventilation along with dust collection equipment such as bag houses will be employed. Each of these areas will be monitored as described in Chapter 5, Section 5.7.2. Figures 5-2a and 5-2b show the areas where monitoring will take place.

The Hank satellite location may have the potential of radon in the IX column area. Building ventilation and tank vents will be used to prevent/mitigate any potential release of radon in this area.

Chemicals used in the processing of uranium will be stored and located in areas where they should not have any effect on radiological emissions. The effects of potential accident scenarios such as a plant fire are discussed in detail in Chapter 7.

Section 3.2.7 has been added to reflect the information above

g. Figures 3-3 and 3-4 need to be either re-titled to describe accurately what is shown or re-drawn to display accurately what is labeled. Figures 3-3 and 3-4 are labeled as

"Process Flow" diagrams for the Nichols Ranch Unit and Hank Unit respectively. These figures in fact merely show the general locations of major process equipment in the process buildings.

Response:

Figures 3-3 and 3-4 have been re-drawn to accurately show the Process Flow Diagrams for the Nichols Ranch Unit and the Hank Unit respectively. The new figures are Figure 3-3A Nichols Ranch Unit Process Flow Diagram Details, and Figure 3-4A Hank Unit Process Flow Diagram Details. Copies of the two diagrams are attached to this document.

Section 3.3 Chemical Storage Facilities

Provide detailed and specific descriptions of the process and wellfield instrumentation, controls and radiation safety monitoring instrumentation, including their minimum specifications and operating characteristics. The applicant provides only a general commitment to have instrumentation and controls to monitor production, injection, and waste flows, and to have instrumentation to alarm for system failures. The descriptions of the process and wellfield instrumentation and controls and radiation safety monitoring instrumentation need to be more detailed and specific, including their minimum specifications and operating characteristics (alarms, interlocks, etc.). The descriptions should focus on how the instrumentation and controls are adequate to quickly identify and remedy all potential processing problems that can increase exposures to radiological and chemical hazards.

Response:

Uranerz has consulted with existing ISR mining operations and with system engineers who provide these types of control systems. Based upon this review process, Uranerz believes one option for a control system could be the Allen-Bradley (AB) Programmable Logic Controllers. The AB Controllers could provide control and shutdown interlocks for the Nichols Ranch Unit and Hank Unit. This equipment is currently in service at existing mines in the same geographical area. This platform is designed for use in mining and industrial applications. Uranerz could also utilize fiber optic technology within the main process facility, satellite facility, header houses, and production areas to provide the maximum communications speed available. This technology can allow Uranerz to deal with power failures or flow interruptions in the most efficient manner.

This equipment will be specifically designed to be customized to the Nichols Ranch ISR Project and to optimize process control/shutdown control in the event an anomaly occurs. Application software is developed based upon the final process design. During development of the application software a Process Safety Hazard Analysis (PSHA) will be performed by engineering and operations personnel. During this analysis personnel will identify and define parameters for normal and emergency operation. Final outcomes of the PSHA will be operational descriptions and a Cause and Effect chart that will detail actions to be taken based upon operational events or upsets. This chart will be utilized in the development of interlocks and creation of system shutdowns.

Upon completion of the application software the control system will be tested under controlled conditions at the supplier's facility. During the Factory Acceptance Test the control system will be fully tested to confirm it meets the intent of the design parameters

and shutdown requirements developed during the PSHA and defined in the Cause and Effect chart.

As with the control system platform, Uranerz will investigate and select the most current technology for our instrumentation and field end devices. These end devices will be selected based upon process requirements developed during final process engineering. All instrumentation will be selected based upon intended service. Confirmation of metallurgy, pressure ratings, etc. will be confirmed during the PSHA.

Section 3.5 Plant Equipment, Instrumentation, and Control

Provide the following additional information related to the liquid effluents at the proposed facility:

a. As part of the discussion of potential spills from pipelines and well heads, provide the plans for inspection of these aspects of the facility, including frequency of inspection, and provide the contingency plans and procedures for responding to system failures resulting in liquid waste release, including notifications and recordkeeping.

Response:

URZ has added section 3.6 "Spills and Excursions" to Chapter 3. The section includes the following text, and the revised version of Chapter 3 is attached to this document.

3.6 Spills and Excursions

The proper handling of spills and excursions is extremely important to Uranerz. Uranerz commits to the proper handling and reporting of spills and excursions.

3.6.1 Excursion Reporting

Uranerz Energy Corporation will verbally report to the WDEQ/LQD within 24 hours of becoming aware of noncompliance occurrences which may endanger public health or the environment including monitoring or other information which indicates contaminates endangered an Underground Source of Water (USW), and/or non-compliances with a permit or malfunction of the injection system which caused fluid migration into or between USWs or unauthorized zones. Uranerz will also provide a written report within 7 days of becoming aware of the noncompliance occurrence.

Uranerz will notify the WDEQ/LQD within 24 hours of a second or third confirmation of a noncompliance occurrence in a regularly scheduled sample. The second sample will be conducted within 24 hours upon receipt of the results of the first sample. When the first and second samples agree, a noncompliance occurrence is confirmed. However, if the first and second samples conflict, a third sample will be obtained within 48 hours of the results of the second sample. The excursion will be considered a noncompliance occurrence if the re-samples are not completed within 30 days. Uranerz will also submit a written report within 7 days of the confirmation.

An excursion is controlled when it can be demonstrated that recovery fluid in unauthorized areas is declining. If the excursion is controlled, but the fluid has not been recovered, Uranerz will submit within 90 days of the excursion, a plan and compliance schedule. Monthly reports will be submitted to the WDEQ/LQD until the excursion is over. As part of

a WDEQ/LQD requirement, a map will be generated of areas outside process pads affected by significant spills of process fluids for the respective report year, along with depiction of areas affected by previous years' significant spills. The maps will be included in the Uranerz Annual Report to the WDEQ/LQD and NRC.

Along with the state regulatory reporting requirements, Uranerz will verbally notify the NRC within 48 hours of becoming aware of a noncompliance occurrence reportable to the WDEQ/LQD. Within 30 days of becoming aware of the noncompliance occurrence, Uranerz will also submit a written report in compliance with NRC license conditions.

3.6.2 Maintenance, Spill Prevention and Spill Reporting

In the event that a significant spill occurs in the wellfield or process plants, measures will be taken to safely and quickly contain the spill and mitigate the impacts of any released material. Proper notification of plant and corporate management will be made along with properly contacting the NRC and WDEQ/LQD.

Administrative and engineering controls will be established to limit both surface and subsurface releases to the environment and to mitigate the effects should a release occur. These controls, including response actions, will be implemented by operating procedures.

Releases can be of two primary types at an in-situ uranium recovery facility: surface releases such as vessel failure, piping failure, etc.; and subsurface releases such as well excursion or piping failure.

Liquid effluents are expected to be generated from well development water, pumping test water, process bleed, process solutions, wash-down water, and restoration water. The water generated during well development and pumping tests is expected to satisfy WDEQ/WQD Class III (Livestock) standards at a minimum and has minimal potential radiological impact on soils or surface water. No alternate handling or disposal method is required allowing water to be pumped onto the ground.

The process bleed and wash down water will be transferred to a deep disposal well. This deep disposal well will be equivalent in design and depth to existing deep disposal wells at similar ISR uranium recovery sites. This deep disposal well will be permitted through the WDEQ and operated according to permit requirements.

The restoration water will be treated by reverse osmosis or other purification technology. The treated restoration water will be re-injected into the production area undergoing restoration with the restoration water bleed transferred to the deep disposal well.

3.6.3 Flow Alarms for Leak Detection

The Uranerz Standard Operating Procedures (SOP) will address alarm responses, automatic shutdowns, and start up after automatic shutdowns. The SOPs at both the Nichols Ranch Unit and Hank Unit facilities will be designed to minimize the risks of uncontrolled releases of recovery fluids, chemicals, and plant fluids, and provide the maximum safety and protection to the environment and personnel. Activation of the flow alarms prompts corrective actions which inherently include inspection for leaks and spills.

At each header house the individual injection and recovery flow and pressure readings

can be monitored. Individual well flow readings will be recorded on a shift basis, and the overall wellfield flowrates will be balanced at least once per day. Alternately, flow and totalizer data will be transferred to the main or satellite plant and checked automatically. The recovery and injection trunk lines will have electronic pressure gauges and the information will be monitored from the Unit's control room. The control system will have high and low alarms for pressure and flow. If the pressure and/or flow is out of range the alarms will alert personnel to make adjustments, and certain high or low readings will signal automatic shutoffs or shutdowns.

3.6.4 Inspections for Wellfields and Header Houses

In the Uranerz NRC Technical Report, Section 5.3 "Management Audit and Inspection Program" discusses "operating wellfields and header houses". An Environmental, Safety, & Health staff representative or designate will conduct a daily walk through inspection of the process and storage areas, operating wellfields, and header houses. The inspection will provide for a visual survey of proper implementation of procedures, housekeeping, and contamination control.

b. Provide information on the ability of the sump system to handle the volume of the largest hazardous materials source.

Response:

Section 3.2, "Site Facilities Layout" has been modified to include the following information. A copy of the revised Chapter 3 is attached to this document.

The central processing plant at the Nichols Ranch Unit and the satellite plant at the Hank Unit will each have a concrete foundation. The concrete foundation will have concrete curbed side walls. The height of the concrete sides will be such that the curbed foundation will contain the volume of the largest tank located at that Unit. Any of the spills located within the curbed foundation areas will be considered contained spills. The Unit's foundation will be sloped toward multiple sump pumps. If the sump pump is in a production area, the fluid may be pumped back into the process circuit. However all sump pumps will also be routed to the waste tanks to be pumped down the deep disposal well.

Section 4.0 Effluent Controls System

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

Section 4.1 Gaseous and Airborne Particulates

a. General Comments

i. Describe the work area ventilation system in more detail. In general, the current description of the ventilation system is not adequate. For example, the discussion should include how many fans are used to ventilate the

general area facility, the intake and exhaust points for the general area ventilation, the general area ventilation intake flow rate into the facility, the exchange rate and how radiation monitors are used to measure effluent releases. Consider that open doorways and convection vents will assist in providing satisfactory work area ventilation.

Response:

Preliminary general area ventilation design work for the Nichols Ranch ISR CPP includes the installation of four fans with a design capacity of 10,000 cfm per each fan. Two of the fans will be located in the IX area, one in the elution/precipitation area, and one fan in the yellowcake storage area. The four fans will be capable of producing an air exchange rate of approximately 2.7 air exchanges per hour. As stated in Section 4.1.1.1 of the Technical Report during favorable weather conditions, open doorways and convection vents will assist in providing ventilation to the general work area. When conditions exist, such as winter conditions, the four fans will provide adequate ventilation to the general work area if doorways must be shut. The building will also be heated in the winter months to maintain comfortable temperatures within the CPP.

Preliminary general area ventilation design work for the Hank Satellite includes the installation of two fans with a design capacity of 10,000 cfm per each fan. The two fans will be located so that one fan is on a separate half of the Hank Satellite processing building. The air exchange rate for the two fans is approximately 3.1 air exchanges per hour. Like the Nichols Ranch CPP, during favorable weather conditions, open doorways and convection vents will assist in providing ventilation to the general work area. The Hank Satellite processing building will also be heated during the winter months to maintain comfortable temperatures within the processing building.

Section 4.1.1.1 has been revised. Figures 4-1 and 4-2 have been added to Chapter 4. The figures depict the preliminary ventilation system at the Nichols Ranch CPP and the Hank Unit Satellite.

ii. Describe the acceptable radiation monitoring criteria and flow rates for these systems.

Response:

It is not practicable to provide radiation monitoring of the work area ventilation system. However, monitoring will be provided of the work area atmosphere as described in the Technical Report at Section 5.7.3 Airborne Radiation Monitoring Program. The results of this monitoring, in combination with the flow rate and run time of the work area ventilation system, may be used to estimate a quantity of radioactivity released to the environment.

Monitoring of radioactivity concentration in environmental media, described in the Technical Report at Section 7.7.7 Airborne Effluent and Environmental Monitoring, will also provide an assessment of radioactivity released from the work area ventilation system.

A conservative estimate of the quantity of radioactivity released to the environment from operation of the facility is provided in the Technical Report at Section 7.3 RADIOLOGICAL EFFECTS.

iii. Provide a map or diagram (similar to Figure 5-2a and Figure 5-2b) that shows the ventilation system.

Response:

Figures 4-1, Nichols Ranch CPP Ventilation Diagram, and Figures 4-2, Hank Ventilation Diagram have been added to Chapter 4 to show the preliminary ventilation system.

iv. Describe what is meant by "a satisfactory work area ventilation."

Response:

Process design and engineering controls will be used to control the concentrations of radioactive material in air. Ventilation will be used in these regard to prevent the existence of airborne radioactivity areas. The concentration of radioactive material will particularly be controlled to meet the design objectives provided in the first two bullets of Technical Report at Section 4.1 GASEOUS AND AIRBORNE PARTICULATES. The concentration of radioactive material will otherwise be maintained ALARA. The phrase "satisfactory work area ventilation" is a general reference to satisfaction of these requirements and objectives.

v. In Figure 5-2a, explain why radon airborne radioactivity monitoring is not conducted in the YC Drum Storage area.

Response:

The drummed yellowcake is not a radon source term. The YC (Yellowcake) Drum Storage will not share passive ventilation with main process area; e.g., the doors of the Motor Control Center will remain closed except during normal ingress/egress. The Dryer area will be maintained under negative ventilation thus precluding radon passing from the main process area through the Dryer area to YC Drum Storage. Finally, the YC Drum Storage includes a dedicated fresh air intake from outside the building.

b. Section 4.1.2, TR-133

i. In Section 4.1.2, explain what is meant by "low intermittent air flow." In Section 4.1.2, sixth bullet, the applicant states that the low intermittent air flow exiting the vacuum system precludes sampling of this effluent.

Response:

The term "low" refers to the pressure equalization that occurs in the vacuum pump of scrubber/condenser circuit of the rotary vacuum dryer system. With that, a vent is present so that the scrubber/condenser circuit does not become pressurized. The term intermittent refers to the condition that the dryer will not be in continuous operation. The dryer is expected to operate for part of each of two shifts per day; e.g. about 12 of every 24 hours.

ii. In Section 4.1.2, demonstrate why sampling of the effluent is not necessary.

Response:

Uranerz proposes to use vacuum dryer technology in its drying and packaging operation. In a vacuum dryer, the heating source is contained in a separate, isolated system so that no radioactive materials are entrained in the heating system or the exhaust it generates. The drying chamber containing yellowcake is subjected to vacuum pressure. Moisture in the yellowcake is the only source of vapor remaining in the system. Any potential leak would result in outside air flowing into the dryer system.

Emissions from the drying chamber are treated in two phases. First, all water vapor is drawn through a bag filter to remove yellowcake particulates with an efficiency exceeding 99 percent. Captured particulates are returned to the drying chamber. Second, all water from the drying chamber is condensed by cooling. The vapor is drawn through a water jacket and condensate, thereby capturing virtually all particulates escaping the bag filter. The condensate is then returned to the uranium precipitation circuit at the facility.

Sampling of the effluent from vacuum dryer is considered unnecessary based on NRC recognition of the efficiency of vacuum dyers:

- NUREG-1508, Section 2.1.2.1: "HRI proposes to use vacuum dryer technology in its yellowcake drying and packaging system ...This technology would result in zero emissions, and require no ventilation from the drying chamber to the atmosphere."

- NUREG/CR-6733, Section 2.2.3: "Newer plants usually employ vacuum yellowcake dryers. ... This process captures virtually all escaping particulates."

- NUREG-1569

  - Section 4.1.3 (3): "... Aspects of design that can significantly limit airborne releases include ... the use of vacuum dryers that eliminate airborne uranium particulate releases from drying operations."

- Section 5.7.1.1: "For example, the use of vacuum packaging equipment has been shown to eliminate uranium releases from packaging operations."

Uranerz will ensure that the manufacturer-recommended vacuum pressure is maintained in the drying system during periods of yellowcake drying. This shall be accomplished by continuously monitoring differential pressure and use of audible and/or visual alarm if the air pressure differential falls outside manufacturer specifications. The alarm operability shall be checked and recorded per shift. Additionally, yellowcake drying operations shall be immediately suspended if any emission control equipment for the yellowcake drying or packaging areas is not operating within manufacturer specifications.

Section 4.2 Liquids and Solids

Section 4.2.1 Liquid Effluents

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

a. Information on the expected chemical and radiological composition of the liquid waste stream to be disposed of in the deep wells.

Response:

An expected chemical and radiological composition of the liquid waste stream to be disposed of in the deep wells that is based on a currently operating ISR operation is described as follows:

Constituent	mg/l *
Ammonia as nitrogen	~ 1
Sodium	50 - 100
Calcium	400 - 700
Potassium	15 - 30
Bicarbonate as HCO3	500 - 700
Carbonate as CO3	0
Sulfate	600 - 800
Chloride	150 - 900
TDS	1900 - 3200
Uranium as U3O8	1 - 10
Ra-226, pCi/l	900 - 3200
pH, standard units	5 - 7

* unless otherwise indicated

b. A demonstration that well development and pumping test water will have a minimal potential I radiological impact on soils or surface water.

Response:

The water that is used during drilling operations and well development is normally drawn from an aquifer that is not in the production area. This water is either from CBM wells, a

pre-existing well, or another well that has been developed for the purpose of supplying drilling water. The water that is used during drilling operations and well development is contained in a mud pit, recycled throughout the drilling process, and then allowed to evaporate. This water does not contain significant concentrations of radioactivity thus not contributing any radiological impact to surface soil.

Water from pump tests of production wells is drawn from the well being tested. This water is discharged and distributed over the local area while the pump test is taking place. Even though a pump test may run for some time with water that could have high Ra values, the water will have little radiological impact to the soils since it is distributed over an area and is not a constant stream. A maximum soil loading of Ra-226 may be estimated as follows:

Given:

- Ra-226 in pump test water = 562 pCi/l (Technical Report, Table 2-14, maximum Ra-226 for F Sand wells)
- Pump test discharge rate = 20 gallons per minute
- Pump test discharge period = 48 hours
- Local soil density = 110 pounds per cubic foot (1.76 g/cm^3)
- Soil contact area = 100 m^2
- Soil contact depth = 0.15 m
- Fraction Ra-226 retained in soil = 1

Result:

- The calculated Ra-226 in contacted surface soil = 4.6 pCi/g

This maximum estimate of Ra-226 in soil does not exceed the standard in 10 CFR Part 40, Appendix A, Criterion 6(6).

Surface water will not be impacted by well development and water discharged from pump tests because no surface water currently exists at either location. As stated above, well development water is allowed to evaporate and kept confined to the mud pit. Water discharged from pump tests is distributed over the local area.

c. The basis for the number of deep wells needed for liquid waste disposal.

Response:

Two deep disposal wells are planned for the Nichols Ranch ISR Project. The use of the deep disposal wells is described in the Technical Report at Section 3.2.6 Sources of Plant Liquids and Disposal Methods, including a water balance between deep disposal well flow rate capacity and the anticipated maximum flow rates of waste waters to the deep disposal well.

d. Plans for inspection of pipelines and well heads as part of the discussion of potential spills from the facility, including frequency of inspection, and the contingency plans and procedures for responding to system failures resulting in liquid waste release, including notifications and recordkeeping.

Response:

Inspection of the wellfield and associated systems is discussed in Chapter 3, Section 3.6.4. Spill Prevention and Spill Reporting are discussed in Section 3.6.2 of Chapter 3 of the Technical Report. Additionally, questions 3.1d, 3.5a, and 5.2b addresses this topic.

Section 4.2.2 Solid Wastes

Please provide a statement that the applicant will notify NRC staff within 7 days if any disposal agreement is terminated and will submit a new agreement to NRC staff for approval within 90 days of expiration or termination. Also, discuss why soils contaminated from operations (spills, leaks, etc.) are not included in the listing of contaminated solid wastes.

Response:

Section 4.2.2.2 Contaminated Solid Waste has been revised to include the requested statement regarding notifications of status of disposal agreement(s). A new statement has been added and an existing statement revised in Section 4.2.2.2 to include contaminated soils within the scope of a disposal agreement.

Section 5.0 Operations

Section 5.1 Organizations

Provide information on the integration among management groups below senior management that support the operation and maintenance of the facilities. The description of the applicant's organization provides no information on the integration among groups below senior management that support these functions. The applicant needs to show this integration aspect of the site organization, including integration between plant construction and plant management. Demonstration of this integration is necessary to all the staff to determine whether or not the corporate structure is appropriate to operating the Nichols Ranch project safely.

Response:

Section 5.1 Organization has been revised to include description of responsibility and authority for Line Management i.e. groups below senior management. The description of Mine Superintendent has been revised, and the descriptions of Line Management include that these organization elements have responsibility for construction and operation activities. Note also that this condition is also recognized with the second sentence of Section 5.1.1 Management.

Section 5.2 Management Control Program

Providing the information presented below will allow NRC staff to ensure that the proper information is being reported and cultural resources will be protected.

a. Please provide a commitment to administer a cultural resources inventory before engaging in any development activity not previously assessed by NRC, and that any disturbances associated with such development will be completed in compliance with the National Historic

Preservation Act, the Archeological Resources Protection Act, and their implementing regulations. In addition, please provide a commitment to cease any work resulting in the discovery of previously unknown cultural artifacts to ensure that no unapproved disturbance occurs.

Response:

A new Section 5.2.3 Cultural Resources Inventory has been added incorporating the requested commitment.

b. Specify that spills, leaks, or excursions will be reported per 10 CFR Part 40.60.

Response:

A new Section 5.2.1.4 Reporting has been added incorporating the requested statement.

c. Specify the contents of an annual report that will be submitted to the NRC.

Response:

Section 5.2.2.4 SERP Reports has been revised to specify the content of an annual report that will be submitted to the NRC.

d. Note that Section 5.2.2.4, "SERP Reports," consists of the identical language that is in Section 5.2.2.3, "SERP Records." Correct this error so that Section 5.2.2.4 discusses reports, not records.

Response:

Section 5.2.2.4 SERP Reports has been revised to include the correct information.

Section 5.6 Security

Please specify the type of fencing proposed to provide security for all wellfields and processing areas. This information is necessary to allow the staff to assess the degree to which the access to radiation or other controlled areas by the public will be limited.

Response:

Section 5.6 Security has been revised to describe use of 3-strand livestock fence around the wellfield and chainlink fence around the process areas.

Section 5.7 Radiation Safety Controls and Monitoring

Section 5.7.1 Effluent Control Techniques

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

a. Section 5.7.1.1.1, Particulate, TR-1 52. It states in the last sentence in the first paragraph, "This type equipment has been shown to eliminate particulate releases from drying and packaging activities at ISR uranium processing facilities." Please demonstrate that this system will not release any particulate emissions.

Response:

Uranerz believes that the response given in Section 4.1 b. ii. is applicable here.

b. Section 5.7.1.1.1, Particulate, TR-152.

i. It states in the second paragraph, first sentence, "Additionally, the vacuum drying and packaging will occur in a dedicated room or enclosure." Figure 3-1, shows two areas. Describe the room or enclosure in terms of dimensions, ventilation flow, and potential release points, as well as how the dryer and YC drum storage relate to each other.

Response:

The room housing the yellowcake dryer (dryer room) is more clearly depicted on Figure 4-1. The dryer room is a single room containing the drying and packaging equipment and operations. Preliminary design dimensions of the dryer room will be 60' L x 60' W x 30' H. The dryer room will be ventilated by the emission control system of the dryer (see also Section 4.1.2). The dryer room will be maintained at a negative pressure during drying and packaging operations. The room will be ventilated to satisfy the criteria in the Technical Report at sections 4.1 GASEOUS AND AIRBORNE PARTICULATES, and 5.7.3 Airborne Radiation Monitoring Program.

The potential release points of uranium in the dryer room are during filling of the dryer and filling of the yellowcake packagings. Spill during fill of the dryer would not be expected to create significant airborne radioactive material due to the high moisture content of the yellowcake at this point (50% or greater), allowing the yellowcake to behave like a sludge. During filling of the yellowcake packagings, local ventilation from the emission control system will prevent significant airborne release during normal operation. A dead-man switch on the fill mechanism will prevent unintended flow of yellowcake when filling packagings.

The dryer room will not normally be accessible from the main process area or the YC (yellowcake) Drum Storage. The dryer room will include a conveyor system for moving the filled yellowcake packages into the adjacent YC Drum Storage.

ii. Discuss the relationship using maps or system diagrams of the equipment of the independent ventilation and filtration systems within this room or enclosure.

Response:

A process flow diagram of the yellowcake dryer emission control system is provided in Figure 5-1a.

iii. Describe in additional detail, all major operational activities or tasks that will take place in this area.

Response:

The major operational activities and tasks that will occur in the dryer room include:

1. Loading the dryer – Wet yellowcake from an intermediate process vessel will be moved mechanically and/or by gravity into the dryer. The dryer will be loaded to a level recommended by the manufacturer. The yellowcake dryer will be loaded with a known volume or weight of yellowcake; the volume or weight will be determined by level gauge and/or weigh scale, or other equivalent device, or visually by an operator.

2. Operating the dryer – The dryer will be operated as recommended by the manufacturer.

3. Filling the yellowcake packagings – The dried yellowcake will be moved mechanically and/or by gravity into the yellowcake packagings. The yellowcake packaging will be filled with a known volume or weight of yellowcake; the volume or weight will be determined by metering gauge and/or weigh scale, or other equivalent device. The yellowcake packagings will be filled one at a time.

4. Moving the yellowcake packages to storage – A closure will be loosely fitted to the filled yellowcake packaging (yellowcake package); this will allow cooling without pressure buildup from remaining entrained moisture. The exterior of the yellowcake package will be cleaned (e.g., wiped) to remove contamination. The yellowcake package will be moved by manual and/or mechanical means to storage for additional cooling and remaining preparation for shipment.

5. Maintenance of the emission control system – Routine maintenance of the emission control system will be performed according to manufacturer recommendations.

6. Maintenance of the dryer system – Routine maintenance of the dryer system will be performed according to manufacturer recommendations.
7. Housekeeping – Housekeeping activities to include routine cleaning of equipment and surfaces will be performed on a schedule and pursuant to

results of routine contamination surveys.

8. Cleanup and decontamination – Cleanup and decontamination will be performed as required by operations, contamination surveys, or other indicator.

Items 1 through 4 will be conducted in accordance with a written operating procedure. Items 5 through 8 will be conducted in accordance with a written operating procedure and/or a radiation work permit.

c. Section 5.7.1.1.1, TR-152

i. Describe in detail, the operations and emission controls for yellowcake drying and packaging with respect to the monitoring parameters and set points.

Response:

The yellowcake drying and packaging system including the emission controls has not been specifically identified. Thus particular monitoring parameters and set points cannot be described. However, the response provided for item 4.1 b. ii. provides a general description.

ii. Describe how entry to this room or enclosure will be controlled.

Response:

Access controls will be established at the point(s) of ingress/egress for the dryer room. The fundamental controls will include performance of a visual and radiation survey prior to exiting the dryer room. The radiation survey will be subject to the requirements described in the Technical Report at Section 5.7.6.3 Surveys for Contamination of Skin and Personal Clothing.

Ingress/egress requirements will include donning/doffing personal protective equipment dependent on the activities occurring in the dryer room. The access control point(s) will include provisions for storage of potentially contaminated items prior to personal radiation survey and exit. The access control will also include provisions for local decontamination of personnel and/or containment of contamination for movement to a suitable decontamination area. The access control requirements for normal activities will be described in a written procedure. These requirements will also be duplicated and supplemented with local postings.

The access control requirements for non-normal activities (e.g., maintenance) will be described in a radiation work permit.

iii. Please describe the manner in which the applicant will determine the amount of material released In the event of a mechanical failure or human error operating the equipment.

Response:

The yellowcake drying and packaging system will be operated on a batch basis. The yellowcake dryer will be loaded with a known volume or weight of yellowcake; the volume or weight will be determined by level gauge and/or weigh scale, or other equivalent device, or visually by an operator. The dried yellowcake will be discharged from the dryer into the prescribed packaging. The yellowcake packaging will be filled with a known volume or weight of yellowcake; the volume or weight will be determined by metering gauge and/or weigh scale, or other equivalent device. Then net weights or volumes can be determined of material remaining in the system and thus also of material released in the event of a mechanical failure or human error operating the equipment. Otherwise, an acceptable estimate of released material can be provided by combination of visual estimate of volume and a known density of the yellowcake.

d. Section 5.7.1.1.1, TR-152 and Section 5.7.1.1.2, TR-153. Describe the minimum performance specifications for the operations of the effluent controls and the frequencies of tests and inspections to ensure proper performance to specifications.

Response:

The yellowcake drying and packaging system including the emission controls has not been specifically identified. Thus performance specifications and the frequencies of tests and inspections for the operation of the effluent controls cannot be described. However, the response provided for item 4.1 b. ii. provides a general description.

Section 5.7.2 External Radiation Exposure Monitoring Program

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

a. Describe the possible major work activities in the plant and wellfields, including CBM work activities in the Nichols Ranch ISR Project area, and the anticipated exposure rate levels that may be expected in these areas.

Response:

The major work activities in the process areas are those typical of operation and maintenance within general industry: cleaning, use of hand and power tools, and operating small and mid-sized machinery remotely or locally. Workers in the process areas may be potentially exposed to elevated gamma exposure rates during operations and maintenance activities. Operations and maintenance activities may occur in or near Radiation Areas. Industry experience reveals that personnel working at *in situ* uranium recovery facilities are not likely to exceed 10% of the external occupational dose limit.

The major work activities in the wellfields are those common to installation of shallow and moderate depth wells: use of hand and power tools, use of mid-sized powered

equipment, and handling pipe and fluids. Typically, exposure rates in the wellfield will not exceed background gamma exposure rates. An anticipated exception is immediately adjacent to wellheads and headerhouses, where scale formed on the inside surfaces of piping may contain radium, resulting in increased local gamma exposure rates. Industry experience reveals that personnel working at *in situ* wellfields are not likely to exceed a few percent of the external occupational dose limit.

The CBM work activities are expected to be of the same type as for installation of the *in situ* wellfields except occurring less frequently (fewer wells) but perhaps longer duration per well due to deeper drilling. Exposure rates at CBM site are not expected to be different than background because no radioactive materials are being recovered through the CBM wellfield. The CBM workers are not expected to be in the vicinity of *in situ* wells or the process area. Personnel working at CBM wellfields are not likely to receive an external dose different than that attributable to background.

b. Describe those areas where elevated exposure rates are anticipated.

Response:

Areas where elevated exposure rates are anticipated include the ion exchange columns, filter housings that remove solid materials from the production and injection streams, tank bottoms where solid material may collect, and yellowcake storage. The gamma dose rates from these areas may exceed 5 mrem per hour and may require posting as Radiation Areas. Radiation Areas are not expected to occur in the wellfield.

c. Describe how the external radiation exposure monitoring program will be integrated with the exposure calculations.

Response:

The result from the individual monitoring device as deep dose equivalent will be summed with the result of monitoring for internal dose as committed effective dose equivalent to derive the total effective dose equivalent. The result from the individual monitoring device as deep dose equivalent will be summed with the result of monitoring for internal dose as committed dose equivalent to derive the dose to any individual organ or tissue, other than lens of the eye. These results will be recorded on NRC Form 5 or equivalent for each monitored individual.

d. Describe the type of survey instruments (i.e., G-M, Proportional, etc.), including instruments used for beta measurements that will be used to conduct exposure rate surveys, and the range of each type of survey instrument.

Response:

The following instruments will be used to conduct exposure rate surveys:

- Low level gamma survey meter
  - Handheld
  - Battery operated
  - NaI(Tl) scintillator
  - Zero to 5000 microR per hour

- Exposure rate survey meter
  - Handheld
  - Battery operated
  - Ion chamber
  - Zero to 5000 milliR per hour

The following instruments will be used to conduct dose rate surveys accounting for beta:

- Exposure rate survey meter
  - Handheld
  - Battery operated
  - Ion chamber
  - Zero to 5000 milliR per hour
  - Retractable phenolic slide
  - Mylar window
  - Correction factor for open window measurements (beta dose) determined from calibration against a uranium metal slab.

e. Explain why survey instruments would only need to operate to the maximum range of 5 mrem per hour. Describe those instruments that could be used to document exposure rates exceeding 5 mrem per hour?

Response:

Section 5.7.2.2 Exposure Rate Surveys included a typographical error; five mrem has been revised to read 5 rem. Instruments used to document exposure rates are described in the previous response.

f. Discuss and define action levels that would require more frequent exposure rate surveys.

Response:

Section 5.7.2.2 Exposure Rate Surveys has been revised to include action levels for increasing frequency of surveys.

g. Section 5.7.2.1, Personnel Monitoring, TR-155

i. The applicant does not identify the group or category of workers who will receive the greatest external occupational dose. Define all groups or category of workers and identify those groups or category of workers who will receive occupational doses in excess of 10% of the applicable external occupational dose limit.

Response:

Section 5.5 Training identifies categories of personnel as follows:

- Visitor, to include employee or contractor, requiring escorted access to controlled or restricted areas. Personnel of this category will not be provided an individual monitoring device.

- Employee or contractor requiring unescorted access to controlled or restricted areas but will not work around radiation and/or with radioactive

materials. Personnel of this category will not be provided an individual monitoring device.

- Employee or contractor requiring unescorted access to restricted areas and will work around radiation and/or with radioactive materials. This category of personnel is not expected to receive an occupational dose in excess of 10 % of the applicable limit, however employees in this category will be provided individual monitoring devices.

ii. Identify those groups or category of workers who will not receive individual monitoring devices.

Response:

A response to this item is provided above (item 5.7.2 g. i.)

h. Section 5.7.2.2, Exposure Rate Surveys, TR-156. The applicant states that exposure rate surveys will be performed on at least a quarterly frequency in the process areas. The applicant does not identify the frequency of exposure rate surveys at other locations other than the process areas. Identify the locations and frequency of exposure rate surveys at other locations not depicted in Figure 5.2a and Figure 5.2b.

Response:

Section 5.7.2.2 Exposure Rate Surveys has been revised to include an exposure rate survey of controlled and unrestricted areas at least quarterly.

Section 5.7.3 Airborne Radiation Monitoring Program

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

a. Section 5.7.3.1.2, Area, TR-158

i. In Section 5.7.3.1.2 of the technical report, it states, "This type of air sampling will be used routinely for drying and packaging activities". Explain the phrase, "This type of air sampling."

Response:

Section 5.7.3.1.2 Area has been revised to specifically refer to Area air samples.

ii. Discuss in more detail the frequency of sampling.

Response:

Section 5.7.3.1.2 Area has been revised to reference the sampling frequencies of NRC Regulatory Guide 8.30 "Health Physics Surveys in Uranium Mills", Revision 1, 2002 at Section 2.3.

b. Section 5.7.3.1.3, Action Level and Limit, Tr-158

i. In Section 5.7.3.1.3 of the technical report, it states that the administrative action will be established for these types of air samples of one derived air concentration (DAC). Explain the phrase "these types of air samples."

Response:

Section 5.7.3.1.3 Action Level and Limit has been revised to specifically refer to breathing zone and area air samples.

ii. The administrative level is not consistent with the ALARA philosophy and Regulatory Guide 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities will be As Low As Is Reasonably Achievable" and Regulatory Guide 8.30, "Health Physics Surveys in Uranium Recovery Facilities," which provides guidance to establish administrative action limits to protect the workers and investigate air sample results that are above the normal fluctuations. The use of one DAC is considered too high for an administrative action level. Develop an administrative action level consistent with the aforementioned regulatory guides.

Response:

Section 5.7.3.1.3 Action Level and Limit has been revised to provide and administrative action level of 0.25 DAC.

iii. Provide clarification to Section 5.7.3.1.3. The limits and values cited in this section for the administrative action limit require clarification for establishing airborne radioactivity areas (See Regulatory Guide 8.25, Section 1.7). Regulatory Guide 8.31, Section 3.3, provides design objectives for ventilation systems. This design objective should be sufficient to maintain airborne concentrations to less than 25% of the DAC. Thus, establishing an administrative limit of one DAC would exceed the design objective of Regulatory Guide 8.31. Regulatory Guide 8.30, Section 4.0, provides guidance to establish administrative action limits to protect the workers and investigate air sample results that are above the normal fluctuations and that should be less than 25% of the DAC.

Response:

Section 5.7.3.1.3 Action Level and Limit has been revised to provide an administrative action level of 0.25 DAC and to clarify that the administrative limit is applicable to air sample results associated with personnel monitoring.

c. Section 5.7.3.4, Respiratory Protection Program, TR-159

i. In Section 5.7.3.4, Respiratory Protection, discuss the basis for the 220,000 dpm per 100 m^2. Include in the discussion whether this value represents gross alpha, gross beta, or beta/gamma activity.

Response:

The basis for use of 220,000 dpm per 100 m^2 is Regulatory Guide 8.30, "Health

Physics Surveys in Uranium Recovery Facilities", Section 2.5, fifth paragraph (1st full paragraph of page 8.30-12). Section 5.7.3.4 Respiratory Protection Program has been revised to indicate the value represents removable alpha activity.

Section 5.7.4 Exposure Calculations

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

a. Opening paragraph, first sentence, TR-160. It states that the methodologies to calculate intake of radioactive materials by personnel in work areas where airborne radioactive material may exist are in accordance with 10 CFR 20.1204, and 20.1201. The applicant does not provide any methodologies. Provide methodologies that show the equations and input parameters for all intake pathways.

Response:

The opening paragraph of Section 5.7.4 Internal Dose Calculations has been revised to more clearly indicate intended practice. The methodologies are provided in the third paragraph of revised Section 5.7.4 by reference to NRC Regulatory Guide 8.30, "Health Physics Surveys in Uranium Recovery Facilities", 2002 and NRC Regulatory Guide 8.34, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses", 1992.

b. Section 5.7.4.1, Uranium, TR-160

i. In Section 5.7.4.1, Uranium, it states that the predominant method for calculating intake of uranium will be compared to the DAC value of 10 CFR 20, Appendix B Table 1, Column 3 for natural uranium. Discuss this predominant method and whether this predominant method justifies the basis for this DAC value.

Response:

Sections 5.7.4 Internal Dose Calculations and 5.7.4.1 Uranium have been revised to more clearly indicate intended practice.

ii. In Section 5.7.4.1, it states that a solubility classification "D" will be assigned to all uranium at the Nichols Ranch ISR project sites. Justify the basis for this decision.

Response:

Section 5.7.4.1 Uranium has been revised to include a reference for basis of solubility classification; i.e. Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities, March 2002, Section 2.2. Supportive reference is provided here by Metzger, Robert L, et. al., Solubility Characterization of Airborne Uranium from an *In Situ* Uranium Processing Plant, Health Physics, Volume 72, pages 418 – 422, 1997.

c. Section 5.7.4.3, Prenatal and Fetal Radiation Exposure, TR-161. Provide and discuss the methods used to calculate prenatal and fetal radiation exposures. In the discussion, identify when the more detailed methodology will be used.

Section 5.7.4 3 Prenatal and Fetal Radiation Exposure has been revised to more clearly indicate intended practice.

Section 5.7.5 Bioassay Program, pg. TR-161

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

a. Specify reporting procedures and record keeping, including record retention.

Response:

Reporting and recordkeeping are describe in sections 5.2.1.4 Reporting and 5.2.1.3 Recordkeeping, respectively. These sections have been revised to indicate reference to reporting requirements of 10 CFR 20 Subpart M and to include bioassay results in the individuals exposure history file, also respectively.

b. Indicate how the bioassay results will be used to confirm results derived from the airborne radiation monitoring program and exposure calculations.

Response:

Section 5.7.5 Bioassay Program has been revised to more clearly indicate that bioassay results will be used to confirm results of the airborne radiation monitoring program in accordance with NRC Regulatory Guide 8.22 "Bioassay at Uranium Mills", 1988, Table 1, column "Interpretation". Bioassay results may be used for exposure calculations (see revised Section 5.7.4) but will not be used to confirm exposure calculations.

c. Indicate how the bioassay program will meet the requirements of 10 CFR Part 20, Subpart L and M, requirements for records and reporting, respectively.

Response:

Reporting and recordkeeping are describe in sections 5.2.1.4 Reporting and 5.2.1.3 Recordkeeping, respectively. These sections have been revised to include bioassay results in the individuals exposure history file and to indicate reference to reporting requirements of 10 CFR 20 Subpart M, also respectively.

d. Describe the procedures that will be followed in the event that a bioassay result is above the action level.

Response:

Section 5.7.5 Bioassay Program has been revised to more clearly indicate that action levels and actions for bioassay results are those of NRC Regulatory Guide 8.22 "Bioassay at Uranium Mills", 1988, Section 5 and Table 1.

Section 5.7.6 Contamination Control Program

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

a. General Comment(s)

i. Discuss how contamination will be measured in the drying and packaging areas and at what contamination limits would the applicant enforce the use of personal protective equipment (PPE) including respiratory protection.

Response:

Section 5.7.6.1 Surveys for Surface Contamination in Restricted Areas has been revised to indicate an inspection of the drying and packaging areas for visible yellowcake will be made at least once per shift when these areas are in use. Section 5.7.6.1 Surveys for Surface Contamination in Restricted Areas has also been revised to indicate a survey of the drying and packaging area for removable contamination will be made daily when these areas are in use.

Personal protective equipment during drying and packaging will include coveralls, safety shoes, gloves, and other equipment as conditions warrant (e.g. hearing protection, safety glasses, ...). Section 5.7.3.4 Respiratory Protection Program has been revised to describe that respiratory protection will be used when airborne radioactivity levels are known or expected to exceed 0.25 DAC or when surface contamination levels are known or suspected to exceed 220,000 dpm/100cm^2.

ii. Discuss the contamination controls used for wellfields.

Response:

The wellfields will be managed as controlled areas pursuant to 10 CFR 20.1003. A new Section 5.7.6.2 Surveys for Surface Contamination in Controlled Areas describes surveys for surface contamination in controlled areas.

b. Section 5.7.6.3, Surveys for Contamination of Skin and Personal Clothing, TR-163. In Section 5.7.6.3, it states that all personnel leaving the restricted area will be required to survey the soles of their shoes and the alpha contamination limit is 5000 dpm/1 00 cm^2. In the third paragraph of this section it states that, *in lieu* of showering, employees are required to survey their clothing, shoes, hands, face and hair with an alpha survey instrument prior to leaving the site. The alpha contamination limit for these surveys is 1000 dpm/100 cm^2. Explain in more detail the basis for the difference between these two surveys and how the applicant will ensure that personnel leaving the restricted area will meet the removable contamination limit of 1000 dpm/100 cm^2.

Response:

Section 5.7.6.4 Surveys for Contamination of Skin and Personal Clothing has been revised to standardize the total alpha contamination limit to 1000 dpm/100 cm^2.

c. Section 5.7.6.5, Surveys for Contamination on Respirators, TR-164. Discuss how the respiratory equipment contamination surveys will be documented for respiratory protection equipment.

Response:

A new Section 5.7.6.8 Survey Record has been added to describe documentation of contamination surveys.

5.7.7 Airborne Effluent and Environmental Monitoring Program

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

a. Section 5.7.7.1, Stack Sampling, TR-165. In Section 5.7.7.1, the applicant states that no air samples will be collected from the yellowcake dryer exhaust because there are no emissions. Demonstrate that there are no emissions from the yellowcake dryer exhaust, as well as, no emissions from other operational activities at the facility.

Response:

To provide additional verification that Uranerz's operations will not significantly approach or exceed doses to the public, particulate emission monitoring will be in place along with Rn-222 detectors and gamma dosimeters at the locations described in the Application and in this response. In addition, Uranerz conducted MILDOS modeling (a NRC-endorsed model that assesses potential doses to members of the public) which adequately demonstrates that the total dose equivalent (TEDE) to members of the public would be at least 100 times less than the 100 mrem limit given in 10 CFR 20.

b. Exhibit 5-1.

i. Exhibit 5-1 does not present any air particulate sample locations. Identify the air particulate locations as suggested in Regulatory Guide 4.14, Revision 1, Table 1, or provide a justification for not including air particulate samples.

Response:

Air particulates where not collected based upon ISR processes being zero particulate emission facilities. By employing rotary vacuum dryer technology, no particulates are released as stated in NUREG-1569, MILDOS AREA – An update, Section 4.3, 1st sentence, Draft MILDOS Users Guide, page 25, first sentence, NUREG/CR-6733, page 2-9, 1st full paragraph, NUREG-1910, page 2-24, lines 7 through 16.

Even though the dryers will not have any particulate emissions, Uranerz will conduct two quarters of air particulate sampling in 2009 for baseline purposes. The data collected will be compared to other baseline data collected in the area (i.e. PRI North Butte, Energy Metals Moore Ranch, and COGEMA Christensen Ranch/Irigaray) for consistency in background radiological particulates.

Air particulate samplers will be located at four different locations at each the Nichols Ranch and Hank Units. The air particulate samplers will be placed in the upwind, downwind, nearest residence, and plant locations. For the upwind, downwind, and nearest residence locations, the air particulate samplers will be placed in the same location used to collect baseline gamma and radon gamma. These locations can be viewed in Figures 2-25 and 2-26 in Chapter 2 of the Technical Report.

ii. If air particulate sampling was performed, demonstrate that the locations represent the highest predicted airborne radionuclide concentrations, as suggested in Regulatory Guide 4.14, Table 1.

Response:

The locations for the air particulate samplers will be in the same locations that were used for collecting background gamma and radon readings with the exception of the plant locations. The gamma and radon locations were selected using the criteria suggested in Regulatory Guide 4.14. The plant location sampler is selected since the plant may be the only source of air particulates.

iii. Regulatory Guide 4.14, Revision 1, Table 2, Operational Radiological Monitoring Program, suggests that surface water samples should be collected at the upstream and downstream site boundary on a quarterly basis. Exhibit 5-1 appears to show only one location at the Hank Unit. Please explain how one surface water sample location is sufficient to determine whether or not site activities have impacted surface water.

Response:

The location of the surface water self sampler at Hank is placed in an area where the surface water self sampler will collect any surface water that flows into Dry Willow Creek. As shown in Figure 2-15 in Chapter 2 of the Technical Report, most of the Hank license area flows into Dry Willow Creek. By placing the surface water self sampler at the west edge of the permit boundary, the self sampler can collect any surface water that flows into Dry Willow Creek if present.

iv. Explain why the surface water samples are to be collected annually and not quarterly. Regulatory Guide 4.14, Revision 1, Table 1, Preoperational Radiological Monitoring Program, suggests that the frequency of sample collection should be quarterly at one location. In the application, Section 5.7.7.3, states that the surface water samples will be collected annually.

Response:

Surface water will be collected whenever surface water is present. Currently there is no standing surface water at the Nichols Ranch ISR Project. Because there is no standing surface water, any surface water samples collected are a result of either storm or seasonal run-off. During run-off periods, efforts will be made to sample water if it is present. Section 5.7.7.3.1 has been revised to include this information.

v. Clarify Section 5.7.7.3 regarding whether this section is discussing the pre-operational or the operational radiological environmental monitoring program.

Response:

The entirety of Section 5.7.7 Airborne Effluent and Environmental Monitoring is discussing the operational environmental monitoring program

vi. In Section 5.7.7.3, identify what radionuclides will be analyzed during the sample analysis.

Response:

Surface water samples will be sampled for the following radionuclides: U-nat, Th-230, Ra-226, and Pb-210. Section 5.7.7.3.1 has been revised to reflect this information.

Section 5.7.7.3.2 Groundwater refers to Section 5.7.8 Groundwater Monitoring Program for descriptive information regarding parameters of analysis for groundwater samples; the parameters include total uranium and Ra-226.

c. Explain how the results from environmental monitoring will be used to demonstrate compliance with the public dose limit in 10 CFR Part 20.1301 and 20.1302.

Response:

Uranerz will show compliance with the annual dose limit in 10 CFR Part 20.1301 by using the results from environmental monitoring pursuant to 10 CFR Part 20.1302(b)(2). The average annual results of environmental monitoring for air particulates, radon, and surface water will be compared to the respective values in table 2 of Appendix B to part 20 including consideration of Note 4 of Appendix B.

The average annual results of environmental monitoring for direct radiation will be compared to the dose limits of 20.1302(b)(2)(ii).

Section 5.7.8 Groundwater and Surface Water Monitoring Programs

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

a. An analysis which takes into consideration the unconfined conditions at Hank Unit to determine the location of monitoring wells in the production zone monitoring well ring in the "F sand." The analysis provided in the application used confined conditions.

Response:

Analysis of the F Sand monitoring ring did account for unconfined aquifer conditions by using a specific yield value for the storage value. The confined Theis equation was used in this analysis but is appropriate for the late-time drawdowns for an unconfined aquifer when a specific yield value is used for the storage. The early time drawdowns in an unconfined aquifer do not need to be accounted for because the late time drawdowns for long-term operation of a wellfield predict the drawdowns accurately.

b. A discussion of how the applicant will conduct pumping tests in the Hank Unit to

establish that each wellfield production zone is in communication with the monitoring well ring, given the reduced drawdown in the unconfined aquifer which may not stress the production zone sufficiently to see communication.

Response:

More multiwell pump tests will likely be required for the Hank unit to establish the wellfield production zones communication due to the unconfined conditions in the aquifer. At least three multi-well pump tests will be used to develop adequate drawdowns across the wellfield. The unconfined aquifer pump test program by the USGS WTAQ will be used to design the multi-well pump test.

c. A statement that the applicant will also submit all wellfield hydrologic packages to NRC or review and approval before mining begins as the applicant does not have a record of performance with NRC.

Response:

The NRC will be supplied a copy of the initial Production Area Pump Tests for the Nichols Ranch and Hank Units prior to mining for review and approval. Section 5.7.8.4 of the Technical Report has been revised to reflect this information.

d. A standard operating procedure for sampling of the monitoring and private wells to ensure sampling is consistent for all wells during operations.

Response:

The Uranerz Energy Corporation Standard Operating Procedure (SOP) for Operational Groundwater Sampling has been added to Chapter 5 of the Technical Report as Addendum 5A. This SOP details how Uranerz has and will collect water samples for any monitor well, including private wells, and surface water samples during baseline and operations.

Sections 5.7.8.5.1 and 5.7.8.10.2 have been revised to include reference of the SOP.

e. The location of the surface water sampling points and description of surface water sampling methods.

Response:

The locations of surface water sampling points can be found on Exhibit 5-1. Currently Uranerz has three surface water self-samplers in place; one at Hank, and two at Nichols Ranch. Additionally surface water sampling will be conducted whenever surface water is present including any areas where Coal Bed Methane produced water may be discharged to the surface.

Surface water sampling procedures can be found in Addendum 5A of the Technical Report. This addendum is being added per this RAI and RAI 5.7.8 d.

f. A discussion on the use of chloride, conductivity, and total alkalinity for excursion

indicators in the overlying aquifer at Nichols Ranch or Hank units if the overlying aquifer is also impacted by future CBM produced water infiltration.

Response:

Several years of data of chloride, conductivity and total alkalinity should be obtained in any overlying aquifers at Nichols Ranch or Hank Units prior to any affects from the CBM produce water. This baseline data should enable a determination to be made as to whether the CBM produce water has affected the water quality.

Additionally, the overlying aquifer is not the surficial aquifer at Nichols Ranch and Hank.

g. Demonstrate that the applicant can distinguish between CBM produced water infiltration impacts and an excursion in the overlying aquifer from operations using chloride, conductivity, and total alkalinity as excursion indicators.

Response:

The chloride concentrations from the CBM produce water should be relatively low and similar to the chloride concentration in the overlying aquifers. This should make chloride still very sensitive as an excursion parameter. The conductivity and total alkalinity of the CBM water may be different but should still be useful indicators for an excursion from the ISR wellfield. Again, the overlying aquifer at the Nichols Ranch and Hank Units is not the surficial aquifer.

Section 6.0 Reclamation Plan

Section 6.1 Groundwater Restoration

The plans and schedules for groundwater quality restoration have not been sufficiently described to determine if they will achieve the required goals of restoration. Provide the following information:

d. A statement that the applicant will return the groundwater quality to the standards listed in Criterion 5B(5) of 10 CFR Part 40, Appendix A.

Response:

Uranerz will return the groundwater quality to the restoration standards that are specified in NUREG-1569. The criteria to be used are as follows:

(a) Primary Restoration Standards—The primary goal of a restoration program is to return the water quality within the exploited production zone and any affected aquifers to pre-operational (baseline) water quality conditions. Recognizing that *in situ* recovery operations fundamentally alter groundwater geochemistry, restoration activities are not likely to return groundwater quality to exact water quality that existed at every location prior to *in situ* recovery operations. Still, as a primary restoration goal, Uranerz will attempt to return the concentrations of the monitored water quality indicator constituents to within the baseline range of statistical variability for each constituent.

(b) Secondary Restoration Standards—*In situ* recovery operations may cause permanent changes in water quality within the exploited production zone, because the *in situ* recovery extraction process relies on changing the chemistry in the production zone to remove the uranium. If baseline conditions cannot be met, then Uranerz will return the water quality to its pre-operational Wyoming class of use (e.g., drinking water, livestock, agricultural, or limited use) as a secondary restoration standard. Uranerz's principal goal of its restoration program will be to return the water to baseline, as long as it is technically and economically feasible, and that secondary standards will not be applied so long as restoration continues to result in significant improvement in groundwater quality. Uranerz first attempt will be to return groundwater quality to primary restoration standards before reverting to the secondary restoration standards such as Wyoming class of use.

In the event secondary restoration standards will be use, it is acceptable to establish secondary restoration standards on a constituent-by constituent basis, with the numerical limits established to ensure state or EPA primary or secondary drinking water standards will not be exceeded in any potential source of drinking water. For radionuclides not included in the drinking water standards, it is acceptable to determine, on a constituent-by-constituent basis, secondary standards from the concentrations for unrestricted release to the public in water, from Table 2 of 10 CFR Part 20, Appendix B.

(c) If a constituent cannot technically or economically be restored to its secondary standard within the exploited production zone, Uranerz will demonstrate that leaving the constituent at the higher concentration would not be a threat to public health and safety or the environment or produce an unacceptable degradation to the water use of adjacent ground-water resources. This situation might arise with respect to general water quality parameters such as the total dissolved solids, sulfate, chloride, iron, and others which do not typically present a health risk. However, not all the major constituents have a primary or secondary drinking water standard (e.g., bicarbonate, carbonate, calcium, magnesium, and potassium). Consequently, ground-water restoration may achieve the secondary standard for total dissolved solids, but may not achieve a secondary standard for individual major ions that contribute to total dissolved solids. If such a situation occurred, Uranerz will show that leaving the individual constituent at a concentration higher than secondary standard would not be a threat to public health and safety nor the environment or produce an unacceptable degradation to the water use of adjacent ground-water resources. Such proposed alternatives must be evaluated on a case-by-case basis as a license amendment request only after restoration to the primary or secondary standard is shown not to be technically or economically achievable. This approach is consistent with the as low as is reasonably achievable philosophy that is used broadly within NRC. Section 6.1 of the Nichols Ranch ISR Project provides a description of the techniques that have been used in past successful groundwater restoration at ISR facilities in Wyoming including the Bison Basin ISR mine, and the nearby COGEMA Christiansen Ranch and Irigaray mines. Also further discussion is provided in Section 6.1.3.5 on three ISR operations that have successfully restored the groundwater to acceptable NRC and WDEQ regulatory standards.

b. A technical basis demonstrating the applicant's ability to meet the standards in Criterion 5B(5) of 10 CFR Part 40, Appendix A. Generally such demonstrations may be based on either experience with previous ISL operations, research and development investigations in similar host rock, computations, or pilot tests.

Response:

The techniques that Uranerz Energy Corporation plans on using to successfully restore the groundwater at the Nichols Ranch ISR Project back to baseline or class of use designation, if baseline cannot be achieved, are those techniques that have been successfully implemented at numerous Wyoming ISR operations and Pilot Plants. Several of the facilities that have successfully restored the groundwater are the Bison Basin ISR operation located in the Great Divide Basin of Wyoming, COGEMA Christiansen Ranch and Irigaray ISR operations, Smith Ranch/Highlands Uranium Project, Collins Draw R&D Facility, Ruth R&D Facility, and the Reno Creek R&D Facility. These last six operations are all located in the Powder River Basin within 35 miles or less of the Nichols Ranch ISR Project. The Reno Creek R&D Facility was also able to demonstrate the successful groundwater restoration of an unconfined aquifer with their Pattern 2 operation. Section 6.1.3 in Chapter 6 of the Technical Report was revised to include this information.

Section 6.1 of Chapter 6 of the Nichols Ranch ISR Project Technical Report contains the techniques that will be implemented.

c. A physical justification (cores, logs, etc) for porosity values for the production ore zones in both the Nichols Ranch and Hank unit. The applicant provides estimates of the pore volume in the surety estimate using a porosity value of 0.27. T states in the Technical Report, Section 2.7.2.3, pg. TR-55, that the effective porosity values for both "A Sand" and "F Sand" are 0.05. In a different location in the Technical Report, a porosity of 0.3 is assumed for Nichols Ranch Unit and Hank Unit (Uranerz Energy Corporation, Technical Report, Tables 7-6 and 7-7).

Response:

The effective porosity values for the A and F Sands of 0.05 was used for calculation of groundwater velocity. A total porosity is more appropriate for the restoration pore volumes than the effective porosity. The effective porosity for ground-water velocity estimates was conservatively estimated from the lithologic materials at the two sites. A smaller effective porosity results in a conservatively higher ground-water velocity. The porosity value in the surety estimate has been revised to 0.3 for consistency, and is typical of the tertiary sandstones of Wyoming.

Section 6.2.8 has been revised to reflect this information.

d. A justification for the method to estimate wellfield pore volume and the assumed 30% flare in the surety estimate. No technical details are provided for estimating the wellfield pore volume and the associated horizontal and vertical flare. Include a new schedule for restoration and surety estimate if the number of pore volumes for restoration is revised.

Response:

The number of pore volumes needed to restore a production area can vary from operation to operation or from wellfield to wellfield. As seen by COGEMA's Christensen Ranch ISR facility, located just a few miles to the North, Northwest of the Nichols Ranch ISR Project and has operated in very similar formations and conditions as the Nichols

Ranch ISR Project, the number of pore volumes needed to restore Wellfieds 1-9, that were fully operational on a commercial scale, has varied from 9.5 to 18.4 with an average of 14.6. Other Wyoming ISR operations such as the commercial Bison Basin ISR uranium project needed just six pore volumes to achieve restoration while the Reno Creek R&D uranium project successfully restored the groundwater, without RO, by using ten pore volumes in both confined and unconfined settings. Based on these operations and the restoration techniques that will be used by Uranerz Energy Corporation, the number of pore volumes that Uranerz estimates that will be needed to restore the operating Production Area 1 in the first year of operation has been modified to seven pore volumes, one pore volume groundwater sweep and six pore volumes circulated through an RO unit.

Along with researching the number of pore volumes used at other commercial and R&D operations, the flare factor for a typical ISR operations can be anywhere from 1.3, as seen and approved for the HRI Churchrock ISR operations in New Mexico, to 1.5 to 1.7, as modeled using MODFLOW and MODPATH by PRI's Smith Ranch wellfields. COGEMA's Irigaray/Christensen Ranch sites has used an overall flare factor of 1.44. Knowing that flare factor can be influenced by such things as well completion, but also taking into account the flare factors that have been used at operating commercial ISR operations that are adjacent to the Nichols Ranch ISR Project and operate in very similar sandstone formations and deposits, Uranerz will be using a flare factor of 1.45 for the surety estimates attached in Addendum 6B.

Section 6.2.8 has been revised to reflect the information along with the surety estimate found in Addendum 6B.

e. A statement that NRC will be informed when a transition from production to restoration occurs in a mine unit and an acknowledgement that the applicant will adhere to the timeliness in decommissioning regulations of 10 CFR Part 40.42.

Response:

Uranerz Energy Corporation will inform the NRC when a transition from production to restoration has occurred in a production unit and will adhere to 10 CFR Part 40.42. Section 6.1 in Chapter 6 of the Technical Report was revised to reflect this information.

f. An explanation of how the restoration methods proposed for Hank Unit which have only been applied to confined aquifers will be successful in an unconfined aquifer like the "F sand" production zone. Address issues on how to ensure contact and sweep of all parts of the mined region, including dewatered zones, predicting the behavior of each constituent in an unsaturated environment where oxygen will be present, and methods to ensure representative sampling. Provide a discussion that the proposed restoration methods are suited to the unconfined aquifer setting and will achieve the primary restoration standard of return to baseline water quality for the entire production zone.

Response:

The restoration methods for confined aquifers should be functional for an unconfined aquifer with possibly some minor changes. The unconfined aquifer may require some adjustment in the approach of the groundwater sweep. Some recycling of the

groundwater sweep water after removal of uranium may be necessary to keep the bleed rate to a reasonable percentage, such as 15 percent.

Restoration in an unconfined aquifer was also demonstrated in Pattern II of the Reno Creek Project (SUA-1338). The Reno Creek Project is located approximately 15 miles to the east of the Nichols Ranch Project. In 1980, Rocky Mountain Energy Company completed a pilot test to demonstrate to the NRC and Wyoming Department of Environmental Quality (WDEQ) that the mine unit Pattern II could be produced and restored utilizing a sodium bicarbonate lixiviant. Pattern II was located in an unconfined portion of the mining aquifer. The water level in the aquifer was approximately 8 feet below the top of the aquifer. During restoration, all measured constituents were returned to baseline parameters with the exception of uranium, but the uranium concentration still met the WDEQ acceptable class of use criteria. The restoration processes employed during the restoration consisted of using ion exchange followed by a groundwater sweep. No reverse osmosis was used during the restoration process.

Section 6.1.3.5 has been added to discuss the successful restoration of groundwater in both confined and unconfined aquifers. Additionally Addendum 6C has been added to the Technical Report. This addendum contains three reports from the Reno Creek Project that detail the restoration of the unconfined Pattern II.

g. A description of the biological reduction method(s) to be used to achieve restoration for targeted constituents in the proposed wellfield mining zone including: the efficacy of the chosen method; additives and rates; how progress will be monitored; estimates of pore volumes required when using biological reductants; and how the stability of water quality in zones treated with biological reductants will be monitored and established.

Response:

The biological reduction method has not been determined at this time since biological reduction is only going through the experimentation and testing phase at another ISR site. If biological reduction does become a viable technique that is commercially available, and Uranerz Energy Corporation does consider using the biological reduction method, the NRC will be informed of this decision with a plan submitted to the NRC with details. Section 6.1.3.3 has been revised to remove "biological reductant."

h. The use of reductant should be addressed in the application to account for any safety hazards associated with its storage and use.

Response:

In Section 6.1.3.3 of the Technical Report, a statement is made that a comprehensive safety plan regarding reductant use will be implemented. This statement has been revised to include the content of the safety plan will address proper PPE and reductant storage location.

i. A description of how the mining zone will be monitored during restoration to track the success of any restoration phase or techniques such as the addition of chemical or biological reductants.

Response:

The production area will be monitored no differently with the addition of a

chemical or biological reductant than it would be with normal restoration techniques. During restoration, the mining zone will be monitored on a frequent basis that will provide Uranerz with adequate information to address the success of the restoration, the effectiveness and efficiency of the restoration techniques being used, and any further restoration that may or may not be needed in areas of the production areas. Samples collected will be analyzed for all of the parameters found in Table 5-1 at the beginning of restoration and then all or some of the parameters as restoration continues.

Section 6.1.3.4 has been revised to include this information.

j. Rationale for selecting wells for monitoring groundwater quality during restoration, the efficiency of the restoration techniques, and whether additional or alternate techniques are necessary.

Response:

The monitor wells that were used to collect the baseline water quality of a production unit will be the same wells that will be used to measure the progress and efficiency of the groundwater restoration. The techniques that Uranerz Energy Corporation will use to complete the groundwater restoration are described in Section 6.1. These same techniques have been used successfully by other ISR operations in the Powder River Basin of Wyoming.

Section 6.1.2 has been revised to include this information.

k. A technical basis for the method used to determine the distances between monitoring wells, including information about the groundwater model used (the applicant states that distances between monitoring wells were determined using a groundwater flow model, but provides no detailed information (Section 5.7.8.2)).

Response:

The WELFLO model was used in selecting the 500 ft spacing from the monitoring wells to the edge of the wellfield. A 500 foot spacing between monitoring wells was also selected. The spacing between monitoring ring wells is equivalent to the distance between the monitoring ring wells and the wellfield. This spacing has become a standard at existing Wyoming operations for ISR sites.

The WELFLO model that was used can be found in Addendum 3A of the Technical Report. Figure 3-15 and 3-16 also detail the selecting of the 500 foot spacing for the monitoring well ring wells.

Section 5.7.8.2 has been revised to reflect this information.

l. A clear definition or illustration of "monitoring ring wells" as described in Uranerz Energy Corporation, Technical Report, Section 6.1.3.4.

Response:

The monitoring ring wells are defined in Section 5.7.8 of Chapter 5 of the Technical Report. Diagrams showing the proposed location of the monitoring wells have been added to Chapter 3 as Figures 3-8A and 3-8B. Section 6.1.3.4 has been revised to include this information.

m. A description of how the water quality data from the horizontal wells will be combined with the data from the vertical monitoring wells to determine restoration progress.

Response:

The water quality data from the horizontal monitoring wells will be used to track the progress of groundwater restoration for the production area that is being restored. These data are independent of the water quality data that is collected for the vertical monitoring wells since the vertical monitoring wells are used to verify that there is no communication between the production unit and the overlying and underlying sands.

n. Justification of the efficacy of sampling frequencies and locations for the purpose of detecting excursions from potential preferential flow paths.

Response:

No known preferential flow paths have been defined at either of the Nichols Ranch and Hank Units. Therefore, a uniform monitoring ring was selected to best detect an excursion. The natural ground-water flow rates for the Nichols Ranch and Hank units in the ore sands are estimated to be 12 and 22 ft/year, respectively. During restoration these ground-water movement rates should be reduced near the monitoring ring wells. The slow ground-water movement rates warrant the monitoring of the wells every 60 days. If the ground water moves at 22 ft/year the actual movement for 60 days is only 3.6 feet.

The multi well pumps tests that will occur for the Nichols Ranch ISR Project prior to the start up of any production area will also give an indication if any preferential flow path are developed or determined.

Sections 5.7.8.2, 5.7.8.3 and 6.1.3.4 have been revised to reflect this information.

o. A description of the spatial distributions of all the monitoring wells named MO, MR, and MP Wells in Section 5.7.8.5.1.

Response:

The spatial distributions of monitoring wells are described in Section 5.7.8.1 Monitor Well Spacing.

p. An explanation of why the groundwater restoration operations will not adversely affect groundwater used outside the production zone.

Response:

The groundwater restoration operations will not adversely affect groundwater used outside of the production zone. During restoration activities, a bleed rate is still maintained to draw in outside water to the production area. The only affect this would have on the groundwater outside of the production zone would be the same as during operations in that it could have potential drawdown effects of the aquifer outside of the production zone. These impacts have been addressed in Chapter 2 and Chapter 7.

Section 6.1.3.6 has been added to include the above information and to discuss the environmental impacts of groundwater restoration.

q. Additional description about impacts to nearby domestic wells in terms of water table drawdown during restoration and justification as to why the groundwater restoration will not affect those wells.

Response:

Nearby stock wells may be impacted by drawdown during restoration. These impacts during restoration are no different then those impacts associated with operation of a wellfield. The impacts to wells have been addressed in response to RAI 2.7.2 v.

r. A description of any areas of recharge for the "F sand "at the Hank Unit as the influx of oxidized water into the unconfined "F sand" from any recharge zone may impact the stability of the restoration if chemical or biological reductants are employed. An explanation of how the applicant will ensure stability in this case.

Response:

The F Sand outcrops to the south of the Nichols Ranch and Hank Units. This outcrop area is a discharge zone for the F Sand ground water; therefore, the recharge to the F sand in the area near the Nichols or Hank Units is from vertical movement through other geologic units. As such, the F Sand at the Hank Unit should not have a potential for an influx of oxidized water. The areas of the F Sand that are unconfined should act similar to deeper confined aquifers in the Powder River Basin.

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

Response:

The six month stability monitoring period is specified in WDEQ-LQD Guideline 4. The criteria to establish restoration stability will be based on wellfield averages for water quality. A determination of aquifer stability should be made upon the "trends" in the data; i.e., a stable aquifer should not exhibit rapid upward or downward trends or be oscillating back and forth over a wide range of values. The data are evaluated against baseline quality and variability to determine if the restoration goal is met and if the water is restored at a minimum to within the class of use.

t. Provide an estimate, with supporting analysis, of how much waste water would be produced during restoration and the ability of the disposal wells to handle the rates and volumes.

Response:

As discussed in Chapter 3, Section 3.2.6, an estimated 50 gpm of waste water could be sent to the deep disposal well during restoration at the Nichols Ranch Unit and at least 22 gpm at the Hank Unit. As can been seen from Section 3.2.6, the deep disposal wells will be able to handle the volumes of water that have been mentioned. Additionally one pore volume from each unit could be disposed of if groundwater sweep is utilized. If groundwater sweep is used, then twenty plus million gallons of water could be consumed for each unit.

The newly added Section 6.1.3.6 discusses the environmental impacts associated with groundwater restoration.

Section 6.2 Surface Reclamation and Decommissioning

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

a. How the cleanup criteria for radium in soils as provided in 10 CFR Part 40, Appendix A, Criterion 6(6), will be met.

Response:

Uranerz will provide a plan for reclamation of land (soil) (plan) 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 plan will include 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, a description of the planned final radiation survey including cleanup criteria for uranium in soil, and a respective cost estimate.

The Technical Report at Section 6.2.6 Site Decontamination and Decommissioning has been revised to include the commitment to provide a plan for reclamation of soils.

b. Acceptable cleanup criteria for uranium in soil, such as those in Appendix E of NUREG–1569, Standard Review Plan for In-Situ Leach Uranium Extraction License Applications.

Response:

The Technical Report at Section 6.2.6 Site Decontamination and Decommissioning has been revised to include that the cleanup criteria for uranium in soil will be derived from the radium benchmark dose approach of 10 CFR Part 40, Appendix A, Criterion 6(6).

c. Acceptable cleanup criteria for Th-230 for areas that already meet the radium cleanup criteria but that still have elevated thorium levels.

Response:

The Technical Report at Section 6.2.6 Site Decontamination and Decommissioning has been revised to include that the cleanup criteria for Th-230 in soil will be that concentration, when combined with the residual concentration of Ra-226 (i.e., contribution from thorium transformation plus residual radium), will result in the radium concentration that would be present in 1000 years satisfying the radium cleanup standard.

d. Assurance that the survey method for verification of soil cleanup is designed to provide 95% confidence that the survey units meet the cleanup guidelines.

Response:

This issue will be addressed in the planned final radiation survey for soil included within the response to Item 6.2 a.

e. In support of the reference to MARSSIM, provide additional discussion of the soil cleanup program. The discussion should include: the areas planned to be surveyed (such as wellfield surfaces, areas around structures in process and storage areas, on-site transportation routes, historical spill areas, and areas near deep disposal wells); details of the pre-reclamation radiological survey, particularly, specifics on how it and the baseline survey will be used to identify potential contamination areas; details on how the final radiological soil conditions after cleanup will be measured and documented (Section 6.2.6).

Response:

This issue will be addressed in the planned final radiation survey for soil included within the response to Item 6.2 a.

f. Provide a discussion of plans for decommissioning non-radiological hazardous constituents as required by 10 CFR Part 40, Appendix A, Criterion 6 (7). (Section 6.2.6).

Response:

Nonradioactive hazardous wastes will be segregated and disposed of at a hazardous waste disposal facility. Non-radiological uncontaminated wastes will be disposed of as ordinary solid waste at a municipal solid waste facility. Closure of the site will otherwise be completed in conformance with 10 CFR Part 40, Appendix A, Criterion 6 (7). The Technical Report at 6.2.6 Site Decontamination and Decommissioning has been revised to include this commitment.

g. Expand on the simple commitment in Section 6.2.6 to decontaminate structures and equipment to regulatory standards, and to either dismantle and dispose of structures or release them for unrestricted use, if appropriate. The expanded discussion should include: information on the program in place to control contamination of structures and equipment; details of survey and decontamination procedures, including a commitment that radioactivity along the interior surfaces of pipes, drain lines, and duct work will be determined by measurements at traps or other access points, and a commitment that

pieces of equipment that are too big to scan will be considered contaminated in excess of the limits; and details of plans for surveying structures and equipment before release for unrestricted use. (Section 6.2.6).

Response:

The contamination control requirements described in the Technical Report at Section 4.3 CONTAMINATED EQUIPMENT and Section 5.7.6 Contamination Control Program will be implemented for decommissioning. Uranerz will provide a plan for decommissioning structures and equipment (plan) to the NRC for review and approval at least 12 months before the planned commencement of decommissioning of such structures and equipment. The plan will include a description of structures and equipment to be decommissioned, a description of planned decommissioning activities, a description of methods to be used to ensure protection of workers and the environment against radiation hazards, a description of the planned final radiation survey, and a respective cost estimate.

Section 6.2.8 Financial Assurance

The applicant has not provided sufficient information regarding financial assurance. Because groundwater restoration is an important part of the surety, more information is required for the staff to assess the adequacy of the surety amount. Please provide the following information.

a. Identify the financial assurance funding mechanism (i.e., surety bond, cash deposit, certificate of deposit, deposit of government securities, etc.) that The applicant plans on using for the Nichols Ranch project.

Response:

The financial assurance funding mechanisms that may be used for the Nichols Ranch ISR Project are indicated in the second paragraph of Section 6.2.8 in Chapter 6 of the Technical Report. Once a surety instrument is chosen, whether it is a bond, letter of credit, etc., the surety will be submitted to the WDEQ-LQD with a copy sent to the NRC.

b. Provide indication in Section 6.2.8 that The applicant will automatically extend the existing surety amount for one year if the NRC has not approved a proposed revision at least 30 days prior to the expiration date for the existing surety; revise the surety arrangement within 3 months of NRC approval of a revised closure (decommissioning) plan, if estimated costs exceed the amount of the existing financial surety; update the surety to cover any planned expansion or operational change not included in the annual surety update at least 90 days prior to beginning associated construction; and provide NRC a copy of the State's surety review.

Response:

Section 6.2.8 was revised to include the statements requested above.

c. The following items in the Financial Assurance spreadsheets in Appendix D of the application need to be discussed, explained, or further evaluated:

   i. Provide the justification for using 4.94 pore volumes total, considering that, for

this surety estimate, the mine unit is still in the early stages of its active life.

ii. Provide the justification for the flare factor of 1 .3.

Response for i and ii:

See the response for RAI 6.1d. The pore volumes for purpose of surety estimate have been revised to 7 total pore volumes, one groundwater sweep and 6 pore volumes treated with RO. The flare factor has been changed to 1.45 based on other ISR operations flare factors.

iii. The years for groundwater sweep are assumed to be 2.82; a similar time for reverse osmosis is assumed. Therefore, the time multiplying factor should be 5.64, not 2.82 when calculating the total labor costs.

Response:

The labor calculation has been corrected to include the total amount of time that it will take for groundwater restoration.

iv. The calculation for total gallons for treatment does not appear to be correct (GW RESTORATION Worksheet 1, Nos. I and II).

Response:

The calculation has been reviewed and determined to be correct. The total gallons for treatment is calculated by taking the number of pore volumes times the volume of one pore volume (gallons per pore volume).

Section 7.0 Environmental Effects

Section 7.3 Radiological Effects

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

a. General Comment for Section 7.3. In Section 7.3, Radiological Effects, it is stated in various subsections (See Sections 7.3.1, 7.3.1.1, 7.3.1.2, 7.3.1.2.7, 7.3.1.2.8.1, 7.3.1.2.8.2, 7.3.1.3, 7.3.1.5) that there are no particulate emissions. Provide a detailed basis for this statement. The applicant should address particulate emissions for each of the aforementioned sections of this application.

Response:

The response provided for item 4.1 b. ii. is applicable here.

b. 7.3.1.2 Exposures from Air Pathways, TR-214. The applicant indicates in Section7.3.1.2.6, Meteorological Parameters, that the fractional joint frequency distribution of wind speed, direction, and stability are for Gillette, Wyoming, for years 1996 thru 2005. In Section 2.5, Meteorological, the meteorological data was collected from the National Weather Service, Midwest 1SW weather station located

approximately 27 miles southwest of the project area, and the Natrona County International Airport near Casper, Wyoming, approximately 60 miles south southwest of the project area. The Gillette meteorological data is not identified in Section 2.5, Meteorology, of the application. Please confirm that the appropriate data were used in Section 2.5. Also, please demonstrate that the meteorological data from Gillette and Casper, Wyoming, are representative of conditions at the site.

Response:

The meteorological data for Casper and Gillette are representative of each other in the aspects of temperature and precipitation. Predominate wind directions for these two locations does vary with Casper having a predominate wind direction from the south/southwest while Gillette's predominate wind direction is from the north/northwest. Predominate wind direction for the Nichols Ranch ISR Project is from the south/southwest. Supplemental weather data was obtained from the Antelope Coal Company (ACC) meteorological station located approximately 35 miles to the south/southeast of the Nichols Ranch ISR Project. Wind direction, temperature, and precipitation data from the ACC station are similar to the Nichols Ranch ISR Project site and therefore is representative of the meteorological conditions occurring at the Nichols Ranch ISR Project site as described in Section 2.5 of the Technical Report.

Using the new data collected from the ACC station, the MILDOS model was ran again to incorporate the new joint frequency distribution data of wind speed, direction, and stability. Results from the new MILDOS run do not vary significantly from the original MILDOS run conducted using Gillette joint frequency distribution data. Tables 7-8, 7-9, and 7-10 have been revised to incorporate the new MILDOS data. The new MILDOS report is attached and has been included as Addendum 7C.

c. 7.3.1.3 Exposures from External Radiation, TR-21 9.

i. Demonstrate that the external radiation exposure at the site boundary meets the regulatory limits in 10 CFR 20.1301(a)(2). Discuss models and input parameters used to support the external radiation exposure at the site boundary.

Response:

An estimate of external radiation exposure at the site may be considered as a major process vessel in the main process area holding a "batch" of uranium (about 6000 lbs as U3O8). Then an exposure rate one meter from the surface of the respective process vessel may be estimated as follows:

Given:

- www.wise-uranium.org, Calculators, External Radiation Dose Calculator
    - Calculation of radiation dose from shielded gamma source

- Mode
    - Volume source
    - No shield layers
- Volume Source Parameters

- U_3O_8, natural, with short-lived progeny
- Source density – 8.3 g/cm^3

- Receptor Parameters
  - Exposure rate in air
  - Exposure for annual dose rate – continuous
  - Gamma dose factor – 1.
- Geometry Parameters
  - Distance of receptor from source – 100 cm^2
  - Depth of source – 400 cm (an approximate height of a process vessel)
  - Radius of source – 200 cm (an approximate for a process vessel)

Result:

- Source total exposure rate at one meter – 10 μSv/h (0.001 rem/h)

Then the external radiation exposure rate at any point of greater distance (e.g., the site boundary) must be less than the regulatory limit in 10 CFR 20.1301(a)(2) (i.e., 0.002 rem/h)

External radiation exposures that may result from releases of radioactive material are calculated within MILDOS-AREA and are included in the dose estimates summarized in the Technical Report at Section 7.3 Radiological Effects.

ii. Provide an exposure pathway diagram that includes the relevant external exposure pathways or identify where this diagram exists in the application.

Response:

Figure 7.3a – Exposure Pathway Diagram has been added to Chapter 7. Section 7.3.1 has been updated to reference the diagram.

d. 7.3.1.4 Total Human Exposures, TR-219

i. In Section 7.3.1.4, Table 7-10, The applicant provides the Total Effective Dose Equivalent, in person-rem per year for the year 2011 to the year 2019 for the population within 80 km to range from 0.04 to 0.2 person-rem per year. However, the population dose for the population beyond 80 km and for all populations ranges from 2 to 8 person-rem per year. Explain why the population doses for the population beyond 80 km and all populations are higher than the population dose to the populations within 80 km.

Response:

The population dose beyond 80 km is determined for a population of 268,000,000 (Technical Report at Section 7.3.1.2.2 Population Distribution). The population dose within 80 km is determined for a population of 21,819 (Technical Report at Table 7-2). The very much larger population outside 80 km compared to within 80 km overwhelms the respective decrease in radon concentration and therefore individual dose. The dose to all populations is simply a sum of the dose to the populations within and outside 80 km; at one significant figure, the increase in dose to all populations compared to the population outside 80 km is not apparent.

e. Provide an exposure pathway diagram that includes the relevant pathways to all effluents expected from facility operations or identify where this diagram exists in the application.

Response:

See the response for item 7.3.1.3 c ii.

Section 7.5 Effects of Accidents

This section describes the environmental effects of various accident scenarios. However, the applicant needs to provide information regarding the systems and procedures that it will use to prevent accidents at the facility or minimize the effects of such accidents on worker and public health. The requested information is described in Section C.6. of Regulatory Guide 3.5.

Response:

Section 7.5.9 has been added to address Occupational Incidents. Uranerz Energy Corporation will have comprehensive safety policies, procedures, and practices that will be used to prevent incidents from occurring. The policies, procedures, and practices will take into account such things as following all building and construction codes during the construction of the Nichols Ranch ISR Project in order to prevent items such as tank and pipeline failures. Additionally, all Uranerz Energy Corporation employees and contractors will be trained on company safety and environmental policies that will cover topics ranging from OSHA rules and regulations to the company vehicle policy, proper use of PPE, and the enforcement of speed limits when traveling to, within, and from the plant locations. Additionally, employees will receive training prior to beginning work in the plants on the correct plant operations including such subjects as regular inspections of all wellfields and plant lines, equipment, and operations.