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May 24, 2016

Attn: Document Control Desk
Director, Scott Moore
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attn: Deputy Director
Division of Decommissioning, Uranium Recovery and Waste Programs
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11545 Rockville Pike, Mail Stop T-8F5
Rockville, MD 20852-2738

Re: Uranerz Energy Corporation, Nichols Ranch ISR Project, Source Materials License SUA-1597, Request for Additional Information on Jane Dough License Amendment (TAC No. J00726, J00875)

Dear Director Moore,

On February 5, 2016, Uranerz Energy Corporation (Uranerz) received a request for additional information (RAI) from the Nuclear Regulatory Commission (NRC) pertaining to the Jane Dough Amendment for the Nichols Ranch ISR Project. A public meeting was held on March 8, 2016 to discuss the RAIs. Subsequent to that meeting Uranerz informed the NRC (via email dated April 1, 2016) that responses to the RAIs would be provided at the end of May 2016.

Enclosed with this letter are responses to the Technical and Environmental Report RAIs along with supporting information and revised pages pertinent to the responses. Uranerz has included an Index of Change to facilitate page insertion into the relevant volumes. Uranerz has sent a total of five (5) copies of the submittal, one for the Document Control Desk and the remaining four (4) for the Deputy Director.

If you have any questions regarding this matter, please contact Dawn Kolkman by phone at 307-265-8900 or by email at dkolkman@energyfuels.com.

Sincerely,

William P. Goranson, P.E.
Executive Vice President ISR Operations
Uranerz Energy Corporation (an Energy Fuels Company)

WP/dk

NM 5520

cc: Dave Brown, NRC Sr. Health Physicist (via email)
Ron Linton, NRC Project Manager (via email)
Mark Rogaczewski, WDEQ-LQD District III Supervisor (via email)

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Nichols Ranch ISR Project, Uranerz Energy Corporation
Jane Dough License Amendment
NRC Request for Additional Information

RAI 1.1-1. Licensee Changes to Technical Report

Description of Deficiency

Under its Safety and Environmental Review Panel (SERP) process and license amendment requests, Uranerz periodically changes documents (e.g., Technical Report) incorporated by reference in Materials License SUA-1597, License Condition 9.2. Uranerz also makes corresponding changes to the version of these documents submitted with its license amendment request for the Jane Dough Unit. This is because the U.S. Nuclear Regulatory Commission (NRC) will, if it ultimately approves the Jane Dough Unit request, amend Materials License SUA-1597 by replacing some of the documents tied down in License Condition 9.2 with the revised version of these documents included with the license amendment request for the Jane Dough Unit. Changes noted by the NRC staff that should be reflected in the license amendment request for the Jane Dough Unit include:

a. Technical Report (TR) page TR-214b (Uranerz 2015) was revised as part of License Amendment 4 (NRC 2015). Please revise the text accordingly.

b. All SERP-approved changes to the license application in 2015.

Basis for Request

10 CFR 40.31(b), "Applications for specific licenses," states that the Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

Request for Additional Information

Provide changes to the Jane Dough license amendment request consistent with the changes made to the versions of documents incorporated by reference in Materials License SUA-1597, License Condition 9.2.

Uranerz Response:

a. Pages TR-214a and TR-214b have been included with this submission for incorporation into the Jane Dough TR document.

b. Some page changes made via SERPs were included in the submittal to NRC in coverletter dated June 26, 2015. The changed pages are enclosed for the SERPs conducted during the remainder of 2015 with this submittal.

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RAI 2.2-1. Update Land and Water Use Section

Description of Deficiency

Section 2.2.1 of the TR has not been revised to reflect the Jane Dough Unit.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.2.3(1) states that the characterization of the uses of adjacent lands and waters is acceptable if the information is presented in detail sufficient to understand the surrounding land and water uses, such that the likely consequences imposed by *in situ* leach operations can be adequately assessed.

Request for Additional Information

Please revise Section 2.2.1 of the TR to include a discussion of the Jane Dough Unit.

Uranerz Response:
Section 2.2.1 of the TR was revised to include a discussion of the Jane Dough Unit. Revised pages are enclosed.

RAI 2.5-1. Description of Meteorological Tower

Description of Deficiency

In Section 2.5 of the TR, Uranerz did not provide a description of its on-site meteorological monitoring tower with sufficient specificity for the NRC staff to determine whether the tower is sited properly and operated with appropriate accuracy and sensitivity.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.5.3(1) states that the characterization of the site meteorology is acceptable if it includes, among other things, the locations of all stations used in the data analysis and the height of the data measurement. This criterion also states that the on-site program should be designed in accordance with Regulatory Guide 3.63, "On-site Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting," (NRC 1988).

Request for Additional Information

Please provide information about: (1) the elevation of base of the tower relative to adjacent facilities; (2) the distance to nearby natural or man-made obstructions (e.g., trees, buildings) that may have influence on measurements; (3) elevation of the instruments on the tower; (4) description of the tower (e.g., open lattice); and (5) wind direction and wind speed accuracies and starting thresholds.

Uranerz Response:
A description of the Meteorological Station at the Nichols Ranch is enclosed under a report prepared by IML title Meteorological Station Description and contains the following information: (1) The tower

base elevation is 4757 feet MSL and the ground elevation of the adjacent facilities is 4715 feet MSL. (2) The nearest obstacle with substantial vertical extent is the adjacent Central Processing Plant roughly 1200 feet to the east of the tower. (3) The tower is 32.8 feet therefore the vertical elevation is 4789.8 feet MSL and some the instruments are located near the summit of the tower and recording devices at approximately 5 ft. above ground level for ease of access. (4) The tower is an open lattice tower mounted to a hinged base allowing the tower to lay over for calibration and repair. (5) The wind direction, speed accuracies and starting threshold are found on Table 3.

RAI 2.5-2. Meteorological Data

Description of Deficiency

Section 2.5 and Appendix JD-D4 of the TR do not include a description of the methodology used to determine on-site atmospheric stability class. There is no summary of the on-site atmospheric stability class data.

Basis for Request

Regulatory Position C.1 of Regulatory 3.63, "On-site Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting" states that the parameters needed to estimate the atmospheric dispersion of radioactive materials are wind direction, wind speed, and an indication of atmospheric stability.

Request for Additional Information

Provide a description of the methodology used to determine on-site atmospheric stability class and a summary of the on-site atmospheric stability class data. A suitable reporting of this information is shown in Table 1 of Regulatory Guide 3.63.

Uranerz Response:
A discussion of the method used to determine on-site atmospheric stability classes has been added in Addendum JD-D4-A (specifically page 18a). Additionally, the text in Section 2.5.3.10 of the TR was updated to reference where the method used to determine the stability classes is presented.

RAI 2.6-1. Coal Bed Methane Target Depths

Description of Deficiency

Section 2.6.1 of the TR (page TR-52) discusses the Coal Bed Methane target depths for the Nichols Ranch and Hank Units, but does not provide this information for the Jane Dough Unit.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.6.3(5) states that the characterization of the geology is acceptable if the information regarding economically significant energy-related deposits is provided such that their location and relationship relative to the proposed facility is clear.

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Request for Additional Information

Please revise Section 2.6.1 of the TR to include a discussion of the Coal Bed Methane target depths at the Jane Dough Unit or provide a reference to a section that provides this information.

Uranerz Response:
A discussion of the Coal Bed Methane Target for Jane Dough Unit has been added to Section 2.6.1. The revised page is attached.

RAI 2.6-2. AB Mudstone Isopach

Description of Deficiency

Exhibit JD-D5-17, which presents an isopach map of the AB mudstone, does not include the locations of the projected wellfields. The AB mudstone plays an important role in the control and prevention of excursions.

Basis for Request

NUREG-1569 Review Procedure Section 2.6.2, states in part, that the application should establish the continuity of the geologic strata and likely ability of the strata to isolate *in situ* leach fluids.

Request for Additional Information

Please revise Exhibit JD-D5-17 to include the locations of the projected wellfields.

Uranerz Response:
It is not customary to include the projected wellfield on isopach maps. The isopach maps that were submitted in the Jane Dough were created in the same fashion as those submitted for the Nichols Ranch and Hank Units that have been approved. That said, for this particular mudstone the projected wellfield outlines have been added. The revised Exhibit JD-D5-17 is enclosed.

RAI 2.7-1. Drainage Basin Map

Description of Deficiency

Figure JD-D6-1, which is referenced in Section 2.7.1.2.1 of the TR, does not show the entire area and shape of the Cottonwood and Seventeen Mile drainage basins.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings and that the maps provided identify the location, size, shape, hydrologic characteristics, and uses of surface-water bodies near the proposed site, including likely surface drainage areas near the proposed facilities.

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Request for Additional Information

Please revise Figure JD-D6-1 to include the entire area and shape of the Cottonwood and Seventeen Mile drainage basins or provide a reference to a figure that provides this information.

Uranerz Response:
The drainage map was updated to include all of the Seventeen Mile drainage. Figure JD-D6-1 has been updated and replaced. The Cottonwood Creek drainage is shown on Figure D6-1 of the Nichols Ranch Technical Report.

RAI 2.7-2. Delineation of Subbasin JDA1

Description of Deficiency

The delineation of subbasin JDA1 presented in Figure JD-D6-1 (referenced in Section 2.7.1.2.1 of the TR) requires additional justification. It is unclear from the figure why additional upstream area from the Seventeen Mile Drainage Area basin, also shown in

Figure JD-D6-1, will not drain through the JDA1 subbasin.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings and that the maps provided identify the location, size, shape, hydrologic characteristics, and uses of surface-water bodies near the proposed site, including likely surface drainage areas near the proposed facilities.

Request for Additional Information

Please provide a detailed rationale for the delineation of subbasin JDA1 along with a clear topographic map illustrating the subbasin delineation. If the delineation of JDA1 is revised, please revise the relevant sections of the TR as necessary (e.g., the information contained in Table JD-D6-1).

Uranerz Response:
Subbasin JDA1 was delineated to define the major part of the local drainage within the Jane Dough area that contributes to Seventeen Mile Creek. As with the other Jane Dough subbasins that define the Jane Dough area, the resulting runoff estimates are representative of only the small local drainage subbasins with uplands located within the permit boundary.

RAI 2.7-3. Flood Analyses

Description of Deficiency

The information provided in Section 2.7.1.2.2 of the TR is insufficient for the NRC staff to verify that acceptable models and input parameters have been used in the flood analyses.

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Basis for Request

The review procedures in NUREG-1569, Section 2.7.2(2) state that the NRC staff should verify that acceptable models and input parameters have been used in the flood analyses.

Request for Additional Information

a. Page TR-69b indicates that the techniques presented in Lowham (1976) were used to estimate the peak flows presented in Table JD-D6-1. Please indicate which equation(s) from Lowham (1976) were used.

b. Page TR-69b indicates that the Craig-Rankl method (1978) was used to estimate the peak flows presented in Table JD-D6-1 for the smaller drainages. Please indicate which equation(s) from Craig and Rankl (1978) was used.

c. Please provide and describe the input parameters used in the Craig and Rankl method to compute the flood flows presented in Table JD-D6-1.

d. Please provide and describe the equations and input parameters used to compute the 25-year flow velocities presented in Table JD-D6-1.

e. Figure JD-D6-2 presents the areas that would be inundated from the 25-year peak flood flows. Please describe the methods used to determine the spatial extent (both lateral and longitudinal) of these inundation areas.

Uranerz Response:

a. The area regression equation for Region 3 presented in the "Summary of regression equations for determining peak flows, using the basin-characteristics method" from Lowham (1976) was used in the peak flow estimation.

b. The area regression equation presented in "Table 12. Results of flood-peak regression analysis" of Craig-Rankl (1978) was used for calculation of peak flows for the small drainages.

c. The drainage area of the subbasin was the input to the Craig-Rankl regression equation for calculation of peak flows for the small drainages.

d. Table JD-D6-1 has been updated and is replaced with this submittal. The 25-year peak flow was used with the channel properties presented in Table JD-D6-1 and Manning's equation to compute the flow depth, flow velocity and other channel hydraulic parameters for the 25-year flood. A Manning's n value of 0.03 was used to represent the roughness of the natural channels.

e. The flow depth for the 25-year peak flow was used with the channel topography to determine the inundation area for the 25-year flood. The typical channel configuration was used for the entire inundation area.

RAI 2.7-4. Source and Use of Reservoir Water

Description of Deficiency

The applicant has not sufficiently described the surface water bodies presented in Table JD-

D6A.1-1.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings.

Request for Additional Information

Please describe in detail, the source, and use of, the water contained in the reservoirs presented in Table JD-D6A.1-1.

Uranerz Response:

The water present in reservoirs is almost entirely CBM production water with the remainder being precipitation events. The production and use of the water in these reservoirs is at the discretion of the CBM operators, and Uranerz has no control over nor has access to the information regarding operations of these CBM reservoirs.

RAI 2.7-5. Accuracy of Figure JD-D6-1

Description of Deficiency

Based on NRC staff observations from a September 2015 site visit, Figure JD-D6-1 does not correctly present the location of at least one surface water reservoir (e.g. JD RES-29-1).

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings and that the maps provided identify the location, size, shape, hydrologic characteristics, and uses of surface-water bodies near the proposed site, including likely surface drainage areas near the proposed facilities.

Request for Additional Information

Please review and revise Figure JD-D6-1 to ensure that it is accurate and current.

Uranerz Response:

The reservoir locations have been corrected, and the entire drainage area for the Seventeen Mile was added to Figure JD-D6-1.

RAI 2.7-6. Self-Sampler Locations

Description of Deficiency

Section 2.7.1.2.3 states there are two self-samplers within the Jane Dough Unit. This section however does not provide a description of the hydrologic feature where the self-samplers are located,

the process by which the samples are collected or the rationale for the location of these sample points.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings. The acceptance criteria in NUREG-1569, Section 2.7.3(4) states that the characterization of the site hydrology is acceptable if the water samples were collected by acceptable sampling procedures.

Request for Additional Information

Please provide a description of the hydrologic feature where the self-samplers are located, the process by which the samples are collected and the rationale for the location of these sample points.

Uranerz Response:
The self-samplers were located in the major drainages (Cottonwood and Seventeen Mile) to increase the potential for collecting a surface water sample during run off events. The self-samplers are generally located in a channel, or low depression where runoff flow depth is of sufficient volume to successfully capture a sample. The self-samplers typically consist of a collection jug that is installed with the top of the jug at or below the channel base. A collection tube is attached to the lid on the collection jug with the open end of the collection tube installed approximately six inches above the channel base. Note, there is no flowing water within the licensed area except during runoff during storm events.

RAI 2.7-7. Self-Sampler 2

Description of Deficiency

Section 2.7.1.2.3 describes the results from self-sampler 2 (JD SS2). Based on the NRC staff observations from a September 2015 site visit, the self-sampler 2 location (JD SS2), does not contain a sampling device but is merely a low spot in Cottonwood Creek.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(4) states that the characterization of the site hydrology is acceptable if the water samples were collected by acceptable sampling procedures.

Request for Additional Information

Please revise the description of the JD SS2 sample location to indicate that a self-sampler is not present at this location. Provide a description of the JD SS2 sample location and the methods used to collect samples from this location.
Uranerz Response: Section 2.7.1.2.3 has been revised to describe that JD SS2 will be sampled via grab sample.

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RAI 2.7-8. Exhibit 2-4

Description of Deficiency

A map is not provided illustrating the location of the reservoirs listed in Table 2-12e. Basis for

Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings and that the maps provided identify the location, size, shape, hydrologic characteristics, and uses of surface-water bodies near the proposed site, including likely surface drainage areas near the proposed facilities.

Request for Additional Information

Please revise Exhibit 2-4 to include the reservoirs listed in Table 2-12e. Additionally, please describe the correlation, if any, between the reservoirs listed in Table 2-12e, and the reservoirs listed in Table JD-D6A.1-1.

Uranerz Response:
Exhibit 2-4 specifically displays the permitted WYPDES outfalls and does not present reservoir locations because not all outfalls are necessarily active and not all outfalls have reservoirs. Figure JD-D6-1 (revised with this submittal) displays the surface water sampling sites which include three channel self-sampler locations with the remaining sample sites representing current CBM reservoirs. Although a significant number of reservoirs have contained water at some point, the samples from the CBM reservoirs are almost exclusively produced water from the coal beds and are not representative of natural surface runoff waters. The names of the reservoir sample sites presented on Figure JD-D6-1 and in Table JD-D6A.1-1 include a Section number to indicate general location. The WYPDES outfall locations shown on Exhibit 2-4 and presented in Table 2-12e are more numerous and are distributed over a larger area than is represented by those sampled reservoirs presented on revised Figure JD-D6-1. However, a comparison of the WYPDES outfall locations on Exhibit 2-4 and the sampled reservoirs on revised Figure JD-D6-1 does show a reservoir is located proximate to most outfalls in and directly adjacent to the permit area. This comparison allows association of the reservoirs shown on Figure JD-D6-1 with a WYPDES outfall shown in Exhibit 2-4.

RAI 2.7-9. Reservoir Discharge

Description of Deficiency

Section 2.7.1.2.4.3 states that discharge from coal bed methane surface water impoundments is only permitted during significant run-off events. However, based on a September 2015 site visit, the NRC staff observed discharge occurring from RES 29-1 under low pool conditions. Staff observed that this discharge eventually flowed through an area of planned in situ recovery (ISR) operations (near well cluster URZJB-15).
Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings and that the maps provided identify the location, size, shape,

hydrologic characteristics, and uses of surface-water bodies near the proposed site, including likely surface drainage areas near the proposed facilities.

Request for Additional Information

Please resolve the discrepancy between the text in Section 2.7.1.2.4.3 regarding discharge from surface water impoundments and NRC staff observations.

Uranerz Response:
According to the documents reviewed, discharge from coal bed methane (CBM) is only permitted during significant run-off events. Uranerz is not privy to day-to-day operations of CBM, has no authority over CBM activities, nor tracks compliance of such CBM regulatory requirements as it is outside the scope of ISR. Exhibit 2-4 specifically displays the permitted WYPDES outfalls and does not present reservoir locations because not all outfalls are necessarily active and not all outfalls have reservoirs.

RAI 2.7-10. Permitted Irrigation

Description of Deficiency

Section 2.7.1.2.4.3 states that permitted irrigation right on Cottonwood Creek is depicted on Exhibit 2-4. The NRC staff could not locate permitted irrigation on Exhibit 2-4.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(1) states that the characterization of the site hydrology is acceptable if it characterizes surface water bodies and drainages within the licensed area and affected surroundings and that the maps provided identify the location, size, shape, hydrologic characteristics, and uses of surface-water bodies near the proposed site, including likely surface drainage areas near the proposed facilities.

Request for Additional Information

Please resolve the discrepancy regarding the information presented in Section 2.7.1.2.4.3 and that presented on Exhibit 2-4. Additionally, please describe the permitted irrigation to Cottonwood Creek.

Uranerz Response:
The irrigation area is presented on Exhibit 2-3. Section 7.2.2 of the Technical Report includes discussion of the spreader dikes used to distribute water in Cottonwood Creek.

RAI 2.7-11. Vertical Hydraulic Conductivity

Description of Deficiency

Page TR-110d makes reference to the vertical hydraulic conductivity near wells URZJA-1, URZJA-7 and URZJA-8. A description of how the vertical hydraulic conductivity values were determined was not presented.

Basis for Request

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The acceptance criteria in NUREG-1569, Section 2.7.3(3) states, in part, that the characterization of the site hydrology is acceptable if the methods or standards used to analyze pumping test data are described and referenced.

Request for Additional Information

Please provide a description of how the vertical hydraulic conductivity values described on page TR-110d were determined.

Uranerz Response:
Drawdown curves from the multiwell tests were matched to WTAQ type curves in order to determine the Kv/Kh ratios (Kv=vertical hydraulic conductivity, Kh=horizontal hydraulic conductivity). The vertical hydraulic conductivity is obtained after the calculation of the horizontal hydraulic conductivity is made.

RAI 2.7-12. A Sand Hydraulic Conductivity

Description of Deficiency

Page TR-110d states a horizontal hydraulic conductivity of 0.54 ft/day is thought to best represent the A Sand; however, 0.54 ft/day exceeds all the A Sand horizontal conductivity values presented in Table JD-D6-3.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(3) states, in part, that the characterization of the site hydrology is acceptable if the methods or standards used to analyze pumping test data are described and referenced.

Request for Additional Information

Please provide rationale to support the statement made on page TR-110d that the hydraulic conductivity of the A Sand is best represented by a value of 0.54 ft/day. Note that the 0.54 ft/day value is also presented on page TR-110g. Similar text regarding the A sand is also present in Appendix JD-D6.

Uranerz Response:
The hydraulic conductivity value was changed to 0.25 ft/day on page TR-110d and in Appendix JD-D6. There have been page numbering changes as a result of revision and the reference to the hydraulic conductivity of the A Sand on page TR-110g now occurs on page TR-110i and has been updated.

RAI 2.7-13. Figure JD-D6-4 Wells

Description of Deficiency

Figure JD-D6-4 presents wells located ½ mile of the Jane Dough Unit that are not discussed in Section 2.7.3.2 (e.g. ENL. SPATULA CS STATE #6).

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(6) states, that the characterization of the site hydrology is acceptable if the applicant has provided information on past, current, and anticipated future water use, including descriptions of local groundwater well locations, type of use, amounts used, and screened intervals.

Request for Additional Information

Please revise Section 2.7.3.2 to discuss all wells presented on Figure JD-D6-4.

Uranerz Response:
The existing ranch wells are discussed in the text. The remaining mining, oil and gas wells are not discussed as this approach is consistent with the information provided and approved with Nichols Ranch and Hank Units.

RAI D5-1. FB Mudstone

Description of Deficiency

Page JD-D5-12 describes the FB Mudstone thickness as 0 to 70 ft across the Jane Dough area. This description is inconsistent with the isopach map of the FB Mudstone (Exhibit JD-D5-24) which shows a significant thickness throughout the Jane Dough Unit area.

Basis for Request

NUREG-1569 Review Procedure Section 2.6.2, states, in part, that the application should establish the continuity of the geologic strata and likely ability of the strata to isolate *in situ* leach fluids.

Request for Additional Information

Please clarify the description of the FB Mudstone presented on Page JD-D5-12 and the representation of the FB Mudstone thickness on Exhibit JD-D5-24.

Uranerz Response:
Page JD-D5-12 has been revised to clarify the FB Mudstone thickness as presented in Exhibit JD-D5-24. The revised page is enclosed.

RAI D6-1. Water Supply Wells Pumping Rate

Description of Deficiency

The estimated pumping rates for the water supply wells located within the Jane Dough Unit are not provided.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.7.3(6) states, that the characterization of the site hydrology is acceptable if the applicant has provided information on past, current, and anticipated future water use, including descriptions of local groundwater well locations, type of use, amounts used, and screened intervals.

Request for Additional Information

Please provide, or provide reference to, the estimated pumping rates for the water supply wells located within the Jane Dough Unit.

Uranerz Response:
The level of information provided on Table JD-D6-2 Basic Well Data for Jane Dough Unit Wells is the same level of information provided for Nichols and Hank Units (see Tables 2-13 and 2-14 in the TR), which has been approved by NRC. As stated in the Basis for Request, the information needed includes, descriptions of local groundwater well locations, type of use, amounts used (i.e. volume), and screened intervals, there is however no requirement to include the estimated pumping rates.

RAI D6-2. Coal Bed Methane Groundwater Model

Description of Deficiency

The discussion of the groundwater flow model (see page JD-D6-13) used to evaluate the potential hydrologic impacts of Coal Bed Methane production on the uranium ore-bearing sands lacks the detail required for NRC staff evaluation.

Basis for Request

NUREG-1569 Area of Review Section 2.7.1, states, in part, that the characterization of hydrogeology should include information relative to the control and prevention of excursions and data to support conclusions concerning the local groundwater flow system.

Request for Additional Information

Please provide:

a. the electronic input/output files for all groundwater model simulations;

b. a detailed rationale for the model setup, boundary conditions and parameter assignments;

c. Any modeling reports that exist describing the simulations; and

d. A detailed description, including figures, of the comparison of the MODFLOW results to that predicted by the Neuman-Witherspoon (1972) method as described on page JD-D6- 14.

Uranerz Response:

a and b.
In lieu of providing model files, the following includes additional description and discussion of the analysis of the potential for impacts on water levels in the production sands by pumping of coal bed methane wells. The MODFLOW modeling used a highly generalized approach to simulate the propagation of drawdown from a hypothetical coal bed production zone up through the geologic profile to the ISR production zones. The modeling is highly generalized in that the simplified layer sequence, aquifer properties, well production rates, operational periods and other inputs were selected to produce a simulation of the expected maximum potential for propagation of drawdown vertically upward from the coal bed to the ISR production intervals. Therefore, the model inputs do

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not represent a specific location, CBM well configuration or forecast of future CBM production rates. Rather, the model configuration allows simulation of a large magnitude of drawdown at a CBM production well and evaluation of the magnitude of drawdown in the strata above the coal bed.

The 50 row by 50 column model grid was developed as a strip arrangement with a 300 feet by 100 feet uniform cell dimension. A schematic of the model configuration is attached. A constant head boundary was used along column #1 of the model grid to maintain the initial head along this boundary. No other boundary conditions were incorporated in the model as the objective was to simulate a large degree of drawdown in the coal bed at the well location(s). The CBM stresses included production from five CBM wells located as shown on the attached schematic.

Because the objective of the CBM modeling was to simulate the vertical propagation of drawdown upward from the produced coal bed, the simulation results presented in Figure JD-D6-13 are for a model cell containing a producing CBM well. The focus of the evaluation on the changes in head in all layers at a cell containing a CBM well reduces the sensitivity of the modeling approach to boundary conditions, estimates of transmissivity, estimates of storage properties, and other model inputs. In short, the evaluation of head changes in all layers at the particular cell is intended to illustrate how head changes or drawdown diminishes with increasing vertical distance from the coal bed. Since the selected cell represents the maximum drawdown within the coal bed, the model results as presented in Figure JD-D6-13 represent the maximum expected drawdown in the generalized lithology above the hypothetical coal bed.

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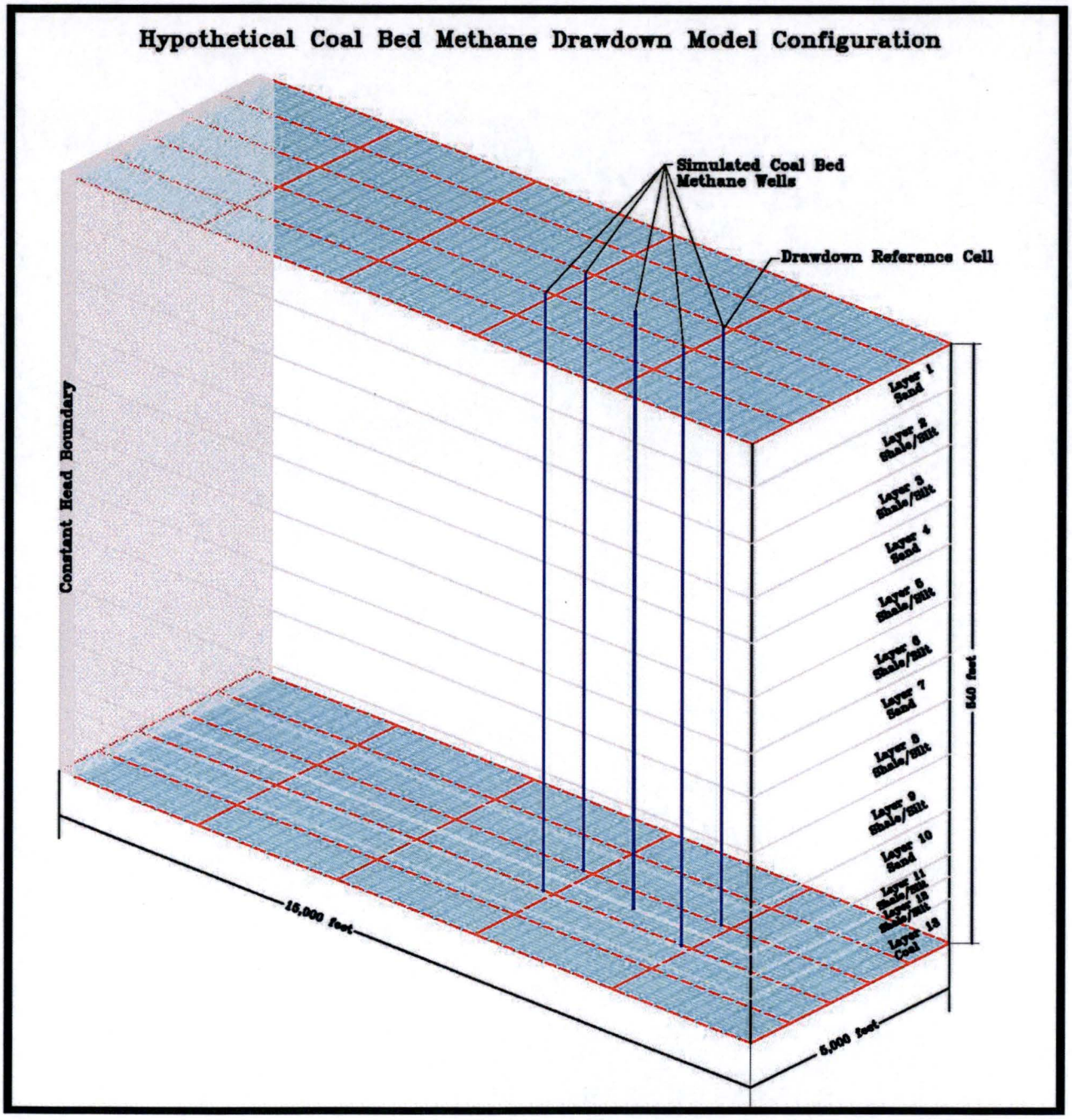

c. No additional modeling reports were produced.

d. The MODFLOW modeling approach was developed as an alternative to using aquifer properties estimation methods such as the method presented in Neuman and Witherspoon (1972) evaluate the potential for propagation of drawdown from a CBM production coal bed to overlying layers. The Neuman-Witherspoon method was developed to allow estimation of permeability in an aquitard adjacent to a stressed aquifer using measured drawdowns in both the aquifer and aquitard. With slight rearrangement of the calculation, the method can be used to estimate drawdown with time in an overlying aquitard given a known drawdown in the

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pumping aquifer. However, the Neuman-Witherspoon method is not appropriate for predicting drawdown in a sequence of layers above the pumped aquifer, and is generally only applied for pumping tests with a duration of hours or days. In the case of evaluating potential CBM drawdown impacts to the ISR mining interval, the duration of CBM pumping can be many years, and multiple layers with a composite thickness of several hundred feet are present between the coal and ISR mining zone. In addition, the "leakage" from the sequence of layers overlying the aquitard tends to mute the drawdown in the aquitard, which adds a layer of complexity not reflected in the Neuman-Witherspoon method. Thus, the comparisons of magnitude of drawdown are qualitative in nature. The cited comparison of the similar magnitude of estimated drawdown with the MODFLOW model results and the Neuman-Witherspoon estimates was done for a 20 year simulation of CBM production using the shale layer assumed to be immediately above the coal seam.

Figure 3 of Neuman and Witherspoon (1972) presents a graphical means of estimating the ratio of drawdown in the aquitard to the drawdown in the pumping aquifer (s'/s) based on two dimensionless variables. Figure 3 of Neuman and Witherspoon (1972) is reproduced below.

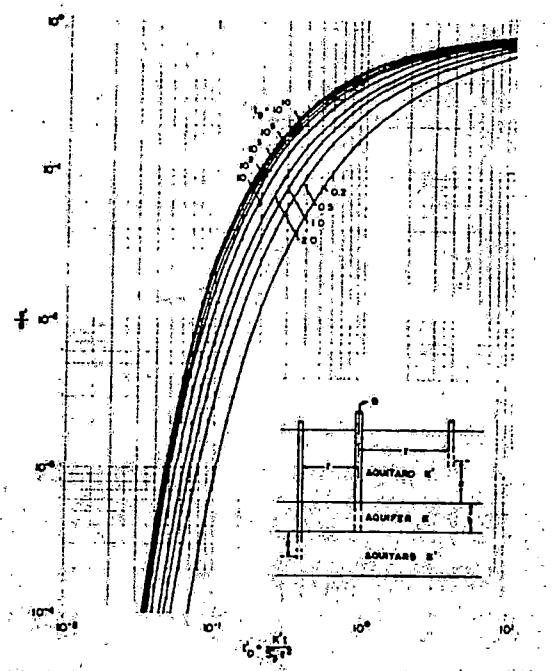

Fig. 3. The variation of s'/s with t_D' for a semi-infinite aquitard.

The dimensionless variable on the horizontal axis of Figure 3 of Neuman and Witherspoon (1972) is:

$$t'_D = K' * t/(S'_s * z^2)$$

where: t'_D = dimensionless time for the aquitard above the coal aquifer
K' = permeability of the aquitard
t = time since start of pumping

S'_s = specific storage of the aquitard = storage coefficient of the aquitard divided by aquitard thickness
z = vertical distance of point of drawdown measurement above base of aquitard

A similar dimensionless variable for the pumped aquifer is calculated as:

$t_D = K * t/(S_s * r^2)$ or $t_D = T * t/(S * r^2)$

where: t_D = dimensionless time for the coal aquifer
K = permeability of the aquifer
t = time since start of pumping
S_s = specific storage of the aquifer = storage coefficient of the aquifer divided by aquifer thickness
r = radial distance from pumping well
T = aquifer transmissivity
S = aquifer storage coefficient

Several combinations of aquifer properties were used in calculating t'_D with results ranging from a few hundred to approximately 12,200. As an example, a transmissivity of 0.5 gal/day/ft, an aquitard thickness of 20 feet, a storage coefficient of 1E-04 feet/feet, a time of twenty years, and a vertical z dimension of 20 feet to the top of the 20 foot thick aquitard results in a calculated t'_D of 12,208. This places the range of t'_D values roughly two to three log cycles beyond the right side of the graph in Figure 3. This is in the area where the family of t_D curves is converging to a s'/s value of between 0.6 and 0.9. The calculation of t_D using a range of likely aquifer properties gives t_D values from approximately 40,000 to over 1,000,000, so it is appropriate to use the upper three to four t_D curves on Figure 3. The general convergence of the family of t_D curves to a value of s'/s of between 0.6 and 0.9 at large values of t'_D indicates that drawdown in the overlying aquitard may approach the magnitude of the drawdown in the pumped aquifer at large time. The hypothetical MODFLOW model predicted 493 feet of drawdown in the coal aquifer with 291 feet of drawdown in the overlying shale after 20 years of CBM production. This gives an s'/s ratio of 291/493 or 0.59 for the MODFLOW prediction. This is reasonably consistent with the Neuman-Witherspoon estimation of s'/s of 0.6 to 0.9 at large values of t'_D.

RAI D6C-1. Multi-Well Pumping Tests

Description of Deficiency

Aquifer pumping tests provide data that can be used to determine the hydrologic properties of the local aquifers and aquitards that affect or may be affected by the proposed *in situ* leach activities. Moreover, these tests provide data that are critical to evaluating the degree of isolation between the ore production zone and upper and lower aquifers. The information presented in Addendum JD-D6C regarding the aquifer pumping tests conducted at the Jane Dough Unit lacks sufficient detail, clarity or is missing information such that the NRC staff cannot fully evaluate their adequacy.
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NUREG-1569 Section 2.7.3(3) states, in part, that an acceptable application describe and reference the methods or standards used to analyze pumping test data. Section 2.7.3(3) additionally states that the application should provide an explanation (e.g., leaky aquitards, delayed yield effects, boundary effects, etc.) for instances where the fitted curves deviate from measured drawdown.

Request for Additional Information

a. Please provide or reference figures that illustrate the location of the wells discussed in this section in plan view. Figures should be at a scale such that the location of each pumping and observation well is readily discernable (e.g. provide a figure for each multi- well pumping test).

b. For each of the aquifer pumping tests conducted, please provide a reference to the geologic cross section figure that shows the location and completion interval of each well included in the test.

c. Section JD-D6.C.1.1 states that the thickness of the A Sand at URZJA-1 is 75 feet while Table JD-D6-3 states that the aquifer thickness at this location is 320 feet. Please resolve this discrepancy.

d. For each of the multi-well pumping test analyses, please include a discussion of the assumptions for each analytical method used and how the assumptions were met or violated. If an assumption was not met, describe how not meeting this assumption impacts the calculated results.

e. For each of the multi-well pumping tests, provide a discussion and rationale for any deviations of the measured drawdown from the theoretical type curve.

f. Figure JD-D6C.1.1-1 indicates the water level changes approximately 1-2 feet in URZJA-1 immediately prior to the start of pumping. Please provide a discussion of this water level change and its impact on the calculation of hydraulic parameters and revise figures and analyses as appropriate.

g. Page JD-D6C.1-1 states that corrected drawdown data for pumping well URZJA-1 are presented in Figure JD-D6C.1.1-2. The text does not discuss how the data were corrected. Please provide a description of and rationale for these corrections.

h. Page JD-D6C.1-1 states that because late time data were used in the curve fitting shown on Figure JD-D6C.1.1-2, no adjustments are needed to account for the partially penetrating well conditions. Please provide additional rationale and literature citations to support this statement.

i. The line fit to the drawdown data on Figure JD-D6C.1.1-7 appears to intercept the time scale axis at approximately 300 minutes (t_o). However, the storage coefficient calculation shown on Figure JD-D6C.1.1-7 uses a t_o value of 10. Please resolve this discrepancy.

j. Addendum JD-D6C references WTAQ analyses in multiple places but does not provide any further details. Please provide additional details relevant to these analyses. For example, what analytical methods were used within WTAQ, what is

the rationale for their selection and what assumptions do the methods make.

k. The water level data for well URZJA-7 presented on Figure JD-D6C.1.2-1 appear to trend to a post-pumping level that is approximately 10 feet above the pre-pumping level. Please provide a rationale for this data trend and revise the relevant figures and analyses as appropriate.

l. Please describe the method and rationale used to calculate the water level changes shown in Figures JD-D6C.1.2-10 and JD-D6C.1.5-7. Referencing water level changes to the initiation of pumping seems appropriate, but it appears some other approach has been adopted in some instances. Please clarify and revise relevant figures as appropriate.

m. Page JD-D6C.1-3 indicates that the distance between wells URZJA-8 and URZJA-7 is 101 feet, while Exhibit JD-D5-12 indicates the distance between these wells is 112 feet. Please resolve this discrepancy.

n. The water level data for wells URZJA-8 and URZJB-9 presented on Figure JD-D6C.1.3- 1 appear to trend to a post-pumping level that is significantly different than their pre- pumping level. Please provide a rationale for these data trends and revise the relevant figures and analyses as appropriate.

o. Section JD-D6C.1.2.5 indicates that observation well URZJC-10 is completed in the C Sand, however the borehole log for URZJC-10 as shown in Exhibit JD-D5-12 does not indicate C Sand at this location. Please provide a rationale to support the presence of the C Sand at URZJC-10 and revise the relevant figures as appropriate.

p. Several sections within Addendum JD-D6C (e.g. JD-D6C.1.1.4 and JD-D6C.1.1.5) suggest that the water level changes observed within overlying and underlying aquifers are a result of variations in barometric pressure rather than a response to pumping. To support these statements, please provide an analysis of the barometric efficiency of these formations and plots of the measured water levels corrected for barometric efficiency at each of these locations and re-evaluate and describe the observed responses.

q. The water level data collected during the multi-well tests conducted at JA-13-1 and JA- 14-1 exhibit significant scatter. Additionally, there is a large disparity between the calculated transmissivity values at these locations when the WTAQ and Jacob methods are used. Please describe the source of the data scatter and provide a rationale for the large disparity in the calculated transmissivity between the Jacob and WTAQ analyses.

r. Section JD-D6C.1.4.2 indicates that observation well URZJA-14-1 is located 55.9 feet from pumping well URZJA-13-1. Exhibit JD-D5-10 indicates the distance between these wells is 117 feet and examination of the coordinates presented in Table JD-D6-2 suggests the distance between these wells is approximately 109 ft. Please resolve this discrepancy and revise any analyses as appropriate.

s. How do wells URZJA-14-1 and URZJA-13-1 discussed in Section JD-D6C.1.4.2 relate to wells URZJA-13 and URZJA-14 presented in Exhibit JD D6-1? Please provide or reference a figure illustrating the locations of URZJA-14-1 and URZJA-13-1.

t. Please provide the aquifer pumping test data (e.g. water level measurements, flow

measurements, atmospheric pressure measurements) presented in Addendums JD-D6B and JD-D6C in electronic form (e.g. Microsoft Excel spreadsheet).

u. Please provide any other reports that were prepared documenting the testing and analysis of the wells discussed in Addendum JD-D6C.

Uranerz Response:

a. Figure JD-D6-4 presents the location of all of the Jane Dough Unit wells that were used in each of the multi-well pump tests. Figures JD-D6-5 through JD-D6-9 present the well locations by individual aquifer for the A Sand, 1 Sand, B Sand, F Sand, and G Sand, respectively.

b. The location and completion interval for each of the wells included in the multi-well pump tests are presented in Table JD-D6-2 Basic Well Data for Jane Dough Unit. The northeast cluster of wells is best represented by the E-E' cross section presented in Exhibit JD-D5-5. The northwest cluster of wells is best represented by the F-F' cross section presented in Exhibit JD-D5-6. Cross section J-J' presented in Exhibit JD-D5-10 best represents the wells located in the southwest cluster, while cross section L-L' presented in Exhibit JD-D5-12 best represents the northeast cluster of wells.

c. The text in Section JD-D6.C.1.1 has been edited to reflect the value given in Table JD-D6-3.

d. The straight line equation and the Theis recovery equation both are based upon the Theis equation. The Theis equation assumes that the aquifer is homogeneous and isotropic, the aquifer has infinite areal extent, the pumping well penetrates and receives water from the entire thickness of the aquifer, the coefficient of transmissivity is constant at all times and at all places, the well has an infinitesimal diameter, and water removed from storage is discharged instantaneously with decline in head. The WTAQ analysis assumes the aquifer is homoegeneous, has infinite lateral extent, has uniform thickness, can be anisotropic provided that the principal directions of the hydraulic conductivity tensor are parallel to the r, z coordinate axes, vertical flow across the lower and upper boundaries of the aquifer are negligible, the porous medium and fluid are slightly compressible and have constant physical properties, and that the pumping and observation wells are infinitesimal in diameter. These assumptions are met well enough to obtain reasonable aquifer properties from these tests.

e. Deviations from the theoretical type curves in multi-well pumping tests are due to the variance in aquifers and wells properties from the assumptions presented in the response to RAI D6C-1 d. While the curves do not match the theoretical curves, the results are close enough to provide tangible information about the aquifer properties.

f. The data points indicating drawdown prior to the start of pumping referenced in Figure JD-D6C.1.1-1 were due to an adjustment being made in the transducer depth and should not have been presented. Figure JD-D6C.1.1-1 has been edited.

g. The transducer data was corrected for barometric pressure changes with a barometric coefficient of 1.0 ft of water/in. of Hg. Barometric pressure can show changes in the transducer readings that do not correlate to physical water level changes, thus the data is corrected to show physical water level changes. The corrections made were not significant

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enough in magnitude compared to the overall drawdown in the well to adversely affect the results.

h. The maximum effects of the partially penetration are attained during the early stages of drawdown. The late time data when plotted on a semi log plot will approximately match the slope of a fully penetrating observation well. Hantush's "Drawdown Around a Partially Penetrating Well" (1961) provides further discussion of partially penetrating effects.

i. The t_o value of 10 was a typo, and has been corrected in Figure JD-D6C.1.1-7.

j. The assumptions made within the WTAQ analysis are stated in the response to RAI D6C-1 d. The analytical methods used within WTAQ for these analyses were for confined aquifers with partially penetrating wells which allows for anisotropic hydraulic conductivity.

k. The post-pumping levels presented in Figure JD-D6C.1.2-1 were a result of a miscalculation in the spreadsheet that produced the figure. The drawdown and recovery for this well exceeded the range of the transducer used for this well and had to be moved during the test. The miscalculation affected only the data presented in Figure JD-D6C1.2-1 and doesn't change the recovery analysis shown in Figure JD-D6C.1.2-3. Figure JD-D6C.1.2-1 has been updated with the corrected data.

l. The data was adjusted to reference water level changes from the start of pumping. Figures JD-D6C.1.2-10 and JD-D6C.1.5-7 have been updated.

m. Distance between URZJA-8 and URZJA-7 is 113 feet. To resolve the discrepancy, Page JD-D6C.1-3 has been edited. Figures JD-D6C.1.2-4, JD-D6C.1.2-5, JD-D6C.1.3-4, and JD-D6C.1.3-5 have been edited as well.

n. The transducer data presented for URZJA-8 was adjusted to match the manual measurement taken on June 21, 2012. It appears that the transducer slipped sometime prior to this measurement being taken. The URZJB-9 data was adjusted to correct for what appears to be movement in the transducer shortly after the manual measurement taken on June 21, 2012. The lagging recovery in this well is likely due to its completion interval being above the pumping well completion interval and the vertical conductivity of the AB Sand.

o. A log for well URZJC-10 was not provided in Exhibit JD-D5-12. The presence of the C Sand is noted on the logs of nearby wells URZJA-8 and URZJA-9.

p. The variations observed in the overlying and underlying wells are insufficient to warrant the adjustment of the presented data. The observed variations show no trends of significance due to the stress of the pump tests.

q. The data scatter could be attributed to a number of issues. The disparity between the Jacob and the WTAQ analyses is due to well storage effects. These effects were large enough that a quality fit of the partially penetrating theoretical curve produced from WTAQ could not be matched to the data. The late time data from both the Jacob and Theis Recovery equations present a more representative value of the A Sand at those locations.

r. URZJA-13-1 and URZJA-14-1 are 113 feet apart. To resolve the discrepancy, Section JD-D6C.1.4.2, Figures JD-D6C.1.4-4, JD-D6C.1.4-5, JD-D6C.1.5-4, and JD-D6C.1.5-5 have been updated.

s. URZJA-14-1 and URZJA-13-1 are replacement wells for URZJA-14 and URZJA-13, respectively. Exhibit JD-D6-1 has been updated to show locations for URZJA-14-1 and URZJA-13-1.

t. The URZJA-1 multi-well pump test is being provided in a Microsoft Excel spreadsheet.

u. No other testing was done on the wells discussed in Addendum JD-D6C.

RAI 3D-1. Jane Dough Groundwater Modeling

Description of Deficiency

Groundwater modeling was conducted to evaluate the impacts on the groundwater flow system due to operations at the Jane Dough Unit. The description of this modeling, presented in Addendum 3D, lacks sufficient detail for the NRC staff to evaluate its adequacy.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (5)(f) states that the description of the *in situ* leaching process and equipment is acceptable if it provides an analysis of the effects that *in situ* leach operations are likely to have on surrounding water users.

Request for Additional Information

a. Please provide the electronic input/output files for all groundwater modeling simulations along with a text file that provides a brief description of each file.

b. Please describe and provide a cross section figure illustrating how the hydrogeological conditions at the Jane Dough site are represented with the five layer model.

c. Please provide a description of the boundary conditions assigned to the model domain and provide references that support the assignment of these conditions.

d. Please provide a description of how the initial potentiometric surface was derived, was a steady-state simulation conducted?

e. Please provide a figure illustrating the location of the general head boundary cells within the model domain.

f. For each layer in the model, please provide the aquifer thickness that is represented.

g. Please provide or reference a map of the extent of the Wasatch aquifer that supports the extent of the model domain.

h. Please provide detailed calculations illustrating how the VCONT terms were derived.

i. Please provide a figure illustrating the assignment of the differing VCONT values within the model domain.

j. Page MPI.2 states that model Layer 1 represents the lower interval of the B Sand. Please provide a discussion detailing the rationale for not representing the entire B Sand thickness in the model.

k. Please provide an annotated table detailing the injection/pumping schedule for each of the 20 stress periods modeled (e.g. Nichols Ranch production Area #1 mining, Jane Dough PA #2 restoration middle ore zone etc.).

l. Please provide any other reports that were prepared documenting the groundwater modeling simulations.

Uranerz Response:

a. During a discussion with NRC personnel on March 17, 2016, NRC staff members indicated that supplying responses to the remaining modeling related requests is sufficient and the electronic model files were not necessary.

b. A cross section schematic has been developed and is included below to illustrate the layer sequence used in the modeling.

c. The boundary conditions used in the modeling included general-head boundary cells located generally around the perimeter of the active model grid. The number of general-head boundary cells was increased until the head in the model layers was stable during a simulation with no well stresses, and not all active cells on the periphery of the grid are general-head boundary cells. A limited number of general-head boundary cells are located a few cells from the edge of the model grid to further stabilize the regional potentiometric surface. A figure has been attached to present the location of the general-head boundary cells.

   General-head boundaries are a commonly accepted means of providing a hydraulic boundary on the periphery of a MODFLOW model grid. Although a constant head cell can also be used as a hydraulic boundary, the general-head cells were selected because they will allow the head in the cell to change and thus present a less restrictive boundary condition. However, the model grid was deliberately extended a long distance from the project area in order to minimize boundary effects on the potentiometric surfaces in the area of mining.

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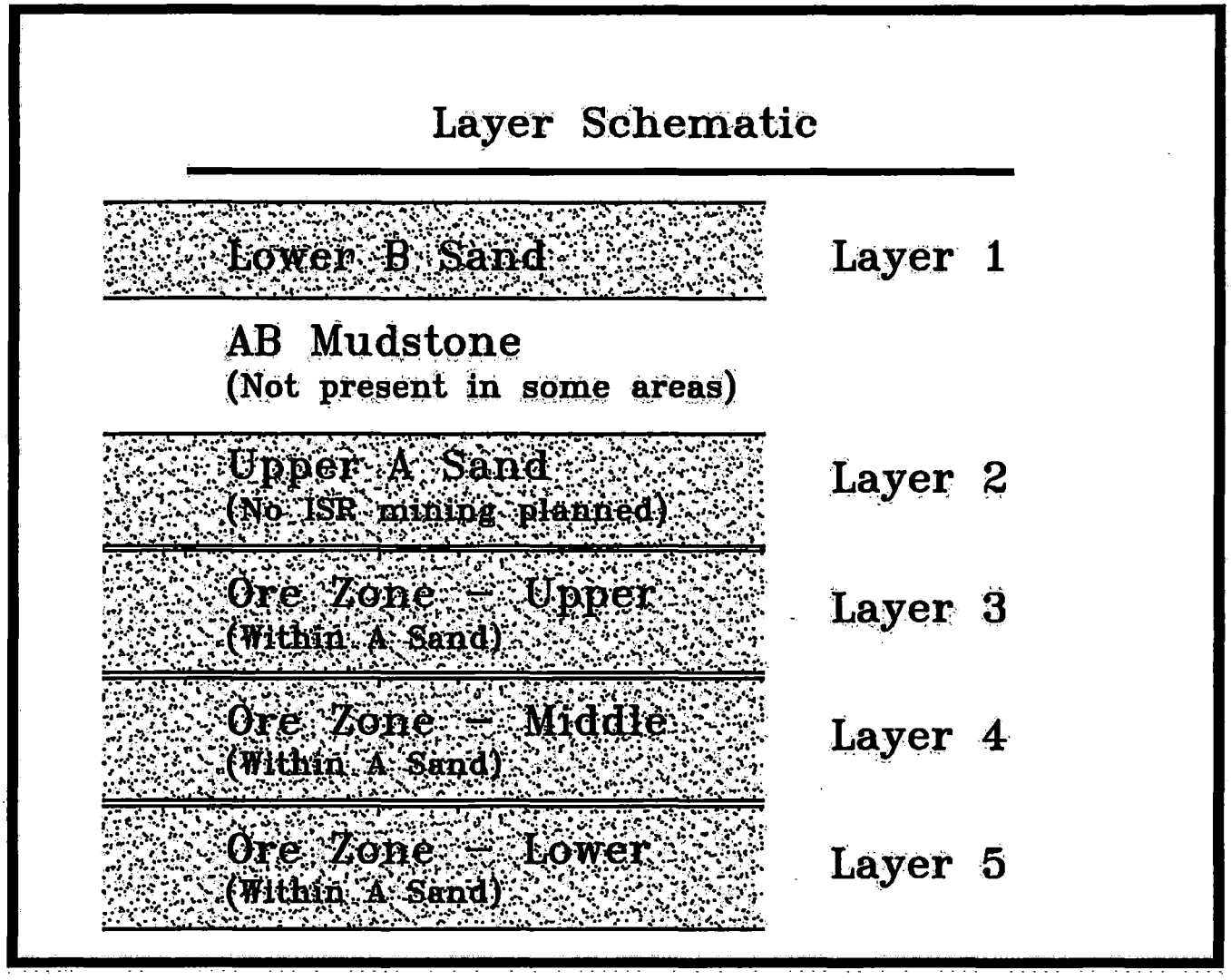

Generalized Layer Sequence for the Jane Dough Modeling

d. The initial potentiometric surface was originally developed for the Nichols Ranch area based primarily upon the measured water levels in the production sand intervals. This initial piezometric surface was then generalized to a uniform gradient of approximately 0.0033 feet/feet in a southeast to northwest orientation and the potentiometric surface was extrapolated to the edge of the model grid using this same gradient and orientation. Because many of the internal cell dimensions were changed with the extension of the fine grid to cover the Jane Dough production area, the initial head in the general-head boundary cells was adjusted to reflect the initial potentiometric surface(s). The model was then run without production well stresses to evaluate stability of the potentiometric surfaces. If there were significant changes in the potentiometric surface(s), the head in the general-head boundary cells was adjusted to reflect those changes and the process was repeated until the potentiometric surface remained stable for a model run with no operational well stresses.

e. A figure titled 'General-Head Boundary Cells' has been attached to present the location of the general-head boundary cells.

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f. The five layers were simulated as confined aquifers in the MODFLOW model and the transmissivity for each layer is described in Addendum 3D. The typical thickness of the layers is expected to range from roughly 18 to 26 feet with a slightly higher transmissivity in layers one, two and four indicating that these layers are expected to be slightly thicker than layers three and five. The completion intervals for the production and injection wells may be smaller than the typical layer thickness.

g. Exhibits JD-D5-a and D5-b both show the regional extent of the Wasatch Formation. The active cells in the model were adjusted to reflect the extent of the Wasatch Formation. It should be noted that the Wasatch Formation is made up of multiple layers of sands, silts and clays, and is not generally considered a single aquifer.

h. The VCONT terms were selected to represent the expected degree of vertical hydraulic communication between the model layers. In addition to the AB mudstone that separates the A and B sands over much of the project area, there are layers and lenses of finer-grained material within the A and B sands that can profoundly restrict vertical movement of ground water. In addition to this, the vertical hydraulic conductivity for these type of sedimentary layers is typically an order of magnitude (or more) smaller than the horizontal hydraulic conductivity.

In the MODFLOW model, the estimation of VCONT for a layer interface between two model layers with an intermediate confining or restrictive layer can be expressed as:

$$VCONT = 1/(1/2(Thick_{i,j,k})/VK_{i,j,k} + (Thick_{CB})/VK_{CB} + 1/2(Thick_{i,j,k+1})/VK_{i,j,k+1})$$

Where:
- $_{i,j,k}$ = subscript indicating cell row (i), column (j), and layer (k)
- $Thick_{i,j,k}$ = thickness of cell i,j,k
- $VK_{i,j,k}$ = vertical hydraulic conductivity of cell i,j,k
- $Thick_{CB}$ = thickness of low permeability layer between layers k and k+1
- VK_{CB} = vertical hydraulic conductivity of layer between layers k and k+1

Multiple finer-grained layers that restrict vertical flow may occur within the A Sand and B Sand and in the calculation of VCONT, these very low permeability layers were represented by the low permeability CB layer with the $Thick_{CB}$ and VK_{CB} terms. The restriction of vertical flow is almost completed controlled by these very low permeability shales, mudstones and siltstones. Several combinations of layer thickness and permeability were considered in estimating VCONT for the MODFLOW model. For the upper layer interfaces where the AB mudstone is present, calculations using a large thickness of very low permeability mudstone (assumed to range from 55 to 100 feet) with an estimated vertical hydraulic conductivity of 2.8E-06 to 5E-06 feet/day gives an estimated VCONT of approximately 5E-08 day^{-1}. Although the vertical hydraulic conductivity of the sand intervals is expected to be one to two orders of magnitude smaller than the corresponding horizontal hydraulic conductivity, the restriction of vertical flow represented by VCONT is almost entirely a function of the presence of the low permeability AB mudstone and other fine-grained layers within the sands.

For the upper layer interfaces where the AB mudstone is absent, the vertical conveyance is expected to be significantly greater. Although the large thickness of mudstone is absent, thinner layers of low permeability are likely to be present. A calculation using a composite thickness of a few feet (five to six feet) of low permeability material (estimated vertical hydraulic conductivity of 2.8E-05 feet/day) that restricts vertical flow within and between the model layers gives an estimated VCONT of approximately 5E-06 day^{-1}or roughly two orders of magnitude greater than

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the estimate with the mudstone present. As with the estimation of VCONT above, the restriction of vertical flow represented by VCONT is almost entirely a function of the presence of the low permeability fine-grained layers within the sands.

For the remaining layer interfaces, the restriction of vertical flow is expected to be a result of low permeability layers within and between the model layers. A calculation using a composite thickness of a few feet (two to three feet) of low permeability material (estimated vertical hydraulic conductivity of 2.8E-06 feet/day) that restricts vertical flow within and between the model layers gives an estimated VCONT of approximately 1E-06 day^{-1}.

i. A figure titled 'VCONT Values Used in Modeling' showing the location of the increased VCONT in the area where the AB mudstone is absent is attached.

j. Model Layer 1 was limited to the lower interval of the B Sand primarily because the potential hydraulic impacts of the ISR mining will first occur within the lower B Sand, and this is the interval where monitoring would be most effective. The presence of lower permeability layers within the B Sand is expected to restrict the vertical propagation of water-level changes from the lower B Sand to higher intervals within the sand, so it is likely that any potential impacts from ISR mining will be greatly muted or undetectable in the upper intervals of the B Sand. Additionally, the prediction of horizontal propagation of drawdown within Layer 1 is more conservative with Layer 1 representing the lower interval of the B Sand.

k. A tabulation of the simulated production schedule for the mining operation is provided below.

Modeling Production Wells and Rates

Mine Area	Production Area	Production Layer	Operation Period	Stress Periods	Number of Production Wells	Production Rate (gpm)	Number of Injection Wells	Injection Rate (gpm)
Nichols Ranch	PA#1	Upper Ore	0 - 1.5 year	1 thru 5	62	986	81	977
Nichols Ranch	PA#1	Middle Ore	0 - 1.5 year	1 thru 5	115	1821	128	1803
Nichols Ranch	PA#1	Lower Ore	0 - 1.5 year	1 thru 5	44	700	58	693
Nichols Ranch	PA#2	Upper Ore	1.5 - 3 year	6 thru 8	25	534	28	528
Nichols Ranch	PA#2	Middle Ore	1.5 - 3 year	6 thru 8	99	2113	111	2092
Nichols Ranch	PA#2	Lower Ore	1.5 - 3 year	6 thru 8	40	854	44	845
Jane Dough	PA#1	Middle Ore - North Area	3 - 6 year	9 thru 13	79	820	155	812
Jane Dough	PA#1	Middle Ore - South Area	3 - 6 year	9 thru 13	258	2679	436	2652
Jane Dough	PA#2	Upper Ore	6 - 7.25 year	14 thru 17	20	359	40	355
Jane Dough	PA#2	Middle Ore	6 - 7.25 year	14 thru 17	131	2351	235	2327
Jane Dough	PA#2	Lower Ore	6 - 7.25 year	14 thru 17	44	790	81	782

l. The preceding responses to RAIs present additional information on the ground-water modeling simulations.

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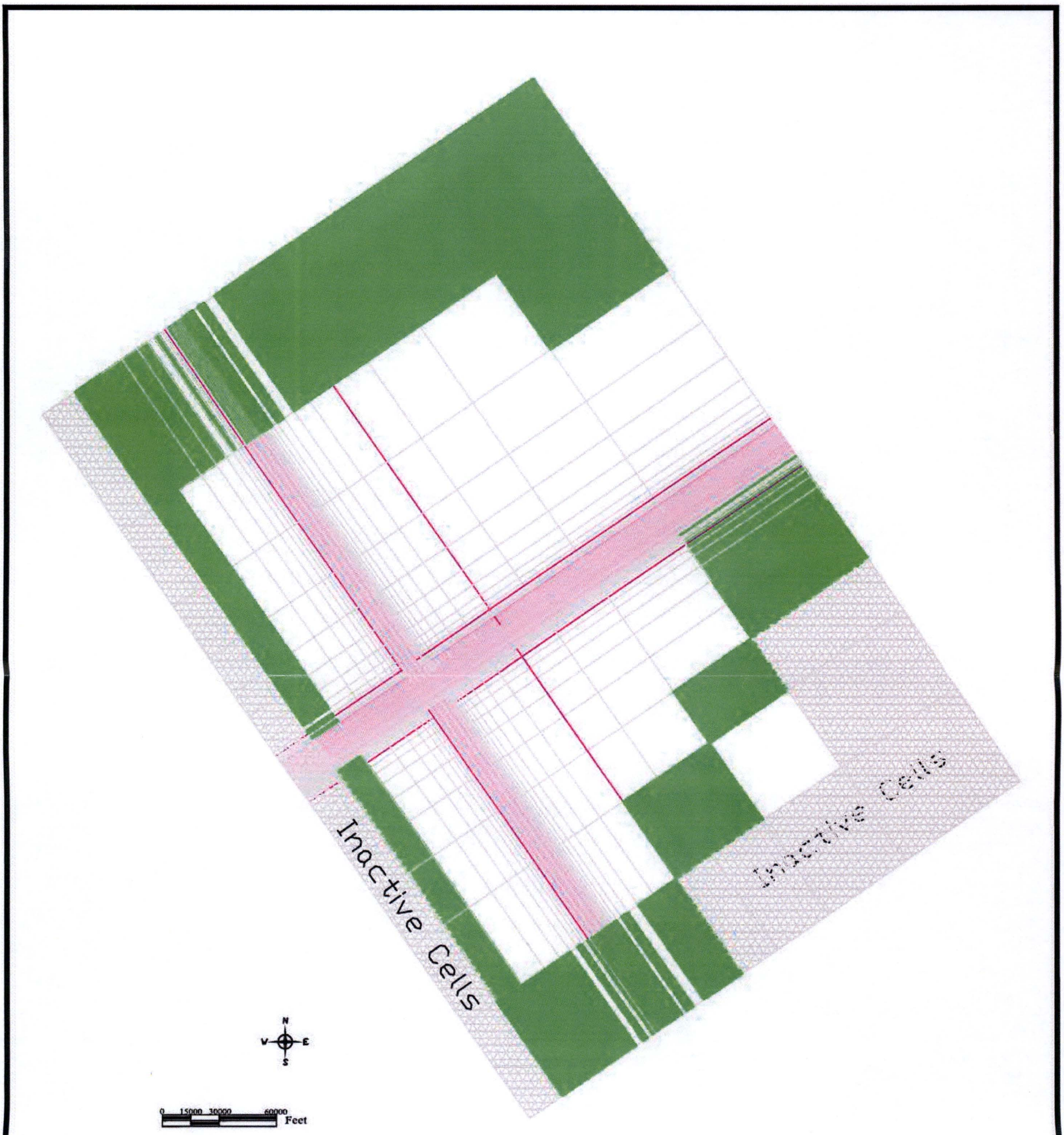

Legend

General-Head Boundary Cell

REVISIONS No.	DATE	MADE BY	DESCRIPTION
1			
2			
3			
4			

DATE	DRAWN BY	CHECKED	APPROVED
4-2016	TGM		

HYDRO-ENGINEERING L.L.C.

HYDRO-ENGINEERING L.L.C.
4685 EAST MAGNOLIA
CASPER, WYOMING, 82604

Uranerz ENERGY CORPORATION
1701 East "E" Street
P.O. Box 50850
Casper, Wyoming
USA 82605-0850

General-Head Boundary Cells

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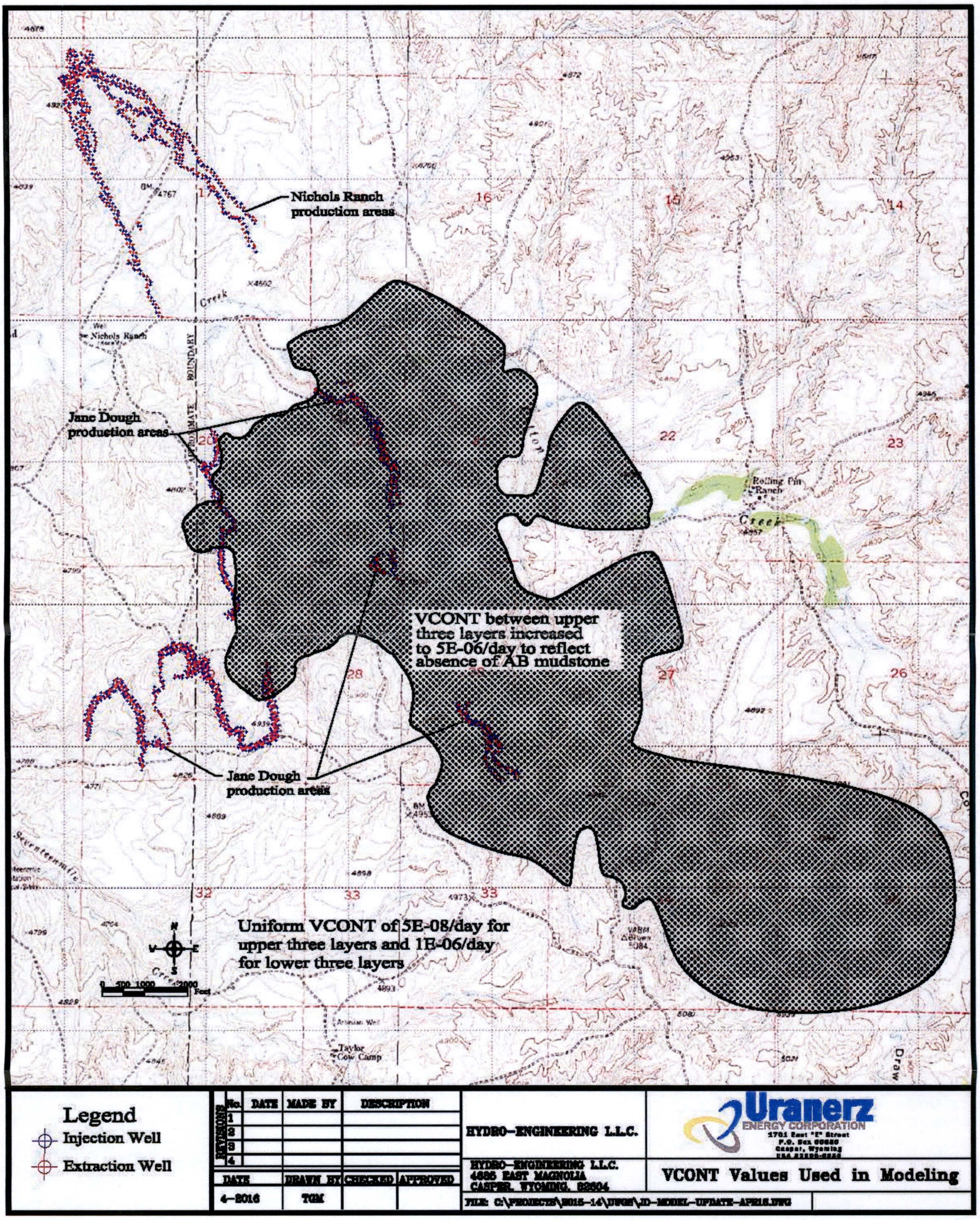

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RAI 2.9-1. Insufficient Explanation of Background Gamma Dose

Description of Deficiency

In Section 2.9.3.5 and Appendix JD-D11, Section JD-D11.3.3, of the TR, Uranerz characterized second quarter 2011 (i.e., April through June 2011) background direct radiation dose of 11.3 mrem/quarter as approximately 72 percent lower than the average of the other three quarters and as "somewhat low," but it didn't provide a credible explanation for the low value. The NRC staff is not aware of any credible physical explanation for the anomalous value.

Basis for Request

The review procedures in NUREG-1569, Section 2.9.2, states that the reviewer should examine data from the pre-operational monitoring program with particular attention paid to the design of the monitoring program, the radionuclides monitored, the results, and the detection limits reported for each radionuclide in each sample medium.

Request for Additional Information

Please review the anomalous background direct radiation dose for the second quarter of 2011 included in Section 2.6 and either provide a credible explanation for the low value or remove the data from the TR.

Uranerz Response:
The second quarter 2011 item being referenced is from Section 2.9.3.5, Table 2-31b of the TR and Appendix JD-D11, Table JD-D11-7. The data provided for first and second quarter 2011 was found to be incorrect and has been corrected in the tables. Although weather conditions that produce excessive snow cover or prolonged soil saturation can reduce gamma radiation from terrestrial sources, Uranerz discovered that the erroneous data contributed to what appeared at that time to be an anomaly. The correct data from the second quarter of 2011 was evaluated and used herein to revise Section JD-D11.3.3. As can be seen from the data, the corrected values yield a more consistent range of values recorded at the other locations. The revised pages are enclosed.

RAI 2.9-2. Sample Locations for Particulate Matter, Radon-222, and Direct Gamma Exposure Rates

Description of Deficiency

The preoperational sample results for particulate matter, radon-222, and direct gamma exposure rates reported in TR Section 2.9 were collected from third calendar quarter 2010 through second quarter 2011, before the on-site meteorological station became operational. As depicted in Exhibit JD-D11-2, preoperational air samples at Jane Dough were generally collected from locations south or east of major ore bodies. Prevailing wind directions shown in Addendum JD-D4, Figure JD-D4-5, are now known, from data collected at the on-site meteorological station, to be from the east, south-southwest, southwest, and north-northwest. Uranerz has since revised the locations of its current operational air samplers around the Nichols Ranch Unit (SERP-1-2014, Uranerz 2014a). Therefore, Uranerz should describe how on-site meteorological data will affect the placement of operational air samplers (which will be co-located with measurements of radon-222 and direct gamma exposure rates) around the Jane Dough Unit.

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Basis for Request

The acceptance criteria in NUREG-1569, Section 2.9.3(1), states that the characterization of the site background radiological characteristics is acceptable if monitoring programs to establish background radiological characteristics, including sampling frequency, sampling methods, and sampling location and density are established in accordance with pre-operational monitoring guidance provided in Regulatory Guide 4.14, Revision 1, Section 1.1 (NRC 1980) and air monitoring stations are located in a manner consistent with the principal wind directions reviewed in Section 2.5 of the standard review plan.

Request for Additional Information

Please revise Section 2.9 of the TR to address changes to the operational environmental monitoring program required as a result of new information about on-site prevailing wind directions, or explain why no changes are needed. Please also identify and change, as needed, any other areas of the license application that are affected by changes in the prevailing wind direction, including, but not limited to:

a. TR Section 2.5.3.4, "Wind Direction";

b. TR Section 2.9.2.1, "Purpose and Procedure," [Baseline Gamma Survey];

c. TR Section 2.9.3.2, "Survey Methdology," [Baseline Radon-222 and Direct Gamma Exposure Rates];

d. TR Section 2.9.3.5, "Jane Dough Unit Results," [Baseline Rn-222 and Direct Gamma Exposure Rates];

e. TR Table 2-31b, "Baseline Gamma Exposure Rate at the Jane Dough Unit Air Monitoring Stations";

f. TR Section 2.9.6, "Air Particulates"; and

g. ER Section 3.6.4.3, "Wind Direction."

Uranerz Response: Prior to starting up the Nichols Ranch Plant, and as a condition of the NRC (License Condition 12.8), Uranerz went through strenuous rounds to establish procedures for surveying and modeling. These rounds are memorialized in License Condition 9.2 as tie downs to the license. It is within these tie down letters that Uranerz procedures of performing operational air monitoring are described and will be adopted into use at the Jane Dough Unit. A statement to this effect has been added to Section 2.9.3.2 along with a commitment to obtain 2 additional quarters of data prior to the commencement of operations (aka wellfield startup) in the Jane Dough Unit. After reviewing the on-site meteorological data three air monitoring stations met stations will be relocated to be more in line with predominant winds. Arrows showing the relocation site have been depicted on Exhibit JD-D11-2. This revision is not intended to replace the exhibit in Appendix JD-D11, it is merely an illustration meant to facilitate a visual understanding for the NRC staff's review.

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RAI 3.1-1. Figure 3-12 Project Schedule

Description of Deficiency

Figure 3-12 indicates that operations in the Hank Unit will begin in early 2016. Since construction has not begun in the Hank Unit, the licensee should revise the project schedule.

Basis for Request

NUREG-1569, acceptance criteria 1.3(1)(g) states that the summary of proposed activities includes, among other things, estimated schedules for construction, startup, and duration of operations.

Request for Additional Information

Please provide an updated Figure 3-12 and update any analyses based on the project schedule, including but not limited to the MILDOS-AREA calculation contained in Appendix JD-D11.

Uranerz Response: The schedule submitted with the amendment application (and license application) was an anticipated proposed schedule estimating what our activities are expected to look like at that time. That said, Uranerz has since submitted an updated schedule to the NRC for the Nichols Ranch project. The schedule was reviewed, revised and forwarded to the NRC for review by letter dated Feb. 4, 2016. The schedule is reviewed annually and revised as needed. This will be an ongoing annual review by the SERP group to determine if an Alternate Decommissioning Schedule is required to be submitted to the NRC. Also, License Condition 10.10 requires the licensee will update or confirm the restoration schedule for the Nichols Ranch Unit PA #2 and provide a basis to the NRC for review and approval for any alternate schedule request that meets the requirements of 10 GFR 40.42. A revised Figure 3-12 is enclosed.

As shown on the updated Projected Production, Restoration and Reclamation Schedule, startup and restoration/reclamation activities at the project site have been extended relative to earlier schedules. With regard to how the schedule change may or may not affect the previous MILDOS Assessment, the sequence and time duration of production and wellfield restoration activities were examined to see if there would be any significant change in the MILDOS Assessment due to overlap and duration. Other important factors were also examined such as increases in the current licensed 3,500 gpm and 2,500 gpm production rates for Nichols Ranch and Hank Units, increases in the number of wells, configuration of the current restricted areas and boundary receptors relative to unrestricted areas, and the results of the on-going radiation monitoring program. After completing this review, the following summary was prepared for NRC's consideration. No significant change in dose to the public is expected in that the overall source terms that were used in the current MILDOS Assessment have not changed. Timing has changed in that the project life is being extended but that just means that the currently-estimated dose, as projected by MILDOS, will not occur in a shorter period of time but instead will be spread over a longer period lowering the dose per year. In short, the overall dose will not be affected by the schedule changes. A new MILDOS assessment would only be warranted if source terms were increased or if production facilities or production areas were changed in such a manner that unrestricted areas would be more exposed to the activities. At this time License Condition 10.2 limits us to 3,500 gpm at the Central Plant and 2,500 gpm at the Hank Unit. Since there is no change in throughput, the existing MILDOS estimates, along with the results from the extensive on-going monitoring program, provide ample assurance that compliance with 20 CFR Part 20 1301

and 1302 will be maintained.

RAI 3.2-1. Jane Dough Bleed Rate

Description of Deficiency

Section 3.2.3.3 provides the planned bleed rate for the Nichols Ranch and Hank Units but not the Jane Dough Unit.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (5)(c) states, the description of the *in situ* leaching process is acceptable if the proposed plant material balance and flow rates are described.

Request for Additional Information

Please revise Section 3.2.3.3 to reflect the planned bleed rate for the Jane Dough Unit.

Uranerz Response: The bleed rate has been added to Section 3.2.3.3 (page TR-167) for Jane Dough. The revised page is enclosed.

RAI 3.2-2. Jane Dough Groundwater Velocity

Description of Deficiency

Section 3.2.6 discusses the natural groundwater velocity and travel distance for a 45-day shut-in period for the Nichols Ranch and Hank Units but not the Jane Dough Unit. This discussion is provided to indicate the containment of the ISR solution during a shut-in period.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (5)(f)(i) states the description of the *in situ* leaching process is acceptable if the ability to control the migration of lixiviant from the production zones to the surrounding environs is described.

Request for Additional Information

Please revise Section 3.2.6 to discuss the natural groundwater velocity and travel distance for a 45-day shut-in period for the Jane Dough Unit (similar to that provided for the Nichols Ranch and Hank Units). Please include the details and references for the groundwater velocity calculation.

Uranerz Response:
The text in Section 3.2.6 has been modified to include a discussion of the travel distance during a 45 day shut-in period.

RAI 3.2-3. Deep Disposal Well Flows

Description of Deficiency

The description of the deep disposal well water balance presented in Section 3.2.6 lacks sufficient detail for the NRC staff to evaluate its adequacy.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (6) states the description of the *in situ* leaching process is acceptable if proposed operating plans and schedules include timetables for wellfield operation, surface reclamation, and groundwater restoration. Water balance calculations should be provided that demonstrate that the liquid waste disposal facilities (surface impoundments, land application, deep well injection) are adequate to process the proposed production and restoration efforts at any time.

Request for Additional Information

a. Please provide a reference for the disposal capacity stated on page TR-173.

b. Please provide a time series figure showing the Deep Disposal Well (DDW) capacity and the planned flows (production and restoration) from the Nichols Ranch and Jane Dough Units for the life of the Nichols ISR Project. The series to be plotted include:

- Total disposal capacity for the Nichols Ranch and Jane Dough Units;
- Total flow to DDW;
- Nichols Ranch production flow to DDW;
- Nichols Ranch restoration flow to DDW;
- Nichols Ranch other flow to DDW;
- Jane Dough production flow to DDW;
- Jane Dough restoration flow to DDW; and
- Jane Dough other flow to DDW.

Uranerz Response:

a. The disposal capacity was a conservative estimate used in the original submittal of the Nichols Ranch ISR license application.

b. A time series figure has been prepared showing the DDW capacity. Because the flows go into the same facility, the Central Processing Plant and co-mingled, the categories have been provided as Planned Flow Production, Production Flow to DDW, Total Disposal Capacity DDW, Total Flow to DDW and Restoration Flow to DDW.

RAI 3.2-4. AB Mudstone's Impact on Operations

Description of Deficiency

Review of Figure 3-8C and Exhibit JD-D5-17 suggests that the planned ISR operations within Jane Dough Production Area 1 may encompass areas where the AB mudstone is present, thins, or is absent, all within the same wellfield. The application does not provide specific details addressing how ISR operations and monitoring will be conducted in this complex subsurface environment.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (3) states that the description of the *in situ* leaching process and equipment is acceptable if it describes, in sufficient detail, the number, location, and screened intervals of excursion monitoring wells in to ensure prompt detection of horizontal and vertical excursions, taking into account site specific parameters such as local geology and hydrology.

Request for Additional Information

a. Please provide a description detailing how ISR operations and monitoring will be conducted in Jane Dough Production Area 1 to ensure that production fluids will be contained within the production zone. This description should emphasize how ISR operations and well design (e.g. well screening interval) will be altered based on the presence and absence of the AB mudstone within a single wellfield.

b. Please provide the criteria that will be used to determine the production zone (i.e. A Sand vs AB Sand) and aquifer exemption boundaries.

c. Please provide a description of how the wellfield testing program will be designed to collect the information outlined in Section 5.7.8 (e.g., degree of production zone isolation, hydraulic connection of the perimeter ring, etc.). This description should emphasize the how the wellfield testing program will be altered based on the presence and absence of the AB mudstone within a single wellfield.

Uranerz Response:

a. The aquiclude above the A Sand at Nichols Ranch is the AB Mudstone (Exhibit JD-D17). While this mudstone is present in the southwest third of the Jane Dough mine unit, the B Sand rests directly upon the A Sand in much of the mine unit. The exterior monitor well ring will consist of wells completed in the A Sand interval.

   For the interior monitor well clusters where the AB mudstone is present, monitor wells will be placed in the B Sand (overlaying aquifer), the A Sand (production aquifer), and the 1 Sand where present.

   Where the AB Mudstone is not present, monitor wells will be completed in the C, F, or G Sand (upper most aquifer), the A Sand (production sand) and 1 Sand where present. Additional trend wells may be added to the base of the B Sand to monitor for vertical flows from the A Sand. The B Sand will be defined as 100 ft above the marker located below the A Sand. There is generally a signature in the resistivity and/or gamma log indicating the presence of a thin shale or depositional surface at that level. This is interpreted to be the contact between the A and B Sands.

b. A minimum of 10 feet of AB Mudstone will be required over the well field area to be considered an adequate aquiclude. Data from additional exploration/delineation drilling will

be utilized to make this determination before interior monitor wells are installed. Where the AB Mudstone in not present the base of the B Sand, the contact will be defined as approximately 100 ft above the marker located below the A Sand. Trend wells may be completed above the B Sand base to monitor for vertical migration. If mining fluids are detected in B Sand processes will be implemented to remedy the vertical migration.

c. The multi-well pump test will be adjusted for areas where the AB mudstone is missing or pinches out near the pumping well. Additional monitoring wells will be added in these areas to define the drawdowns in the bottom of the B Sand from pumping with a completion in only the A Sand. The drawdowns from the B Sand wells will be analyzed for the vertical hydraulic conductivity of the sand in these areas which is an important parameter relative to potential vertical movement. Monitor ring wells in these areas would only be completed in the A Sand and used in the multi-well pump test to prove horizontal continuity in the production aquifer. The overlying and underlying monitoring wells during the pump test will be used to define the vertical isolation.

RAI 3.4-1. Surface Water Pathways at Jane Dough

Description of Deficiency

Section 3.4.8.1, page TR-188, discusses surface pathways that might transport extraction solutions off-site for the Nichols Ranch and Hank Units, but not the Jane Dough Unit.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (5)(f)(ii) states the description of the *in situ* leaching process is acceptable if information regarding the groundwater and surface-water pathways that might transport extraction solutions off-site in the event of an uncontrolled excursion is provided.

Request for Additional Information

Please revise Section 3.4.8.1 to discuss the surface pathways that might transport extraction solutions off-site for the Jane Dough Unit, similar to that provided for the Nichols Ranch and Hank Units.

Uranerz Response:

Section 3.4.8.1 is not the correct location to discuss surface pathways. The correct Section is 7.2.1 of the Technical Report. Text was added to Section 7.2.1 of the Technical Report to address the surface pathways.

RAI 3.4-2. Injection Pressures

Description of Deficiency

The information presented in Section 3.4.6 regarding the maximum injection pressure as it relates to the formation fracture pressure is unclear and incomplete. The use of the term injection pressure is ambiguous as it is not location specific, e.g. surface injection pressure or bottom-hole injection pressure. The discussion stating the injection pressure will be less than the formation fracture pressure does not appear to account for hydrostatic pressure and

therefore may underestimate the bottom-hole injection pressure.

Basis for Request

The acceptance criteria in NUREG-1569, Section 3.1.3 (5)(a) states the description of the *in situ* leaching process is acceptable if the projected down-hole injection pressures with the hydrostatic pressure of the fluid column are demonstrated to be maintained below casing failure pressures and formation fracture pressures, to avoid hydrofracturing the aquifer and promoting leakage into the overlying units

Request for Additional Information

Please provide the following information:

a. A reference Section 3.4.6 for the fracture gradient used to calculate the formation fracture pressure. Are there site-specific data available through testing of the deep disposal wells that support the assumed value?

b. Clarify the use of the term injection pressure (e.g. surface injection pressure or bottom-hole injection pressure).

c. Revise Section 3.4.6 to provide the limiting surface injection pressure to prevent formation fracture. This pressure must account for hydrostatic formation pressure. Note that the limiting surface injection pressure increases with well depth therefore, the limiting value should be based on the shallowest injection well depths, rather than an average.

Uranerz Response:

a. Section 3.4.6 has to do with the performance of Mechanical Integrity Testing (MIT) with regard to Class III UIC injection wells versus Class I UIC Deep Disposal Wells which are governed by WDEQ-WQD and EPA. Class I wells has its own set of permit requirements for MIT of deep disposal wells. The language has not changed from what was evaluated by NRC staff in the 2011 SER and any minor revisions have been approved through the SERP process into the current and existing application document. The SERP documents are available onsite for review by NRC staff during inspection and any page revisions are submitted annually to the NRC per License Condition 9.4.

b. The section, as evaluated by NRC staff in the 2011 SER, Section 3.1.3.2 shows an understanding and acceptance by NRC staff of the fracture pressure and that these pressures are understood to be bottomhole pressures. Furthermore, the NRC staff concluded that "*the applicant has committed, in application Section 3.4.3 to operating the system at pressures less than or equal to this operating pressure to prevent piping failures. As the design operating pressure is less than the wellhead pressure constraints, the staff finds that the operating pressures are acceptable and will not cause the well to exceed the maximum bottomhole formation fracture pressures.*" Therefore Uranerz believes that sufficient clarification is provided.

c. As discussed above, the NRC staff evaluated the pressures and as such the limiting surface pressure is going to be limited by the infrastructure material pressure (e.g. piping, wellheads, etc.) ratings.

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RAI 5.7-1. Baseline Data for Stacked Ore Zones

Description of Deficiency

Section 5.7.8.2 states that monitoring wells will be installed in the ore zone at a density of one monitoring well per four acres. Page TR-189 states that three vertically stacked ore intervals will be mined. The application does not state that baseline groundwater quality data will be collected for each of these three zones.

Basis for Request

The acceptance criteria in NUREG-1569, Section 5.7.8.3(1) states, in part, that the groundwater monitoring program is acceptable if for each new wellfield, the applicant's approach for establishing baseline water quality data is sufficient to: (i) define the primary restoration goal of returning each wellfield to its pre-operational water quality conditions; and, (ii) provide a standard for determining when an excursion has occurred.

Request for Additional Information

Please add a statement to the application confirming baseline data will be collected for each of the ore zones that will be mined.

Uranerz Response:
All sub-rolls are contained in the same aquifer (A Sand) and are in near proximity to each other. Water quality will be the same for all mineralized zones. The separation of the ore into three intervals described on page TR-189 reflects the ore bodies that occur at three levels within the A Sand, but does not reflect a difference in the expected water quality between the three levels. In the event that mineable ore Is located in any other sand or zone distinct from the A Sand, baseline data will be collected for that zone.

RAI 5.7-2. Composition of Lixiviant

Description of Deficiency

Section 5.7.8.8 does not provide the expected concentrations of the proposed excursion parameters (chloride, conductivity, and total alkalinity) within the pregnant lixiviant.

Basis for Request

The acceptance criteria in NUREG-1569, Section 5.7.8.3(2) states, in part, that the choice of excursion indicators is based on lixiviant content and groundwater geochemistry.

Request for Additional Information

Please provide the expected concentrations of the proposed excursion parameters (chloride, conductivity, and total alkalinity) within the pregnant lixiviant.

Uranerz Response:
Section 5.7.8.8 remains unchanged from the initial Nichols Ranch license application as evaluated by NRC staff and accepted in the 2011 SER. NUREG-1569, Section 5.7.8.3(2) indicates that the applicant is to have selected excursion indicator constituents and upper control

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limits. And the choice of excursion indicators is based on lixiviant content and ground-water geochemistry. It is for this reason that the three parameters (chloride, conductivity, and total alkalinity) were chosen. As is described in NUREG-1569, Section 5.7.8.3(2) and the Generic Environmental Impact Statement (GEIS) for Insitu Recovery, Volume I, Chapter 2, Section 2.4.1.3 chloride is an excellent indicator because it does not interact strongly with minerals in the subsurface, it is easily measured, and concentrations are significantly increased during operations making it a good conservative tracer. Conductivity, which is correlated to total dissolved solids, is also a good indicator because of the high concentrations of dissolved constituents in the lixiviant as compared to the surrounding aquifers. And lastly, total alkalinity is used as a parameter in wellfields where sodium bicarbonate or carbon dioxide is used in the lixiviant.

NUREG-1569 5.7.8.3(2) does not however indicate that the expected concentrations of the proposed excursion parameters within the pregnant lixiviant be provided as part of the application. A discussion of lixiviant composition is provided in Section 3.2.3.2 of the TR. The following table represents potential concentration ranges that could be found in the barren or pregnant lixiviant. Uranerz is required by WDEQ-LQD to collect periodic samples of the lixiviant and provides an update of the results annually. These results are available for review by NRC staff during inspections. Additionally, Uranerz provides a courtesy copy of the annual reports submitted to WDEQ-LQD.

	Value (mg/L)	
Chemical	Low	High
Ca	20	500
Cl	200	5,000
CO_3	1	2,500
HCO_3	400	5,000
K	15	300
Mg	3	100
Mn	0.01	50
Na	400	6,000
SO_4	400	5,000
TDS	1,500	12,000
U_3O_8	0.01	500
V_2O_5	0.01	100

RAI 5.7-3. Domestic and Livestock Wells Monitoring

Description of Deficiency

Section 5.7.8.10.1 does not discuss sampling of domestic and livestock wells in the vicinity of the Jane Dough Unit.

Basis for Request

License Conditions 11.7 and 12.4 require Uranerz to, among other things, identify the location, screen depth, and estimated pumping rate of any new ground water wells or new use of an

existing well within the license area and within 2 kilometers of any proposed production area. License Condition 11.7 also requires Uranerz to annually sample all domestic and livestock wells within 1 kilometer of the production area monitoring ring wells in licensed area after commencement of uranium recovery operations.

Request for Additional Information

a. Please revise Section 5.7.8.10.1 to address the requirements in License Conditions 11.7 and 12.4, or request that the license be amended to account for the Jane Dough Unit.

b. Please revise Exhibit JD-D6-1 to differentiate nearby stock wells from nearby domestic wells, such as by using a different symbol to show domestic wells. The revised Exhibit should also clearly show the Uranerz domestic well described in a December 27, 2013 letter to NRC (Uranerz 2013b).

c. Please revise the stated uses of Well URZN2-12 in Table JD-D6G.1-1 to reflect the changes indicated in the December 27, 2013 letter to NRC (Uranerz 2013b).

Uranerz Response:

a. Uranerz requests that license conditions 11.7 and 12.4 be updated to include Jane Dough.
b. Per discussion with NRC staff regarding Exhibit JD-D6-1 a sentence has been added to Appendix JD-D6, Section JD-D6.3 indicating which wells are domestic well.
c. The uses provided in Table JD-D6G.1-1 are specifically derived from the Wyoming State Engineer's Office (WSEO). URZN2-12 permitted use is miscellaneous by the WSEO per state regulations. In checking with the WSEO's office on April 8, 2016 that is the correct use designation in accordance with state law.

RAI 5.7-4. Operational Surface Water Monitoring

Description of Deficiency

Section 5.7.8.11 does not discuss operational surface water monitoring for the Jane Dough Unit. Additionally, Section 5.7.8.11 does not discuss sample collection frequencies or target analytes.

Basis for Request

The acceptance criteria in NUREG-1569, Section 5.7.8.3(6) states, in part, that if an *in situ* leach facility is located adjacent to bodies of surface-water, the applicant must establish a surface-water monitoring program that will be effective to detect migration of contaminants into surface-water bodies.

Request for Additional Information

Please revise Section 5.7.8.11 to address the Jane Dough Unit including sample collection locations, frequencies and target analytes.

Uranerz Response:

Section 5.7.8.11 has been revised to include the Jane Dough Unit in the surface water monitoring program. Please refer to Section 5.7.7.3.1 for additional information regarding surface water monitoring such as frequencies and target analytes.

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RAI 5.7-5. Creek Sampling

Description of Deficiency

Based on a September 2015 site visit, the NRC staff observed flow in a creek that runs through an area of planned ISR mining (near well cluster URZJB-15). It does not appear this creek is included in the monitoring program.

Basis for Request

The acceptance criteria in NUREG-1569, Section 5.7.8.3(6) states, in part, that if an *in situ* leach facility is located adjacent to bodies of surface-water, the applicant must establish a surface-water monitoring program that will be effective to detect migration of contaminants into surface-water bodies.

Request for Additional Information

Please include the creek which flows adjacent to well cluster URZJB-15 in the monitoring program or provide rationale for its exclusion.

Uranerz Response:
There is no known creek adjacent to cluster URZJB-15. This however may have been a CBM reservoir. Sampling of those locations have been accounted for in Section 5.7.8.11 and can be found in Appendix JD-D6, Addendum JD-D6A.

RAI 5.7-6. Quality Assurance Program

Description of Deficiency

Section 5.7.9 indicates a Quality Assurance program has not been established for all radiological, effluent, and environmental programs.

Basis for Request

The acceptance criteria in NUREG-1569, Section 5.7.9.3, states that a quality assurance program is acceptable if it has been established and applied to all radiological, effluent, and environmental programs.

Request for Additional Information

Please develop, or provide reference to, a Quality Assurance program that meets the guidance of NUREG-1569, Section 5.7.9.3.

Uranerz Response:
In accordance with License Condition 12.14 a Quality Assurance Program (QAP) had to be submitted 30 days before the preoperational inspection. The QAP was submitted, the preoperational inspection was completed by NRC staff and the License Condition was removed in the 2nd Amendment of license SUA-1597. Section 5.7.9 of the TR has been revised as a Quality Assurance Program is in place. The revised page is attached.

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RAI 5.7-7. Monitoring of the 1 Sand

Description of Deficiency

Page JD-D5-8 states the 1 Sand is the underlying aquifer with respect to the production zone. Exhibit JD-D5-20 indicates that the 1 Sand is not present throughout most of the Jane Dough Unit. The application does not describe how monitoring for vertical excursions beneath the production zone will be conducted where the 1 Sand is not present.

Basis for Request

The acceptance criteria in NUREG-1569, Section 5.7.8.3 (1) states the *in situ* leach operational monitoring programs should include field perimeter monitor wells and upper and lower aquifer monitor wells.

Request for Additional Information

Please describe how monitoring for vertical excursions beneath the production zone will be conducted where the 1 Sand is not present.

Uranerz Response:
As interior monitor well clusters are installed, a hole will be drilled at least 50 ft. below the base of the A Sand to check for the presence of the 1 Sand. If the 1 Sand (> 10 feet thick less than fifty feet from the base of the A Sand) is encountered, the hole will be cased and completed as a monitor well. Where the 1 Sand is not present and the aquiclude is 50 feet or greater, no monitoring is required as per the WDEQ. The hole will then be plugged back to the A Sand and will be completed as a monitor/production well for the A Sand.

RAI 6.2-1. Seed Mix

Description of Deficiency

TR page TR-271 changes to the description of the seed mix are different than the reported changes as a result of SERP-5-2012 (Uranerz 2013a). Also the page footer indicates the revision was "Rev. Feb. 2009," but the correct revision date is May 2012.

Basis for Request

10 CFR 40.31(b), "Applications for specific licenses," states that the Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

Request for Additional Information

Please revise the description of the seed mix, as appropriate.

Uranerz Response: Page TR-271 and TR-272 have been revised with updated seed mix requirements as approved by WDEQ-LQD. The new mix requirements have been revised on Table 6-1 and a new table Table 6-2 has been added to account for the BLM seed to be used at

the Hank Unit.

RAI 6.2-2. Effect of Aquifer Thickness on Flare Factor

Description of Deficiency

Section 6.2.8 presents the flare for the Nichols Ranch and Hank Units, but not the Jane Dough Unit.

Basis for Request

The acceptance criteria in NUREG-1569, Section 6.1.3(2) states the plans and schedules for groundwater quality restoration are acceptable if they describe the method used for estimating wellfield pore volume and the associated horizontal and vertical flare.

Request for Additional Information

While Section 3.4.8.2 of the TR indicates the flare factor for the Jane Dough Unit should be similar to that used for Nichols Ranch due to their similarities, Section 6.2.8 should be revised to reflect this statement. Additionally, given the Jane Dough production zone may exceed 200 feet thick where the A and B Sands coalesce, please provide a justification supporting the use of the assumed vertical flare factor for a production zone of this thickness.

Uranerz Response: The vertical flare is expected to be limited by both the typically anisotropic permeability and the likely presence of finer-grained horizontal beds within the B Sand or the combined AB Sand. Because the vertical permeability in sedimentary materials is usually dramatically smaller than horizontal permeability, the magnitude of vertical flare is limited by the slower vertical movement. Additionally, there are likely to be layers or lenses of finer-grained material within the sands that act as additional barriers to vertical movement. As the thickness of uranium ore bodies and the corresponding mining completion intervals in the Powder River Basin are typically only a portion of the total sand thickness, the total thickness of the sand is generally not expected to be a significant factor in estimation of vertical flare.

RAI 6.2-3. Restoration Pore Volumes

Description of Deficiency

Section 6.2.8 presents the number of groundwater pore volumes that will be used to estimate the groundwater restoration costs at the Nichols Ranch Unit, but not the Jane Dough Unit.

Basis for Request

The acceptance criteria in NUREG-1569, Section 6.1.3(1) states the plans and schedules for groundwater quality restoration are acceptable if they include estimates of the volume and quality of extraction solutions that need to be cleaned up during groundwater restoration.

Request for Additional Information

Please provide the number of groundwater pore volumes that will be used to estimate the groundwater restoration costs at the Jane Dough Unit.

Uranerz Response: The Jane Dough Unit being similar to the Nichols Ranch Unit with regard to operating parameters, flare factor, porosity etc is estimated to also require approximately 7 pore volumes for ground water restoration. Please be aware that the surety will not be updated to include operations at Jane Dough until the surety is reviewed the year prior to commencing construction. Section 6.2.8 (TR-277) has been revised to include a discussion of Jane Dough.

RAI 7.3-1. Joint Frequency Distribution

Description of Deficiency

Page TR-298, Section 7.3.1.2.6, and page JD-D11-33, Section JD-D11.7.5, both state that a joint frequency distribution of wind speed, direction, and stability class for an on-site meteorological station is presented in Appendix JD-D4. This information is not provided in Appendix JD-D4.

Basis for Request

The acceptance criteria in NUREG-1569, Section 2.5.3(1) states that the characterization of the site meteorology is acceptable if it includes, among other things, the locations of all stations used in the data analysis and the height of the data measurement. This criterion also states that the on-site program should be designed in accordance with Regulatory Guide 3.63, "Onsite Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting," (NRC 1988).

Request for Additional Information

Please revise Appendix JD-D4 to include a joint frequency distribution.

Uranerz Response: The required information is presented in Appendix JD-D4, specifically Addendum JD-D4-A. The text on page TR-298 (Section 7.3.1.2.7) was updated to add the reference to the Addendum JD-D4-A.

RAI 7.3-2. Site-specific Meteorological Data

Description of Deficiency

Page TR-294, Section 7.3.1.2, states that dose commitments were estimated using regional meteorological data.

Basis for Request

10 CFR 40.31(b), "Applications for specific licenses," states that the Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

Request for Additional Information

Revise 7.3.1.2 text (page TR-294) to state that site-specific meteorological data were used, not regional meteorological data. See revision to Sec. 7.3.1.2.6 (page TR-298).

Uranerz Response:
The text in Section 7.3.1.2.6 (on page TR-298) has been revised to indicate that site specific data were used as input.

RAI 7.5-1. Changes to Figure 2-1

Description of Deficiency

The licensee does not appear to have previously provided a summary of the of the SERP evaluation of changes to Figure 2-1 and text on TR page TR-312 which resulted in including the Smith Ranch facility as the destination for ion exchange resin transfers.

Basis for Request

10 CFR 40.31(b), "Applications for specific licenses," states that the Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

Request for Additional Information

Please provide the SERP summary description for changes to include the Smith Ranch facility in ion exchange resin transfers. Please also revise the footer of page TR-312 to reflect the correct version date for that page (i.e., August 2013).

Uranerz Response:
A review of Figure 2-1 shows that it is the correct figure. Furthermore, a review of the content shows that the information from the SERP was incorporated; however, the pagination was incorrect and has been corrected for pages in that section.

Administrative Comments (ADM)

Description of Deficiency

During its technical review, the NRC staff noted a number of errors in the application which Uranerz should correct.

Basis for Request

10 CFR 40.31(b), "Applications for specific licenses," states that the Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

Table of Contents (TOC)

ADM TOC-1 TOC on page TR-xix. Please add Exhibit 2-1A, "Jane Dough Unit, Map Showing Location of Cultural Resources."

ADM TOC-2 TOC on page TR-xx. Please add Addendum 2C1 and 2C2 to the List of Addendums for Volume II.

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ADM TOC-3 TOC on page TR-xxi. Addenda 7A, 7B, 7C, and 7D are misidentified as being in Volume II. This information is provided in Volume III. Please correct the header information.

ADM TOC-4 TOC on page TR-xxiv. The Environmental Report is misidentified as being in Volume III. The Environmental Report is provided as Volume IV. Please correct the header information.

ADM TOC-5 TOC on pages TR-xxii through TR-xxxi. The page number callouts for the Environmental Report are incorrect. For example, the TOC identifies pages up to ER-187. The ER provided with the Jane Dough amendment application is only 162 pages long. Please revise the TOC accordingly.

ADM TOC-6 TOC on page TR-xxviii. Addendum 5A, "Landowner Road Design Construction Letter," is actually provided as Addendum 6A. Please correct the TOC.

ADM TOC-7 TOC on page TR-xxi. Correct spelling of title of Addendum 7A to "Drawdown Predictions."

ADM TOC-8 TOC on page TR-xxxii. Volume IV List of Appendices should be Volume V List of Appendices. Appendices A, B, and C, D1, D2, and D4, should be labeled JD-A, JD-B, JD-C, JD-D1, JD-D2, and JD-D4. Please add callouts to Appendix JD-D3 and Appendix JD-E. These sections are listed below:

i. Appendix JD-A "Owners of Record of Surface and Mineral Rights within the Permit Area Jane Dough Unit";

ii. Appendix JD-B, "Surface Owners of Record with ½ miles of Permit Area Jane Dough Unit";

iii. Appendix JD-C, "Legal Description, Right to Mine, and No Right to Mine Lands within the Permit Area Jane Dough Unit";

iv. Appendix JD-D1, "Land Use";

v. Appendix JD-D2, "History";

vi. Appendix JD-D3, "Archeology";

vii. Appendix JD-D4, "Climatology"; and

viii. Appendix JD-E, "Permits and Licenses Required for the Nichols Ranch ISR Project and Information Maps."

ADM TOC-9 TOC on page TR-xxxiv. Add "Volume VI" to "Table of Contents" in the middle of the page, identifying that these sections (JD-D5, "Geology") are contained in Volume VI.

ADM TOC-10 TOC for Volume V, pages JD-D3-ii, JD-D3-A-i, and JD-D3-B-i mislabels the Addenda. Addendum JD-D3-A should be Addendum 2C1, and Addendum JD-

D3-B should be Addendum 2C2.

Uranerz Response to ADM TOC-1 through TOC-10: After a review of the comments Uranerz believe that NRC staff may have been reviewing the original license application Table of Contents (TOC) versus the Jane Dough TOC which was provided in a separate binder to NRC. That said, the TOC has had to be updated to correlate with RAI responses provided and is included in this submittal.

1.0 Proposed Activities

ADM 1.0-1 Page TR-1 states that the Jane Dough Unit consists of two wellfields; however Figure 3-8C indicates four wellfields will be installed. Please resolve this discrepancy.

Uranerz Response: Two wellfields is correct. Figure 3-8C has been revised.

2.4 Historic, Scenic, and Cultural Resources

ADM 2.4-1 Page TR-17. Callout to Addendum 2B3 should be Addendum 2C1. Callout to Addendum 2C2 appears correct.

Uranerz Response: Page TR-17 has been revised to callout Addendum 2C1.

ADM 2.4-2 Page TR-22. Callout to Addendum 2D should be Addendum 2C2.

Uranerz Response: Page TR-22 has been revised to callout Addendum 2C2.

ADM 2.4-3 Pages TR-49a through TR-49e. Footnotes all indicate the version date is November 2007. The information on these pages is all Jane Dough information. Please update the version date to April 2014 or appropriate version date.

Uranerz Response: The citation and footnote have been corrected.

2.6. Geology and Seismology

ADM 2.6-1 Page TR-52 cites Sharp and Gibbons 1964. This citation is not included in the reference section. Please resolve this discrepancy.

Uranerz Response: This citation has been added to a reference section.

ADM 2.6-2 Page TR-54a indicates the C Sand unit is shown on Figure JD-D5-2. Examination of Figure JD-D5-2 indicates the C Sand is not shown on this figure. Please resolve this discrepancy.

Uranerz Response: The figure has been revised and is included with the pages changes related to Appendix JD-D5-2.

ADM 2.6-3 Page TR-54 cites Davis 1970. This citation is not included in the reference section. Please resolve this discrepancy.

Uranerz Response: The citation is correct and a reference section has been added and includes this citation.

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2.7 Hydrology

ADM 2.7-1 The bottom paragraph on Page TR-61 (which concerns the Nichols and Hank Units) states that the installation of wells in drainages will be avoided and lists the protective actions that will be taken if wells must be installed in a drainage. Please revise this section to confirm that this paragraph is also applicable to the Jane Dough Unit.

Uranerz Response: The discussion provided on page TR-61 does not specify either Nichols or Hank Units. The paragraph is making a general statement about well installation in drainages, regardless of the wellfield. Page TR-62 has been revised however to provide the corrected information with regard to culvert installation and citation of WDEQ-LQD rules.

ADM 2.7-2 The sampling locations "Cottonwood U Nichols" and "Cottonwood D Nichols" referenced in Table JD-D6A.1-1 are not readily apparent on Figure JD-D6-1. Please provide or reference a figure that clearly identifies these sampling locations.

Uranerz Response: Figure JD-D6-1 has been revised to include the sampling locations.

ADM 2.7-3 Table JD-D6A.1-1 has an "(e)" note on the Ra226 result column which is not explained. Please provide an explanation for this note.

Uranerz Response: Table JD-D6A.1-1 updated. A footnote was added to the table describing that the (e) signifies for the sample value error.

ADM 2.7-4 Page TR-110c indicates the Jane Dough aquifer aquitard sequence is shown in Figure JD-D6-2, it appears this reference should be to Figure JD-D6-3. Please resolve this discrepancy.

Uranerz Response: The page TR-110C reference has been updated to Figure JD-D6-3.

ADM 2.7-5 The title on Figure JD-D6-4 indicates that the figure displays the water wells within a 3 mile radius of the Jane Dough Unit; however, it appears that only wells within a ½ mile radius are shown on this figure. Please resolve this discrepancy.

Uranerz Response: The title on Figure JD-D6-4 has been corrected from 3 mile radius to ½ mile radius.

ADM 2.7-6 Figure JD-D6-5 presents the locations of well JA-13-1 and JA-14-1. These wells could not be located on Exhibit JD D6-1 or Figure JD D6-4. Please resolve this discrepancy.

Uranerz Response: Wells JA-13-1 and JA-14-1 have been added to Exhibit JD-D6-1 and Figure JD-D6-4.

ADM 2.7-7 The locations of wells JA-8, JA-7, JA-1, JA-2, JA-19 and JA-20 presented in Exhibit JD D6-1 appear inconsistent with those shown in Figure JD-D6-5. Please resolve this discrepancy.

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Uranerz Response: The well locations on Exhibit JD-D6-1 have been adjusted.

ADM 2.7-8 Page TR-110i states Figure JD-D6-8 shows the water-level elevation for F Sand wells URZJF-5, URZJF16, and URZJF-22; however, Figure JD-D6-8 presents the locations for wells URZJC16, and URZJC-22 (rather than the "F" series wells). Please resolve this discrepancy.

Uranerz Response: Wells URZJC-16 and URZJC-22 are F sand wells in spite of the wellname and as such are included in Figure JD-D6-8. The text has been corrected to resolve this discrepancy.

ADM 2.7-9 Page TR-110j states that Figure D6-6 of Appendix D6 of the Nichols Ranch application shows wells from Nichols Ranch, Hank and the Jane Dough Unit. Review of this figure does not indicate any wells from the Jane Dough Unit. Please resolve this discrepancy.

Uranerz Response: The text on Page TR-100j was reworded for clarity. Figure D6-6 in the Nichols Ranch permit does not show the Jane Dough Unit wells.

ADM 2.7-10 Figure JD-D6-6 presents the location of well J1-23-1. This well could not be located on Exhibit JD D6-1 or Figure JD D6-4. Please resolve this discrepancy.

Uranerz Response: Well J1-23-1 has been added to Exhibit JD-D6-1 and Figure JD-D6-4.

ADM 2.7-11 The locations of wells J1-12 and J1-6 presented in Exhibit JD D6-1 appear inconsistent with those shown in Figure JD-D6-6. Please resolve this discrepancy. Additionally, the permit boundary shown on Exhibit JD D6-1 and Figure JD-D6-6 appear slightly different.

Uranerz Response: The well locations on Exhibit JD-D6-1 have been adjusted. The permit boundary shown on Figure JD-D6-6 and other water-level elevation maps is approximate and is used for general location purpose.

Note that ADM 2.7-12 through ADM 2.7-18 also apply to Section JD-D6.2.4 because the text from Section 2.7.2.2.4 is repeated there.

ADM 2.7-12 Page TR-110l discusses the northwest well cluster water levels but references wells in the northeast (e.g. URZJB-3). Please resolve this discrepancy.

Uranerz Response: The text has been changed from northwest to northeast.

ADM 2.7-13 Page TR-110v indicates the A sand sulfate concentrations range from 114-141 mg/L, however, Table JD-D6-6 indicates the range is 88-114 mg/L. Please resolve this discrepancy and revise text as needed.

Uranerz Response: The text on Page TR-110v was changed to reflect the data presented in Table JD-D6-6.

ADM 2.7-14 Page TR-110v indicates the TDS average concentration for the 1 Sand is 378

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mg/L, however, Table JD-D6-6 indicates that the average concentration is 253 mg/L. Please resolve this discrepancy and revise text as needed.

Uranerz Response: The text on Page TR-110v was changed to reflect the data presented in Table JD-D6-6.

ADM 2.7-15 Page TR-110v indicates the 1 Sand sodium concentrations range from 76-96 mg/L, however, Table JD-D6-6 indicates the range is 77-107 mg/L. Please resolve this discrepancy and revise text as needed.

Uranerz Response: The text on Page TR-110v was changed to reflect the data presented in Table JD-D6-6.

ADM 2.7-16 Table JD-D6-6 does not include measurement units. Please resolve this deficiency.

Uranerz Response: Table JD-D6-6 has been updated with measurement units for all constituents presented.

ADM 2.7-17 Please reference the analytical methods used corresponding to the results presented in Table JD-D6-6.

Uranerz Response: Table JD-D6-6 has been updated with analytical methods used for each constituent. Tabulations in Addendum JD-D6L also list the analytical methods.

ADM 2.7-18 Table D6E.1-1 has an "(e)" note on the Ra226 result column which is not explained. The "#" symbol is also used intermittently on some values. Please provide an explanation for these notes.

Uranerz Response: Table JD-D6E.1-1 has been updated. A footnote was added to the table describing that the (e) signifies the sample value error. The # symbol indicates a duplicate QA/QC sample and a footnote has been added to the table.

ADM 2.7-19 Page TR-113a states that Figure JD-D6-4 presents the locations of the Jane Dough Unit surface water rights; however, Figure JD-D6-4 presents Jane Dough groundwater wells. Please resolve this discrepancy.

Uranerz Response: The reference to Figure JD-D6-4 was incorrect and has been removed and corrected on page TR-113a.

ADM 2.7-20 The last paragraph of section 2.7.3.2 (see page TR-114) appears to be incomplete. Please resolve this discrepancy.

Uranerz Response: The incomplete sentence has been corrected on page TR-114.

D5 Geology

ADM D5-1 Page JD-D5-4 indicates that the C sand is shown on Figure JD-D5-2. The C sand is not labeled Figure JD-D5-2. Please resolve this discrepancy.

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Uranerz Response: This is a duplicate comment to ADM 2.6-2. Figure JD-D5-2 has been revised and is enclosed.

ADM D5-2 Appendix JD-D5 does not include a list of references. Please resolve this discrepancy.

Uranerz Response: A list of references for Appendix JD-D5 is enclosed.

ADM D5-3 Page JD-D5-8 provides the measured permeabilities of mudstones and ore sands but does not include a reference for these values. Please provide the reference for the presented permeability values.

Uranerz Response: Page JD-D5-8 has been revised to include a reference for the permeability values

ADM D5-4 Page JD-D5-9 references Exhibit JD-D5-16 with respect to the 1 Sand. It appears the text should reference Exhibit JD-D5-20. Please resolve this discrepancy.

Uranerz Response: The text has been revised to reference Exhibit JD-D5-20.

ADM D5-5 Page JD-D5-10 references Exhibit JD-D5-17 with respect to the 1A Mudstone. It appears the text should reference Exhibit JD-D5-19. Please resolve this discrepancy.

Uranerz Response: The text has been revised to reference Exhibit JD-D5-19.

ADM D5-6 Page JD-D5-10 references Exhibit JD-D5-19 with respect to the AB Shale. It appears the text should reference Exhibit JD-D5-17. Please resolve this discrepancy.

ADM D5-7 Page JD-D5-11 references Exhibit JD-D5-20 with respect to the B Sand. It appears the text should reference Exhibit JD-D5-16. Please resolve this discrepancy.

Uranerz Response: The text has been revised to reference Exhibit JD-D5-16.

ADM D5-8 Page JD-D5-11 references Exhibit JD-D5-27 with respect to the C Sand. It appears the text should reference Exhibit JD-D5-25. Please resolve this discrepancy.

Uranerz Response: The text has been revised to reference Exhibit JD-D5-25.

D6 Hydrology

ADM D6-1 Page JD-D6-4 indicates that the Jane Dough aquifer aquitard sequence is shown in Figure JD-D6-2, it appears this reference should be to Figure JD-D6-3. Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference was changed to

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Figure JD-D6-3.

ADM D6-2 It does not appear that all the Jane Dough Unit wells presented in Figure JD-D6-4 are presented in Table JD-D6-2 (e.g. Dry Fork Samson #1). Please resolve this discrepancy.

Uranerz Response: Jane Dough wells that have been sampled are presented in Table JD-D6-2, thus wells such as Dry Fork Samson #1 are not presented.

ADM D6-3 Page JD-D6-6 references Exhibit JD-D5-2 as the AB Mudstone isopach, it appears this reference should be to Exhibit JD-D5-17. Please resolve this discrepancy.

Uranerz Response: Page JD-D6-6 has been edited and the reference was changed to Exhibit JD-D5-17.

ADM D6-4 Page JD-D6-6 references Exhibit JD-D5-4 as the 1A Mudstone isopach, it appears this reference should be to Exhibit JD-D5-19. Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference was changed to Exhibit JD-D5-19.

ADM D6-5 Please provide a reference(s) for the values provided in Table JD-D6-4.

Uranerz Response: The values presented have been compiled from previous Uranerz and other company pump test reports.

ADM D6-6 Page JD-D6-8 states that the B Sand hydraulic conductivity is 0.16 ft/day. Please describe how this value was determined.

Uranerz Response: Hydraulic conductivity was determined from the B and AB pump tests presented in Addendums JD-D6B and JD-D6C. These values were obtained through Jacob's straight line analyses of both the drawdown and the recovery. Drawdown curves from the multiwell tests were also matched to WTAQ type curves in order to determine the Kv/Kh ratios (Kv=vertical hydraulic conductivity, Kh=horizontal hydraulic conductivity). The hydraulic conductivity stated is an average of the best values obtained from these analyses.

ADM D6-7 Figure JD-D6-9 presents data for F series wells (e.g URZJF-17), however these wells appear to have been renamed to G series wells in Table JD-D6-2. Please resolve this discrepancy.

Uranerz Response: Well URZJF-17 is a G Sand well in spite of the name. Table JD-D6-2 has been updated.

ADM D6-8 Page JD-D6-9 discusses the northwest well cluster water levels but references wells in the northeast (e.g. URZJB-3). Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference changed to northeast well cluster from northwest.

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D6B Single Well Pumping Tests

ADM D6B-1 Page JD-D6B-1 states the Jane Dough Unit aquifer properties are summarized in Table JD-D6-4. It appears this reference should be to Table JD-D6-3. Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference was changed to Table JD-D6-3.

D6C Multi- Well Pumping Tests

ADM D6C-1 Page JD-D6C.1-5 states Figure JD-D6C.1.3-7 presents the recovery data from URZJA-7. It appears this reference should be to Figure JD-D6C.1.3-6. Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference was changed to JD-D6C.1.3-6.

ADM D6C-2 Several figures (e.g. JD-D6C.1.1-10 and JD-D6C.1.3-10) present water level changes over time. Please clarify whether a positive water level represents an increase or a decrease in the water level elevation.

Uranerz Response: A positive water level change represents a water-level elevation decline.

ADM D6C-3 Section JD-D6C.1.4.1 references Figure JD-D6C.1.3-2 when discussing well URZJA-13-1, it appears this reference should be to Figure JD-D6C.1.4-2. Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference was changed to JD-D6C.1.4-2.

ADM D6C-4 Section JD-D6C.1.4.1, on the bottom of page JD-D6C.1-6 references well URZJA-8. Presumably this reference should be to well URZJA-13-1. Please resolve this discrepancy.

Uranerz Response: The text has been edited and the reference was changed to URZJA-13-1.

ADM D6C-5 Section JD-D6C.1.3.3 (and Table JD-D6-3) states that the storage coefficient determined from the URZJB-9 data is 5.6 E-2; however, Figure JD-D6C.1.3-8 indicates the storage value determined from the URZJB-9 data is 5.6e-6. Please resolve this discrepancy.

Uranerz Response: Edits were made to text and Table JD-D6-3. The storage coefficient value was updated to 4.8 E-6.

ADM D6C-6 The calculated transmissivity value shown on Figure JD-D6C.1.3-4 is 276 gal/day/ft; however, the storage coefficient calculation presented on the same figure uses a transmissivity value of 630 gal/day/ft. Please resolve this discrepancy. Note this storage coefficient is also presented in Table JD-D6-3.

Uranerz Response: Edits have been made to Figure JD-D6C.1.3-4 and Table JD-D6-3. The transmissivity value of 630 gal/day/ft used in the storage calculation was an error, and the storage coefficient has been updated to 8.0E-5.

ADM D6C-7 The calculated transmissivity value on Figure JD-D6C.1.3-7 is 358 gal/day/ft; however, the storage coefficient calculation presented on the same figure uses a transmissivity value of 630 gal/day/ft. Please resolve this discrepancy. Note this storage coefficient is also presented in Table JD-D6-3.

Uranerz Response: Edits have been made to Figure JD-D6C.1.3-7 and Table JD-D6-.3. The transmissivity value of630 gal/day/ft in the storage coefficient calculation was incorrect. The storage coefficient has been updated to 2.9E-3.

ADM D6C-8 Section JD-D6C.1.3.6 discusses well URZJF-11 and references Figure JD-D6C.1.3-10. Figure JD-D6C.1.3-10 and Table JD-D6-2 present data for a well named URZJG-11 rather than URZJF-11. Exhibit JDD5-12 also presents well URZJF-11. It appears this well may have been renamed at some point. Please resolve this discrepancy.

Uranerz Response: Figure JD-D6C.1.3-10 and Table JD-D6-2 have been edited, URZJF-11 is the correct well name.

ADM D6C-9 How does well J1-23-1 presented in Table JD-D6-2 relate to well URZJ1-23 presented in Exhibit JD D6-1? Please provide or reference a figure illustrating these locations.

Uranerz Response: URZJ1-23-1 is a replacement well for URZJ1-23.

ADM D6C-10 Section JD-D6C.1.4.4 discusses well URZJC-16. It appears this well has been renamed in Table JD-D6-2 to JF-16. Please clarify. Note that URZJC-16 also appears on Exhibit JD D5-10 and Exhibit JD D6-1.

Uranerz Response: URZJC-16 is the correct well name and it is an F sand well. Table JD-D6-2 has been updated.

2.9 **Baseline Radon-222 and Direct Gamma Exposure Rate**

ADM 2.9-1 Figure 2-25 included in the Jane Dough TR is dated February 21, 2014. However, a different version dated February 27, 2014, was provided in a March 6, 2014, letter to the NRC (Uranerz 2014b). SERP-2-2014 describes the change, but a revised figure was not included in the 2nd half 2014 semi-annual effluent report.

Uranerz Response: A review of the figure provided in the referenced March 6, 2014 letter is titled Restricted/Controlled/Unrestricted Areas whereas Figure 2-25 is meant to illustrate the Particulate Monitoring Locations. The Figure 2-25 provided in the Technical Report is the same as what provided in the February 28, 2014 (ML14063A214) and is therefore the correct figure for the Technical Report.

ADM 2.9-2 Page TR-143b, Table 2-31a. There is an asterisk on two items in the first column, which appears to indicate a footnote to the table. There is no footnote. Please add the footnote.

Uranerz Response: Table 2-31a has been revised to include a footnote. The table is on page TR-143c.

ADM 2.9-3 Page TR-143b, Table 2-31a. The column headers for First Quarter 2011 and Second Quarter 2011 incorrectly state First Quarter 2010 and Second Quarter 2010. Please correct the column headers.

Uranerz Response: The column headers have been revised in Table 2-31a and the table is now located on page TR-143c.

ADM 2.9-4 Page TR-143c, Table 2-31b. The footnote indicated by an asterisk on two items in the first column states "nearest resident upwind and downwind." Please clarify which location is upwind and which location is downwind.

Uranerz Response: Table 2-31a and 2-31b footnotes have been revised.

ADM 2.9-5 Page TR-143d footer indicates the version date is July 2010. The new information on this page is Jane Dough information. Please update the version date to April 2014.

Uranerz Response: With the recent changes to this page the foot has been revised to April 2016 to reflect the revisions made with these RAI response submittals.

ADM 2.9-6 Page TR-150.

a. The revised text in the first two sentences of Section 2.9.6.1 contains several errors. First, the date range of third quarter 2010 through second quarter 2011 is incorrectly summarized in the parenthetical text as "(July 2010-June 2010)." Second, the revised statement attributes the date range "(July 2010-June 2010)" to a collection of samples from the Nichols Ranch and Hank Units, instead of the Jane Dough Unit. Third, there is a callout to Figure 2-26A, which isn't provided in the application. Either provide Figure 2-26A, or correct the callout to Exhibit JD-D11-2 or an equivalent figure.

b. The callouts to Figure 2-25 and Figure 2-26 under Section 2.9.6.2, "Methods" are incorrect. Please revise to cite the correct figures, which appear to be Figures 2-27 and 2-28.

Uranerz Response:

a. The text on page TR-150 has been revised accordingly.
b. The callouts for the figures in Section 2.9.6.2 have been revised.

ADM 2.9-7 Pages TR-159b through TR-159f footnotes all indicate in incorrect version date. The information on these pages is all Jane Dough information. Please update the version date to April 2014.

Uranerz Response: The page date footnote has been revised accordingly for the pages stated.

3.0 Description of the Facilities

ADM 3.0-1 A callout to Figure 3-4a was not found in the text. Please revise text as needed.

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Uranerz Response: Section 3.2.2, page TR-165 has been updated to call out Figure 3-4a.

3.2 Site Facilities Layout

ADM 3.2-1 In the text presented on TR-173, consider changing "Deep Disposal Well (DDW) Flow" to "Deep Disposal Well (DDW) Capacity" to clarify that the 100 gpm is a capacity, not the planned flow.

Uranerz Response: Page TR-173 has been revised to clarify capacity.

3.4. Wellfields

ADM 3.4-1 Page TR-182. Two lines of text forced onto the next page by the addition of text to page TR-182 in the May 2015 revision is not included in a revised page TR-183. Please provided the missing text.

ADM 3.4-2 Page TR-184. The parenthetical text states "(which is less)." However, the September 2012 change related to SERP-3-2012 states "(whichever is less)", which is correct. Please revise the text on page TR-184.

Uranerz Response: The word 'which' on page TR-184 has been revised to 'whichever'.

ADM 3.4-3 Section 3.4.3 states: "Over-production can be adjusted to guarantee the horizontal ore zone monitor wells are influenced by the cone of depression from the wellfield bleed." The use of the term "guarantee" in this context is not appropriate and should be replaced with a more appropriate term e.g. "ensure".

Uranerz Response: The paragraph of Section 3.4.3 that includes this statement was previously approved by NRC with the issuance of the license as evaluated in the SER. This is an instance of NRC staff grammatical preference versus a substantive RAI. The word 'guarantee' in this context is adequate according to Oxford Dictionary as it means to provide assurance, especially that certain conditional shall be fulfilled. Uranerz would request an adjustment of billing for this RAI.

ADM 3.4-4 The first sentence of Section 3.4.1 needs to be revised, the description of the ore zone is not applicable to the Jane Dough unit as stated e.g. "two long narrow trends meeting at the nose."

Uranerz Response: The sentence has been revised and the page is enclosed.

ADM 3.4-5 Section 3.4.1 needs to be revised to reflect the ore properties for the Jane Dough unit, including: host sand, average ore grade, average ore thickness and areal distribution.

Uranerz Response: Section 3.4.1 has been revised to include the ore properties for the Jane Dough Unit.

3.5 Plant Equipment, Instrumentation, and Control

ADM 3.5-1 Please revise Section 3.5 to address Standard Operating Procedures for the

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Jane Dough Unit.

Uranerz Response: Section 3.5 (page TR-190) has been revised to address procedures at Jane dough

3.6 **Spills and Excursions**

ADM 3.6-1 The responses (ML090820538) to the NRC's September 11, 2008, Request for Additional Information states that Chapter 3 will be revised to include "Section 3.6 Spills and Excursions." This section could not be located in the Jane Dough amendment request. Please resolve this discrepancy.

Uranerz Response: According to License Condition 9.2 the license application was subsequently amended by submissions on March 11, 2009, February 24, 2010, and September 15, 2010 that may have replaced these pages. ADAMS contains many of these documents, as well they should be on file with the NRC. It would appear that Section 3.6 did not make the final approval process and does not appear to have been specifically evaluated in the SER; although spills and excursions were. It also appears that the components of the content of what was Section 3.6 are contained elsewhere in various Sections including 3.4.3, 5.2.1.4, 5.3.2, 5.7.1.2, 5.7.1.2.1, 5.7.1.3, 5.7.1.3.1, and 5.7.8.10.3. Please also refer to the July 2011 SER for additional evaluation information.

5.7 Radiation Safety Controls and Monitoring

ADM 5.7-1 Page TR-228, Section 5.7.4.1. The first and second paragraph appear to have contradictory statements about the pulmonary retention classification for natural uranium. The first paragraph states that Class D will be assigned, whereas the second paragraph states that Class W will be used to establish the appropriate annual limit on intake (ALI) and derived air concentration (DAC). Please resolve the discrepancy.

Uranerz Response: Section 5.7.4.1 was not revised from what has already been approved. The letter D has been revised to a letter W on page TR-228.

ADM 5.7-2 Page TR-229, Section 5.7.4.1. The third paragraph of this section appears to repeat the same information provided in the second paragraph. Please remove the duplicate text.

Uranerz Response: Section 5.7.4.1 has been revised.

ADM 5.7-3 Page TR-235, Section 5.7.7. The third paragraph incorrectly cites 10 CFR Part 20.1301(b)(1). There is no 10 CFR Part 20.1301(b)(1). The text should be revised to cite 10 CFR Part 20.130**2**(b)(1).

Uranerz Response: Page TR-235 has been revised.

ADM 5.7-4 Section 5.7.8.5.1, page TR-242, text bullet 3, references Table D6-6. Should this reference be to Table D6-6a?

Uranerz Response: Section 5.7.8.5.1 contained no changes or revisions with this amendment and remained the same as is currently approved in the application evaluated and described in the Nichols Ranch ISR Project SER. That

said, the section has been completely revised in response to another RAI.

ADM 5.7-5 The text in Section 5.7.8.7 regarding restoration target values is inconsistent with language in Section 6.1.2. Section 5.7.8.7 states that the averages of parameters will constitute the restoration target values, while Section 6.1.2 states that the mean plus two standard deviations of pre-mining water quality will be the restoration target values. Please resolve this discrepancy.

Uranerz Response: Section 5.7.8.7 has been revised to coordinate with Section 6.1.2. Again these sections are not new information and were previously approved as evaluated in the Nichols Ranch ISR Project 2011 SER.

ADM 5.7-6 Section 5.7.8.10.3 references numerical modeling for the Nichols Ranch Unit, but not the Jane Dough Unit. Please resolve this deficiency.

Uranerz Response: A reference to the Jane Dough modeling in Addendum 3D has been added to section 5.7.8.10.3.

ADM 5.7-7 The procedure for confirming an excursion presented in Section 5.7.8.10.3 is inconsistent with the requirements of License Condition 11.5. License Condition 11.5 indicates that a third set of samples should be collected to confirm excursions, Section 5.7.8.10.3 does not discuss a third set of samples. Please resolve this discrepancy.

Uranerz Response: Section 5.7.8.10.3 also uses a 24 hour verification sampling whereas the License Condition 11.5 provides for a 48 hour sampling verification. Both Section 5.7.8.10.3 and the License Condition 11.5 need revised. WDEQ/LQD also has requirements pertaining to excursions per Non Coal Rules and Regulations Chapter 11, Section 12 in accordance with Wyoming Statute 35-11-429(a) and the state Class III Underground Injection Control Program. The state requirements are more stringent than the NRC, therefore Uranerz must adhere to the more stringent requirements. Alternate language, matching the WDEQ/LQD permit has been provided indicating that,
the conflicting second sample results an excursion will not have occurred.

ADM 5.7-8 Section 5.7.8.5.1, page TR-242, text bullet 3, states that only 1 round of samples will be collected for the WDEQ-LQD Guideline No. 8 parameters at the Ore Zone Monitoring Ring Wells. This language is inconsistent License Condition 11.3 (D) which states that the third and fourth sampling events do not require analyses for parameters that were below minimum analytical detection limits for the first and second sampling events. Please resolve this discrepancy.

Uranerz Response: Section 5.7.8.5.1 has been revised to match the language in License Condition 11.3. Uranerz requests that the license condition be be removed in light of the changes to the application text.

ADM 5.7-9 The contents of the Production Area Pump Test document do not include all the items listed in License Condition 10.8 (e.g. background groundwater data, restoration target values, upper control limits at each monitoring well). Please resolve this discrepancy.

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Uranerz Response: Section 5.7.8.4 Production Area Pump Test Document has been revised to include the items requested. With this administrative change, Uranerz requests a revision of the license condition 10.8.

6.1 **Groundwater Restoration**

ADM 6.1-1 Page TR-262 states that Figure 3-8C shows the location of all monitoring well (i.e. MP, MR, MO and MU wells), however Figure 3-8C only shows MR wells. Please resolve this discrepancy.

Uranerz Response: Figure 3-8C has been revised to account for the inner wellfield monitor wells.

ADM 6.1-2 Section 6.1.4 states the restoration goal of returning water baseline or pre-mining class of use category. Restoration of water to pre-mining class of use is not an NRC-approved standard. This language should be removed.

Uranerz Response: As discussed with NRC staff during public meeting March 8, 2016, the text indicates that these requirements are per WDEQ/LQD regulations and Wyoming State Statutes and that this language did not change from what has already been approved and evaluated by the NRC staff and described in the 2011 SER Sections 6.1.3.1 and 6.1.4. Also, please note that NRC issued a requirement in License Condition 10.6 Groundwater Restoration which establish NRCs restoration criteria. Therefore, this language should remain as originally evaluated and approved.

6.2 **Surface Reclamation and Decommissioning**

ADM 6.2-1 Section 6.2.3 states an estimated 135 acres of topsoil will be salvaged, stockpiled and reapplied during the life of the Nichols Ranch ISR Project. Please confirm that this estimate includes the Jane Dough Unit, or revise the estimate as needed.

Uranerz Response: Section 6.2.3 page TR-270 topsoil acreage of 135 acres is correct.

7.2 Effects of Operation

ADM 7.2-1 Page TR-284 states that groundwater will be restored to pre-mining condition or class of use category. Restoration of water to pre-mining class of use is not an NRC-approved standard. This language should be removed.

Uranerz Response: The discussion indicates that these requirements are per WDEQ/LQD regulations and Wyoming State Statutes. Please note that this language did not change from what has already been approved and evaluated by the NRC staff via the 2011 SER. Please note that NRC issued a requirement in License Condition 10.6 Groundwater Restoration which establish NRCs restoration criteria. Therefore, this language should remain as originally evaluated and approved.

ADM 7.2-2 Figure 7-2A and MPI.1-12 (located in Addendum 3D) have the same title but somewhat different predicted drawdown contours. Please resolve this discrepancy.

Uranerz Response: Figure 7-2A has been updated.

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7.3. Incorrect Figure

ADM 7.3-1 Please revise TR Section 7.3.1.2.4 by replacing the reference to Figure 3-11, "Hank Unit Production Area," to Figure 3-12, "Production, Restoration, and Reclamation Schedule."

Uranerz Response: The text has been corrected and the revised page is attached.

Addendum JD-D11 Radiology

ADM JD-11-1 Page JD-D11-3. Revise the statement at the top of the page, "...routinely the condition pipelines and wellheads." to read "...routinely the condition **of** pipelines and wellheads."

Uranerz Response: Page JD-D11-3 has been revised to include the word 'of'.

ADM JD-11-2 Page JD-D11-14. In Table JD-D11-5, "Gamma Survey Results: Jane Dough Unit," please state the date or date range the measurements were taken.

Uranerz Response: A date for the gamma survey has been added to the text on page JD-D11-14.

ADM JD-11-3 Page JD-D11-24. Line 10 result for Pb-210 is missing a minus sign. It should read Pb-210 (6E-13);".

Uranerz Response: A minus sign has been added to the lead 210 value on page JD-D11-24.

ADM JD-11-4 Page JD-D11-27. Please correct the units in each column of Table JD-D11-15.

Uranerz Response: The units, missing an 'i' was changed in the table.

ADM JD-11-5 Page JD-D11-32. In the third line of Section JD-D11.7.3, please revise the cross-reference from Figure 3-11 of the Mine Plan to Figure 3-12 of the TR.

Uranerz Response: Page JD-D11-32 has been revised to reference Figure 3-12.

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RESPONSE TO THE NRC REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE ENVIRONMENTAL REPORT OF THE JANE DOUGH AMENDMENT TO THE NICHOLS RANCH ISR PROJECT

GENERAL

RAI – GEN-1 Permit Updates

Section 1.4 of the ER (Uranerz, 2014a) states that Table 10-2 of the TR (Uranerz, 2014b) identifies necessary environmental approvals and status of each with corresponding Federal and State agencies for the Nichols Ranch ISR Project. Additionally, the text in the ER states that all listed approvals will be obtained for the proposed Jane Dough Project prior to the start of mining and are listed in Table 10-2a of the Nichols Ranch ISR Project NRC Source Material License Application TR. The NRC staff are unable to locate either Table 10-2 or Table 10-2a, which lists permits applicable to the proposed Jane Dough Project.

Provide an update of the status of proposed, pending and approved licenses and permits specifically for the proposed Jane Dough Project.

The information provided should identify: (i) the issuing agency; (ii) the type of license, permit, or approval needed; and (iii) the current status of securing the license, permit or approval. This information is needed to complete the description of the proposed action and determine the environmental impacts of the licensing and permitting process on the proposed project.

Uranerz Response: The reference to Table 10-2 was incorrect and should be Tables 10-1 and 10-1a. Therefore, Section 1.4 of the ER has been corrected to include a reference to Table 10-1 and Table 10-1a in the TR. Additionally, a Table 10-1a has been created for the TR and is included in this submittal.

RAI – GEN-2 Site Layout

Section 2.2.4.2 of the ER states that Exhibit 2–1A illustrates current coalbed and natural gas infrastructure (e.g., wells, pipelines, utilities, and roads) located in the Jane Dough area; however, Exhibit 2–1A does not contain this information. Provide a map or several maps showing: (i) injection, recovery, and monitoring well locations; (ii) existing primary roads and secondary and tertiary roads currently used to access oil and gas and coalbed methane well pads; (iii) proposed new roads, especially where they will cross ephemeral drainage channels (including secondary and tertiary roads used to access injection, recovery, and monitoring wells); (iv) proposed pipelines, especially where they will cross ephemeral drainage channels (including Cottonwood Creek); (v) trunk lines; and (vi) proposed power lines. Also, specify the anticipated total new road length to be added within the Jane Dough Unit, and the number of anticipated drainage channel crossings for both roads and pipelines. Additionally, provide more detail in the text of the RAI response specifying the licensee's plans and process for pipeline crossings of drainages, including Cottonwood Creek (see RAI – SW-3 Wells Bored in Drainages).

Uranerz Response: The infrastructure information being request to be shown, such as well locations, roads is not available at this phase of permitting. The GEIS discusses how these types of items are planned at a later phase. However, per additional discussion with NRC staff an exhibit was emailed on April 15, 2016 under confidential submittals and limited disclosure per

NHPA. The emailed exhibit provides information to help facilitate this RAI to the extent possible as discussed with NRC staff.

RAI – GEN-3 Project Schedule

Figure 3-12 of the TR shows Nichols Ranch ISR activities for various production units; however, Figure 3-12 does not include the construction phase (Uranerz, 2015a). Additionally, Figure 3-12 also presents time information by two methods: text and graphically (i.e., arrow length). In some cases, these two methods do not express the same value. For example, the Nichols Ranch Production Area #1 production phase lasts 2.5 years according to the text and 2.25 years according to the arrow.

Revise Figure 3-12 to

a) Include the construction phase.

b) Ensure that the time values expressed by the two methods (text and graphically with arrows) are consistent.

Uranerz Response: Figure 3-12 has been revised per a similar comment from the Technical Review (RAI 3.1-1). The updated figure was constructed in the same fashion as the schedule approved in the original application for which Uranerz updates annually to the NRC.

ECOLOGY

RAI – EC-1 Annual Wildlife Monitoring Plan

Section 4.5.1.2.4 of the ER (Raptors and Nongame/Migratory Birds) states that "Potential conflicts between active nest sites and project-related activities would be mitigated by annual raptor monitoring and mitigation plans as presented in the Mine Plan."

Provide copies of all annual wildlife monitoring plans and reports completed to date for the Nichols Ranch Unit. Also provide a migratory bird plan, if such a plan exists, for the Nichols Unit. These plans and reports will provide the NRC staff with important information on wildlife behavior in the area and serve as an example of the licensee's approach to mitigating potential impacts to wildlife.

Additional Non-RAI Information Needs – Figures for the NRC Staff's Use

The following request is not required to complete the NRC staff's review but would aid in development of the required environmental documents. Please provide the figures in digital form for the NRC staff's use in developing the Jane Dough Environmental Assessment. It is requested that the revised figures not contain figure numbers and that figures are provide in a non-flattened format or in black and white (b/w) when indicated in the list of needs.

Please provide a figure with the criteria detailed in RAI – GEN-1 Site Layout, which includes all raptor nests or roosts on or within 0.8 km [0.5 mi] of the Jane Dough Unit, as well as sage-grouse leks on or within 3.2 km [2 mi] of the Jane Dough Unit.

Uranerz Response: Uranerz provides a courtesy copy of the annual wildlife survey reports to the NRC via a copy of the Annual Report required by the WDEQ/LQD. That said, a copy of each of those annual wildlife surveys is enclosed. Each survey report contains a map illustrating various locations of birds. Furthermore, because the Jane Dough Unit is not expected to adversely impact passerine bird populations no migratory bird plan is necessary. That said, mitigation plans are described in the Technical Report.

AIR QUALITY

RAI – AQ-1 Emissions from Deep Disposal Well Drilling

Section 2.2.1.6.1 of the Nichols Ranch Supplemental Environmental Impact Statement (NRC, 2011) identifies drilling deep disposal wells as one of the activities that generates air emissions. Uranerz is permitted to install up to eight deep disposal wells for the Nichols Ranch ISR Project (WDEQ, 2009).

Provide the number of deep disposal wells that have been drilled to date, along with the maximum number of disposal wells that Uranerz expects will be needed to support operating three units including the Jane Dough unit.

Uranerz Response: To date Uranerz has drilled two deep disposal wells at the Nichols Ranch Unit. While WDEQ/WQD has issued a permit, 10-392, for a total of 8 disposal wells for the entire project, four of which are allocated to the Nichols Ranch Unit proper, the remaining four (4) deep disposal wells are allocated to the Hank Unit. The Hank Unit will be a satellite plant and is a separate plumbing system from Nichols Ranch Unit, thus the four wells are assigned to each unit area for deep disposal, as needed. Jane Dough Unit wellfields will pipeline mine solutions directly to Nichols Ranch CPP and 0.5%to 1.5%of the co-mingled mine solutions will be disposed of through the current Deep Disposal Wells as wellfield bleed. At this time Uranerz does not anticipate needing to drill an additional well to support operations for the two production areas at the Jane Dough; however, should a well be needed the permits are in place for installation.

RAI – AQ-2 Fugitive Dust Calculation – Sources

Section 2.5.4.3 of the TR states that particulate matter PM_{10} fugitive dust emissions estimates are based on the travel on unpaved roads from two sources: tractor trailers and workers commuting to the site. This section of the TR also states that in the calculation of fugitive dust emissions, the wellfield was assumed not to be a significant source.

a) Provide a basis for the assumption that fugitive dust from the wellfield (e.g., travel on unpaved roads within the wellfield and wind erosion to disturbed land) is not a significant source. Otherwise, revise the fugitive dust calculation accordingly.

b) Provide a basis for why travel on unpaved roads the outside of the wellfield by sources other than the travel trailers and commuters (e.g., construction equipment, drill rigs, and water trucks for dust suppression) are not included in the emission estimate. Otherwise, revise the fugitive dust calculation accordingly.

Uranerz Response:

a). The approach taken by Uranerz for Jane Dough emission calculations was conservative

and actually provides an over estimation to the amount of fugitive dust that would be generated by all phases of operations at the Jane Dough Unit. However, at the direction of NRC personnel and in response to this RAI, Uranerz has provided more detailed information how fugitive emissions were generated for the Jane Dough Unit. This information on includes a revised production schedule based on Figure 3-12. This information was used along with monthly miles traveled by all vehicles accessing the project area to calculate the monthly and annual emissions. Refer to Section 2.5.4.3 and Figure 2-11 for updated information on fugitive dust emissions.

b). Refer to Section 2.5.4.3 and Figure 2-11 for updated information on fugitive dust emissions

RAI – AQ-3 Fugitive Dust Calculation

The particulate matter PM_{10} fugitive dust emission estimates in TR Sections 2.5.4.2 and 2.5.4.3 overestimate Nichols Ranch ISR Project fugitive dust emissions as a result of errors in the calculation. Please revise the description of the methodology and provide one correct estimate of annual maximum fugitive dust emissions for the Nichols Ranch ISR Project that addresses all areas of operation (i.e., Nichols Ranch, Hank, and Jane Dough). In your response, please address the following concerns.

1. TR Section 2.5.4.2 described an estimate of fugitive dust emissions for the Nichols Ranch and Hank Units only. In TR Section 2.5.4.3, Uranerz used the same methodology and same assumptions described in Section 2.5.4.2 to provide a separate estimate of fugitive dust emissions for the Jane Dough Unit, and arrived at the same estimate of fugitive dust emissions reported for the Nichols Ranch and Hank Units, which is 135.9 tons per year. However, elsewhere in the text and in Table 2-10, Uranerz provides information which indicates that the project-wide fugitive dust emissions are not expected to change as a result of operations in the Jane Dough Unit. Please revise TR Section 2.5.4 to clarify whether Uranerz's project-wide estimate of maximum annual fugitive dust emissions as a result of licensed operations in the Nichols Ranch, Hank, and Jane Dough Units.

2. As stated in the TR, each estimate in TR Sections 2.5.4.2 and 2.5.4.3 is based on a total distance traveled on unpaved road by all vehicles of 47,375.6 miles, a value which is based on a single-vehicle roundtrip travel distance on unpaved roads of 15 miles. However, Uranerz stated that the distance is 17 miles from Highway 50 and 22.3 miles from Highway 387. The NRC staff notes that the actual distances appear to be about 17 miles one-way (34 miles roundtrip) from Highway 50 and about 12 miles one-way (24 miles roundtrip) from Highway 387. On p. TR-46 of the TR, Uranerz stated it used the longer of the two access routes as a basis for the fugitive dust emission calculations. The NRC staff observes that a roundtrip using the longer of the two routes (which would be about 34 miles from Highway 50) would result in an estimate of total vehicle miles traveled per year of 109,651 miles, a value which does not appear in the TR. Uranerz appears to have used a round trip distance of 22.3 miles to calculate fugitive dust emissions of 135.9 tons per year. Please revise the description of the methodology for estimating fugitive dust emissions by using the correct roundtrip distance.

3. In TR Sections 2.5.4.2 and 2.5.4.3, the incorrect total vehicle miles traveled of 47,375.6 miles is incorrectly multiplied by the total number of vehicles and "semi's" (8 vehicles + 1 semi = 9), a mistake which causes the number of vehicles to be considered twice in the computation. As a result of this error, Uranerz reported a value of 89.5 tons per year.

However, a separate total of 135.9 tons per year appears in statements below the value of 89.5 tons, and also on pp. TR-46, TR-49, TR-49b, TR-49e, and in Tables 2-10, 7-1 and 7-1a. As stated above, the higher value of 135.9 tons is the result of using an incorrect roundtrip maximum distance traveled on unpaved roads of 22.3 miles (from Highway 387), and also incorrectly includes a redundant factor of 9 vehicles. The NRC staff estimated the correct unmitigated fugitive dust emissions to be about 23 tons per year. Please revise the description of the methodology for estimating fugitive dust emissions, ensuring that the number of vehicle trips per day is not used twice.

4. In addition, in its May 8, 2009, response to NRC's request for additional information (Uranerz 2009), Uranerz stated that "reduced tractor trailer traffic" during aquifer restoration and decommissioning activities would reduce maximum annual fugitive dust emissions from 135.9 tons per year to 109 tons per year. However, the NRC staff used the equations in TR Sections 2.5.4.2 and 2.5.4.3 (without correcting the error of double-counting vehicles), assumed a roundtrip maximum distance traveled on unpaved roads of 22.3 miles, reduced tractor trailer traffic to zero, and calculated 123 tons per year. Therefore, it isn't clear how Uranerz arrived at 109 tons per year with just "reduced" tractor trailer traffic. Please explain the methodology used to estimate fugitive dust emissions during aquifer restoration and decommissioning activities and provide a correct estimate of the maximum annual fugitive dust emissions.

Uranerz Response: Response to items 1-4 - Based on these RAI's and conversations with NRC personnel on March 8, 2016, Uranerz has revised and updated the methodology and estimates for fugitive dust emissions contained in the TR and has included the basis for the assumption included in Section 2.5.4.2 and 2.5.4.3 (including Figure 2-11). The information presented in Figure 2-11 also includes an emission schedule by year for each mining unit and cumulative fugitive dust emissions for the entire project.

RAI – AQ-4 Fugitive Dust Calculation – Dust Suppression Estimate

Section 2.5.4.3 of the TR estimates the Nichols Ranch ISR project fugitive dust emission levels at 123.3 metric tons [135.9 short tons] per year. This estimate does not appear to incorporate any fugitive dust suppression mitigation. The Wyoming Department of Environmental Quality (WDEQ) air permit (WDEQ, 2009) estimates the Nichols Ranch ISR project fugitive dust emission levels at 61.7 metric tons [68 short tons] per year and requires the licensee to treat the haul road from the Hank unit to the Nichols Ranch central processing plant (CPP) and the access road to the CPP with water, a chemical dust suppressant, or both. The WDEQ permit estimate was revised based on incorporating mitigation (i.e., Best Available Control Technologies). However, the permit does not specify the efficiency of this mitigation or what the initial emission estimates were prior to incorporating this mitigation.

Verify the staff's understanding that the TR and air permit emission estimates vary because the air permit estimate incorporates dust suppression mitigation

If the calculation in Section 2.5.4.3 of the TR includes dust suppression mitigation or if the licensee intends to revise the fugitive dust emission estimates in the ER analyses by incorporating dust suppression mitigation:

- Identify the mitigation.
- Specify the efficiency of the mitigation.
- Provide the basis for the efficiency of the mitigation.

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Uranerz Response: The fugitive dust emissions presented in the TR were calculated with mitigation measures. The text in Section 2.4.3.2 and 2.5.4.3 has been revised and includes a note to this fact. In addition, the text also documents the mitigation measure, the efficiency, and the basis for the efficiency.

RAI – AQ-5 Fugitive Dust Calculation – Dust Suppression

The WDEQ air permit requires the licensee to treat the haul road from the Hank Satellite to the Nichols Ranch CPP and the access road to the processing plant (WDEQ, 2009). Access to the Nichols Ranch processing plant can be from the east by Highway 50 or the south by Highway 387. Clarify using TR Figure 2-1 which road segments Uranerz treats for dust suppression. Also, use this figure to identify any road segments used by Uranerz that are (i) treated by another entity (e.g., the county), (ii) describe mitigation measures implemented by the other entity, and (iii) clarify whether any changes to the current practice of dust suppression are expected with the addition of the Jane Dough unit.

Uranerz Response: (i) Figure 2-1 has been updated to identify who has responsibility for dust control on which roads in the area. (ii) Mitigation measures implemented by other entities such as the county are per their own policies and procedures. (iii) Dus suppression practices are per the WDEQ-AQD air permit for which Uranerz must comply. It is expected that the current practices will be implemented with the addition of Jane Dough.

RAI – AQ-6 Fugitive Dust Calculation – Peak Year and ISR Phases

It is unclear what the individual project year particulate matter PM_{10} fugitive dust emission levels are for the proposed action (i.e., addition of Jane Dough unit) and cumulatively (i.e., all three units, including Nichols Ranch and Hank). To account for overlapping phases and simultaneous activities at different production areas, the emissions estimate needs to be incorporated into the context of the project schedule. Generating emission estimates for individual years identifies the "peak year" where emissions are the greatest and the potential impacts are the largest. Text in Section 2.5.4.3 and Appendix JD–D4 of the TR estimates that the Jane Dough unit generates 123.3 metric tons [135.9 short tons] of particulate matter PM_{10} fugitive dust annually. However, emission estimates are not specified for individual ISR phases. In addition, Table 2-10 in TR Section 2.5.4.3 attributes this estimate to all three units whereas Table JD–D4–4 in TR Appendix JD–D4 attributes this estimate to just the Jane Dough unit. Section 2.5.4.2 of the TR estimates that combined the Nichols Ranch and Hank units also generates 135.9 tons of particulate matter PM_{10} fugitive dust annually. The May 8, 2009, RAI responses (Uranerz, 2007) specified that the Nichols Project (i.e., Nichols and Hank units) construction and operation phases generate 123.3 metric tons [135.9 short tons] annually and the restoration and reclamation phases generate 98.9 [109 short tons] annually. However, the RAI response did not provide the detailed calculation for estimating the restoration and reclamation phase estimate.

a) Provide the estimated particulate matter PM_{10} fugitive dust emission levels for each ISR phase. Identify whether ISR phase estimates vary by unit (i.e., Nichols, Jane Dough, and Hank). If so provide ISR phase estimates by unit.

b) Follow the example of TR Figure 2-11a and provide a detailed outline of the method used to calculate the ISR phase estimates.

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c) Provide the estimated particulate matter PM_{10} fugitive dust emission levels for each project year based on the update project schedule in TR Figure 3-12 (see RAI – GEN-3).

d) Provide a detailed outline of the method used to calculate the project year estimates and any other values used to generate the project year estimates.

Additional Non-RAI Information Needs – Figures for the NRC Staff's Use

The following requests are not required to complete the NRC staff's review but would aid in development of the required environmental documents. Please provide the figures in digital form for the NRC staff's use in developing the Jane Dough Environmental Assessment. It is requested that the revised figures not contain figure numbers and that figures are provide in a non-flattened format or in black and white (b/w) when indicated in the list of needs.

TR Figure 3-12: Projected Production, Restoration, and Reclamation Schedule: Nichols Ranch, Hank, and Jane Dough Units

- Revise per RAI – GEN-3.
- Change to b/w.
- Ensure capability to delete Uranerz legend, footnote and title.

ER Figure 3-1: Monthly Temperature Comparison for the Jane Dough Unit (ER page ER–36)

- Revise so that the actual numerical values for the monthly data presented within the figure can be determined (e.g., enlarge to a full page and use smaller hash marks on the Y-axis rather than the "10"s currently used).

- Change to b/w; revise the various data lines within the figure so they can be distinguished.

- To address the above issues, consider presenting the data as a table rather than a figure.

ER Figure 3-2: Monthly Wind Speed Statistics, Baseline (Year 1) and Year 2 Comparison for the Jane Dough Unit (ER page ER–38)

- Revise so that the actual numerical values for the monthly data presented within the figure can be determined (e.g., enlarge the scale and use smaller hash marks on the Y-axis than the "5"s currently used).

- Change to b/w; revise the various data lines within the figure so they can be distinguished.

- To address the above issues, it may be easier to present the data as a table rather than a figure.

ER Figure 3-3: Wind Rose Comparison, Baseline (Year 1) and Year 2 for the Jane Dough Unit (ER page ER–39)

- If possible, separate the two wind roses and create individual files/figures for each one.

- Change to b/w; increase size of labels, legend text and symbols, and figure text throughout to improve readability.

Uranerz Response: Based on this RAI and conversations with NRC personnel during the March 8, 2016 conference call, Uranerz has revised and updated the fugitive dust emissions contained in the TR and has included the basis for assumption included in Section 2.5.4.2 and 2.5.4.3 (including Figure 2-11). The information presented in Figure 2-11 also includes an emission schedule by year for each mining unit and cumulative fugitive dust emissions for the entire project. This emissions table addresses overlapping and simultaneous operations. Total fugitive dust emissions for each phase and each unit are also summarized in Figure 2-11.

SURFACE WATER

RAI – SW-1 Ephemeral Channels

New production area access roads, pipelines, and wells will be constructed and installed on the Jane Dough Unit, and some of this infrastructure will either cross or be installed within ephemeral drainages. This information was provided for the Nichols Ranch Unit, but was not included in the Jane Dough application. Provide the linear length of first and second order ephemeral channel thalwegs (i.e., the line drawn to join the lowest points along the entire length of a stream bed or valley in its downward slope) on the Jane Dough Unit that are known to seasonally carry focused flow.

Uranerz Response: The approximate channel slopes and channel characteristics are listed in Table JD-D6-1. The delineation of drainage basins and channel sections for the Jane Dough Unit was done in a manner similar to that of the Nichols Ranch Mine area. As indicated in the response to RAI–GEN-2, the design of major infrastructure for the Jane Dough unit has not been completed, so the location of road crossings and pipeline corridors is not yet available. The wellfields within the Seventeen Mile drainage basin are located near the drainage divide on highly ephemeral drainages with very small upland contributing areas (see revised Figure JD-D6-1). The wellfields within the Cottonwood Creek drainage basin also have limited upland contributing areas. As indicated in revised Figure JD-D6-1, there are also several on-channel CBM reservoirs located on ephemeral channels within or adjacent to the production areas.

RAI – SW-2 Surface Water Class(es)

The application has not identified the surface water classes or their intended use within the license application packet. Provide the surface water class(es) for surface waters occurring on the Jane Dough Unit and their intended use in order for staff to analyze potential impacts to surface waters.

Uranerz Response: The surface water bodies in the permit area are almost entirely coal bed methane (CBM) reservoirs with remaining few being from intermittent ephemeral drainages. The production and use of CBM waters is at the discretion of the CBM operators. According to the Wyoming Department of Environmental Quality - Water Quality Division (WDEQ-WQD) stream classification system, the stream classification for Cottonwood Creek on the Dry Fork tributary to the Powder River drainage is 3B. A 3B classification indicates the stream can potentially support aquatic life, and recreational, wildlife, agricultural, and industrial uses. No other tributaries to the Dry Fork Powder River drainage in the Jane Dough project area are classified by the WDEQ-WQD.

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RAI – SW-3 Wells Bored in Drainages

Several injection (and possibly recovery) wells may be placed within an ephemeral channel crossing over the southeastern ore body in Production Area #2 (Uranerz, 2015, Addendum MPI 3D of Figure MPI.1-5). An indeterminate but potentially greater number of wells (injection, recovery, and monitoring) may be placed in the flowing waters of the U.S. channel crossing over the southwestern ore body in Production Area #1. Provide the anticipated number of wells, well type (e.g., injection, recovery, and monitoring), and a map showing where they will be placed in the ephemeral drainage channels crossing above the southern ore bodies (and northern ore bodies, if applicable).

Uranerz Response: As discussed with NRC staff at this stage of permitting and licensing the site the number and location of wells is not known. Volume I, Chapter 2, Section 2.2 of the Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities (NUREG-1910) describes that the NRC does not require a comprehensive discussion of all aspects of the site and of planned operations. Instead, at this licensing stage, the applicant needs to provide enough information to generally locate the mineralization, understand the systems involved and establish baseline conditions. The information being requested here is not available at this stage of licensing.

Proposed locations of monitor wells have been illustrated on various maps such as Figure 3-8C. It should be noted that in accordance with Wyoming Department of Environmental Quality-LQD Chapter 11 rules and regulations wells shall not be located in the channel of a drainage. As such, construction of wells in drainages is discussed on page TR-61 of the Technical Report.

RAI – GW-1 Aquifer and Aquitard Hydrologic Properties and Gradients

Site-specific hydrologic property data provide the basis for understanding natural and induced flow processes in aquifers and aquitards. Hydrologic property data relevant to ISR operations on the Jane Dough Unit in Table 2 are needed to complete NRC review of the proposed project.

Table 2. Jane Dough (or Nichols Ranch/Hank/Other) Hydrologic Unit Properties

Groundwater Unit	Effective Porosity	Hydraulic Conductivity (m/d)	Gradient	Average Linear Velocity (m/d)	Average Direction
G Sand	0.05	1.5×10^{-3}	0.01	4.3×10^{-4}	North
FG Aquitard			1.1		Up & Down
F Sand	0.14	0.67	0.011	0.05	Northwest
BCF Aquitard	0.22	2.9×10^{-5}	0.37		Up & Down
B Sand	0.05	0.02 or 0.05	0.008	0.008	West-Northwest
AB Mudstone	0.19	9.4×10^{-5}	0.15		Up
A/AB Sand	0.05	0.16	0.0064	0.02	Northwest
1A Mudstone	0.24	6.0×10^{-5}	0.24		Up
1 Sand	0.05	0.046	0.008	0.007	Northwest

Based on information given in Appendix JD–D6

The licensee has provided limited information concerning the properties of the main surficial aquifer, the G Sand, and somewhat less information for the underlying aquitard, FG, at the

Jane Dough Unit. The G Sand information provided was primarily for the Hank Unit (Uranerz, 2014b), with the exception of the gradient. Aquitard properties appear to be from Nichols Ranch or wells located further from the Jane Dough Unit. Some aquitard gradient values were only available from the Hank Unit. Provide missing hydrologic property information for the FG aquitard. Provide a map that explicitly indicates where the wells are located that produced the data relied on in the preceding table, relative to the location of the Jane Dough Unit. If new site-specific hydrologic property data are available for any hydrologic units measured at the Jane Dough Site, provide these new site-specific data.

Clarify the discrepancy in values for the B Sand hydraulic conductivity reported on pages 5 and 8 of Appendix JD–D6 (also see table above).

Clarify the opposing gradient signs provided in Table JD–D6–5. All indications are that flow would be upward in both cases. Head in 1 Sand is greater than head in A Sand. Head in A Sand is greater than head in B Sand. This indicates upward flow in both 1A and AB aquitards. Consequently, both gradients should have the same sign.

Uranerz Response: The ISR projects in the Powder River basin for the last decade have not measured the properties of the aquitards because previous measurements have shown that the vertical hydraulic conductivity of the aquitards is sufficiently small to retard movement of water from one aquifer to the next. The primary aquitard property that needs to be defined at each site is the thickness of the aquitard and its continuity. The aquitard properties that are presented in Table JD-D6-4 are historical values in this area of the Powder River Basin that are useful properties of the aquitard.

The B Sand estimate of ground-water velocity on page JD-D6-8 used a hydraulic conductivity of 0.16 ft/day. The hydraulic conductivities for the B Sand varied from 0.05 to 0.37 ft/day from the B Sand single well tests and the AB Sand multiple well tests.

The heads are greater in the 1 Sand than the A Sand and greater in the A Sand than the B Sand resulting in an upward gradient in lower aquifers to the B Sand in the Jane Dough area. The heads are greater in the G Sand than the F Sand, greater in the F Sand than the C Sand and greater in the C Sand than the B Sand resulting in a downward gradient in the upward aquifers to the B Sand in the Jane Dough area.

The head difference between two aquifers is not the best estimate of the gradient across the aquitard between the two sands because the gradient in the aquitard varies greatly near the boundary of the aquitard. The estimate of the aquitard gradients was developed from previous field measurements.

RAI – GW-2 Geochemistry Clarification

For Radium-226 in the 1 Sand, two conflicting values were reported. Clarify the nature of the discrepancy (i.e., whether this was a rounding error), given that in the ER Appendix JD–D6 has this as 0.32 picocuries per liter (pCi/L) (page JD–D6–28) while Addendum JD–D6E.1-35 has this as 0.3 pCi/L (Table JD–D6E.1-1).

Uranerz Response: The two values reflect the same activity with the 0.3 pCi/L value being rounded.

RAI – GW-3 Consumptive Water Use During Construction and Decommissioning

During wellfield construction and decommissioning, consumptive water use will include water used for dust suppression, cement mixing, drilling support, well development, well abandonment, revegetation, and reclamation of disturbed areas. Provide information regarding the main source of the groundwater consumed. Will groundwater be pulled only from surficial sources (F and G Sands)? Clarify that the two northern ore bodies extend slightly to the north beyond where the G Sand has been fully down cut and eroded by Cottonwood Creek, such that the F Sand is the surficial aquifer above limited portions of these two ore bodies. Provide the depth from land surface to the F Sand in areas of the Jane Dough unit where the F Sand is the surficial aquifer.

Uranerz Response: Uranerz has a water supply well located in the vicinity of the CPP which provides water for both plant and construction uses (i.e. consumptive use). The source of the water is from the Ft. Union sands located 200 ft to 700 ft below the A Sand. It is not anticipated that wells would be drilled or produced from either the F or G Sands. The water right for the well is permitted through the Wyoming State Engineer's Office. At this time there are no plans for additional water wells at Jane Dough and should there be it would be anticipated that the depths would be far below the F and G sands.

PUBLIC AND OCCUPATIONAL HEALTH

RAI – POH-1 Reporting Units for Uranium in Soil

ER Table ER6-2, Radiological Background in Surface and Subsurface Soil – Jane Dough Unit, (Uranerz, 2014a) provides uranium results in units of mass concentrations, whereas all the other soil concentrations are reported in activity concentrations.

Provide the uranium concentrations in Table ER6–2 based on activity concentrations (e.g., pCi/g).

Uranerz Response: Per discussion with NRC on March 8, 2016 no revision of the units in Table ER-6-2 is required. The reason the units were used as such was to maintain consistency between the existing approved Nichols Ranch license application and the Jane Dough application documents. The purpose of the Jane Dough submittal is to amend the information into an existing and approved document.

RAI – POH-2 Yellowcake Dryer and Scope of Baseline Gamma Monitoring

ER Section 6.1.2.1 Baseline Gamma Survey, Purpose and Procedure, second paragraph (Uranerz, 2014a) states, "Additionally, the survey design took into account the fact that the Jane Dough Unit will not have a central or satellite processing facility and fact [sic] that the processing facility at the Nichols Ranch Unit will be limited to resin loading." This description suggests a uranium dryer will not be added to the Nichols Ranch processing facility, which is consistent with current conditions; however, the Nichols Ranch facility is licensed to have a uranium dryer and ER Section 1.3, The Proposed Action, states, "Uranerz is also approved by NRC for its own dryer and will also use its own dryer in the Nichols Ranch CPP should this equipment be installed. Initially, Uranerz will transport uranium-loaded resin beads from the Nichols Ranch CPP to Cameco Resources Inc.'s Smith Ranch Highland CPP but at some point this activity would not be necessary or conducted."

Clarify whether the statement about the sampling methodology being affected by the assumed

lack of yellowcake drying at the CPP is correct and, if so, whether there are plans to conduct additional baseline sampling of the Jane Dough Unit if a dryer is installed.

Uranerz Response: The statement regarding Nichols Ranch activities is being revised with this RAI to capture the fact that Nichols Ranch is approved to carry out drying activities. The sampling methodology for the Jane Dough amendment area is correct for the minimal anticipated disturbance and type of proposed activities. Jane Dough is directly south and adjacent to the Nichols Ranch licensed area. As stated above, Jane Dough will not have a Central Processing Plant nor a Satellite Facility, but will only transfer mining solutions through pipelines from Jane Dough to Nichols Ranch for processing..

RAI – POH-3 Clarify Summary of Groundwater Quality Data

TR Addendum JD–D6E, Groundwater Quality, second paragraph (Uranerz, 2014b) states that Table JD–D6E.1-1 includes the detailed groundwater quality data for the Jane Dough Unit and that "the summary of this water quality data is presented in Table JD–D6–6." Review of these tables indicates that the summary table does not summarize the data for all the monitored wells in Table JD–D6E.1-1.

Clarify why all the well monitoring data are not summarized in Table JD–D6–6 (data for some wells are not included in the summary). Provide the missing well monitoring data for the table or clarify why the information is not otherwise informative, applicable, or needed.

Uranerz Response: Wells JC-16 and JC-22 were determined to be completed in the F Sand but the original well names in Table JD-D6-6 are used because the historical records have used these well names. Wells JF-11 and JF-17 were determined to be completed in the G Sand but the original well names are used because the historical records have used these well names. The well names in Tables JD-D6-2 and have been corrected with the original well names.

RAI – POH-4 Miscellaneous Editorial Clarifications

Review of information described in the ER (Uranerz, 2014a) and TR (Uranerz, 2014b) related to public and occupational health identified areas where correction or clarification is needed. These include the following:

a) ER Page ER–118, second paragraph (Uranerz, 2014a), which describes the baseline radiological characterization, cites Exhibit JD–D11–1 as "Jane Dough Unit-Soil and Sediment Sample Location Map"; however, this exhibit is actually titled "Nearest Residential Location" and JD–D11–2 is titled "Jane Dough Unit Radiological Sample Location." Confirm the correct figure reference for this description.

b) ER Section 6.1.2.3, first paragraph (Uranerz, 2014a) summarizes the results presented in Table ER6–8, Gamma Survey Results: Jane Dough Unit. The range of gamma readings described in the text does not match the data presented in the table. Confirm that the values in the table and in the text are consistent and make any necessary corrections. For example, the text describes a range of gamma readings for surface soil as 13 to 17 µR/hr when the table shows no surface soil measurements that reach 17 µR/hr. **Additionally**, for surface soil the text refers to a high reading of 17 µR/hr at location LAS-13 but there is no entry in the table for that sampling location. Also, Table ER6–8 includes two sets of average, minimum, and maximum values located at the bottom of the figure that are not labeled clearly.

c) ER Section 6.4.1.2, (Flora and Fauna) Methods (Uranerz, 2014a) refers to the "NRC" Technical Report; however, it appears to be referencing a Uranerz report. Clarify which reference is correct.

d) ER Table ER6–11 Radiological Baseline Values in Vegetation: Jane Dough Unit (Uranerz, 2014a) includes averages at the bottom of the table that appear to be incorrect (many orders of magnitude different than all the values in the table that are being averaged). The table averages also do not match the comparable averages listed in Table ER6–12. The licensee should provide a corrected Table ER6–11.

e) ER Section 6.2.1.1 Regional Groundwater Monitoring (Uranerz, 2014a) states that the results of baseline water quality sampling are detailed in Addendum D6B of Appendix JD–D6. Addendum JD–D6B is titled "Single Well Pump Tests" while Addendum JD–D6E is titled "Groundwater Quality." Clarify the correct reference and make any appropriate changes to the text.

f) TR Section 2.7.3.2 (Uranerz, 2014b), first paragraph, states that in Addendum JD–D6G Table JD–D6G1–1 "lists the wells within the Jane Dough Unit" while Table JD–D6G.1–2 "lists wells in and within three miles of the Jane Dough Unit." These descriptions are inconsistent with the titles of each table. Describe the content of each table particularly with regard to whether the wells are within or outside of the Jane Dough unit boundary.

g) TR Section 2.7.3.2 (Uranerz, 2014b), first paragraph, references Exhibit JD–D6–1 as showing "the locations of the permitted wells within 4.8 km [3 mi] of the Jane Dough Unit." Exhibit JD–D6–1 is titled "Surface Water Drainage Areas." Provide the correct exhibit reference.

Uranerz Response:

a. Page ER-118 has been revised to reference Exhibit JD-D11-2.
b. The values in Table ER6-8 are correct and were not changed. The average, min, and max information has been clarified.
c It appears that the NRC reviewer cited the wrong section in the comment. It is actually 6.1.4.2 and not 6.4.1.2. Uranerz has acronymmed the term "Uranerz Jane Dough Unit NRC Source Material License Application" to mean "Uranerz Technical Report" and updated the text of the TR to reflect this change.
d The average values included at the bottom of table ER6-11 have been corrected.
e The correction has been made.
f. The distinction in the listing of wells is (1) within the Jane Dough boundary and the adjacent (½ mile), and (2) wells located within the Jane Dough boundary extending out to three miles from the boundary. Table JD-D6G.1-1 lists wells within the Jane Dough boundary and the adjacent ½ mile. Table JD-D6G.1-2 includes wells within the boundary and a three mile radius from the permit boundary, and by default includes wells listed in Table JD-D6G.1-1.
g. Exhibit JD-D6-1 is the correct exhibit for displaying well locations. Figure JD-D6-1 displays surface drainage areas and is being replaced with this submittal.

RAI – POH-5 Clarify Baseline Air Radionuclide Concentration Units

TR Appendix D–11, Table JD–D11–15 shows the results of quarterly air sampling of

uranium, Ra-226, Th-230, and Pb-210 in concentration units of microcurie (µCi)/milliliter. Table JD–D11–16 in the same appendix presents the same data in a different format and provides averages for each sampling location; however, the units are reported as µCi/kilogram. Table JD–D11–16 indicates that they are same numerical values as in Table JD–D11–15. For consistency, provide the same units (µCi/milliliter) in both tables.

Uranerz Response: Table JD-D11-16 data is correct; however the unit use of kilogram is not. The table has been revised to correct the units. The revised pages are enclosed.

WASTE MANAGEMENT

RAI – WM-1 Decommissioning Wastes from Proposed Pipelines

ER Section 1.3, Proposed Action (Uranerz, 2014a) states that the uranium recovered from the Jane Dough Unit would be "transported via pipelines to the CPP in the Nichols Ranch Unit where the uranium would be processed." The installation of new pipelines changes the volume of waste that would be generated during decommissioning when the pipelines are removed; therefore, additional information is needed on the volumes of these new wastes.

Describe the pipelines that will be installed, including the type of piping that would be used, whether the piping would be installed above or below the ground, the estimated total length of piping that would be used, and an estimate of the volume of decommissioning waste and type of waste (e.g., solid byproduct material, nonhazardous solid waste) from this piping when it is removed during decommissioning (e.g., chipped volume of pipe that is byproduct material destined for a licensed disposal facility and/or nonhazardous solid waste destined for a landfill).

Uranerz Response: As discussed with the NRC during the March 8, 2016 conference, the information being requested in this RAI is discussed in the Technical Report (TR) save for the length and volume of the pipeline. Section 3.0 of the TR describes the process by which the pipelines will be used. Section 6.2.6 of the TR describes site decontamination and decommissioning practices and Section 6.2.8 of the TR includes a discussion of how financial assurance is established and will be established for Jane Dough Unit in the future, understanding that pipe is a component that must be accounted for in the surety. Page ER-2 has been revised to include a reference to the Technical Report to help facilitate where information on the pipeline can be found.

RAI – WM-2 Solid Byproduct Material Disposal Site

The ER (Uranerz, 2014a) and TR (Uranerz, 2014b) do not describe the facility that is being used by the Nichols Ranch ISR Project to dispose of solid byproduct material. Describe any disposal agreement currently in place for Nichols Ranch.

Provide the name and location of the solid byproduct material disposal facility where this waste material from the proposed action will be disposed.

Uranerz Response: As discussed with the NRC on March 8, 2016 this information is not required as there is a license condition describing when to inform the NRC of the disposal site and any changes. The disposal agreement is maintained on site and reviewed during the NRC inspection(s). As stated in Materials License SUA-1597, Amendment No. 4, License Condition 9.9 "The licensee shall dispose of solid byproduct material from the Nichols Ranch ISR Project

operations at a site that is authorized by the NRC or an Agreement State to receive byproduct material. The licensee's approved solid byproduct material disposal agreement must be maintained on site. In the event that the agreement expires or is terminated, the licensee shall notify the NRC within 7 working days after the date of expiration or termination. A new agreement shall be submitted for NRC review within 90 days after expiration or termination, or the licensee will be prohibited from further lixiviant injection."

NICHOLS RANCH and JANE DOUGH DEEP DISPOSAL WELL (DDW) CAPACITY - RAI 3.2-3

DDW Capacity

Planned Flow Production (gpm)				2014		2015				2016				2017				2018			
Site	Rec	PA	HH	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Nichols Ranch	35	1	1	317	352	363	366	314	239	202	230	184	129	90	63	63	63				
Nichols Ranch	27	1	2	329	362	390	376	347	302	246	243	194	136	95	67	67	67				
Nichols Ranch	26	1	3	374	391	370	373	364	304	265	244	195	137	96	67	67	67				
Nichols Ranch	32	1	4	239	249	358	419	422	404	384	260	208	146	102	71	71	71				
Nichols Ranch	21	1	5						322	333	354	354	319	287	258	207	165	116	81	57	57
Nichols Ranch	35	1	6				295	496	448	486	472	425	382	306	245	171	120	84	84	84	
Nichols Ranch	35	1	7								504	504	504	453	408	367	294	235	164	115	81
Nichols Ranch	22	1	8									324	324	324	324	291	262	236	189	151	106
Nichols Ranch	35	2	9										515	515	515	515	463	417	375	300	240
Nichols Ranch	35	2	10											515	515	515	515	463	417	375	300
Nichols Ranch	35	2	11														515	515	515	515	463
Nichols Ranch	35	2	12																515	515	515
Nichols Ranch	35	2	13																		515
Nichols Ranch	35	2	14																		
Jane Dough	35	3	15																		
Jane Dough	35	3	16																		
Jane Dough	35	3	17																		
Jane Dough	35	3	18																		
Jane Dough	35	3	19																		
Jane Dough	35	3	20																		
Jane Dough	35	3	21																		
Jane Dough	35	3	22																		
Jane Dough	35	4	23																		
Jane Dough	35	4	24																		
Jane Dough	35	4	25																		
Jane Dough	35	4	26																		
Jane Dough	35	4	27																		
Jane Dough	35	4	28																		
Jane Dough	35	4	29																		
Jane Dough	35	4	30																		
Production Flow to DDW (gpm)																					
Wellfield Bleed (gpm)				10	11	12	15	16	16	15	18	19	21	22	20	19	21	17	19	17	18
CPP Washdown (gpm)				0.9	0.9	0.9	0.9	0.9	0.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Brine from RO's to create BiCarb solution (gpm)				2.7	2.9	3.2	3.9	4.2	4.4	4.1	5.0	5.2	5.6	6.1	5.5	5.1	5.7	4.5	5.1	4.6	4.9
Plant Process Waste Solution: Elution & Press Drop (gpm)										2.8	3.4	3.5	3.8	4.1	3.7	3.5	3.8	3.1	3.5	3.1	3.4
Total Production Flow to DDW (gpm)				14	15	16	19	21	21	24	29	30	32	34	31	29	32	26	29	26	28
Restoration Flow to DDW (gpm)																					
Groundwater Sweep (gpm)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RO Brine (gpm)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Restoration Flow to DDW (gpm)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Disposal Capacity (gpm)																					
Total Disposal Capacity DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW - Prod (gpm)				136	135	134	131	129	129	126	121	120	118	116	119	121	118	124	121	124	122
Total Flow to DDW (gpm)				14	15	16	19	21	21	24	29	30	32	34	31	29	32	26	29	26	28

Planned Flow Production (gpm)				2019				2020				2021				2022			
Site	Rec	PA	HH	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Nichols Ranch	35	1	1																
Nichols Ranch	27	1	2																
Nichols Ranch	26	1	3																
Nichols Ranch	32	1	4																
Nichols Ranch	21	1	5	57															
Nichols Ranch	35	1	6																
Nichols Ranch	35	1	7	81	81														
Nichols Ranch	22	1	8	74	52	52	52												
Nichols Ranch	35	2	9	168	118	82	82	82											
Nichols Ranch	35	2	10	240	168	118	82	82	82										
Nichols Ranch	35	2	11	417	375	300	240	168	118	82	82	82							
Nichols Ranch	35	2	12	515	463	417	375	300	240	168	118	82	82	82					
Nichols Ranch	35	2	13	515	515	515	463	417	375	300	240	168	118	82	82	82			
Nichols Ranch	35	2	14	515	515	515	515	463	417	375	300	240	168	118	82	82	82		
Jane Dough	35	3	15		515	515	515	515	463	417	375	300	240	168	118	82	82	82	
Jane Dough	35	3	16				515	515	515	515	463	417	375	300	240	168	118	82	82
Jane Dough	35	3	17					515	515	515	515	463	417	375	300	240	168	118	82
Jane Dough	35	3	18						515	515	515	515	463	417	375	300	240	168	118
Jane Dough	35	3	19								515	515	515	515	463	417	375	300	240
Jane Dough	35	3	20									515	515	515	515	463	417	375	300
Jane Dough	35	3	21										515	515	515	515	463	417	375
Jane Dough	35	3	22												515	515	515	515	463
Jane Dough	35	4	23													515	515	515	515
Jane Dough	35	4	24														515	515	515
Jane Dough	35	4	25																515
Jane Dough	35	4	26																
Jane Dough	35	4	27																
Jane Dough	35	4	28																
Jane Dough	35	4	29																
Jane Dough	35	4	30																
Production Flow to DDW (gpm)																			
Wellfield Bleed (gpm)				21	22	20	23	24	26	23	25	26	27	25	26	27	28	25	26
CPP Washdown (gpm)				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Brine from RO's to create BiCarb solution (gpm)				5.6	6.1	5.5	6.2	6.7	7.1	6.3	6.8	7.2	7.5	6.7	7.0	7.4	7.6	6.7	7.0
Plant Process Waste Solution: Elution & Press Drop (gpm)				3.8	4.1	3.7	4.2	4.5	4.8	4.3	4.6	4.9	5.0	4.6	4.7	5.0	5.2	4.6	4.7
Total Production Flow to DDW (gpm)				32	34	31	35	37	40	35	38	40	42	38	39	41	43	38	39
Restoration Flow to DDW (gpm)																			
Groundwater Sweep (gpm)				0	80	80	0	0	0	0	0	0	0	0	100	100	0	0	0
RO Brine (gpm)				0	0	0	100	100	100	100	100	100	100	100	0	0	100	100	100
Total Restoration Flow to DDW (gpm)				0	80	80	100	100	100	100	100	100	100	100	100	100	100	100	100
Disposal Capacity (gpm)																			
Total Disposal Capacity DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW - Prod (gpm)				118	116	119	115	113	110	115	112	110	108	112	111	109	107	112	111
Total Flow to DDW (gpm)				32	114	111	135	137	140	135	138	140	142	138	139	141	143	138	139

Planned Flow Production (gpm)				2023				2024				2025				2026			
Site	Rec	PA	HH	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Nichols Ranch	35	1	1																
Nichols Ranch	27	1	2																
Nichols Ranch	26	1	3																
Nichols Ranch	32	1	4																
Nichols Ranch	21	1	5																
Nichols Ranch	35	1	6																
Nichols Ranch	35	1	7																
Nichols Ranch	22	1	8																
Nichols Ranch	35	2	9																
Nichols Ranch	35	2	10																
Nichols Ranch	35	2	11																
Nichols Ranch	35	2	12																
Nichols Ranch	35	2	13																
Nichols Ranch	35	2	14																
Jane Dough	35	3	15																
Jane Dough	35	3	16	82															
Jane Dough	35	3	17	82	82														
Jane Dough	35	3	18	82	82	82													
Jane Dough	35	3	19	168	118	82	82	82											
Jane Dough	35	3	20	240	168	118	82	82	82										
Jane Dough	35	3	21	300	240	168	118	82	82	82									
Jane Dough	35	3	22	417	375	300	240	168	118	82	82	82							
Jane Dough	35	4	23	463	417	375	300	240	168	118	82	82	82						
Jane Dough	35	4	24	515	463	417	375	300	240	168	118	82	82	82					
Jane Dough	35	4	25	515	515	515	463	417	375	300	240	168	118	82	82	82			
Jane Dough	35	4	26	515	515	515	515	463	417	375	300	240	168	118	82	82	82		
Jane Dough	35	4	27		515	515	515	515	463	417	375	300	240	168	118	82	82	82	
Jane Dough	35	4	28				515	515	515	515	463	417	375	300	240	168	118	82	82
Jane Dough	35	4	29					515	515	515	515	463	417	375	300	240	168	118	82
Jane Dough	35	4	30						515	515	515	515	463	417	375	300	240	168	118
Production Flow to DDW (gpm)																			
Wellfield Bleed (gpm)				27	28	25	26	27	28	25	22	19	16	12	10	8	6	4	2
CPP Washdown (gpm)				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	0.9	0.9	0.9	0.9
Brine from RO's to create BiCarb solution (gpm)				7.4	7.6	6.7	7.0	7.4	7.6	6.7	5.9	5.1	4.2	3.3	2.5	2.0	1.4	0.9	0.5
Plant Process Waste Solution: Elution & Press Drop (gpm)				5.0	5.2	4.6	4.7	5.0	5.2	4.6	4.0	3.5	2.9	2.3	1.8	1.4	1.0	0.7	0.4
Total Production Flow to DDW (gpm)				41	43	38	39	41	43	38	33	29	24	20	16	12	9	6	4
Restoration Flow to DDW (gpm)																			
Groundwater Sweep (gpm)				0	0	0	0	0	100	100	0	0	0	0	0	0	0	0	100
RO Brine (gpm)				100	100	100	100	100	0	0	100	100	100	100	100	100	100	100	0
Total Restoration Flow to DDW (gpm)				100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Disposal Capacity (gpm)																			
Total Disposal Capacity DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW - Prod (gpm)				109	107	112	111	109	107	112	117	121	126	130	134	138	141	144	146
Total Flow to DDW (gpm)				141	143	138	139	141	143	138	133	129	124	120	116	112	109	106	104

Planned Flow Production (gpm)				2027				2028				2029				2030			
Site	Rec	PA	HH	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Nichols Ranch	35	1	1																
Nichols Ranch	27	1	2																
Nichols Ranch	26	1	3																
Nichols Ranch	32	1	4																
Nichols Ranch	21	1	5																
Nichols Ranch	35	1	6																
Nichols Ranch	35	1	7																
Nichols Ranch	22	1	8																
Nichols Ranch	35	2	9																
Nichols Ranch	35	2	10																
Nichols Ranch	35	2	11																
Nichols Ranch	35	2	12																
Nichols Ranch	35	2	13																
Nichols Ranch	35	2	14																
Jane Dough	35	3	15																
Jane Dough	35	3	16																
Jane Dough	35	3	17																
Jane Dough	35	3	18																
Jane Dough	35	3	19																
Jane Dough	35	3	20																
Jane Dough	35	3	21																
Jane Dough	35	3	22																
Jane Dough	35	4	23																
Jane Dough	35	4	24																
Jane Dough	35	4	25																
Jane Dough	35	4	26																
Jane Dough	35	4	27																
Jane Dough	35	4	28	82															
Jane Dough	35	4	29	82	82														
Jane Dough	35	4	30	82	82	82													
Production Flow to DDW (gpm)																			
Wellfield Bleed (gpm)				2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
CPP Washdown (gpm)				0.9	0.9	0.9													
Brine from RO's to create BiCarb solution (gpm)				0.4	0.2	0.0													
Plant Process Waste Solution: Elution & Press Drop (gpm)				0.4	0.2	0.1	0.0												
Total Production Flow to DDW (gpm)				4	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Restoration Flow to DDW (gpm)																			
Groundwater Sweep (gpm)				100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RO Brine (gpm)				0	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0
Total Restoration Flow to DDW (gpm)				100	100	100	100	100	100	100	100	100	0	0	0	0	0	0	0
Disposal Capacity (gpm)																			
Total Disposal Capacity DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW (gpm)				150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Actual DDW - Prod (gpm)				146	147	148	150	150	150	150	150	150	150	150	150	150	150	150	150
Total Flow to DDW (gpm)				104	103	102	100	100	100	100	100	100	0	0	0	0	0	0	0

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Nichols Ranch ISR Project

Nichols Ranch and Jane Dough Deep Desposal Well DDW) Capacity - RAI 3.2-3

By: A. AMZAL	**Date:** 4/25/2016
Contour Interval:	**Revision Date:**
Scale:	**Dwg:** Datum: UTM 1927 ZONE 13
	Exhibit Number:

The drawing specifically in this package have been processed into ADAMS.

This drawings can be accessed within the ADAMS package or by performing a search on the Document/Report Number.

D01

Technical and Environmental Report Page Revisions

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INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

Date 5/20/2016
TAC: J00726, J00875
License NO.: 1569

MINE COMPANY NAME: Uranerz Energy Corporation
MINE NAME: Nichols Ranch ISR Project

Statement: I, William P. Goranson, an authorized representative of Uranerz Energy Corporation declare that only the items listed on this and all consecutively numbered Index Sheets are intended as revisions to the current permit document. In the event that other changes inadvertently occurred due to this revision, those unintentional alterations will not be considered approved. Please initial and date. _____

NOTES:
1) Include all revision or change elements and a brief description of or reason for each revision element.
2) List all revision or change elements in sequence by volume number; number index sheets sequentially as needed.

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
Jane Dough Amendment Volume I	Technical Report Cover Page TR-i	Cover Page TR-i	Cover page updated to reflect latest revision date.
Jane Dough Amendment Volume I	Technical Report Table of Content, Pages TR-ii through TR-xxii	Table of Content, Pages TR-ii through TR-xxii	Table of Content pages have been updated and revised.
Jane Dough Amendment Volume I	Technical Report Section 2, Pages TR-6, TR-7, TR-17, TR-22, TR-44, TR-45 through TR-49e, TR-52, TR-62, TR-69c, TR-110c, TR-110d, TR-110i, TR-110j, TR-110l, TR-110v, TR-113a, TR-114, TR-140 through TR-143d, TR-145 through TR-150, TR-152 through TR-157, TR-159a through TR-159f, Figure 2-1	Section 2, Pages TR-6, TR-7, TR-17, TR-22, TR-44, TR-45 through TR-49e, TR-52, TR-62, TR-69c, TR-110c, TR-110d, TR-110i, TR-110j, TR-110l, TR-110v, TR-113a, TR-114, TR-140 through TR-143d, TR-145 through TR-150, TR-152 through TR-157, TR-159a through TR-159f, Figure 2-1, References	The enclosed pages of this section have been revised in correlation with responses to NRC RAIs and need to replace the existing pages in the Jane Dough TR. The Reference page is a new document which goes at the end of Chapter 2.
Jane Dough Amendment Volume I	Technical Report Section 3, Pages TR-163 through TR-165, TR-167, TR-172, TR-173, TR-178, TR-180 Through TR-190, Figure 3-8C, Figure 3-12	Section 3, Pages TR-163 through TR-165, TR-167, TR-172, TR-173, TR-178, TR-180 Through TR-190, Figure 3-8C, Figure 3-12	The enclosed pages of this section have been revised in correlation with responses to NRC RAIs and need to replace the existing pages in the Jane Dough TR.
Jane Dough Amendment Volume I	Technical Report, Section 5, Pages TR-212 through TR-215, TR-228, TR-229, TR-235, TR-241, TR-242, TR-244, TR-247, TR-248	Section 5, Pages TR-212 through TR-215, TR-228, TR-229, TR-235, TR-241, TR-242, TR-244, TR-247, TR-248	The enclosed pages of this section have been revised in correlation with responses to NRC RAIs and need to replace the existing pages in the Jane Dough TR.

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Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
Jane Dough Amendment Volume I	Technical Report Section 6, Pages TR-270, TR-271, TR-272, TR-277, TR-278	Section 6, Pages TR-270, TR-271, TR-272, TR-277, TR-278	The enclosed pages of this section have been revised in correlation with responses to NRC RAIs and need to replace the existing pages in the Jane Dough TR.
Jane Dough Amendment Volume I	Technical Report Section 7, Pages TR-281, TR-281a, TR-294, TR-297, TR-298, Figure 7-2A	Section 7, Pages TR-281, TR-281a, TR-294, TR-297, TR-298, Figure 7-2A	The enclosed pages of this section have been revised in correlation with responses to NRC RAIs and need to replace the existing pages in the Jane Dough TR.
Jane Dough Amendment Volume I		Section 10, Page TR-333a	This page is a new table in the Technical Report created in correlation with responses to NRC RAIs.
Jane Dough Amendment Volume I		Appendix JD-D4, Addendum JD-D4-A, Page 18a	This page is newly created in response to the NRC RAIs
Jane Dough Amendment Volume IV	Environmental Report Table of Contents pages ER-xxiii through ER-xxx	Environmental Report Table of Contents pages ER-xxiii through ER-xxx	Table of Contents for the Environmental Report updated and revised.
Jane Dough Amendment Volume IV	Environmental Report, Pages ER-2, ER-3, ER-118, ER-127, ER-136, ER-137	Environmental Report, Pages ER-2, ER-3, ER-118, ER-127, ER-136, ER-137	The enclosed pages of the ER have been revised in correlation with responses to NRC RAIs and need to replace the existing pages in the Jane Dough ER.
Jane Dough Amendment Volume VI	Appendix JD-D5 Table of Contents page JD-D5-ii, Pages JD-D5-2 through JD-D5-15, Figure JD-D5-2	Appendix JD-D5 Table of Contents page JD-D5-ii, Pages JD-D5-2 through JD-D5-16, Figure JD-D5-2	The Table of Contents for the Appendix JD-D5 was updated. The pages of the text for the Appendix have been revised in response to NRC RAIs.
Jane Dough Amendment Volume VII	Exhibit JD-D5-17	Exhibit JD-D5-17	The Isopach map has been revised to include the proposed locations of the monitor well and wellfield areas per NRC request.

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Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
Jane Dough Amendment Volume VIII	Appendix JD-D6, Pages JD-D6-2, JD-D6-4 through JD-D6-7, JD-D6-9, JD-D6-18, JD-D6-19, JD-D6-22, JD-D6-23, JD-D6-24, JD-D6-26 through JD-D6-30, Figures JD-D6-1, Exhibit JD-D6-1, Exhibit JD-D6-4	Appendix JD-D6, Pages JD-D6-2, JD-D6-4 through JD-D6-7, JD-D6-9, JD-D6-18, JD-D6-19, JD-D6-22, JD-D6-23, JD-D6-24, JD-D6-26 through JD-D6-30, Figures JD-D6-1, Exhibit JD-D6-1, Exhibit JD-D6-4	The enclosed pages of this appendix have been revised in correlation with responses to NRC RAIs and need to be replaced.
Jane Dough Amendment Volume VIII	Appendix JD-D6, Addendum JD-D6A, Pages JD-D6A.1-1 through JD-D6A.1-6	Appendix JD-D, Addendum JD-D6A, Pages JD-D6A.1-1 through JD-D6A.1-6	The enclosed pages of this appendix have been revised in correlation with responses to NRC RAIs and need to be replaced.
Jane Dough Amendment Volume VIII	Appendix JD-D6, Addendum JD-D6B, Pages JD-D6B-1	Appendix JD-D6, Addendum JD-D6B, Pages JD-D6B-1	The enclosed pages of this appendix have been revised in correlation with responses to NRC RAIs and need to be replaced.
Jane Dough Amendment Volume VIII	Appendix JD-D6, Addendum JD-D6C, Pages JD-D6C.1-1 through JD-D6C.1-9, JD-D6C.1-15, JD-D6C.1-19, JD-D6C.1-22, JD-D6C.1-23, JD-D6C.1-25, JD-D6C.1-26, JD-D6C.1-28, JD-D6C.1-29, JD-D6C.1-32, JD-D6C.1-33, JD-D6C.1-35, JD-D6C.1-36, JD-D6C.1-38, JD-D6C.1-42, JD-D6C.1-43, JD-D6C.1-49, JD-D6C.1-50, JD-D6C.1-52	Appendix JD-D6, Addendum JD-D6C, Pages JD-D6C.1-1 through JD-D6C.1-9, JD-D6C.1-15, JD-D6C.1-19, JD-D6C.1-22, JD-D6C.1-23, JD-D6C.1-25, JD-D6C.1-26, JD-D6C.1-28, JD-D6C.1-29, JD-D6C.1-32, JD-D6C.1-33, JD-D6C.1-35, JD-D6C.1-36, JD-D6C.1-38, JD-D6C.1-42, JD-D6C.1-43, JD-D6C.1-49, JD-D6C.1-50, JD-D6C.1-52	The enclosed pages of this appendix have been revised in correlation with responses to NRC RAIs and need to be replaced.
Jane Dough Amendment Volume IX	Appendix JD-D6, Addendum JD-D6E, Pages JD-D6E.1-18 through JD-D6E.1-21	Appendix JD-D6, Addendum JD-D6E, Pages JD-D6E.1-18 through JD-D6E.1-21	The enclosed pages of this appendix have been revised in correlation with responses to NRC RAIs and need to be replaced.
Jane Dough Amendment Volume X	Appendix JD- JD-D11-3D11, Pages JD-D11-3, JD-D11-18, JD-D11-19, JD-D11-24, JD-D11-27, JD-D11-28, JD-D11-29, JD-D11-32	Appendix JD- JD-D11-3D11, Pages JD-D11-3, JD-D11-18, JD-D11-19, JD-D11-24, JD-D11-27, JD-D11-28, JD-D11-29, JD-D11-32	The enclosed pages of this appendix have been revised in correlation with responses to NRC RAIs and need to be replaced.

SUPPORTING INFORMATION