

January 21, 2016

Ms. Dawn Kolkman, Permitting Manager
Uranerz Energy Corporation
(an Energy Fuels Company)
P.O. Box 50850
1701 East E Street
Casper, WY 82605-0850

SUBJECT: URANERZ ENERGY CORPORATION, NICHOLS RANCH IN-SITU RECOVERY (ISR) PROJECT, REQUEST FOR ADDITIONAL INFORMATION ON JANE DOUGH LICENSE AMENDMENT REQUEST, SOURCE MATERIALS LICENSE SUA-1597 (TAC NOS. J00726, J00875)

Dear Ms. Kolkman:

By letter dated May 8, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14164A274), Uranerz Energy Corporation (Uranerz), submitted an application for amendment of Source Materials License SUA-1597 to authorize the recovery of uranium from the Jane Dough Unit. Uranerz revised its application on October 29, 2014 (ADAMS Accession No. ML14309A118), April 13, 2015 (ADAMS Accession No. ML15118A063), and June 26, 2015 (ADAMS Accession No. ML15182A013).

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of the information and provides the enclosed request for additional information. The NRC staff requests that you either respond to this request or provide a schedule for submitting your responses within 30 days of receipt of this letter. Upon receipt of Uranerz's reply, the staff will continue its evaluation and notify Uranerz in writing of its results.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure" a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

D. Kolkman

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If you have any questions regarding this action, please contact me at 301-415-7677 or by e-mail at David.Brown@nrc.gov.

Sincerely,

/RA/

David D. Brown, Sr. Health Physicist
Uranium Recovery Licensing Branch
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

Docket No.: 040-09067

License No.: SUA-1597

Enclosures:

1. Technical Report RAIs
2. Environmental Report RAIs

cc: Mr. Dorran Lerner, WDEQ

D. Kolkman

- 2 -

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cc: Mr. Dorran Lerner, WDEQ

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ADAMS Accession No.: ML16013A407

OFFICE	DUWP	DUWP	FCSE/ERB	DUWP	DUWP
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DATE	1/19/16	1/19/16	1/19/16	1/20/16	1/20/16
OFFICE	FCSE/ERB	DUWP			
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**Nichols Ranch ISR Project, Uranerz Energy Corporation
Jane Dough License Amendment Request
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.

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.

Enclosure 1

Request for Additional Information

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

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.

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.

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.

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.

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.

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.

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.

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).

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.

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.

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.

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.

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.

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.

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.

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.

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.

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

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.

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.

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.

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.

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.

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.

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.

Basis for Request

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_0). However, the storage coefficient calculation shown on Figure JD-D6C.1.1-7 uses a t_0 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.

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.

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.

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.

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 Methodology," [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."

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.

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.

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.

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.

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, thin, 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.

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.

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 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.

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.

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.

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).

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.

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.

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.

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.

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.

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.

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.

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.

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).

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).

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.
- 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.

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.

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.

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

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.

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.

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

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.

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.

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.

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.

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

- ADM 2.7-16** Table JD-D6-6 does not include measurement units. Please resolve this deficiency.
- ADM 2.7-17** Please reference the analytical methods used corresponding to the results presented in Table JD-D6-6.
- 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.
- 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.
- 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.

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

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

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.

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.
- 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.
- 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.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

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.
- 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.
- 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.

- 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.
- 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.
- 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.
- 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.

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.

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.

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.
- 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”.

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.”

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.

3.5 Plant Equipment, Instrumentation, and Control

ADM 3.5-1 Please revise Section 3.5 to address Standard Operating Procedures for the Jane Dough Unit.

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.

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.

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.

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 20.1302(b)(1).

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?

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.

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.

- 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.
- 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.
- 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.

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.
- 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.

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.

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.
- 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.

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."

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."

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.

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);"

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

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.

References

10 CFR Part 40. *Code of Federal Regulations*, Title 10, *Energy*, Part 40, "Domestic licensing of source material." Washington, D.C.

Craig, Gordon S, Jr., and James G. Rankl. 1978. *Analysis of Runoff from Small Drainage Basins in Wyoming*. Geological Survey Water-Supply Paper 2056.

Lowham, H.W. 1976. *Techniques for Estimating Flow Characteristics of Wyoming Streams*. U.S. Geological Survey. Water Resource Investigation 76-112.

Neuman, S.P. and P.A. Witherspoon. 1972. *Field Determination of the Hydraulic Properties of Leaky Multiple Aquifer Systems*. Water Resources Research. Vol. 8, No 5.

NRC. 1980. Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills," Washington DC: NRC, Office of Standards Development. Accession No. ML003739941.

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NRC. 2003. *Standard Review Plan for In Situ Leach Uranium Extraction License Applications*. NUREG-1569, Washington, D.C. ADAMS Accession No. ML032250177.

NRC. 2015. Letter from A. Persinko, NRC to M. Thomas, Uranerz Energy Corporation (Uranerz), dated August 28, 2015, Re: Uranerz, Nichols Ranch *In-Situ* Recovery (ISR) Project, License Amendment, License Condition 9.7, Proposal to Train Plant Operators and other Suitable Personnel to Perform Daily Inspections, Materials License SUA-1597, (TAC J00727), Washington, D.C. ADAMS Accession Number ML15215A412.

Uranerz. 2013a. Letter from M. Thomas, Uranerz, to NRC, dated January 25, 2013, RE: Semi-Annual and Annual Report Uranerz Energy Corporation Nichols Ranch ISR Project SUA-1597, Casper, Wyoming. ADAMS Accession Number ML13037A310.

Uranerz. 2013b. Letter from M. Thomas, Uranerz, to NRC, dated December 27, 2013, RE: Uranerz Energy Corporation, Nichols Ranch Project, Source Materials License SUA-1597, Docket No. 40-9067, License Condition 12.4. Casper, Wyoming. ADAMS Accession Number ML14003A092.

Uranerz. 2014a. Letter from M. Thomas, Uranerz, to NRC, dated February 19, 2014, RE: Uranerz Energy Corporation, Nichols Ranch Project, Source Materials License SUA-1597, Docket No. 40-9067, License Condition 12.8 Request for Additional Information Response, Casper, Wyoming. ADAMS Accession Number ML14051A113.

Uranerz. 2014b. Letter from M. Thomas, Uranerz, to NRC, dated March 6, 2014, RE: Uranerz Energy Corporation, Nichols Ranch Project, Source Materials License SUA-1597, Docket No. 040-09067, Pre-Operational License Condition 12.8 Supplemental Information, e-mail correspondence only, Casper, Wyoming. ADAMS Accession No. ML14066A051.

Uranerz. 2014c. Letter from M. Thomas, Uranerz to D. Persinko, NRC dated May 8, 2014, RE: Uranerz Energy Corporation, Nichols Ranch ISR Project, NRC License SUA-1597, Docket No. 40-9067 Jane Dough Unit License Amendment Request, Casper, Wyoming, ADAMS Accession No. ML14164A274.

Uranerz. 2015. E-mail from D. Kolkman, Uranerz to D. Brown, NRC dated August 4, 2015, RE: HP Designee – page TR-214b change, Casper, Wyoming, ADAMS Accession No. ML15218A530.