September 23, 2015

MEMORANDUM TO: Bill W. Von Till, Branch Chief
Uranium Recovery Licensing Branch
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

FROM: Ron C. Linton, Project Manager ***/RA/***
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Office of Nuclear Material Safety
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SUBJECT: REVIEW OF URANERZ ENERGY CORPORATION, NICHOLS RANCH ISR PROJECT, SEMI-ANNUAL AND QUARTERLY REPORT REVIEW, JULY 1 THROUGH DECEMBER 31, 2014 (TAC NO. L00778)

Uranerz Energy Corporation (Uranerz or the licensee), submitted to the U.S. Nuclear Regulatory Commission (NRC), the following reports for the Nichol's Ranch ISR [In Situ Recovery] Project. These documents are available in the Agencywide Documents Access and Management System (ADAMS) under Accession Numbers as stated:

- Uranerz Energy Corporation, Nichols Ranch ISR Project, WDEQ-LQD [Wyoming Department of Environmental Quality – Land Quality Division] Permit to Mine No. 778 and NRC SUA-1597, Quarterly Report, October 28, 2014, ADAMS Accession No. ML14310A421.

- Uranerz Energy Corporation, Nichols Ranch ISR Project, WDEQ-LQD Permit to Mine No. 778 and NRC SUA-1597, Quarterly Report, January 28, 2015, ADAMS Accession No. ML15036A064.

- Uranerz Energy Corporation, Nichols Ranch ISR Project SUA-1597, Semi-Annual Report, March 4, 2015, ADAMS Accession No. ML15076A032.

- Uranerz Energy Corporation, Nichols Ranch ISR Project SUA-1597, Revised Semi-Annual Report, April 13, 2015, ADAMS Accession No. ML15117A067.

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Uranerz Materials License SUA-1597, License condition 11.1.A, requires the submission of a quarterly report summarizing wells on excursion. License condition 11.1 B, requires a semiannual report that discusses the status of long term excursions and a summary of MITs [Mechanical Integrity Tests] during the reporting period. License condition 11.1.D, requires, consistent with Regulatory Position 2 of Regulatory Guide 4.14 (as revised), a semiannual report that summarizes the results of the operational effluent and environmental monitoring program.

NRC staff reviewed the Semi-Annual Report, which consists of monitoring results for groundwater, surface water, unplanned releases, sediments and soils, air particulate, radon-222, gamma radiation monitoring and the effluent monitoring program. NRC staff also reviewed quarterly reports submitted during the reporting period. Staff's observations are provided in the enclosure.

Enclosure:
NRC Staff Review of Uranerz
Semi-Annual Effluent Report

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ADAMS Accession No.: ML15259A036

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NRC STAFF REVIEW OF SEMI-ANNUAL EFFLUENT AND ENVIRONMETNAL MONITORING REPORT, AND QUARTERLY REPORTS, JULY 1, 2014 TO DECEMBER 31, 2014 URANERZ ENERGY CORPORATION, NICHOLS RANCH ISR PROJECT

Introduction

The licensee reported that operations continued at the Nichols Ranch Project, Nichols Ranch Unit, Production Area #1, header houses 1 through 4. The licensee reports that two deep disposal wells are operating.

Operational Monitoring

The licensee reported for the quarter, from July 1, 2014, through September 31, 2014, a total of 136,645,850 gallons of lixiviant injected, 137,654,950 gallons recovered, with a total bleed rate of 1,700,245 gallons. This was equal to an overall bleed rate of 1.2% for the quarter. However, using values reported in Table 3 of the October 28, 2014, quarterly report (3rd quarter) (ML14310A421), NRC staff independently calculated weekly bleed rates that were different than the licensee's values (see columns below). The NRC staff calculations show a quarterly average bleed rate of 0.73%.

Week Ending	Recovery	Injection	Reported Bleed	Reported % Bleed	NRC Calculated Bleed	NRC Calculated % Bleed
07/06/2014	11,668,250	11,562,800	141,680	1.2%	105,450	
07/13/2014	11,819,250	11,747,950	136,460	1.2%	71,300	
07/20/2014	11,362,700	11,271,850	141,479	1.0%	90,850	
07/27/2014	12,148,400	12,078,600	143,997	1.2%	69,800	
08/03/2014	12,664,450	12,565,850	159,744	1.3%	78,870	
08/10/2014	12,408,900	12,334,700	150,721	1.2%	74,200	
08/17/2014	13,192,050	13,076,950	170,365	1.3%	115,100	
08/24/2014	13,159,100	13,045,750	168,836	1.3%	113,350	
08/31/2014	13,159,650	13,066,000	163,757	1.2%	93,650	
09/07/2014	13,051,850	12,975,300	156,999	1.2%	76,550	
09/14/2014	13,020,350	12,920,100	166,207	1.3%	100,250	
09/21/2014	13,199,900	13,108,800	163,443	1.2%	91,100	
09/28/2014	13,545,450	13,423,650	182,319	1.3%	121,800	
Totals	137,654,950	136,645,850	1,700,245	1.2%	1,009,100	0.73%

The licensee reported for the quarter, from October 1, 2014, through December 31, 2014, a total of 148,366,800 gallons of lixiviant injected, 149,760,050 gallons recovered, with a total bleed rate of 1,896,837 gallons. This was equal to an overall bleed rate of 1.2% for the quarter. NRC staff reviewed Table 3 of the January 28, 2015, quarterly report (4th quarter) (ML15036A064) and the reported bleed does not equal the gallons recovered minus the gallons injected (values

from the 4th quarter report are not tabulated and reported in this Memorandum). Uranerz should take steps to ensure that bleed rates are reported correctly or explain why the calculated values in the bleed column are not equal to the gallons recovered minus the gallons injected.

The licensee reported:

- There were four unplanned releases that were reported to the NRC.
- There was one exceedance of the maximum injection pressure of 150 psi during the reporting period, shown as 551 psi. The exceedance was deemed due to a frozen transmitter. The licensee has moved the transmitter indoors to prevent freezing.
- There are no activities occurring at the Hank Unit.
- No wells were on excursion during the reporting period.
- Four wells failed mechanical integrity testing and will be abandoned.

Environmental Monitoring

Surface and Groundwater Environmental Monitoring

- Section 3.1. The licensee reported results of ground water monitoring. Ground water monitoring well URNZG-15 is reported dry during monitoring period, as it was during the previous reporting period. The NRC staff notes the licensee should consider taking samples from other surficial wells near the production area if this well continues to be dry. NRC staff notes that if well URNZG-15 continues to be dry, the licensee may need to deepen well to meet monitoring requirements.

- Section 3.3. The licensee reported four unplanned releases during the reporting period. The NRC staff suggests that that the license summarize unplanned releases by listing the date, location, volume and area of soil impacted by any reportable release in the Semi-Annual Report and whether it entered a water of the state.

- Appendix A, B, C, and D. The licensee reported water quality analysis of livestock and domestic wells within 1 kilometer in Appendix A, surface water quality analysis in Appendix B, sediment analysis in Appendix C, and soil analysis in Appendix D. The NRC staff suggests that the licensee include cumulative monitoring results in Appendix A, B, C, and D so that any trends may be observed in the data. This may provide efficiency for reviewing the data.

Radiation Protection and Air Monitoring

During an inspection of the Nichols Ranch ISR Project on March 17-18, 2015, NRC staff reviewed the licensee's March 4, 2015, Semi-annual Effluent and Environmental Monitoring Report for July 1 through December 31, 2014 (ADAMS Accession No. ML15076A032).

Since this was the first Semi-Annual Report which provided results of the licensee's Effluent Monitoring Program for radon-222, NRC staff focused its review on Section 3.6, "Effluent Monitoring Program." The Effluent Monitoring Program is described in letters dated February 28, 2014 (ADAMS Accession No. ML14063A214), March 6, 2014 (ADAMS Accession No. ML14066A051), and March 11, 2014 (ADAMS Accession No. ML14071A092), which are

tied down in License Condition 9.2 of Materials License SUA-1597. Deficiencies identified by the NRC staff during the inspection were addressed in a revised report submitted by Uranerz on April 14, 2015 (ADAMS Accession No. ML15117A067).

During the March 17-18, 2015, inspection, NRC staff asked the licensee questions about Section 3.6, "Effluent Monitoring Program," of the March 4, 2015, Semi-Annual Report. The NRC staff's questions, for which the licensee provided responses, are as follows:

Q1. Why did the licensee use different values for the header house ventilation rates when calculating quantities of particulate matter in effluent (1,750 cfm) versus radon-222 in effluent (1,275 cfm)?

A1. The licensee stated that the correct value for the header house ventilation rate is 1,275 cfm. The licensee will correct the calculations and resubmit the Semi-Annual Report.

Q2. Why were central processing plant (CPP) tank effluent concentrations reported in working levels? The Pylon Model AB6A and 600A Lucas cell measure radon-222 concentrations (e.g., in units of pCi/L) and not working levels (i.e., radon-222 progeny).

A2. The licensee stated that it assumed equilibrium between radon-222 and radon-222 progeny when reporting the working levels in the Semi-Annual Report. Since equilibrium may not occur this close to a source, and equilibrium was not measured, the NRC staff asked to review the documented analysis of the CPP tank effluent (see section below on Radon-222 quantities in CPP tank vent effluent).

Q3. What is the basis for the 9.1E-08 µCi/mL per working level (WL) conversion factor used in the effluent calculation? Generally, one WL is the concentration of radon-222 progeny in equilibrium with 1E-07 µCi/mL (i.e., 100 pCi/L) of radon-222.

A3. As stated in its Effluent Sampling Plan, ADAMS Accession No. ML14066A051, the licensee stated that it used the values from 10 CFR 20, Appendix B, Table 1, column 3, which indicate that the derived air concentration (DAC) is 3E-8 µCi/mL = 0.33 WL, from which it derived 9.1E-08 µCi/mL per WL. The NRC staff observed that the use of the DAC value in the Appendix B results in a rounding error. However, this approached is explained in the NRC-approved Effluent Sampling Plan.

Q4. Why does the equation for calculating the air effluent of radon-222 from recovery wells use a volume of air effluent of 15,000 mL for one recovery well, multiplied by the time interval for the CY 2014 operational period?

A4. The licensee stated that the calculation used to estimate radon-222 effluent from recovery wells used the air flow rate of the pump used in the modified Kusnetz method (3 LPM) and the duration of the operational period (374,400 minutes in CY 2014), as explained in the licensee's Effluent Sampling Plan. The licensee will correct the equation stated in the Semi-Annual Report and resubmit the Semi-Annual Report.

Q5. Why did the licensee assume equilibrium between radon-222 and radon-222 progeny?

A5. The licensee stated that it was required to assume equilibrium exists as a result of NRC staff's position on the use of 10 CFR 20, Appendix B, Table 2 values for radon-222 with daughters present. However, the licensee acknowledged that when measuring radon-222 progeny to infer radon-222 concentrations, radon-222 progeny are not likely to be in equilibrium with radon-222 this close to the source, and it is non-conservative to assume that equilibrium has occurred. The licensee stated that it will continue to try to measure equilibrium factors to estimate radon-222 effluent quantities using working level measurements.

Q6. Grab samples for radon-222 in CPP tank effluent were taken twice: on September 30, 2014, and December 10, 2014. What was the configuration of the system and sampling system on those dates?

A6. The licensee stated that the plant was in normal operations with no resin transfers occurring during the sample period.

Q7. Why is the uncertainty larger than the result for the December 10, 2014 CPP tank vent air sample?

A7. To estimate uncertainty for the Lucas cell measurements, the licensee used the square root of the final calculated value of working level. The NRC staff stated that this was not correct. Correct methods for calculating uncertainty are generally based on the gross radiation counts, as described in Section 19 of the Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual. For example, given that the raw counts detected by the Lucas cell during each 2-minute analysis were about 2,000 counts, the square root of 2,000, or 45, indicates that the counting uncertainty, neglecting the contribution from background, would be about 45 / 2,000, or about 2%, of the measured value.

Q8. Appendix H of the Semi-Annual Report states that concentrations of natural uranium in air values are >1,000% of the values in 10 CFR 20, Appendix B, Table 2. Given that the comparison to Appendix B values would not yield an acceptable result, the NRC staff asked how the licensee will demonstrate compliance with public dose limits.

A8. The licensee stated that it did not intend to compare to effluent concentrations of natural uranium concentrations in air to values in 10 CFR 20, Appendix B, Table 2. Public dose will be calculated in accordance with the NRC-approved Effluent Sampling Plan. The licensee will remove the comparison and resubmit the Semi-Annual Report.

Q9. Why are the measurement uncertainties so variable (and some are zero)?

A9. The licensee stated that if the minimum detectable concentration (MDC) for a single measurement is higher than the measured value, then it reports the MDC value.

This method of censoring results is not acceptable. As described in Section 19.3.8 of the MARLAP Manual, and in accordance with Regulatory Guide 4.14, all results, whether positive, negative, or zero, should be reported as obtained, together with their uncertainties.

Q10. The value of the control thermoluminescence dosimeter (TLD) has increased two-fold between the first and last quarters of CY 2014. How is Uranerz storing the control TLD in the environmental dosimetry program?

A10. The licensee explained that the control TLD is stored in the RSO's office. Regulatory Guide 4.14 cross-references Regulatory Guide 4.13, which states that the requirements and recommendations for performance specifications, testing procedures, calibration procedures, field procedures, and reporting procedures that are included in ANSI N545-1975 are generally acceptable to the NRC staff as the basis for using thermoluminescence dosimetry for the measurement of X-ray and gamma radiation in the environs of NRC-licensed facilities. Appendix B of ANSI N545-1975 describes the use of control TLDs to isolate field exposures, including the use of a lead shield of at least 5 cm thickness to store control TLDs during field exposures.

Q11. How are the environmental dosimetry (TLD) values used in public dose estimate?

A11. The licensee stated that the net public dose from external radiation will be small because the average field exposure from the background location (NR-5) is 39.7 mrem per quarter, and the highest field exposure was measured at the southern boundary (NR-2), which was 41.8 mrem per quarter. Neither the average background nor the southern boundary exposure rates were corrected for the control TLD results (see Q10 and A10 above). The public dose will be reported in the annual ALARA report.

Q12. When will the annual ALARA report be completed and submitted?

A12. The licensee stated the ALARA report will be provided with the next Semi-Annual Report in August 2015.

After the NRC staff review of the March 4, 2015, Semi-Annual Report Uranerz provided a revised report on April 14, 2015 (ADAMS Accession No. ML15117A067), and staff found that the issues summarized above were appropriately addressed in the revised report. The revised April 14, 2015, Semi-Annual Report is the first Uranerz Semi-Annual Report which contains estimates of the quantities of principal radionuclides released to air in accordance with 10 CFR 40.65. NRC staff's review of the revised report regarding the measured effluent quantities and downwind air samples are provided below.

Radon-222 quantities in CPP tank vent effluent

NRC staff evaluated the licensee's use of a Pylon AB6A Portable Radiation Monitor (serial no. 130907) with a Pylon model 600A large active Lucas cell detector (serial no. 131103) to measure radon-222 effluent quantities from the CPP tank vents. The 600A Lucas cell has an

inner volume of 0.271 L and two Swagelok quick connectors on one end of the cylindrical cell; the other end of the cell is a glass window which optically couples to the AB6A radiation monitor. The licensee collected grab samples at the end of the vent pipes on September 30, 2014, and December 10, 2014. Three vent pipes exit the CCP horizontally on the east side and then turn upward through a vertical section that terminates slightly above the elevation of the roof.

To take samples of the CPP tank vents, the licensee used a Gilian GilAir-3 air sampling pump at a rate of 0.5 liters per minute (LPM) to pull a 5-minute grab sample into the 600A Lucas cell. This is a departure from the Effluent Sampling Plan, which states that cells will be evacuated with a vacuum pump to draw samples into the cell. However, the NRC staff agrees that continuously drawing several Lucas cell volumes is necessary to ensure that a representative sample is taken from the effluent, and not just the sample line. The licensee then closed the Lucas cell; brought the filled Lucas cell back to the AB6A radiation monitor in the laboratory; coupled the Lucas cell to the AB6A radiation monitor, and; waited 3 hours to allow radon-222 progeny to reach equilibrium with radon-222.

The NRC staff evaluated the licensee's analysis of the sample collected on September 30, 2014. For the radon-222 sample collected from the CPP tank vents on September 30, 2014, the licensee first determined a system background count rate of 2.12 cpm. The licensee then took a grab sample at 3:23 p.m., and waited over 3 hours (to 6:55 p.m.), as recommended by Pylon, before using the Model AB6A radiation monitor to analyze the sample. The licensee then made repeated 2 minute measurements of the same grab sample over a two hour period, resulting in 61 measurements with an average net count rate of 1,010 cpm. The NRC staff examined the 61 independent analysis results and determined that the sample count rate remained constant for 2 hours. The steady count rate indicates that radon-222 was not leaking from the Lucas cell and that radon-222 progeny were in equilibrium with radon-222.

The licensee used the efficiency of the 600A Lucas cell of 0.743 cpm/dpm to determine that the alpha-emitting radioactivity contained in the Lucas cell was 1,359 dpm (or 612 pCi). However, the licensee incorrectly used the total amount of air sampled (0.5 LPM x 5 minutes = 2.5 L) to calculate a radon-222 concentration of 245 pCi/L. The licensee recognized the error while explaining the calculations to the NRC staff. The licensee should have determined the sampled radon-222 concentration by: (1) dividing the total alpha-emitting radioactivity contained in the Lucas cell (612 pCi) by the grab sample volume of the Lucas cell (0.271 L), and; (2) determining the fraction of total alpha-emitting radioactivity contained in the Lucas cell attributable to radon-222. Alternatively, NRC staff determined that Pylon states in its literature for the 600A Lucas cell that the nominal sensitivity of the 600A Lucas cell is 1.36 cpm/pCi/L. Using the 1,010 cpm net count rate, and dividing by the Pylon sensitivity value, yields a radon-222 concentration of 743 pCi/L, which is about three times higher than the result used by the licensee in its Semi-Annual Report to estimate effluent quantities from the CPP tank vents. The licensee provided a revised Semi-Annual Report to correct the quantities of radon-222 in CPP tank vent air effluent.

The NRC staff also observed that the licensee's Pylon AB6A was not functioning. As a result of a software error, the unit will not operate during daylight savings time. The licensee was in communication with Pylon to resolve the problem.

Air Monitoring Stations

Continuous air particulate sampling was conducted at locations around Nichols Ranch ISR Project. These stations monitored conditions at the nearest residence, a background location, and at the boundaries of the licensed area. The NRC staff observed the changing of weekly air samples at stations at NA-2 (southern boundary), NA-3 (northern boundary), and NA-4 (background). The NRC staff examined the sample results reported by the licensee for natural uranium, thorium-230, radium-226, thorium-230, lead-210, and polonium-210. With the exception of a single natural uranium concentration for the 2nd quarter 2014 at the background air station (NA-4), there were no discernible elevated values or trends. The 2nd quarter 2014 NA-4 natural uranium concentration was nearly 30 times the average value for all other stations in all other quarters in 2014, and 50 times the detection limit. The licensee compared all radionuclide in air concentrations to the values in 10 CFR Part 20, Appendix B, Table 2. However, to demonstrate compliance with 10 CFR 20.1302, this comparison should be made to annual average concentrations at the boundary of the unrestricted area, and the comparison in Appendix E should be removed in future reports. The licensee should also investigate the elevated uranium concentration value to determine whether the result is valid and whether any further action is warranted.

The licensee sampled radon-222 concentrations in air at six air sample stations (at the nearest residence, a background location, and at the boundaries of the licensed area in each of four directions). The licensee also sampled radon-222 concentrations at eight locations on the boundary of the unrestricted area at the fence around the CPP and four locations in the well field. All results for locations in the well field, around the CPP, and at the site boundary were near, at, or below the concentration measured at the background location.