Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82605
307-265-8900
www.energyfuels.com

August 30, 2017

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

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

Re: Semi-Annual Report Uranerz Energy Corporation Nichols Ranch ISR Project, SUA-1597

Dear Director and Deputy Director,

This letter and attachment serves as the Semi-Annual Report for the Uranerz Energy Corporation Nichols Ranch ISR Project that is required by License Condition 11.1 B and D in SUA-1597.

If you have any questions regarding the provided information, please contact Aaron Linard at 307-265-8900 or by email at alinard@energyfuels.com.

Sincerely,

B. Bonifas

Bernard Bonifas
Mine Manager
Uranerz Energy Corporation (an Energy Fuels Company)

BB/al

Attachments – January - June 2017 Semi-Annual Report

cc: Ron Linton, NRC Project Manager (email)
Bernadette Baca, NRC Health Physicist (email)
Mark Rogaczewski, WDEQ-LQD District III Supervisor (email)

NM5520

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street
Casper, WY 82605
307-265-8900
www.energyfuels.com

ENERGY FUELS

Nichols Ranch ISR Project
License Number SUA-1597
Docket No.40-9067

Semi-Annual Report

January - June 2017

ENERGY FUELS

Table of Contents

ENERGY FUELS

List of Appendices

Appendix A: Surface Water Quality Analysis

Appendix B: Long Lived Air Particulate Data

Appendix C: Radon Monitoring

Appendix D: Passive Gamma Radiation Monitoring

Appendix E: Effluent Program - Particulates

Appendix F: Effluent Program - Radon

Appendix G: 2016 Annual Dose to the Public

Appendix H: 2016 ALARA Audit Report

1.0 INTRODUCTION

Uranerz received Source Material License SUA-1597 on July 19, 2011. In accordance with 10 CFR 40.65 and Source Material License SUA-1597 Uranerz Energy Corporation submits the first half 2017 Semi-Annual Effluent and Monitoring Report summarizing the operational effluent and environmental monitoring activities monitored for the Nichols Ranch, Hank, and Jane Dough Units. Semi-Annual reporting is performed according to SUA-1597 License Condition 11.1 and includes information for the period of January 1, 2017 through June 30, 2017.

2.0 OPERATIONAL MONITORING

2.1 Production Areas in Operation and Restoration

License Condition 11.1(B) requires a semiannual report that discusses the status of production areas in operation and restoration. This information was included in the Quarterly Reports submitted to the NRC on April 27 and July 28, 2017. As described in those reports, production continued at the Nichols Ranch Unit in Production Area #1 (PA#1) in header houses 1 through 8 and began in PA#2 in header house 9 during the report period. In addition, no operational activities occurred at the Jane Dough or Hank Units during the report period.

2.2 Long-Term Excursions

License Condition 11.1(B) requires a semiannual report that discusses the status of any long term excursions. As reported in the Quarterly Reports mentioned above, no wells were on excursion status during the report period.

2.3 Disposal Well Volumes

License Condition 10.11 requires the volumes of solution disposed in each disposal well to be reported in the annual report. Uranerz presently has two deep disposal wells permitted through the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ-WQD), (Permit 10-392). The volumes of solution disposed in each disposal well for the 2017 period will be included in the July through December 2017 Semiannual Report to the NRC.

2.4 Mechanical Integrity Tests

License Condition 11.1(B) requires a semiannual report that provides a summary of mechanical integrity tests (MITs). A summary of MIT results during the report period was included in the Quarterly Reports mentioned above

3.0 ENVIRONMENTAL MONITORING

3.1 Ground Water Monitoring

In accordance with License Condition 11.5, monitor wells in the production area (perimeter, overlying and underlying wells) are sampled for excursion parameters. Per License Condition 11.1(A), a summary of the weekly excursion parameter values, corrective actions taken, and the results obtained for all wells that were on excursion are provided in the above referenced Quarterly Reports submitted to the NRC.

License Condition 11.7 requires an annual evaluation of the impacts of ISR operations on potential ground water users, annual sampling of all domestic and livestock wells located within 1 kilometer of the production area monitor ring wells and submittal of the evaluation and sampling results as part of the annual reporting to the NRC. Collected samples are analyzed at an offsite laboratory for natural uranium, radium-226, and those constituents, chloride, conductivity, and alkalinity, as listed in Section 5.7.8.9 of the license application. The sampling results and annual evaluation will be included in the July through December 2017 Semi-Annual Effluent Report to the NRC.

3.2 Surface Water Monitoring

In accordance with License Condition 11.1(D), Regulatory Guide 4.14 and Sections 5.7.7.3.1 and 5.7.8.11 of the license application, surface water, if available, will be collected and analyzed for total uranium, Th-230, Ra-226, and Pb-210 at least annually, or quarterly if water is present. There are two surface water self-samplers located at the Nichols Ranch Unit. Appendix A contains the surface water quality results for the report period.

As per discussion with NRC staff on September 11, 2014, the Hank and Jane Dough Units are not operational at this time; therefore, surface water monitoring will not occur until production begins in the respective areas

3.3 Unplanned Releases

There was one reportable unplanned release of production solution during the reporting period that was reported to the NRC on June 13, 2017. Documentation pertaining to the unplanned releases is maintained on site and available to inspectors on site upon their request.

3.4 Sediment and Soil Sampling

In accordance with License Condition 11.1(D), Regulatory Guide 4.14 and Section 5.7.7.5 of the license application, sediment and soil samples will be collected annually and analyzed for total uranium, Ra-226, Pb-210 and Th-230. Sampling results will be reported in the July through December 2017 semiannual report to the NRC.

3.5 Air Particulate, Radon, and Gamma Radiation Monitoring

In accordance with Section 5.7.7.2.1, 5.7.7.2.2, and 5.7.7.6 of the approved license application Uranerz maintains an environmental monitoring program at six locations around the licensed Nichols Ranch facility. These stations are used to monitor air particulates, radon, and passive gamma measurements.

The six environmental monitoring station locations are as follow:

- NA-1/NR-1, monitors the nearest full time resident at Dry Fork Ranch
- NA-2/NR-2, is located at the southern license boundary and monitors the down wind conditions of the northwest winds for the CPP.
- NA-3/NR-3, is located at the northern license boundary and monitors the downwind conditions of south west winds for the wellfield and the CPP
- NA-4/NR-5, is located at the eastern license boundary and is the background station upwind from the wellfield and the CPP.
- NA-5/NR-6, is located west of the CPP and monitors the downwind conditions of the easterly winds that occur at night.
- NA-6/NR-7, is located northeast of the CPP and monitors the man camp that is historically the maximally exposed member of the public.

Air particulate samples are collected weekly and then composited quarterly for analysis by an outside laboratory. Appendix B contains the air particulate data collected from the six environmental long-lived particulate air monitoring stations for the report period.

As mentioned above, radon gas is also monitored continuously at the six air particulate stations. In accordance with document ML17019A233 which is referenced under document ML17019A241 in License Condition 9.2 there are also eight additional radon detectors surrounding the CPP and six surrounding the active wellfield which are used for public dose assessments and personnel dose assessments. The historical location known as Wellfield (fence) was located on the boundary of Header House 1. With the addition of Header House 9 during the report period, the Wellfield (fence) radon detector was located in between Header House 1 and 9 so it will no longer be reported as a surrounding wellfield monitoring location. In order to replace it a new passive outdoor radon monitor was installed designated as WFNR-2 beginning January 2017. In addition to this location, two additional monitoring locations have been added, NCBM-3 and NCBM-4, to account for expansion of the wellfield in accordance with document ML17019A233. Passive outdoor radon detectors are exchanged quarterly for the six environmental locations and semi-annually for the wellfield and CPP locations, as required, and sent to Landauer for analysis. The radon monitoring data is shown in Appendix C. These values are then compared to radon daughter effluent releases found in 10 CFR 20 Appendix B values to assess dose to the public.

As mentioned above, passive gamma radiation is monitored continuously at the six air particulate stations. The monitoring is performed using Optically Stimulated Luminescence (OSL) dosimeters that are exchanged and analyzed by Landauer quarterly. The passive gamma radiation monitoring data is shown in Appendix D.

3.6 Effluent Monitoring Program

The effluent monitoring program is designed to meet the requirements of 10 CFR 40.65 and is reported in accordance with License Condition 11.1. Sampling occurs inside the Central Processing Plant (CPP) monthly, Deep Disposal Wells (DDW) semi-annually, and the header houses quarterly, to measure long-lived particulate effluents in accordance with NRC Regulatory Guide 8.30. The results are summarized in Appendix E.

Sampling also occurs inside the CPP, DDW, and the header houses to measure radon effluents, using the modified Kusnetz method. These measurements are taken in accordance with NRC Regulatory Guide 8.30. Radon monitoring also includes quarterly samples of at least 10% of operational recovery wells using the modified Kusnetz method as well as measurements of radon emitted from point source tank ventilation located in the CPP using Method 115 from 40 CFR 61 Appendix B. The results are summarized in Appendix F.

The total effluents emitted during the monitoring period are a sum of each source's effluents and are calculated for long-lived particulate and radon effluents, as shown below. These amounts are compared to operational projections in the license application and will be analyzed and summarized in the annual ALARA report included with this report in (Appendix G). Average concentrations are taken from Appendix E and Appendix F and the background (BKD) concentration for U-Nat is taken from averaging the concentration of U-Nat for NA-4 for the period monitored (which is 1.00E-16 µCi/ml). The average background concentration of radon is taken from averaging the concentration of radon for NR-5 for the period monitored (which is 2.5E-10 µCi/ml).

$$\textbf{Total Effluent of Natural Uranium (period monitored)} = (\textbf{CPP } \mu Ci) + (\textbf{Header House } \mu Ci) + (\textbf{DDW } \mu Ci)$$

$$CPP\ (\mu Ci) = \left[Avg.Conc\left(\frac{\mu Ci}{ml}\right) - BKD\ Conc.\left(\frac{\mu Ci}{ml}\right)\right] * 13{,}500(cfm) * 28{,}316\left(\frac{ml}{ft^3}\right) * 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

$$Header\ House\ (\mu Ci) = \left[Avg.Conc\left(\frac{\mu Ci}{ml}\right) - BKD\ Conc.\left(\frac{\mu Ci}{ml}\right)\right] * 1{,}275(cfm) * 28{,}316\left(\frac{ml}{ft^3}\right) * 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

$$DDW\ (\mu Ci) = \left[Avg.Conc\left(\frac{\mu Ci}{ml}\right) - BKD\ Conc.\left(\frac{\mu Ci}{ml}\right)\right] * 1{,}275(cfm) * 28{,}316\left(\frac{ml}{ft^3}\right) * 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

$$CPP\ (\mu Ci) = (2.87E^{-13} - 1.00E^{-16}) * 13{,}500 * 28{,}316 * 262{,}800 = 28.79\ \mu Ci$$

$$Header\ House\ (uCi) = (3.13E^{-13} - 1.00E^{-16}) * 1{,}275 * 28{,}316 * 262{,}800 = 2.97\ \mu Ci$$

$$DDW\ (uCi) = (5.25E^{-13} - 1.00E^{-16}) * 1{,}275 * 28{,}316 * 262{,}800 = 4.98\ \mu Ci$$

$$\textbf{Total Effluents of U - Nat (period monitored)} = 28.79 + 2.97 + 4.98 = 36.73\ \mu Ci = 3.673\ E^{-5}\ \textbf{Ci of Natural Uranium}$$

$$\textbf{Total Effluents of Radon and its Progeny (period monitored)} = (\textbf{CPP } (\mu Ci)) + (\textbf{CPP Tanks } (\mu Ci)) + (\textbf{Header House } (\mu Ci)) + (\textbf{DDW } (\mu Ci)) + (\textbf{Recovery Wells } (\mu Ci) + (\textbf{Spills } (\mu Ci))$$

$$CPP\ (\mu Ci) = \left[\left(Avg.\,Conc\ (WL) * 9.1E^{-8}\left(\frac{\mu Ci/ml}{WL}\right)\right) - BKD\ Conc.\left(\frac{\mu Ci}{ml}\right)\right] * 13{,}500\ (cfm) * 28{,}316\left(\frac{ml}{ft^3}\right) * 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

$$CPP\ Vents\ (\mu Ci) = \left[\left(Avg.\,Conc\ (WL) * 9.1E^{-8}\left(\frac{\mu Ci/ml}{WL}\right)\right) - BKD\ Conc.\left(\frac{\mu Ci}{ml}\right)\right] * 293\ (cfm) * 28{,}316\left(\frac{ml}{ft^3}\right) * 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

Header House (μCi)

$$= \left[\left(Avg.\,Conc\,(WL) * 9.1E^{-8}\left(\frac{\mu Ci/ml}{WL}\right)\right) - BKD\,Conc.\left(\frac{\mu Ci}{ml}\right)\right]$$
$$* 1{,}275\,(cfm) * 28{,}316\left(\frac{ml}{ft^3}\right)$$
$$* 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

DDW (μCi)

$$= \left[\left(Avg.\,Conc\,(WL) * 9.1E^{-8}\left(\frac{\mu Ci/ml}{WL}\right)\right) - BKD\,Conc.\left(\frac{\mu Ci}{ml}\right)\right]$$
$$* 1{,}275\,(cfm) * 28{,}316\left(\frac{ml}{ft^3}\right)$$
$$* 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

Recovery Wells (μCi)

$$= \left[\left(\frac{Avg.\,Conc\,(WL)}{Well} * 9.1E^{-8}\left(\frac{\mu Ci/ml}{WL}\right)\right) - BKD\,Conc.\left(\frac{\mu Ci}{ml}\right)\right]$$
$$* 259\,(maximum\ number\ of\ operational\ recovery\ wells)$$
$$* 3{,}000\,(emmision\ rate\ in\ \frac{ml}{min}.)$$
$$* 262{,}800(minutes\ of\ operations\ in\ period\ monitored)$$

Spills (μCi)
= There were no spills that contributed detectable amounts of radon to the environment during the

$$CPP\ (\mu Ci) = [(0.0108 * 9.1E^{-8}) - 2.50E^{-10}] * 13{,}500 * 28{,}316 * 262{,}800 = 5.53E^{4}\mu Ci$$

$$CPP\ Vents\ (\mu Ci) = [(12.6 * 9.1E^{-8}) - 2.50E^{-10}] * 293 * 28{,}316 * 262{,}800 = 5.46\ E^{6}\ \mu Ci$$

$$Header\ House\ (\mu Ci) = [(0.0095 * 9.1E^{-8}) - 2.50E^{-10}] * 1{,}275 * 28{,}316 * 262{,}800 = 7.50\ E^{3}\ \mu Ci$$

$$DDW\ (\mu Ci) = [(0.0077 * 9.1E^{-8}) - 2.50E^{-10}] * 1{,}275 * 28{,}316 * 262{,}800 = 5.40\ E^{3}\ \mu Ci$$

$$Recovery\ Wells\ (\mu Ci) = [(0.5170 * 9.1E^{-8}) - 2.50E^{-10}] * 259 * 3{,}000 * 262{,}800 = 1.70\ E^{4}\ \mu Ci$$

Total Effluents of Radon and its Progeny (period monitored)
$= 5.53\ E^{4}\mu Ci + 5.46\ E^{6}\ \mu Ci + 7.50\ E^{3}\ \mu Ci + 5.40\ E^{3}\ \mu Ci + 1.70\ E^{4}\mu Ci = 5.55E^{6}\ \mu Ci$
$= 5.55$ ***Ci of Radon and its Progeny***
– 222. Radon is assumed to be in equilibrium with its short lived progeny.

3.7 Meteorological Data

In accordance with License Condition 10.15 meteorological data is collected in order to verify the data to be representative of long term conditions at Nichols Ranch ISR Project. Uranerz has requested removal of this license condition and are awaiting review and approval from NRC. The data collected includes temperature, wind speed and direction. This report will be submitted in the July-December 2017 semiannual report.

A review of the previous report shows no changes in conditions warranting a change in environmental monitoring stations or radon detectors at this time.

4.0 SUMMARY OF EMPLOYEE URINALYSIS RESULTS

Bioassay samples are collected on all employees at initial hiring. Monthly samples are collected from plant operators. Analysis is performed by an outside laboratory. The bioassay results are summarized annually, pursuant to 10 CFR Part 20, Subpart M and will be included in the July through December 2017 semiannual report.

5.0 PUBLIC DOSE

10 CFR 20.1301 requires that each NRC licensee conduct their operations in a manner that the total effective dose equivalent (TEDE) to members of the public does not exceed 100 mrem in a year, and that the dose from external sources in any unrestricted area does not exceed 2 mrem in any hour. Additionally, 10 CFR 20.1302 requires licensees to show compliance to these dose limits by demonstrating one of the following:

1. Show by actual measurement or calculation that the TEDE to the public does not exceed 100 mrem; or
2. Show that the annual average concentration of radioactive effluent released at the restricted boundary do not exceed the values in Table 2 of Appendix B in 10 CFR 20. Also that the external dose to an individual continuously present in an unrestricted area would not exceed 2 mrem in an hour.

The public dose data is summarized annually and is included in this semi-annual report (Appendix G).

6.0 SAFETY AND ENVIRONMENTAL REVIEW PANEL (SERP) EVAULATIONS

Per License Condition 9.4E, Uranerz shall furnish, in an annual report to the NRC, a description of such changes, tests, or experiments, including a summary of the evaluations made by the safety and environmental evaluation panel (SERP). A summary of SERPs performed during the annual report period will be included in the July through December semiannual report to the NRC.

7.0 RADIATION PROTECTION PROGRAM

As required by License condition 11.2, the licensee shall submit the results of the annual review of the radiation protection program content and implementation performed in accordance with 10 CFR 20.1101(c) (i.e., the ALARA Audit). These results shall include an analysis of doses to individual members of the public. A copy of the 2016 ALARA Audit is included in Appendix H.

Energy Fuels Inc.

Appendix A

Surface Water Quality Analysis

January to June 2017 Semi-Annual Report

Sample Location	Sample Date	Uranium-Natural (Total)		Radium 226			Lead 210			Thorium 230		
		Concentration (µCi/ml)	RL (µCi/ml)	Concentration (µCi/ml)	Precision (±) (µCi/ml)	MDC or RL (µCi/ml)	Concentration (µCi/ml)	Precision (±) (µCi/ml)	MDC or RL (µCi/ml)	Concentration (µCi/ml)	Precision (±) (µCi/ml)	MDC or RL (µCi/ml)
NRSSW (Cottonwood D Nichols)	Not Sampled, Dry (checked 3/30/17)											
NRSSE (Cottonwood U Nichols)	Not Sampled, Dry (checked 3/30/17)											
NRSSW (Cottonwood D Nichols)	12 Jun 17	3.91E-8	2.031E-10	2.4E-9	3E-10	2E-10	5E-10	6E-10	1E-9	2E-10	2E-10	2E-10
NRSSE (Cottonwood U Nichols)	12 Jun 17	6.17E-8	2.031E-10	1.0E-9	2E-10	2E-10	9E-10	6E-10	1E-9	1E-10	1E-10	2E-10

Notes:

MDC = Minimum Detectable Concentration

RL = Reporting Limit

Energy Fuels Inc.
Appendix B
Long Lived Air Particulate Data
January to June 2017 Semi-Annual Report

Sample Location	Sample Period	Radionuclide	Concentration (µCi/ml)	Error ±(µCi/ml)	LLD (µCi/ml)	10CFR 20 APP B Table 2 Values (µCi/ml)	Percent Concentration % (Does not Include Background Subtraction)
NA-1 Air Station Nearest Resident	1st Quarter	U-Nat	9.7E-17	*	1.0E-16	9E-14	0.11
		Th-230	2.2E-16	1.1E-16	1.0E-16	3E-14	0.73
		Ra-226	9.4E-17	5.3E-17	1.0E-16	9E-13	0.01
		Pb-210	1.4E-14	1.3E-15	2.0E-15	6E-13	2.33
		Po-210	6.4E-15	1.3E-15	2.0E-15	9E-13	0.71
	2nd Quarter	U-Nat	1.2E-16	*	1.0E-16	9E-14	0.13
		Th-230	0.0E+00	3.1E-17	1.0E-16	3E-14	0.00
		Ra-226	1.3E-16	6.2E-17	1.0E-16	9E-13	0.01
		Pb-210	1.2E-14	1.0E-15	2.0E-15	6E-13	2.00
		Po-210	2.8E-15	1.2E-15	2.0E-15	9E-13	0.31
	3rd Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
	4th Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
NA-2 Air Station Downwind Southern Boundary	1st Quarter	U-Nat	1.0E-16	*	1.0E-16	9E-14	0.11
		Th-230	2.8E-16	1.3E-16	1.0E-16	3E-14	0.93
		Ra-226	2.0E-16	8.9E-17	1.0E-16	9E-13	0.02
		Pb-210	9.7E-15	1.4E-15	2.0E-15	6E-13	1.62
		Po-210	5.4E-15	1.5E-15	2.0E-15	9E-13	0.60
	2nd Quarter	U-Nat	1.9E-16	*	1.0E-16	9E-14	0.21
		Th-230	6.7E-17	5.9E-17	1.0E-16	3E-14	0.22
		Ra-226	1.1E-16	2.9E-17	1.0E-16	9E-13	0.01
		Pb-210	1.3E-14	1.4E-15	2.0E-15	6E-13	2.17
		Po-210	2.6E-15	1.1E-15	2.0E-15	9E-13	0.29
	3rd Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
	4th Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00

*No result provided from laboratory

Energy Fuels Inc.
Appendix B
Long Lived Air Particulate Data
January to June 2017 Semi-Annual Report

Sample Location	Sample Period	Radionuclide	Concentration (µCi/ml)	Error ±(µCi/ml)	LLD (µCi/ml)	10CFR 20 APP B Table 2 Values (µCi/ml)	Percent Concentration % (Does not include Background Subtraction)
NA-3 Air Station Downwind North Boundary	1st Quarter	U-Nat	7.3E-17	*	1.0E-16	9E-14	0.08
		Th-230	1.3E-16	8.2E-17	1.0E-16	3E-14	0.43
		Ra-226	8.4E-17	4.1E-17	1.0E-16	9E-13	0.01
		Pb-210	1.8E-14	1.4E-15	2.0E-15	6E-13	3.00
		Po-210	7.2E-15	1.7E-15	2.0E-15	9E-13	0.80
	2nd Quarter	U-Nat	1.4E-16	*	1.0E-16	9E-14	0.16
		Th-230	1.6E-16	8.9E-17	1.0E-16	3E-14	0.53
		Ra-226	1.7E-16	5.9E-17	1.0E-16	9E-13	0.02
		Pb-210	1.1E-14	1.0E-15	2.0E-15	6E-13	1.83
		Po-210	2.9E-15	1.1E-15	2.0E-15	9E-13	0.32
	3rd Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
	4th Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
NA-4 Air Station Background Site	1st Quarter	U-Nat	8.5E-17	*	1.0E-16	9E-14	0.09
		Th-230	7.5E-17	6.3E-17	1.0E-16	3E-14	0.25
		Ra-226	1.3E-16	6.3E-17	1.0E-16	9E-13	0.01
		Pb-210	1.5E-14	1.1E-15	2.0E-15	6E-13	2.50
		Po-210	6.2E-15	1.4E-15	2.0E-15	9E-13	0.69
	2nd Quarter	U-Nat	1.2E-16	*	1.0E-16	9E-14	0.13
		Th-230	2.0E-16	9.7E-17	1.0E-16	3E-14	0.67
		Ra-226	1.5E-16	3.2E-17	1.0E-16	9E-13	0.02
		Pb-210	1.2E-14	1.0E-15	2.0E-15	6E-13	2.00
		Po-210	2.8E-15	1.2E-15	0.0E+00	9E-13	0.31
	3rd Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
	4th Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00

*No result provided from laboratory

Energy Fuels Inc.
Appendix B
Long Lived Air Particulate Data
January to June 2017 Semi-Annual Report

Sample Location	Sample Period	Radionuclide	Concentration (µCi/ml)	Error ±(µCi/ml)	LLD (µCi/ml)	10CFR 20 APP B Table 2 Values (µCi/ml)	Percent Concentration % (Does not include Background Subtraction)
NA-5 Air Station Downwind West of CPP	1st Quarter	U-Nat	0.0E+00	*	1.0E-16	9E-14	0.00
		Th-230	0.0E+00	3.6E-17	1.0E-16	3E-14	0.00
		Ra-226	0.0E+00	3.6E-17	1.0E-16	9E-13	0.00
		Pb-210	1.8E-14	1.5E-15	2.0E-15	6E-13	3.00
		Po-210	1.5E-15	7.9E-16	2.0E-15	9E-13	0.17
	2nd Quarter	U-Nat	1.6E-16	*	1.0E-16	9E-14	0.18
		Th-230	5.2E-16	2.0E-16	1.0E-16	3E-14	1.73
		Ra-226	1.2E-16	5.9E-17	1.0E-16	9E-13	0.01
		Pb-210	1.4E-14	1.1E-15	2.0E-15	6E-13	2.33
		Po-210	2.7E-15	1.1E-15	2.0E-15	9E-13	0.30
	3rd Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
	4th Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
NA-6 Air Station Downwind North East of CPP	1st Quarter	U-Nat	3.3E-16	*	1.0E-16	9E-14	0.37
		Th-230	0.0E+00	1.6E-16	1.0E-16	3E-14	0.00
		Ra-226	2.4E-16	8.2E-17	1.0E-16	9E-13	0.03
		Pb-210	2.6E-14	2.6E-15	2.0E-15	6E-13	4.33
		Po-210	6.8E-15	2.4E-15	2.0E-15	9E-13	0.76
	2nd Quarter	U-Nat	2.9E-16	*	1.0E-16	9E-14	0.32
		Th-230	0.0E+00	3.7E-16	1.0E-16	3E-14	0.00
		Ra-226	7.5E-16	3.7E-16	1.0E-16	9E-13	0.08
		Pb-210	3.7E-14	1.0E-14	2.0E-15	6E-13	6.17
		Po-210	1.1E-14	8.6E-15	2.0E-15	9E-13	1.22
	3rd Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00
	4th Quarter	U-Nat			1.0E-16	9E-14	0.00
		Th-230			1.0E-16	3E-14	0.00
		Ra-226			1.0E-16	9E-13	0.00
		Pb-210			2.0E-15	6E-13	0.00
		Po-210			2.0E-15	9E-13	0.00

*No result provided from laboratory

Energy Fuels Inc.
Appendix C
Radon Monitoring
January to June 2017 Semi-Annual Report

Location Nichols Ranch Project	1st Quarter (µCi/ml)	Uncertainty (µCi/ml)	2nd Quarter (µCi/ml)	Uncertainty (µCi/ml)	3rd Quarter (µCi/ml)	Uncertainty (µCi/ml)	4th Quarter (µCi/ml)	Uncertainty (µCi/ml)	Location Average Gross(µCi/ml)	Location Average - Background (µCi/ml)	Average Uncertainty (µCi/ml)	10CFR 20 APP B Table 2 Values (µCi/ml)
NR-1 (Nearest Resident)	4.00E-10	3.00E-11	4.00E-10	3.00E-11					4.00E-10	1.50E-10	3.00E-11	1.00E-10
NR-2 (Southern Boundary Downwind)	6.00E-10	4.00E-11	5.00E-10	3.00E-11					5.50E-10	3.00E-10	3.50E-11	1.00E-10
NR-3 (North Boundary Downwind)	7.00E-10	5.00E-11	8.00E-10	5.00E-11					7.50E-10	5.00E-10	5.00E-11	1.00E-10
NR-5 (Background)	4.00E-10	3.00E-11	1.00E-10	1.00E-11					2.50E-10	N/A	2.00E-11	1.00E-10
NR-6 (West of CPP downwind)	6.00E-10	4.00E-11	4.00E-10	3.00E-11					5.00E-10	2.50E-10	3.50E-11	1.00E-10
NR-7 (North East of CPP)	7.00E-10	5.00E-11	1.10E-09	6.00E-11					9.00E-10	6.50E-10	5.50E-11	1.00E-10
NR-1 (Duplicate #1)	4.00E-10	3.00E-11	5.00E-10	3.00E-11					4.50E-10	2.00E-10	3.00E-11	1.00E-10
NR-1 (Duplicate #2)	4.00E-10	3.00E-11	6.00E-10	4.00E-11					5.00E-10	2.50E-10	3.50E-11	1.00E-10

Energy Fuels Inc.
Appendix C
Radon Monitoring
January to June 2017 Semi-Annual Report

Nichols Ranch CPP Locations (9 locations changed semi-annually)												
Location Nichols Ranch Project	Quarter 1 2017 to Quarter 2 2017	Uncertainty			Quarter 3 2017 to Quarter 4 2017	Uncertainty			Location Average (µCi/ml)			10CFR 20 APP B Table 2 Values (µCi/ml)
Man Camp	1.00E-10	1.00E-11							1.00E-10			1.00E-10
CPP Ranch (East Side)	5.00E-10	3.00E-11							5.00E-10			1.00E-10
CPP Fence (SW Corner)	5.00E-10	3.00E-11							5.00E-10			1.00E-10
CPP Fence (South Corner)	4.00E-10	3.00E-11							4.00E-10			1.00E-10
CPP Fence (SE Corner)	4.00E-10	3.00E-11							4.00E-10	N/A	N/A	1.00E-10
CPP Fence (NW Corner)	4.00E-10	3.00E-11							4.00E-10			1.00E-10
CPP Fence (North Side)	5.00E-10	3.00E-11							5.00E-10			1.00E-10
CPP Fence (NE Side)	4.00E-10	3.00E-11							4.00E-10			1.00E-10
CPP Fence (West Side)	7.00E-10	4.00E-11							7.00E-10			1.00E-10

Energy Fuels Inc.
Appendix C
Radon Monitoring
January to June 2017 Semi-Annual Report

Nichols Ranch Wellfield Locations (6 locations changed semi-annually)												
Location Nichols Ranch Project	Quarter 1 2017 to Quarter 2 2017	Uncertainty			Quarter 3 2017 to Quarter 4 2017	Uncertainty			Location Average (µCi/ml)			10CFR 20 APP B Table 2 Values (µCi/ml)
NCBM-3	4.00E-10	3.00E-11							4.00E-10			1.00E-10
NCBM-4	4.00E-10	3.00E-11							4.00E-10			1.00E-10
NCBM-5	7.00E-10	3.00E-11							7.00E-10	N/A	N/A	1.00E-10
NCBM-6	6.00E-10	3.00E-11							6.00E-10			1.00E-10
WFNR-2	1.50E-09	6.00E-11							1.50E-09			1.00E-10
NR-4 (North Wellfield Boundary)	6.00E-10	3.00E-11							6.00E-10			1.00E-10

MDA for all samples is 3.00E-10

Green box indicates time due to semi-annual changeout.

Energy Fuels Inc.
Appendix D
Passive Gamma Radiation Monitoring
January to June 2017 Semi-Annual Report

Location Nichols Ranch Project (2017)	1st Quarter (mrem/quarter) Gross	2nd Quarter (mrem/quarter) Gross	3rd Quarter (mrem/quarter) Gross	4th Quarter (mrem/quarter) Gross	Location Total (mrem) Gross	Location - BKD (mrem) Net
Control Badge	38.4	41.3			79.7	N/A
NR-1(Nearest Resident)	40.1	46.2			86.3	4.3
NR-2 (Southern Boundary Downwind)	40.9	48.8			89.7	7.7
NR-3 (North Boundary Downwind)	42.0	46.1			88.1	6.1
NR-5 (Background Upwind)	40.7	41.3			82.0	N/A
NR-6 (West of CPP downwind)	38.3	44.9			83.2	1.2
NR-7 (North East of CPP Downwind, maximally exposed member of the public)	37.5	46.5			84.0	2.0

Energy Fuels Inc.
Appendix E
Effluent Program
Particulates
January to June 2017 Semi-Annual Report

Sample Location	Sample Date	Radionuclide	Concentration (µCi/ml)	Error ±(µCi/ml)	MDC (µCi/ml)
Header House**	7/12/2016	U-Nat	2.27E-13	5.09E-15	2.27E-13
CPP*	7/12/2016	U-Nat	1.92E-13	0.00E+00	1.92E-13
DDW***	7/26/2016	U-Nat	5.25E-13	7.07E-15	2.05E-13
CPP*	8/2/2016	U-Nat	5.27E-13	3.10E-13	1.92E-13
CPP*	9/9/2016	U-Nat	2.02E-13	4.57E-14	1.84E-13
CPP*	10/6/2016	U-Nat	2.27E-13	0.00E+00	2.27E-13
Header House**	10/10/2016	U-Nat	3.99E-13	2.51E-13	2.18E-13
CPP*	11/9/2016	U-Nat	3.17E-13	1.41E-13	2.62E-13
CPP*	12/8/2016	U-Nat	2.55E-13	8.71E-14	1.93E-13

Average CPP measurements	2.87E-13	9.73E-14	2.08E-13
Average Header House measurements	3.13E-13	1.28E-13	2.22E-13
Average DDW measurements	5.25E-13	7.07E-15	2.05E-13

*CPP concentrations are taken at least monthly from an average of six different sampling locations inside the CPP.
** Header House concentrations are taken at least quarterly from an average of each operational header house (8 houses were operational during the period)
***DDW concentrations are taken at least semi-annually from an average of each operational DDW (currently 2 wells)

Energy Fuels Inc.
Appendix F
Effluent Program
Rn-222 and Progeny
January to June 2017 Semi-Annual Report

Sample Location	Sample Date	Concentration (Working Levels)	Error ±(Working Levels)	MDC (Working Levels)
CPP*	7/12/2016	0.0104	0.0015	0.0102
Header House**	7/12/2016	0.0126	0.0047	0.0115
DDW***	7/12/2016	0.0090	0.0000	0.0090
CPP Vents	7/26/2016	54.3515	N/A*****	0.1066
CPP*	8/2/2016	0.0087	0.0008	0.0087
Header House**	8/3/2016	0.0105	0.0007	0.0105
Recovery Wells****	8/30/2016	1.5978	7.5222	0.0110
CPP*	9/9/2016	0.0035	0.0055	0.0120
Header House**	9/15/2016	0.0130	0.0014	0.0130
CPP*	10/6/2016	0.0098	0.0012	0.0098
Header House**	10/10/2016	0.0051	0.0115	0.0090
DDW***	10/11/2016	0.0090	0.0014	0.0090
Recovery Wells****	11/14/2016	0.2425	0.8859	0.0114
CPP Vents	11/15/2016	0.7077	N/A*****	0.0014
Header House**	11/16/2016	0.0185	0.0134	0.0085
CPP*	11/16/2016	0.0113	0.0020	0.0113
CPP*	12/14/2016	0.0090	0.0010	0.0090
Header House**	12/30/2016	0.0090	0.0000	0.0090

Energy Fuels Inc.
Appendix F
Effluent Program
Rn-222 and Progeny
January to June 2017 Semi-Annual Report

Average CPP measurements	0.0088	0.0020	0.0102
Average Header House measurements	0.0114	0.0053	0.0103
Average DDW measurements	0.0090	0.0007	0.0090
Average Recovery Wells	0.9202	4.2041	0.0112
Average CPP Tanks	27.5296	N/A*****	0.0540

*CPP concentrations are taken from an average of six different sampling locations inside the CPP
** Header house concentrations are taken from an average of each operational header house (8 houses were operational during the period)
***DDW concentrations are taken from an average of each operational DDW (currently 2 wells)
****Recovery well concentrations are an average of at least 10% of active recovery wells during the sampling period. The average number of wells sampled each quarter was 27 wells with a maximum number of operational recovery wells of 225 during the monitoring period.
*****No published way to perform uncertainty calculations with sampling method.

Energy Fuels Inc.
Appendix G
2016 Annual Dose to the Public
January to June 2017 Semi-Annual Report

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

MEMORANDUM

To: File cc:

From: Aaron Linard

Date: 7/13/2017

RE: 2016 Public Dose Assessments

10 CFR 20.1301 requires that each NRC licensee conduct their operations in a manner that the total effective dose equivalent (TEDE) to members of the public does not exceed 100 mrem in a year, and that the dose from external sources in any unrestricted area does not exceed 2 mrem in any hour.

Additionally, 10 CFR 20.1302 requires licensees to show compliance to these dose limits by demonstrating one of the following:

1. Show by actual measurement or calculation that the TEDE to the public does not exceed 100 mrem; or
2. Show that the annual average concentration of radioactive effluent released at the restricted boundary do not exceed the values in Table 2 of Appendix B in 10 CFR 20. Also that the external dose to an individual continuously present in an unrestricted area would not exceed 2 mrem in an hour or exceed 50 mrem in a year.

To demonstrate compliance with 10 CFR 20.1301 by the company at the Nichols Ranch facility, option 1 listed above was used. In order to calculate the TEDE doses from: external radiation, internal exposures to Radon-222 (and its short lived progeny), and long lived particulates were summed. There were two members of the public evaluated and approved as the potentially maximally exposed members of the public (ML17019A233). These were CBM Workers and Workforce Housing employees. Below is a description of how each exposure was evaluated with the TEDE at the bottom.

Workforce Housing

The first worker evaluated as having a potential for being the maximally exposed member of the public is an employee residing in the company provided Workforce Housing. In 2014 it was evaluated that these workers would spend conservatively 2,400 hours/year in the area while off-shift. This value will be used for the occupancy factor as a conservative estimate. This equates to a 27.4% or 0.274 occupancy factor.

For the 2016 calendar year, an OSL was placed at the monitoring station and exchanged quarterly, designated NCBM-2, in order to determine exposure to external radiation. This station is located on the uncontrolled area boundary surrounding the CPP and is located exterior and next to the workforce housing building. The doses from the first through the fourth quarter of 2016 were summed. Once the exposures from the year are summed, the background station (NR-5) is subtracted from the total. This difference is the resulting exposure that a person, with

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

an occupancy factor of 100%, would have received at the location. This value is then multiplied by the occupancy factor to determine the deep dose equivalent (DDE). Below is the calculation with the result.

$$External\ Radiation\ (mrem) = (sum\ of\ NCBM\ 2\ doses\ in\ mrem) - (sum\ of\ NR\ 4\ doses\ in\ mrem)$$

$$External\ Radiation\ (mrem) = (45.3 + 39.7 + 39.8 + 44.5) - (46.1 + 36.1 + 39.0 + 44.9) = 3.2\ mrem$$

$$\boldsymbol{Total\ Exposure\ External\ Radiation\ (DDE\ in\ mrem) = 3.2\ mrem * 0.274\ (occupancy\ factor) = 0.88\ mrem}$$

In order to determine compliance with 10 CFR 20.1301 for the 2016 calendar year, measurements were made with radon track etch detectors inside of the workforce housing building. These were exchanged every 6 months and ran from January through June 2016, and from July through December 2016. For all measurements and calculations it is assumed that Radon-222 is in equilibrium with its associated progeny. An average concentration from the track etch detectors was calculated and then an average background concentration (NR5 which is collocated with NA4) was calculated and subtracted off (See below for the calculation and final concentration above background.). This average concentration was compared with the value in 10 CFR 20 Appendix B Table 2 effluent concentration limit for Radon-222 with Daughters Present which is the equivalent of 50 mrem if exposed to the concentration for an entire year for a conversion to mrem (see below calculation for result). This resulted in a negative number indicating less than background concentrations inside Workforce Housing therefore no additional dose was applied for radon with daughters present.

$$Average\ Radon\ with\ Daughters\ Present\ Concentration\ (WL) = \left(\frac{(WFH\ Q1Q2) + (WFH\ Q3Q4)}{2}\right) - \left(\frac{(NR5Q1Q2 + NR5Q3Q4)}{2}\right)$$

Where:

WFH Q1Q2 = Concentration in uCi/ml of Workforce Housing track etch detector for quarter 1 through 2 of 2016.

WFH Q3Q4 = Concentration in uCi/ml of Workforce Housing track etch detectors for quarter 3 through 4 of 2016.

NR5Q1Q2 = Average concentration of track etch detector in uCi/ml located at background location NR-5 for quarter 1 through 2 of 2016.

NR5Q3Q4 = Average concentration of track etch detector in uCi/ml located at background location NR-5 for quarter 3 through 4 2016.

$$Average\ Radon\ with\ Daughters\ Present\ Concentration\ (uCi/ml) = \left(\frac{6E^{-10} + 4E^{-10}}{2}\right) - \left(\frac{5E^{-10} + 6E^{-10}}{2}\right) = -0.5E^{-10}\ uCi/ml$$

In order to determine compliance with 10 CFR 20.1301 for the 2016 calendar year, measurements were made at air sampling station NA-6. This station is co-located with station NR-7 and is located exterior to and next to the Workforce Housing building. The average concentration of each isotope for 2016 was calculated and then the average concentration of the background station (NA4) was calculated and subtracted. If a value was reported as non-detectable (ND), then the reporting limit was used in the calculation (See below for the calculation and final concentrations for natural uranium (U-nat), Th-230, Ra-226, Pb-210 and Po-210). The concentrations were compared with the values in 10 CFR 20 Appendix B Table 2 effluent concentration limits where the most

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

conservative value was used which is the equivalent of 50 mrem if exposed to that concentration for an entire year for a conversion to mrem (see below calculation for result). Results which returned a negative number indicates less than background concentrations inside Workforce Housing therefore this dose was assumed to be zero. The individual doses were then summed to get an overall mrem of exposure to long-lived particulate radiation (see below) and multiplied by the occupancy factor for a total exposure for the year.

$$Average\ Airborne\ Long\ Lived\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (Average\ of\ NA-6\ concentrations) - (Average\ of\ NA-4\ concentrations)$$

$$Airborne\ Natural\ Uranium\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{2.0E^{-16}+1.0E^{-16}+2.4E^{-16}+8.8E^{-16}}{4}\right) - \left(\frac{1.0E^{-16}+1.9E^{-16}+1.2E^{-16}+5.2E^{-16}}{4}\right)$$

$$= \frac{1.3E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{9.0E^{-13}\frac{uCi}{ml}} = 0.01\ mrem$$

$$Airborne\ Th-230\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{1.0E^{-16}+1.0E^{-16}+7.3E^{-17}+1.2E^{-16}}{4}\right) - \left(\frac{1.0E^{-16}+1.0E^{-16}+6.5E^{-17}+0}{4}\right)$$

$$= \frac{-0.8E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{2.0E^{-14}\frac{uCi}{ml}} = 0.00\ mrem$$

$$Airborne\ Ra-226\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{1.0E^{-16}+1.0E^{-16}+2.8E^{-16}+2.5E^{-16}}{4}\right) - \left(\frac{1.1E^{-16}+1.0E^{-16}+3.4E^{-16}+1.7E^{-16}}{4}\right)$$

$$= \frac{0.03E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{9.0E^{-13}\frac{uCi}{ml}} = 0.00\ mrem$$

$$Airborne\ Po-210\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{2.6E^{-15}+2.0E^{-15}+2.8E^{-15}+3.1E^{-15}}{4}\right) - \left(\frac{2.6E^{-15}+2.0E^{-15}+1.2E^{-15}+2.8E^{-15}}{4}\right)$$

$$= \frac{0.48E^{-15}\frac{uCi}{ml} * 50\ \text{mrem}}{9.0E^{-13}\frac{uCi}{ml}} = 0.03\ mrem$$

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

$$Airborne\ Pb-210\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right)$$
$$= \left(\frac{2.5E^{-14} + 2.0E^{-15} + 2.0E^{-14} + 2.3E^{-14}}{4}\right) - \left(\frac{2.5E^{-14} + 1.2E^{-14} + 1.9E^{-14} + 1.8E^{-14}}{4}\right)$$
$$= \frac{-0.1E^{-15}\frac{uCi}{ml} * 50\ \text{mrem}}{6.0E^{-13}\frac{uCi}{ml}} = 0.00\ mrem$$

$$\textbf{Sum of Long Lived Airborne Particulate Exposures: } 0.01 + 0.00 + 0.00 + 0.03 + 0.00$$
$$= 0.04\ mrem * 0.274\ (occupancy\ factor) = 0.01\ mrem$$

$$\textbf{Sum of all Exposures (TEDE)}$$
$$= External\ exposure\ (mrem) + Radon\ exposure\ (mrem)$$
$$+ Long\ Lived\ Airborne\ Particulate\ Exposure\ (mrem) = 0.88 + 0 + 0.01$$
$$= 0.89\ mrem$$

This demonstrates that if a person were to occupy the Workforce Housing for 2,400 hours a year it would result in a TEDE of 0.89 mrem which is less than the 100 mrem requirement in 10 CFR 20.1301.

CBM Worker

The second worker evaluated as having a potential for being the maximally exposed member of the public is a CBM worker. In 2014 it was evaluated that these workers would spend approximately 660 hours/year in the permitted area. After discussion with local CBM companies it was evaluated that operations have decreased since that initial evaluation. Therefore, 660 hours/year will be used for the occupancy factor as a conservative estimate. This equates to a 7.5% or 0.075 occupancy factor.

For external radiation exposure for the 2016 calendar year, an OSL was placed at the monitoring station labeled NR-2 in order to determine exposure to external radiation. Since CBM wells are located throughout the permitted area the environmental monitoring station with the highest total – BKD was used to estimate conservative CBM worker exposures. This station is located on the southern permit boundary. The doses from the first through the fourth quarter of 2016 were summed. Once the exposures from the year are summed, the background station (NR-5) is subtracted from the total. This difference is the resulting exposure that a person, with an occupancy factor of 100%, would have received at the location. This value is then multiplied by the occupancy factor to determine the DDE. Below is the calculation with the result.

$$External\ Radiation\ (mrem) = (sum\ of\ NR-2\ doses\ in\ mrem) - (sum\ of\ NR-4\ doses\ in\ mrem)$$

$$External\ Radiation\ (mrem) = (46.2 + 38.0 + 42.4 + 46.9) - (46.1 + 36.1 + 39.0 + 44.9) = 7.4\ mrem$$

$$Exposure\ External\ Radiation\ (DDE\ in\ mrem) = 7.4\ mrem * 0.075\ (occupancy\ factor)$$
$$= 0.56\ mrem$$

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

In order to determine compliance with 10 CFR 20.1301 for the 2016 calendar year, measurements were made with eight radon track etch detectors surrounding the processing plant area which represented the highest levels of radon at the unrestricted boundary a member of the public could be exposed to. These detectors were exchanged every 6 months and ran from January through June 2016, and from July through December 2016. For all measurements and calculations it is assumed that Radon-222 is in equilibrium with its associated progeny. The average concentration for the eight radon track etch detectors was calculated and then an average background concentration was calculated and subtracted off (See below for the calculation and final concentration above background.). This average concentration was compared with the value in 10 CFR 20 Appendix B Table 2 effluent concentration limit for Radon-222 with Daughters Present which is the equivalent of 50 mrem if exposed to the concentration for an entire year for a conversion to mrem (see below calculation for result). This value is then multiplied by the occupancy factor to calculate a committed effective dose equivalent for a CBM worker for the year.

$$\textit{Average Radon with Daughters Present Concentration (WL)} = \left(\frac{(CPP\ Q1Q2) + (CPP\ Q3Q4)}{2}\right) - \left(\frac{(NR5Q1Q2 + NR5Q3Q4)}{2}\right)$$

Where:

CPP Q1Q2 = Average concentration in uCi/ml of the unrestricted boundary surrounding the CPP track etch detector for quarter 1 through 2 of 2016.

CPP Q3Q4 = Average concentration in uCi/ml of the unrestricted boundary surrounding the CPP track etch detectors for quarter 3 through 4 of 2016.

NR5Q1Q2 = Average concentration of track etch detector in uCi/ml located at background location NR-5 for quarter 1 through 2 of 2016.

NR5Q3Q4 = Average concentration of track etch detector in uCi/ml located at background location NR-5 for quarter 3 through 4 2016.

$$\textit{Average Radon with Daughters Present Concentration } \left(\frac{uCi}{ml}\right) = \left(\frac{6.88E^{-10} + 9.50E^{-10}}{2}\right) - \left(\frac{5.00E^{-10} + 6.00E^{-10}}{2}\right) = 2.69E^{-10}\frac{uCi}{ml}$$

$$\textbf{\textit{Exposure from Radon with Daughters Present (CEDE in mrem)}} = \frac{2.69E^{-10}\frac{uCi}{ml} * 50\ \text{mrem}}{1.0E^{-10}\frac{uCi}{ml}} * 0.075\ (\textit{occupancy factor}) = 10.09\ \textit{mrem}$$

In order to determine compliance with 10 CFR 20.1301 for the 2016 calendar year, measurements were made at monitoring location NA-1 which represented the highest levels of air particulates outside of the unrestricted area boundary a member of the public could be exposed to. This station is co-located with station NR-1 and is located by the nearest resident. The average concentration of each isotope for 2016 was calculated and then the average concentration of the background station was calculated and subtracted. If a value was reported as non-detectable (ND), then the reporting limit was used in the calculation (See below for the calculation and final concentrations for natural uranium (U-nat), Th-230, Ra-226, Pb-210 and Po-210). The concentrations were compared with the values in 10 CFR 20 Appendix B Table 2 effluent concentration limits where the most conservative value was used which is the equivalent of 50 mrem if exposed to that concentration for an entire year for a conversion to mrem (see below calculation for result). Results which returned a negative number indicates less than background

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

concentrations therefore this dose was assumed to be zero. The individual doses were then summed to get an overall mrem of exposure to long-lived particulate radiation (see below) and multiplied by the occupancy factor for a total exposure for the year.

$$Average\ Airborne\ Long\ Lived\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = (Average\ of\ NA-1\ concentrations) - (Average\ of\ NA-4\ concentrations)$$

$$Airborne\ Natural\ Uranium\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{1.4E^{-16}+3.2E^{-16}+1.6E^{-16}+6.1E^{-16}}{4}\right) - \left(\frac{1.0E^{-16}+1.9E^{-16}+1.2E^{-16}+5.2E^{-16}}{4}\right)$$

$$= \frac{7.50E^{-17}\frac{uCi}{ml} * 50\ \text{mrem}}{9.0E^{-13}\frac{uCi}{ml}} = \mathbf{0.00\ mrem}$$

$$Airborne\ Th-230\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{1.0E^{-16}+1.0E^{-16}+0+0}{4}\right) - \left(\frac{1.0E^{-16}+1.0E^{-16}+6.5E^{-17}+0}{4}\right)$$

$$= \frac{-0.16E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{2.0E^{-14}\frac{uCi}{ml}} = \mathbf{0.00\ mrem}$$

$$Airborne\ Ra-226\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{1.0E^{-16}+1.0E^{-16}+2.1E^{-16}+1.2E^{-16}}{4}\right) - \left(\frac{1.1E^{-16}+1.0E^{-16}+3.4E^{-16}+1.7E^{-16}}{4}\right)$$

$$= \frac{-0.48E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{9.0E^{-13}\frac{uCi}{ml}} = \mathbf{0.00\ mrem}$$

$$Airborne\ Po-210\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right) = \left(\frac{6.0E^{-15}+2.0E^{-15}+8.5E^{-16}+2.4E^{-15}}{4}\right) - \left(\frac{2.6E^{-15}+2.0E^{-15}+1.2E^{-15}+2.8E^{-15}}{4}\right)$$

$$= \frac{6.63E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{9.0E^{-13}\frac{uCi}{ml}} = \mathbf{0.04\ mrem}$$

Uranerz Energy Corporation
(an Energy Fuels Company)
1701 East "E" Street, Suite 100
Casper, WY 82601
307 265 8900
www.energyfuels.com

$$Airborne\ Pb-210\ Particulate\ Concentration\ \left(\frac{uCi}{ml}\right)$$
$$= \left(\frac{2.7E^{-14} + 2.2E^{-14} + 2.1E^{-14} + 1.9E^{-14}}{4}\right) = \left(\frac{2.5E^{-14} + 1.2E^{-14} + 1.9E^{-14} + 1.8E^{-14}}{4}\right)$$
$$= \frac{3.75E^{-16}\frac{uCi}{ml} * 50\ \text{mrem}}{6.0E^{-13}\frac{uCi}{ml}} = \mathbf{0.03\ mrem}$$

$$\textbf{Sum of Long Lived Airborne Particulate Exposures (CEDE in mrem): } \mathbf{0.00 + 0.00 + 0.00 + 0.04 + 0.03 = 0.07\ mrem * 0.075\ (occupancy\ factor) = 0.01\ mrem}$$

$$\textbf{Sum of all Exposures (TEDE)} = \textbf{External exposure (mrem) + Radon exposure (mrem) + Long Lived Airborne Particulate Exposure (mrem) = 0.56 + 10.09 + 0.01 = 10.66 mrem}$$

This demonstrates that if a CBM worker operated 660 hours a year within the permitted property then it could result in a TEDE of 10.66 mrem which is less than the 100 mrem requirement in 10 CFR 20.1301.

Energy Fuels Inc.
Appendix H
2016 ALARA Audit Report
January to June 2017 Semi-Annual Report

2016
ALARA AUDIT REPORT

URANERZ ENERGY CORPORATION
NICHOLS RANCH ISR PROJECT

August 14, 2017

Contents

LIST OF TABLES

Nichols Ranch ISR Project
2016 ALARA REPORT
Conducted June 6 – 7, 2017

1.0 INTRODUCTION

License condition 11.2 of the Nichols Ranch ("NR") In-Situ Recovery ("ISR") Project United States Nuclear Regulatory Commission ("NRC") Materials License Number SUA-1597 (the "License") requires that Uranerz Energy Corporation (an Energy Fuels Company) ("Uranerz"), as Licensee, perform an annual review of the radiation protection program at NR. As part of the annual review, an As Low As Reasonable Achievable ("ALARA") audit was conducted in accordance with NRC Regulatory Guide 8.31 ("Reg. Guide 8.31"). The NR ALARA program (RAD-SOP-02, Revision 2, dated April 24, 2014) (the "ALARA Program") also requires that an annual ALARA audit be performed (see specifically, Procedure Section 2). Procedure Section 2.1 of the ALARA Program requires that the results of this audit be summarized in an annual ALARA Report.

The ALARA Audit for calendar year 2016 ("2016") was conducted at NR from June 6 through June 7, 2017. This ALARA Report has been prepared by the ALARA audit team and summarizes the conclusions and recommendations arising from the audit for the period reviewed.

This ALARA audit report is prepared for, and reviewed by, Energy Fuels Resources (USA) Inc. ("EFRI") and NR Management, which considers the conclusions and recommendations in the Report to further improve conditions to ALARA.

1.1 Audit Dates/Audit Team

The ALARA audit involved a site visit from June 6 through June 7, 2017 and additional reviews of documentation during, prior to and following the site visit dates.

The audit team was comprised of Kathy Weinel, Quality Assurance Manager and David Turk EFRI's Manager, Environmental Health and Safety and Radiation Safety Officer ("RSO") at the White Mesa Mill. Aaron Linard, the NR RSO, accompanied and assisted the audit team, but was not a member of the team.

2.0 PERSONNEL EXPOSURE RECORDS

Individual employee exposures are determined for each employee using results of radiological monitoring and surveys of airborne gross alpha activity, airborne uranium, radon progeny, and external dose rate measurements in various areas of the site, and adjusting these results by the amount of time each worker spends in the various areas of the site. Exposure records for employees of the NR site were completed in early 2017 for 2016 after the fourth quarter OSL results were available.

The exposure information provides fundamental data for calculating the Total Effective Dose

Equivalent ("TEDE") for all NR personnel. The TEDE dose and the contributions from internal (uranium air particulate and radon progeny) and external (gamma) exposure pathways for 2016 are summarized in Table 2.5-1.

2.1 Personnel Exposure to Airborne Uranium

2.1.1 Review of DACs Used

Uranium air particulate exposures are determined by measuring the gross alpha activity concentration an employee may have inhaled while working in an area for a known amount of time. The employee's exposure is based on these measurements and the radionuclide content of the material the employee was exposed to. The conventional Derived Area Concentration ("DACs") are listed in 10 CFR Part 20, Appendix B.

The DACs employed during 2016 provided an appropriate basis for estimating doses to the radioactive material processed at the facility.

2.1.2 Average Exposure Rates for Air Particulate

Uranium air particulate exposures are determined by measuring the gross alpha activity concentration an employee may have inhaled while working in an area for a known amount of time.

Area airborne samples are supplemented by breathing zone ("BZ") samples collected for a known period of time on select individuals performing particular job tasks.

The overall uranium air particulate exposures for 2016 were low. One elevated sample, of 547.33% of the DAC was collected in May 2016. The employee was wearing respiratory protection during the event and a follow-up bioassay was collected. There was no uptake to the employee. The procedure being utilized works and the data demonstrates that.

2.2 Personnel Exposure to Radon Progeny

Personnel exposure to radon progeny (daughters) is determined on a time weighted exposure assessment. The results are expressed in rems, which are calculated by dividing the Working Levels ("WLs") in each area by 0.33 and multiplying by the time spent in each such area. Radon progeny was measured throughout the site and various work activities.

During 2016, the average exposure to radon progeny was approximately 0.010 rem with a maximum value of 0.019 rem. This is a reduction from the previous calendar year.

The radon working levels for 2016 are low. As a result, at this time there are no additional ALARA practices identified.

2.3 Committed Effective Dose Equivalent

The sum of the exposures to uranium air particulates and radon progeny are expressed as an employee's Committed Effective Dose Equivalent ("CEDE"). The CEDE dose is summarized in Table 2.5-1. The average CEDE for all workers in 2016 was approximately 0.021 rem with the highest value approximately 0.151 rem.

2.4 External Radiation (Beta/Gamma)

Whole body external radiation doses were measured using personal Optically Stimulated Luminescence ("OSL") dosimeter badges. Quality assurance/quality control comparison of an individual's exposure to external radiation can be determined using a time weighted exposure assessment based on data collected in locations that are equipped with environmental OSL badges. In addition, field survey measurements of the site are performed using portable survey equipment. Personnel OSL measurements of external radiation doses accumulated during 2016 were low with an average of about 0.011 rem (11 mrem) and a maximum of 0.062 rem (62 mrem).

The external radiation levels for 2016 are well below the NRC regulatory limits. There are no trends that were determined. There are no additional ALARA practices to recommend at this point to further reduce exposures.

If NR decides to establish a uranium packaging circuit, NR will need to address the increased external radiation exposure to their personnel.

2.5 Total Effective Dose Equivalent

The TEDE dose is a summation of the doses arising from internal uranium air particulate and radon progeny (CEDE) and external (gamma) exposures (Deep Dose Equivalent ("DDE")) converted to a common metric (rem) and summed. Table 2.5-1 summarizes the average and maximum individual worker CEDE, external gamma and TEDE doses for 2016.

The maximum TEDE for 2016 was approximately 0.174 rem (174 mrem) with an average TEDE of approximately 0.048 rem (48 mrem). The TEDE results are low, compared to the ALARA goal of 1.25 rem (1,250 mrem) per year. There were no practical ALARA practices, which would further reduce overall exposures.

3.0 BIOASSAY RESULTS

The site performs bioassays in accordance with NRC Regulatory Guide 8.22, "Bioassays at Uranium Mills", which states that frequent bioassays are to be performed for employees who are routinely exposed to yellowcake dust, uranium ore dust, or involved in maintenance tasks in which potential yellowcake exposure may occur. Urinalysis measurements are performed in accordance with the recommendations contained in Regulatory Guide 8.22. The recommendations in Regulatory Guide 8.22 require corrective actions based on the bioassay results. The detection limit for uranium bioassays is 5 µg/l. No investigations or corrective actions are required for bioassay results below 15 µg/l. If results exceed 15 µg/l investigations

into the potential cause(s) for the elevated bioassay are required, and if appropriate, corrective actions are to be implemented to reduce additional positive bioassays and assumed uranium exposure.

All bioassay results for 2016 were ND as shown on Table 3.0-1. There were no issues observed, and all spike results were within tolerance ranges.

4.0 INSPECTION LOG ENTRIES AND SUMMARY REPORTS OF DAILY, WEEKLY AND MONTHLY INSPECTIONS

Exposures are reduced through routine audits, inspections of work areas, and associated worker health protection practices.

This report serves as the annual ALARA audit of the radiation safety program at NR in accordance with Reg. Guide 8.31 Section 2.3.3.

Daily, weekly, and monthly inspection, reporting, and monitoring are required by Reg. Guide 8.31 Sections 2.3.1 and 2.3.2. The routine NR inspections, monitoring and reporting are discussed below.

4.1 Responsibility to Perform

The RSO and Radiation Safety Technicians ("RSTs") are responsible for performing all routine and special radiation surveys in accordance with NRC Regulatory Guide 8.30 (Health Physics Surveys in Uranium Mills) and Reg. Guide 8.31.

4.2 Daily Inspections

Paragraph 2.3.1 of Reg. Guide 8.31 provides that the RSO or designated RST should conduct a daily walk-through (visual) inspection of all work and storage areas to ensure proper implementation of good radiation safety procedures, including good housekeeping that would minimize unnecessary contamination. In addition, as noted in License Amendment 5 the licensee may identify qualified designees to perform daily inspections in the absence of the RSO or RSTs specifically on weekends and holidays when the RSO(s) and RST(s) are not present. The number of consecutive days per week that a designate may perform the daily inspection is limited in this License condition. These inspections are documented and on file in the radiation safety department. If an issue is identified on any inspection, the person performing the inspection is expected to advise radiation safety and operations/maintenance staff as appropriate.

4.3 Weekly Inspections

Paragraph 2.3.1 of Reg. Guide 8.31 provides that the RSO and facility foreman (Nichols Ranch equivalent position is the Operations Supervisor) should conduct a weekly inspection of all facility areas to observe general radiation control practices and review required changes in procedures and equipment. Particular attention is to be focused on areas where potential exposures to personnel might exist and in areas of operation or locations where contamination is evident.

A weekly inspection is conducted by the RSO. A Weekly Inspection form is completed and kept on file in the radiation safety department. The results of the weekly reports are transmitted to the Mine Manager for implementation of corrective actions for items identified during the weekly inspection.

Section 2.3.2 of the ALARA Program provides that the RSO or his designee review the daily work order and shift logs on a regular basis to determine that all jobs and operations having a potential for exposing personnel to radiation are evaluated, either through a properly completed Radiation Work Permit ("RWP") or an authorized written Standard Operating Procedure ("SOP"), prior to initiation of work. This requirement is satisfied by the RSO initialing the shift logbook in the control room weekly and through daily meetings with operations and maintenance personnel and the RSO. The RSO identifies any potential issues and determines any safety precautions that are required prior to the work being performed. In addition, the RSO reviews all RWPs before and after the completion of work.

The RSO reviews all violations of radiation safety procedures or other potentially hazardous problems with the Mine Manager or other employees who have authority to correct the problem, as required by Section 2.3.1 of Reg. Guide 8.31. In addition, all issues identified in violations are discussed with the employees in the daily and weekly meetings as noted on the weekly meeting minutes.

4.4 Monthly Reports

Reg. Guide 8.31 provides that at least monthly, the RSO should review the results of daily and weekly inspections, including a review of all monitoring and exposure data for the month and provides a monthly report containing a written summary of the month's significant worker protection activities. Paragraph 2.3.2 of Reg. Guide 8.31 states that the Monthly Report should contain, at a minimum, the following information:

a. a summary of the most recent personnel exposure data, including bioassays and time-weighted calculations;

b. a summary of all pertinent radiation survey records;

c. a discussion of any trends or deviation from the radiation protection and ALARA program, including an evaluation of the adequacy of the implementation of license conditions regarding radiation protection and ALARA; and

d. a description of unresolved problems and the proposed corrective measures.

Based upon the review of the 2016 monthly reports the RSO completes the required reviews and the resultant monthly reports contain all of the required information.

It was noted that several of the monthly reports were completed but were not signed by the RSO. The RSO should assure all monthly reports are signed.

One SFI for the Monthly Report would be to include a distribution list to assure monthly reports are distributed as appropriate.

5.0 DOCUMENTED TRAINING PROGRAM ACTIVITES

5.1 Hazard and Radiation Training for New Employees

All new employees receive hazard training in accordance with the NR training plan for new hires. The training plans are detailed in TRN-SOP-01 and Rad-SOP-02. The outline for hazard and radiation training for new hires is included as Addendum A to the Rad-SOP-02. All new employees are trained by means of an established course on the inherent risks of exposure to radiation and the fundamentals of protection against exposure to uranium and its daughters before beginning their jobs. The topics listed in 2.5(1) to (6) of Reg. Guide 8.31 are covered in that training.

Written and oral tests with questions directly relevant to the principles of radiation safety and health protection and respiratory protection are covered in the training course given to each worker. Based on requirements in the NR SOPs and in the License application, the instructor reviews the test results with each worker. Workers who fail the test are retested after items of confusion are discussed. The tests and results are maintained on file. The audit team reviewed tests and confirmed that failed tests were retaken and passed.

Based on a spot check of NR records, it appears that NR new hires received the required training, and copies of the signed training logs and tests were readily available on site for review.

One best practice was noted during the review of the new hire training records. A new hire training log is used at the NR site. The log is completed prior to the new employee arriving for work. The log outlines all routine and task-specific training required for the employee. It provides a tracking mechanism for completed training but also encourages an in depth review of an employee's proposed job activities and better assures the completion of all training before working in a given area. This best practice provides an added level of safety for new hires.

5.2 Radiation Safety Refresher Training

All NR employees received annual refresher training during the audit operational period. This training included a review of radiation safety training, including relevant information that became available during the past year, a review of safety problems that arose during the year, changes in regulations and license conditions, exposure trends and other current topics. NR conducts annual refresher training for all employees on the same schedule for consistency and tracking.

Retraining is tracked via spreadsheet. The spreadsheet indicates the annual refresher training date. Additionally, the spreadsheet tracks which specialty training each employee has completed. The spreadsheet for the annual refresher trainings was complete, up-to-date and a useful way for NR staff to track training throughout the year. Attendance logs for annual refresher training highlighting individuals who took the training are maintained in employees training files.

One Suggestion for Improvement ("SFI") was noted during the 2015 ALARA audit regarding the radiation safety refresher training records. The SFI suggested that NR should consider administering a test after the annual refresher to assure training provided is being absorbed by the employees. Review of the 2016 refresher training records indicated that a test was administered after the annual refresher training class as suggested.

One SFI resulted from the review of the refresher training records. The SFI recommends adding any repeat issues identified or repeat categories (eg. PPE left in job area, overflowing trash cans etc.) from the daily and weekly inspections to the annual refresher training.

One best practice was noted during the review of the radiation safety training refresher course materials. The best practice noted that the annual refresher included a review of the ALARA audit results, and Self-Identified Violations ("SIVs") completed during the year and included exposure results by work group. This best practice enforces ALARA principles and implements the concept of continuous process improvement. As previously noted, communication with the employees at NR is excellent and provides significant positive results in the overall implementation of ALARA at the site.

5.3 Specialized Instruction

All new workers, including supervisors, are given specialized instruction on the health and safety and radiation safety aspects of the specific job they will perform. All employees receive the initial radiation and safety training, as applicable, when first employed. In addition, when the employees get to their jobs, their supervisors give them specific on-the-job training using SOPs. On-the-job training and the associated SOPs specifically focus on non-radiologic activities. The radiologic aspects of each task are addressed in separate SOPs, which are cross-referenced in the job-specific SOPs. Hardcopies of specialized training are maintained in the employee training file.

If specific radiation protection issues arise for any particular job or new job, such issues are reviewed and a new procedure (for routine tasks) or RWP (for non-routine task) will be completed. The RSO will determine any new radiation procedures or actions that are required in order to ensure that radiation protection is ALARA. If the job is a one-time or short duration type of job, then an RWP will typically be employed. If the job is to be a recurring job, then SOP training will be utilized. The audit team reviewed the specialized training records for all NR personnel.

5.4 Contractor Training

Contractors who provide services on a long-term or short-term basis are given the same training as full-time NR employees. They are given basic radiation and safety training and are required to pass the training quizzes. The contractor training outline and requirements can be found in SFT-SOP-29. Job specific training is conducted on a case-by-case basis for contractors who perform work utilizing NR equipment. Signed acknowledgements, in the form set out in the SFT-SOP-29, are on file for numerous contractors who have performed work at NR during 2016. A review of the contractor training forms identified that all available forms were completed correctly.

NR personnel stated that for contractors who frequently performed work on-site, a separate file is maintained for easy access and quick review to ensure all contractor personnel were current in their training. These records were reviewed during the ALARA audit.

5.5 Visitors

All visitors who have not received training are escorted by someone properly trained and knowledgeable about the hazards at NR. In addition, the RSO or a member of his staff will also provide a short safety briefing about possible hazards that exist at NR before any visitor is permitted to enter NR's restricted area. This hazard training is performed on a calendar year basis and stored in a binder in the front desk office.

5.5.1 Occasional Corporate Visitors

Corporate EFRI personnel visit NR occasionally. Such visitors are accompanied by the RSO or designee during any tour of the NR operating areas. Based on the purpose and duration of the corporate personnel's visit, the RSO has the flexibility to issue a badge at his discretion in order to calculate a gamma dose for the corporate visitor if needed. Corporate visitors are provided basic Hazard Awareness Training upon arrival at the site. Throughout 2016 there were no temporary badges issued to corporate visitors.

6.0 RADIATION SAFETY MEETINGS

NR conducts monthly meetings that all employees are required to attend. The meetings cover a variety of topics related to safety, regulatory/environmental, land, Human Resources/accounting, and site wide updates and priorities. Each monthly meeting is videotaped to ensure all employees have the opportunity to participate. Employees sign a log sheet documenting their attendance at the meeting. The audit team reviewed the monthly sign off sheets, and they appear to be complete.

Additionally, there are weekly meetings for supervisors to discuss operational priorities and review safety incidents. NR has an impressive culture of communication throughout the site and the main Casper office.

The previous audit noted one SFI during the review of the radiation safety meetings. The SFI was to provide some of the safety, radiological, and mine site topics to long-term contractors. Based on the review of the contractor training matrix, long-term contractors are selectively receiving radiological training. The training is tracked in a spreadsheet.

7.0 RADIOLOGICAL SURVEY DATA

Radiological surveys were performed at frequencies and locations equivalent to those detailed in the NR SOPs during 2016, as summarized below.

7.1 Airborne Particulate Sampling

The highest air particulate sample was noted in April 2016. That sample was collected at the Maintenance Shop and was 0.95% of the DAC. The air particulate data are shown on Table 7.1-1.

7.1.1 Annual 8-Hour Area Airborne Concentrations

License condition 10.14, requires that the Licensee shall conduct radiological characterization of airborne samples for U, Th-230, Ra-226, Po-210, and Pb-210 for each restricted area particulate sampling location at a frequency of once every 6 months for the first 2 years, and annually thereafter. A review of the area airborne data indicate that the sampling was completed as required by License Condition 10.14.

7.1.2 Other Airborne Particulate Sampling

All activities are being conducted according to NR SOPs. There were no ALARA concerns noted.

A review of the air particulate monitoring data shows that concentrations of uranium have increased over the past year, but procedures appear to be followed and the individual employees are not showing any uptake in their bioassay sampling.

No ALARA practices were identified which would further reduce exposures.

7.2 Surveys of Radon Progeny

During 2016, radon samples were collected and exposures are determined by the Modified Kusnetz method and expressed as WLs. Radon Progeny samples were also collected during work activities.

The highest reading during the audit period was in October 2016 at 0.0541 WL or 16.4% of the DAC at HH-5.

No ALARA practices were identified which would further reduce exposures.

7.3 Area Gamma

Survey measurements of the Restricted Area were conducted using portable survey equipment. All areas with dose rates greater than 2.0 mrem/hr are located within restricted areas as required by License Condition 10.13. The Header Houses are posted due to elevated gamma measurements as expected.

No ALARA practices were identified which would further reduce exposures.

7.4 Weekly Contamination Surveys

Weekly contamination surveys were conducted as required.

No ALARA practices were identified which would further reduce exposures.

7.5 Monthly Contamination Survey

No ALARA practices were identified which would further reduce exposures.

7.6 Conclusion

All airborne, radon progeny, and gamma measurements in routinely occupied areas at the NR facility were ALARA. Personnel are aware of the benefits of good housekeeping practices, as evidenced by the fact that areas, such as the Central Control Room ("CCR") that have shown levels of alpha contamination readings are typically cleaned the same day once the situation has been identified. The NR staff has self-identified this and has a working relationship with Operations to curb potential contamination issues and as a result, there were no other practical ALARA practices, which would further reduce exposures.

7.7 Surveys of Material Released From the Restricted Area

7.7.1 Release of Product and Intermodal Containers

Product is released from NR in the form of uranium slurry via trailer trucks and sent to the White Mesa Mill for processing. Additionally, in 2016, intermodal containers ("IMCs") containing 11e.(2) byproduct material were released from NR and sent to the White Mesa Mill for disposal. The slurry trailer trucks and IMCs are released from NR after they are decontaminated and surveyed for contamination levels. If a slurry truck or IMC is designated for return and reuse, only the exterior of the outside package is measured using the U.S. Department of Transportation ("DOT") criteria for acceptable release during transport.

7.7.2 Surveys of Employees Leaving the Restricted Area

Employees leaving the restricted area are required to be monitored for alpha radiation contamination. The audit team conducted a review of the employee scan log sheets. The review noted that the log sheets were consistently initialed by each employee each time he or she scans prior to leaving the restricted area. In addition, there was good notation from employees who did not pass the initial scan criteria, the actions taken to clean the material not passing the scan criteria (usually an article of clothing), and then the final scan prior to leaving the restricted area. The log sheets are collected by the RSOs occasionally for evaluation and filing.

The instruments used to conduct the surveys were calibrated at the required frequency and the alarm point set at approximately 240 counts per minute. The instruments are checked daily for functionality by the RSOs and NR staff.

8.0 OPERATING PROCEDURES

8.1 Standard Operating Procedures Established

The audit team is satisfied that written SOPs and RWPs have been established for all activities that involve handling, processing, or storing radioactive materials, as well as health physics monitoring, sampling, analysis and instrument calibration.

8.1.1 Review of Applicable SOPS

The audit team reviewed the radiation safety and environmental SOPs provided.

The Audit team concluded that overall, the SOPs for activities involving the handling, processing or storing of radioactive materials and associated health physics activities (e.g., monitoring, sampling, analysis and instrument calibration) have been developed and are appropriately documented.

The audit team is satisfied that the foregoing procedures, together with the RWPs are adequate for the protection from radiation and consistent with ALARA.

8.1.2 Up-to-Date Copy of All Procedures Kept Accessible

An up-to-date copy of each written procedure, including accident response, and radiological, and fire protection plans, has been kept accessible to all employees. All employees have access to the electronic versions of the most recent revision of all SOPs on the facility network. When computer access is unavailable, hardcopies are available at the front desk (Administration Office) and in the control room of the plant.

8.1.3 Review by RSO and Documentation of Revisions

In accordance with Section 2.2 of Reg. Guide 8.31, all written SOPs for both operational and non-operational activities should be reviewed annually and approved in writing by the RSO before implementation and whenever a change in procedure is proposed to ensure that proper radiation protection principles are being applied.

The SOPs are reviewed annually by the RSO as required. A memo documenting the annual RSO review was inspected during the audit. It appears from the documentation that the SOPs are reviewed annually.

All written procedures involving radioactive material control have been compiled in a manner that allows documentation of each revision and its date. All written procedures are reviewed by the RSO, as a member of the Safety and Environmental Review Panel ("SERP"), before being implemented and whenever a change in a procedure is proposed.

8.2 Radiation Work Permits

A Job Safety Analysis ("JSA") is used for all work not covered by an SOP. The JSA initially determines the potential for exposure to radioactive materials. An RWP is generated in conjunction with the JSA and is designed to provide a job procedure plan to prevent excessive exposure to radioactive materials when non-routine work that is not covered by an existing SOP is performed. RWPs are issued for non-routine work tasks where exposure potential may exist at levels undetermined or at levels known to be elevated. Unless the RSO or designee determines it is not necessary, an RWP is issued to keep potential exposures ALARA. When an RWP is issued, the location, date issued and other relevant information are listed to help track permits and maintain exposure ALARA.

When RWP's are issued, NR maintains employee exposure ALARA through engineering controls and established management practices. Verification of the effectiveness of these practices is monitored through various radiological surveys, including breathing zone sampling, area airborne sampling, etc.

The audit team reviewed the RWPs issued during the period. The NR RSO noted that RWPs are good for a period of one week. After one week, a new RWP is generated.

The RWPs were signed by the RSO or his designate. The RWPs were fully completed.

On a review of the RWP file, the audit team concluded that the RWP program is comprehensive and appears to be used on all non-routine maintenance jobs where the potential for worker exposure to radioactive material exists and for which no SOP exists. In general, the RWPs appear to appropriately describe:

- The details of the job to be performed;
- Any precautions necessary to reduce exposure to uranium and its daughters;
- The radiological monitoring and sampling necessary before, during, and following completion of the job; and
- Each RWP appears to be adequately protective.

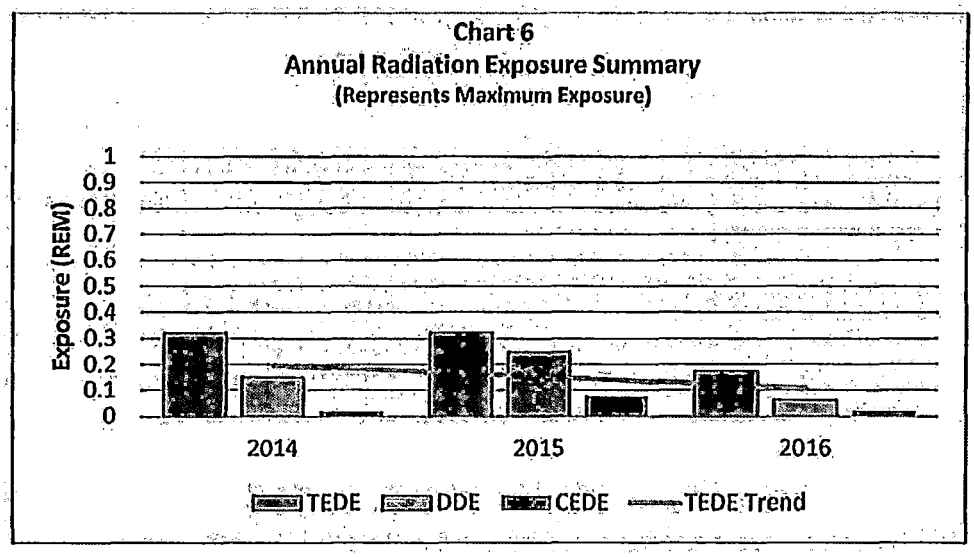
Overall, the review of these RWPs indicated that the health physics controls, use of personnel protective equipment and surveillance sampling identified in the RWPs were considered prudent and consistent with ALARA.

9.0 TRENDS IN PERSONNEL EXPOSURES

Based on the personnel data reviewed during the audit, it appears that personnel exposures are ALARA.

A significant consideration for an ALARA program is the assessment of trends in exposures to employees. At the time of the ALARA audit, there were no trends determined in the exposures of the employees at NR. The NR staff has provided graphs of radiological data in the monthly reports. The NR staff is also providing the graphs in their annual refresher training. The

presentation of the graphs and other items is a great training aid, and the staff should be commended on their inclusion of this information.



10.0 EQUIPMENT FOR EXPOSURE CONTROL

10.1 Calibration

All equipment used to conduct Health Physics surveys is calibrated within the required frequency for each instrument. All portable and stationary air sampling equipment (high volume air pumps, BZ and radon), are calibrated internally monthly. All other radiation detection equipment including portable alpha and beta/gamma instruments is sent to an outside calibration laboratory annually.

One SFI was noted during the 2015 review of the calibration documentation. The SFI suggested creating a database (or other electronic tracking mechanism) that tracks instrumentation and calibration due dates. A spreadsheet was developed for all on-site instrumentation calibration due dates and is in use as suggested.

10.2 Respiratory Protection Program

Paragraph 2.7 of Reg. Guide 8.31 provides that the RSO is responsible for maintenance of a respiratory protection program and that there should be adequate supplies of respiratory devices to enable issuing a device to each individual who enters an airborne radioactivity area. The RSO stated that NR has approximately 12 full-face respirators. Paragraph 2.7 of Reg. Guide 8.31 also provides that additional respiratory protection devices should be located near access points of airborne radioactivity areas. Currently there are no airborne radioactivity areas, and therefore the requirement to have respirators located throughout the facility is unnecessary.

Paragraph 2.7 of Reg. Guide 8.31 also provides that routine medical evaluations should be

performed for all those individuals who will use respirators. These evaluations are performed when the employee first commences employment and are repeated annually. On a spot check of personnel files, it was observed that employees routinely complete annual refresher training and complete the required medical evaluations as well as an annual fit test. However, two employees had checked out respirators when either their annual refresher training or their annual fit test or both were expired. A 90-day grace period is allowed by NRC Reg. Guide 8.15, and both individuals were within the 90-day grace period. A chart is available listing all pertinent dates in the respirator sign-out book so the employees were able to check the appropriate expiration dates. During the next training session, the importance of not utilizing respiratory protection without current certification should be stressed. The RSO should check the respirator sign-out logs more frequently to assure this is not recurring, perhaps during the weekly inspection.

The audit team is satisfied that all equipment for exposure control at NR is being properly used, maintained and inspected.

11.0 DOSE TO THE PUBLIC

License condition 11.2 requires the completion of an annual review of the radiation program content and implementation and an annual assessment of dose to individual members of the public.

The calculation of dose to the individual members of the public was completed as required by License Condition 11.2.

One SFI was noted during the review of the previous dose to the public. The audit team noted that NRC provided comments on the calculation of the annual dose to the public for 2015. The 2016 ALARA team reviewed the comments and the 2016 dose to the public, and it appears that the comments were reviewed and the necessary corrections to calculations were made in 2016.

12.0 RECOMMENDATIONS

The audit team is satisfied that appropriate ALARA principles are being followed.

Recommendations for continued ALARA performance and for future ALARA audits include:

- One SFI is for the release of other equipment or items for unrestricted release, that a photograph also be taken and added to the paperwork. The current procedure is to document the item by drawing a picture and then indicating on the drawing where it was surveyed. By having a photograph along with this drawing it just helps to visualize the object that is being released.

Specific SFIs resulting from the audit are provided in Table 12-1.

LIST OF ACRONYMS

ALARA	As Low as Reasonably Achievable
BZ	Breathing Zone
CEDE	Committed Effective Dose Equivalent
CCR	Central Control Room
DAC	Derived Area Concentrations
DDE	Deep Dose Equivalent
DOT	United States Department of Transportation
EFRI	Energy Fuels Resources (USA) Inc.
IMC	Intermodal Container
ISR	In-Situ Recovery
JSA	Job Safety Analysis
License	Radioactive Materials License
ND	non-detect
NR	Nichols Ranch
NRC	United States Nuclear Regulatory Commission
OSL	Optically Stimulated Luminescence
RSO	Radiation Safety Officer
RST	Radiation Safety Technician
RWP	Radiation Work Plan
SFI	Suggestion for Improvement
SIV	Self-Identified Violation
SERP	Safety and Environmental Review Panel
SOP	Standard Operating Procedure
TEDE	Total Effective Dose Equivalent
ULR	Uranium Loaded Resin
Uranerz	Uranerz Energy Corporation
WL	Working Level

TABLES

Table 2.5-1 Summary of Individual Dose for 2016 by Exposure

Exposure Type	Average Worker Exposure (rem)	Maximum Individual Exposure (rem)
Radon	0.010	0.019
CEDE	0.021	0.151
External	0.011	0.062
TEDE	0.048	0.174

Table 3.0-1 Summary of Bioassay Results 2016

Month	Number of Samples Above 5 µg/L	Number of Samples Above 15 µg/L	Number of Samples Above 35 µg/L
January	ND	ND	ND
February	ND	ND	ND
March	ND	ND	ND
April	ND	ND	ND
May	ND	ND	ND
June	ND	ND	ND
July	ND	ND	ND
August	ND	ND	ND
September	ND	ND	ND
October	ND	ND	ND
November	ND	ND	ND
December	ND	ND	ND

Table 7.1-1 Uranium Particulates - Maximum Percent of DAC for 2016

Month	Location	Maximum (% of DAC)
January	HH-6	0.08
February	Maintenance Shop	0.28
March	HH-5	0.70
April	Maintenance Shop	0.95
May	Slurry Press Room	0.40
June	Slurry Room	0.22
July	Waste Water Tank	0.53
August	Slurry Press Room	0.35
September	Waste Tank Area	0.04
October	HH-1	0.31
November	Slurry Press Room	0.19
December	Slurry Press Room*	0.67

* BZ samples were used for the December calculations.

Table 12-1 2016 ALARA SUGGESTIONS FOR IMPROVEMENT

Reference Section in Report	Suggestion for Improvement	Recommended Action	Responsibility	Timeline	Status
		Suggestions for Improvement			
AAR 4.4	It was noted that several of the monthly reports were completed but were not signed by the RSO. Reg. Guide 8.31 lists a minimum distribution for the monthly reports.	The RSO should assure all monthly reports are signed or remove the signature line from the monthly report as this is not required by Reg. Guide 8.31. The Monthly Report should include a distribution list to assure the monthly reports are distributed as appropriate.			
AAR 5.2	Daily and weekly inspection information can be useful for training.	The audit team recommends adding any repeat issues identified or repeat categories (eg. PPE left in job area, overflowing trash cans etc.) from the daily and weekly inspections to the annual refresher training.			
AAR 10.2	Two employees had checked out respirators when either their annual refresher training or their annual fit test or both were expired. A 90-day grace period is allowed by NRC Reg. Guide 8.15 and both individuals were within the 90-day grace period. A chart is available listing all pertinent dates in the respirator sign-out book so the employees were able to check the appropriate expiration dates.	During the next training session, the importance of not utilizing respiratory protection without current certification should be stressed. The RSO should check the respirator sign-out logs more frequently to assure this is not recurring, perhaps during the weekly inspection.			