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March 01, 2018

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.

Revised pages to the license application are enclosed in accordance with SUA-1597 License Condition 9.4E. An index of change has been included to guide insertion into the license application.

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

Sincerely,

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

BB/al

Attachments – July - December 2017 Semi-Annual Report  
Revised Pages

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



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

**Semi-Annual and Annual Report**

**July - December 2017**



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## **1 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 second 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 July 1, 2017 through December 31, 2017. Annual Reporting is submitted per License Conditions 9.4E, 10.11, 11.2 and 11.7.

## **2 OPERATIONAL MONITORING**

### **2.1 Production Areas in Operation and Restoration**

License Condition 11.1(B) requires a Semi-Annual 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 October 25, 2017 and January 23, 2018. As described in those reports, production continued at the Nichols Ranch Unit in Production Area (PA) #1 in header houses 1 through 8 and 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 Semi-Annual 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 deep disposal well (DDW) to be reported in the Annual Report. Uranerz presently has two DDWs permitted and operating through the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ-WQD), (Permit 10-392). The total volume of solution disposed was 299,117 barrels (bbl), during 2017. 136,364 bbl were disposed in NICH-DW-1 and 162,753 bbl were disposed in NICH-DW-4.

### **2.4 Mechanical Integrity Tests**

License Condition 11.1(B) requires a Semi-Annual 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 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 action 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 the constituents: chloride, conductivity, and alkalinity, as listed in Section 5.7.8.9 of the license application. Radioactive constituents are compared with 10 CFR 20 Appendix B Table 2 Liquid effluent concentration limits and are less than the limits. No new wells have been installed within the licensed areas or within 2 kilometers of any production area requiring a new evaluation of activities. The sampling results can be found in Appendix A.

### **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 B contains the surface water quality results for the report period. Radioactive constituents are compared with 10 CFR 20 Appendix B Table 2 Liquid effluent concentration limits and are less than the limits.

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 were no reportable unplanned releases of production solution during the reporting period. 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**

License Condition 11.1(D), Regulatory Guide 4.14, and Section 5.7.7.5 of the license application, requires sediment and soil samples will be collected annually and analyzed for total uranium, Ra-226, Pb-210, and Th-230. Sampling results are included in Appendix C for Sediment and Appendix D for Soil and are similar to previously reported values.

### **3.5 Air Particulate, Radon, and Gamma Radiation Monitoring**

In accordance with Sections 5.7.7.2.1, 5.7.7.2.2, and 5.7.7.6 of the license application, Uranerz maintains an environmental air 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 air 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 Central Processing Plant (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 E 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 the license application as amended by submission dated November 7, 2016 (ADAMS Accession No. ML17019A241) of 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. Passive outdoor radon detectors are exchanged quarterly for six 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 F.

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 can be found in Appendix G.

An evaluation of the environmental monitoring data is completed in the annual public dose assessments.

### **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 CPP monthly, DDWs 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 H.

Sampling also occurs inside the CPP, DDWs, 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 I.

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 dose to the public. Average concentrations are taken from Appendix H and Appendix I and the background (BKD) concentration for U-Nat is taken from averaging the concentration of U-Nat for NA-4 for the period monitored ( $1.80E-16$   $\mu\text{Ci/ml}$ ). The background concentration of radon is taken from averaging the concentration of radon for NR-5 for the period monitored ( $4.60E-10$   $\mu\text{Ci/ml}$ ).

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

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

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

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

$$\text{CPP } (\mu\text{Ci}) = (4.61E^{-13} - 1.80E^{-16}) * 13,500 * 28,316 * 262,800 = 46.3 \mu\text{Ci}$$

$$\text{Header House } (\mu\text{Ci}) = (4.57E^{-13} - 1.80E^{-16}) * 1,275 * 28,316 * 262,800 = 4.33 \mu\text{Ci}$$

$$\text{DDW } (\mu\text{Ci}) = (1.41E^{-12} - 1.80E^{-16}) * 1,275 * 28,316 * 262,800 = 13.4 \mu\text{Ci}$$

$$\begin{aligned} \text{Total Effluents of U – Nat (period monitored)} &= 46.3 + 4.33 + 13.4 = 64.03 \mu\text{Ci} \\ &= 6.403 E^{-5} \text{ Ci of Natural Uranium} \end{aligned}$$



*Total Effluents of Radon and its Progeny (period monitored)*

$$= (CPP \text{ } (\mu\text{Ci})) + (CPP \text{ Tanks } (\mu\text{Ci})) + (Header \text{ House } (\mu\text{Ci})) + (DDW \text{ } (\mu\text{Ci})) \\ + (Recovery \text{ Wells } (\mu\text{Ci})) + (Spills \text{ } (\mu\text{Ci}))$$

*CPP (μCi)*

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

*CPP Tanks (μCi)*

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

*Header House (μCi)*

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

*DDW (μCi)*

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

$$\begin{aligned}
 &\text{Recovery Wells } (\mu\text{Ci}) \\
 &= \left[ \left( \frac{\text{Avg. Conc (WL)}}{\text{Well}} * 9.1E^{-8} \left( \frac{\mu\text{Ci}/\text{ml}}{\text{WL}} \right) \right) - \text{BKD Conc.} \left( \frac{\mu\text{Ci}}{\text{ml}} \right) \right] \\
 &\quad * 255 \text{ (maximum number of operational recovery wells)} \\
 &\quad * 3,000 \text{ (emission rate in } \frac{\text{ml}}{\text{min} * \text{well}} \text{.)} \\
 &\quad * 262,800 \text{ (minutes of operations in period monitored)}
 \end{aligned}$$

*Spills ( $\mu\text{Ci}$ ) = There were no spills that contributed detectable amounts of radon to the environment during the reporting period*

$$CPP (\mu\text{Ci}) = [(0.0139 * 9.1E^{-8}) - 4.60E^{-10}] * 13,500 * 28,316 * 262,800 = 8.09 E^4 \mu\text{Ci}$$

$$CPP \text{ Tanks } (\mu\text{Ci}) = [(0.8797 * 9.1E^{-8}) - 4.60E^{-10}] * 293 * 28,316 * 262,800 = 1.74 E^5 \mu\text{Ci}$$

$$\text{Header House } (\mu\text{Ci}) = [(0.0140 * 9.1E^{-8}) - 4.60E^{-10}] * 1,275 * 28,316 * 262,800 = 7.72 E^3 \mu\text{Ci}$$

$$DDW (\mu\text{Ci}) = [(0.0123 * 9.1E^{-8}) - 4.60E^{-10}] * 1,275 * 28,316 * 262,800 = 6.26 E^3 \mu\text{Ci}$$

$$\text{Recovery Wells } (\mu\text{Ci}) = [(9.0983 * 9.1E^{-8}) - 4.60E^{-10}] * 255 * 3,000 * 262,800 = 1.66 E^5 \mu\text{Ci}$$

**Total Effluents of Radon and its Progeny (period monitored)**

$$\begin{aligned}
 &= 8.09 E^4 \mu\text{Ci} + 1.74 E^5 \mu\text{Ci} + 7.72 E^3 \mu\text{Ci} + 6.26 E^3 \mu\text{Ci} + 1.66 E^5 \mu\text{Ci} = 4.35 E^5 \mu\text{Ci} \\
 &= 0.435 \text{ Ci of Radon - 222 and its Progeny.}
 \end{aligned}$$

**Radon is assumed to be in equilibrium with its short lived progeny.**

In accordance with 10 CFR 40.65 the quantities of radioactive materials released during the reporting period are compared with the design objectives previously reviewed as part of the licensing action. In Table 7.6 of the license application the expected total amount of Rn-222 released from production activities would be 170 Ci/yr, or 85 Ci/6 months. Uranerz is well below these design objectives.

### **3.7 Meteorological Data**

License Condition 10.15 requires that meteorological data be collected to verify the data to be representative of long term conditions at Nichols Ranch ISR Project until the NRC verifies in writing that the data is representative. The NRC verified, in correspondence dated October 5, 2017, that on-site meteorological data from July 1, 2011 through June 30, 2016 was representative of long-term meteorological conditions at the project, thus satisfying the requirements of the license condition. The NRC concluded that the continued operation of the Nichols Ranch meteorological station was no longer required; therefore no meteorological data or results are included in this report and will be discontinued in future reports. The NRC will remove the license condition in a future amendment.

## **4 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. The public dose assessment for 2017 will be submitted with the January through June 2018 Semi-Annual report.

## **5 SAFETY AND ENVIRONMENTAL REVIEW PANEL (SERP) EVALUATIONS**

License Condition 9.4E requires an annual report to the NRC which contains a description of such changes, tests, or experiments, including a summary of the evaluations made by the safety and environmental evaluation panel (SERP).

Uranerz completed a total of four (4) SERPs completed in 2017. A summary of SERPs performed during the annual report period are found in Appendix J. Page changes related to the approved SERPs are attached.

## **6 RADIATION PROTECTION PROGRAM**

License Condition 11.2 requires an 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. The ALARA audit for calendar year 2017 is scheduled for June 2018 and the report is expected to be submitted with the January through June 2018 Semi-Annual report.

Energy Fuels Inc.  
Appendix A  
Livestock and Domestic Wells Within 1 Kilometer  
Ground Water Quality Analysis  
July to December 2017 Semi-Annual Report

Sample Location	Sample Date	Uranium-Natural (Total)			Radium 226				Alkalinity (mg/l)	Conductivity (μmhos/cm)	Chloride (mg/l)
		Concentration (μCi/ml)	Reporting Limit (μCi/ml)	10 CFR 20 App B Table 2 Col. 2 (μCi/ml)	Concentration (μCi/ml)	Precision (±) (μCi/ml)	MDC or RL (μCi/ml)	10 CFR 20 App B Table 2 Col. 2 (μCi/ml)			
Nichols Ranch Unit											
DW-4L	20 Jul 17	6.77E-11	6.77E-11	3.00E-07	2.00E-10	1.00E-10	1.00E-10	6.00E-08	114	621	9
DW-4M	20 Jul 17	2.03E-10	6.77E-11	3.00E-07	7.00E-10	1.00E-10	1.00E-10	6.00E-08	211	719	13
DW-4U	20 Jul 17	4.54E-08	2.03E-10	3.00E-07	5.00E-10	1.00E-10	1.00E-10	6.00E-08	127	1460	4
Nichols #1	25 Oct 17	1.11E-08	2.03E-10	3.00E-07	1.00E-10	4.00E-11	4.00E-11	6.00E-08	131	503	5
Pug #2	25 Oct 17	4.74E-11	2.03E-11	3.00E-07	1.00E-10	5.00E-10	5.00E-10	6.00E-08	248	505	3
Red Springs Artesian	Not Sampled, Dry Well (Checked October 25, 2017)										

Notes:

MDC = Minimum Detectable Concentration

RL = Reporting Limit

NA = Not Applicable

Energy Fuels Inc.  
Appendix B  
Surface Water Quality Analysis  
July to December 2017 Semi-Annual Report

Sample Location	Sample Date	Uranium-Natural (Total)			Radium 226				Lead 210				Thorium 230			
		Concentration (µCi/ml)	Reporting Limit (µCi/ml)	10 CFR 20 App B Table 2 Col. 2 (µCi/ml)	Concentration (µCi/ml)	Precision (±) (µCi/ml)	MDC or RL (µCi/ml)	10 CFR 20 App B Table 2 Col. 2 (µCi/ml)	Concentration (µCi/ml)	Precision (±) (µCi/ml)	MDC or RL (µCi/ml)	10 CFR 20 App B Table 2 Col. 2 (µCi/ml)	Concentration (µCi/ml)	Precision (±) (µCi/ml)	MDC or RL (µCi/ml)	10 CFR 20 App B Table 2 Col. 2 (µCi/ml)
NRSSW (Cottonwood D Nichols)	12 Jun 17	3.91E-08	2.03E-10	3.00E-07	2.40E-09	3.00E-10	2.00E-10	6.00E-08	5.00E-10	6.00E-10	1.00E-09	1.00E-08	2.00E-10	2.00E-10	2.00E-10	1.00E-07
NRSSE (Cottonwood U Nichols)	12 Jun 17	6.17E-08	2.03E-10	3.00E-07	1.00E-09	2.00E-10	2.00E-10	6.00E-08	9.00E-10	6.00E-10	1.00E-09	1.00E-08	1.00E-10	1.00E-10	1.00E-10	1.00E-07
NRSSW (Cottonwood D Nichols)	Not sampled; self-sampler dry (checked 19 Sep 17)															
NRSSE (Cottonwood U Nichols)	Not sampled; self-sampler dry (checked 19 Sep 17)															
NRSSW (Cottonwood D Nichols)	Not sampled; self-sampler dry (checked 29 Nov 17)															
NRSSE (Cottonwood U Nichols)	Not sampled; self-sampler dry (checked 29 Nov 17)															

Notes:

MDC = Minimum Detectable Concentration

RL = Reporting Limit

NA = Not Applicable

Energy Fuels Inc.  
Appendix C  
Sediment Analysis  
July to December 2017 Semi-Annual Report

Sample Location	Sample Date	Uranium-Natural (Total)		Radium 226			Lead 210			Thorium 230		
		Concentration (µCi/g-dry)	Reporting Limit (µCi/g-dry)	Concentration (µCi/g-dry)	Precision (±) (µCi/g-dry)	MDC or RL (µCi/g-dry)	Concentration (µCi/g-dry)	Precision (±) (µCi/g-dry)	MDC or RL (µCi/g-dry)	Concentration (µCi/g-dry)	Precision (±) (µCi/g-dry)	MDC or RL (µCi/g-dry)
NRSSW (Cottonwood D Nichols)	31 Jul 17	1.7E-06	2.0E-07	1.0E-06	2.0E-07	3.0E-07	8.0E-07	3.0E-07	2.0E-07	6.0E-07	2.0E-07	2.0E-07
NRSSE (Cottonwood U Nichols)	31 Jul 17	2.0E-06	2.0E-07	1.7E-06	2.0E-07	3.0E-07	2.2E-06	4.0E-07	2.0E-07	1.0E-06	3.0E-07	2.0E-07
SD-1	31 Jul 17	5.0E-07	2.0E-07	6.0E-07	1.0E-07	3.0E-07	1.2E-06	4.0E-07	2.0E-07	5.0E-07	2.0E-07	2.0E-07
SD-2	1 Aug 17	8.0E-07	2.0E-07	1.1E-06	2.0E-07	3.0E-07	9.0E-07	4.0E-07	2.0E-07	8.0E-07	3.0E-07	2.0E-07
SD-3	31 Jul 17	1.5E-06	2.0E-07	1.0E-06	2.0E-07	3.0E-07	1.2E-06	4.0E-07	2.0E-07	5.0E-07	1.0E-07	2.0E-07
SD-4	31 Jul 17	1.4E-06	2.0E-07	1.0E-06	2.0E-07	3.0E-07	6.0E-07	3.0E-07	2.0E-07	8.0E-07	2.0E-07	2.0E-07
SD-5	31 Jul 17	1.3E-06	2.0E-07	1.1E-06	2.0E-07	3.0E-07	1.7E-06	4.0E-07	2.0E-07	4.0E-07	1.0E-07	2.0E-07
SD-6	1 Aug 17	2.9E-06	2.0E-07	1.0E-06	2.0E-07	3.0E-07	1.4E-06	3.0E-07	2.0E-07	1.0E-06	3.0E-07	2.0E-07
SD-7	31 Jul 17	1.4E-06	2.0E-07	1.1E-06	2.0E-07	3.0E-07	2.6E-06	4.0E-07	2.0E-07	7.0E-07	2.0E-07	2.0E-07
SD-8	31 Jul 17	1.3E-06	2.0E-07	1.3E-06	2.0E-07	3.0E-07	4.0E-07	2.0E-07	2.0E-07	8.0E-07	2.0E-07	2.0E-07
SD-9	31 Jul 17	1.2E-06	2.0E-07	9.0E-07	2.0E-07	3.0E-07	9.0E-07	3.0E-07	2.0E-07	1.2E-06	4.0E-07	2.0E-07
SD-10	31 Jul 17	1.2E-06	2.0E-07	1.2E-06	2.0E-07	3.0E-07	1.7E-06	3.0E-07	2.0E-07	1.1E-06	4.0E-07	2.0E-07
SD-1 (QA/QC)	31 Jul 17	6.0E-07	2.0E-07	7.0E-07	1.0E-07	3.0E-07	1.1E-06	3.0E-07	2.0E-07	4.0E-07	2.0E-07	2.0E-07

Notes:

MDC = Minimum Detectable Concentration

RL = Reporting Limit

Energy Fuels Inc.  
Appendix D  
Soil Analysis  
July to December 2017 Semi-Annual Report

Sample Location	Sample Date	Uranium-Natural (Dissolved)		Radium 226			Lead 210			Thorium 230		
		Concentration (µCi/g-dry)	Reporting Limit (µCi/g-dry)	Concentration (µCi/g-dry)	Precision (±) (µCi/g-dry)	MDC or RL (µCi/g-dry)	Concentration (µCi/g-dry)	Precision (±) (µCi/g-dry)	MDC or RL (µCi/g-dry)	Concentration (µCi/g-dry)	Precision (±) (µCi/g-dry)	MDC or RL (µCi/g-dry)
SSNA-1 (Previously reported as SS-1)	31 Jul 17	8.0E-07	2.0E-07	1.3E-06	3.0E-07	3.0E-07	2.0E-06	4.0E-07	2.0E-07	7.0E-07	2.0E-07	2.0E-07
SSNA-2 (Previously reported as SS-2)	31 Jul 17	1.1E-06	2.0E-07	1.7E-06	2.0E-07	3.0E-07	1.5E-06	4.0E-07	2.0E-07	7.0E-07	3.0E-07	2.0E-07
SSNA-3 (Previously reported as SS-3)	31 Jul 17	7.0E-07	2.0E-07	1.0E-06	2.0E-07	3.0E-07	1.0E-06	4.0E-07	2.0E-07	5.0E-07	2.0E-07	2.0E-07
SSNA-4 (Previously reported as SS-5)	31 Jul 17	5.0E-07	2.0E-07	1.3E-06	2.0E-07	3.0E-07	9.0E-07	4.0E-07	2.0E-07	6.0E-07	2.0E-07	2.0E-07
SSNA-5 (Previously reported as SS-6)	31 Jul 17	6.0E-07	2.0E-07	1.0E-06	2.0E-07	3.0E-07	5.0E-07	2.0E-07	2.0E-07	6.0E-07	2.0E-07	2.0E-07
SSNA-6 (Previously reported as SS-7)	31 Jul 17	6.0E-07	2.0E-07	1.0E-06	2.0E-07	3.0E-07	2.2E-06	4.0E-07	2.0E-07	9.0E-07	3.0E-07	2.0E-07
SSNA-1 (QA/QC)	31 Jul 17	8.0E-07	2.0E-07	1.2E-06	2.0E-07	3.0E-07	1.3E-06	4.0E-07	2.0E-07	8.0E-07	2.0E-07	2.0E-07

Notes:

MDC = Minimum Detectable Concentration

RL = Reporting Limit

**Energy Fuels Inc.**  
**Appendix E**  
**Environmental Air Particulate Data**  
**2017**

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	2.9E-16	*	1.0E-16	9E-14	0.32
		Th-230	4.5E-16	1.2E-16	1.0E-16	3E-14	1.50
		Ra-226	9.1E-17	3.0E-17	1.0E-16	9E-13	0.01
		Pb-210	2.2E-14	1.2E-15	2.0E-15	6E-13	3.67
		Po-210	1.6E-14	4.2E-15	2.0E-15	9E-13	1.78
	4th Quarter	U-Nat	8.6E-17	*	1.0E-16	9E-14	0.10
		Th-230	0.0E+00	3.2E-17	1.0E-16	3E-14	0.00
		Ra-226	1.5E-16	3.2E-17	1.0E-16	9E-13	0.02
		Pb-210	1.7E-14	1.0E-15	2.0E-15	6E-13	2.83
		Po-210	5.6E-15	1.9E-15	2.0E-15	9E-13	0.62
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	1.7E-16	*	1.0E-16	9E-14	0.19
		Th-230	3.0E-16	1.5E-16	1.0E-16	3E-14	1.00
		Ra-226	9.4E-17	3.0E-17	1.0E-16	9E-13	0.01
		Pb-210	2.1E-14	1.2E-15	2.0E-15	6E-13	3.50
		Po-210	4.1E-15	2.3E-15	2.0E-15	9E-13	0.46
	4th Quarter	U-Nat	1.2E-16	*	1.0E-16	9E-14	0.13
		Th-230	1.2E-16	6.7E-17	1.0E-16	3E-14	0.40
		Ra-226	1.6E-16	3.3E-17	1.0E-16	9E-13	0.02
		Pb-210	1.6E-14	1.1E-15	2.0E-15	6E-13	2.67
		Po-210	7.3E-15	2.1E-15	2.0E-15	9E-13	0.81



**Energy Fuels Inc.**  
**Appendix E**  
**Environmental Air Particulate Data**  
**2017**

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	2.0E-16	*	1.0E-16	9E-14	0.22
		Th-230	5.2E-16	2.3E-16	1.0E-16	3E-14	1.73
		Ra-226	1.5E-16	5.7E-17	1.0E-16	9E-13	0.02
		Pb-210	1.9E-14	1.7E-15	2.0E-15	6E-13	3.17
		Po-210	7.7E-14	1.3E-14	2.0E-15	9E-13	8.56
	4th Quarter	U-Nat	5.6E-17	*	1.0E-16	9E-14	0.06
		Th-230	0.0E+00	3.4E-17	1.0E-16	3E-14	0.00
		Ra-226	0.0E+00	3.4E-17	1.0E-16	9E-13	0.00
		Pb-210	7.8E-15	8.3E-16	2.0E-15	6E-13	1.30
		Po-210	3.8E-15	1.5E-15	2.0E-15	9E-13	0.42
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	1.2E-16	*	1.0E-16	9E-14	0.13
		Th-230	1.9E-16	9.7E-17	1.0E-16	3E-14	0.63
		Ra-226	1.0E-16	3.2E-17	1.0E-16	9E-13	0.01
		Pb-210	2.0E-14	1.3E-15	2.0E-15	6E-13	3.33
		Po-210	7.4E-14	9.7E-15	2.0E-15	9E-13	8.22
	4th Quarter	U-Nat	2.3E-16	*	1.0E-16	9E-14	0.26
		Th-230	1.2E-16	1.0E-16	1.0E-16	3E-14	0.40
		Ra-226	1.5E-16	5.2E-17	1.0E-16	9E-13	0.02
		Pb-210	1.4E-14	1.3E-15	2.0E-15	6E-13	2.33
		Po-210	6.5E-15	2.5E-15	2.0E-15	9E-13	0.72

**Energy Fuels Inc.**  
**Appendix E**  
**Environmental Air Particulate Data**  
**2017**

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	2.0E-16	*	1.0E-16	9E-14	0.22
		Th-230	1.0E-15	3.3E-16	1.0E-16	3E-14	3.33
		Ra-226	2.2E-16	5.5E-17	1.0E-16	9E-13	0.02
		Pb-210	2.0E-14	1.7E-15	2.0E-15	6E-13	3.33
		Po-210	1.8E-14	6.4E-15	2.0E-15	9E-13	2.00
	4th Quarter	U-Nat	7.3E-17	*	1.0E-16	9E-14	0.08
		Th-230	7.0E-17	6.6E-17	1.0E-16	3E-14	0.23
		Ra-226	8.5E-17	3.3E-17	1.0E-16	9E-13	0.01
		Pb-210	1.1E-14	8.6E-16	2.0E-15	6E-13	1.83
		Po-210	5.4E-15	1.7E-15	2.0E-15	9E-13	0.60
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	9.5E-17	*	1.0E-16	9E-14	0.11
		Th-230	6.8E-17	6.5E-17	1.0E-16	3E-14	0.23
		Ra-226	1.6E-16	3.2E-17	1.0E-16	9E-13	0.02
		Pb-210	2.0E-14	1.3E-15	2.0E-15	6E-13	3.33
		Po-210	5.0E-15	2.5E-15	2.0E-15	9E-13	0.56
	4th Quarter	U-Nat	7.6E-17	*	1.0E-16	9E-14	0.08
		Th-230	9.4E-17	9.0E-17	1.0E-16	3E-14	0.31
		Ra-226	1.2E-16	4.5E-17	1.0E-16	9E-13	0.01
		Pb-210	2.5E-14	1.5E-15	2.0E-15	6E-13	4.17
		Po-210	6.7E-15	2.3E-15	2.0E-15	9E-13	0.74

\* No value given from contract laboratory who performed analysis

**Energy Fuels Inc.**  
**Appendix F**  
**Environmental Radon-222 and Progeny Data**  
**2017**

Nichols Ranch Environmental Locations (6 locations, exchanged quarterly)												
Location	1st Quarter ( $\mu\text{Ci/ml}$ )	Uncertainty ( $\mu\text{Ci/ml}$ )	2 <sup>nd</sup> Quarter ( $\mu\text{Ci/ml}$ )	Uncertainty ( $\mu\text{Ci/ml}$ )	3 <sup>rd</sup> Quarter ( $\mu\text{Ci/ml}$ )	Uncertainty ( $\mu\text{Ci/ml}$ )	4th Quarter ( $\mu\text{Ci/ml}$ )	Uncertainty ( $\mu\text{Ci/ml}$ )	Location Average Gross( $\mu\text{Ci/ml}$ )	Location Average - Background ( $\mu\text{Ci/ml}$ )	Average Uncertainty ( $\mu\text{Ci/ml}$ )	10CFR 20 APP B Table 2 Values ( $\mu\text{Ci/ml}$ )
Nichols Ranch Project												
NR-1 (Nearest Resident)	4.00E-10	3.00E-11	4.00E-10	3.00E-11	6.50E-10	1.10E-10	6.20E-10	1.10E-10	5.18E-10	1.63E-10	7.00E-11	1.00E-10
NR-2 (Southern Boundary Downwind)	6.00E-10	4.00E-11	5.00E-10	3.00E-11	4.60E-10	9.00E-11	5.10E-10	1.10E-10	5.18E-10	1.63E-10	6.75E-11	1.00E-10
NR-3 (North Boundary Downwind)	7.00E-10	5.00E-11	8.00E-10	5.00E-11	2.70E-10	6.00E-11	4.30E-10	1.10E-10	5.50E-10	1.95E-10	6.75E-11	1.00E-10
NR-5 (Background)	4.00E-10	3.00E-11	1.00E-10	1.00E-11	4.60E-10	9.00E-11	4.60E-10	1.10E-10	3.55E-10	0.00E+00	6.00E-11	1.00E-10
NR-6 (West of CPP downwind)	6.00E-10	4.00E-11	4.00E-10	3.00E-11	3.20E-10	9.00E-11	4.10E-10	9.00E-11	4.33E-10	7.75E-11	6.25E-11	1.00E-10
NR-7 (North East of CPP )	7.00E-10	5.00E-11	1.10E-09	6.00E-11	5.10E-10	9.00E-11	5.70E-10	1.10E-10	7.20E-10	3.65E-10	7.75E-11	1.00E-10
NR-1 (Duplicate #1)	4.00E-10	3.00E-11	5.00E-10	3.00E-11	N/A*	N/A*	7.30E-10	1.40E-10	5.43E-10	1.88E-10	6.67E-11	1.00E-10
NR-1 (Duplicate #2)	4.00E-10	3.00E-11	6.00E-10	4.00E-11	N/A*	N/A*	N/A*	N/A*	5.00E-10	1.45E-10	3.50E-11	1.00E-10
NR-2 (Duplicate)	N/A*	N/A*	N/A*	N/A*	5.70E-10	1.10E-10	5.10E-10	1.10E-10	5.40E-10	1.85E-10	1.10E-10	1.00E-10
NR-3 (Duplicate)	N/A*	N/A*	N/A*	N/A*	3.00E-10	6.00E-11	4.60E-10	1.10E-10	3.80E-10	2.50E-11	8.50E-11	1.00E-10


**Energy Fuels Inc.**  
**Appendix F**  
**Environmental Radon-222 and Progeny Data**  
**2017**

Nichols Ranch CPP Locations (9 locations, exchanged semi-annually)												
Location	Quarter 1 2017 to Quarter 2 2017	Uncertainty			Quarter 3 2017 to Quarter 4 2017	Uncertainty			Location Average (µCi/ml)	N/A	N/A	10CFR 20 APP B Table 2 Values (µCi/ml)
Nichols Ranch Project												
Man Camp	1.00E-10	1.00E-11			5.40E-10	9.00E-11			3.20E-10			1.00E-10
CPP Fence (East Side)	5.00E-10	3.00E-11			5.70E-10	9.00E-11			5.35E-10			1.00E-10
CPP Fence (SW Corner)	5.00E-10	3.00E-11			5.90E-10	1.10E-10			5.45E-10			1.00E-10
CPP Fence (South Corner)	4.00E-10	3.00E-11			5.90E-10	1.10E-10			4.95E-10			1.00E-10
CPP Fence (SE Corner)	4.00E-10	3.00E-11			5.90E-10	9.00E-11			4.95E-10			1.00E-10
CPP Fence (NW Corner)	4.00E-10	3.00E-11			5.40E-10	9.00E-11			4.70E-10			1.00E-10
CPP Fence (North Side)	5.00E-10	3.00E-11			5.40E-10	9.00E-11			5.20E-10			1.00E-10
CPP Fence (NE Side)	4.00E-10	3.00E-11			6.50E-10	1.10E-10			5.25E-10			1.00E-10
CPP Fence (West Side)	7.00E-10	4.00E-11			5.70E-10	9.00E-11			6.35E-10			1.00E-10

**Energy Fuels Inc.**  
**Appendix F**  
**Environmental Radon-222 and Progeny Data**  
**2017**

Nichols Ranch Wellfield Locations (6 locations changed semi-annually)												
Location	Quarter 1 2017 to Quarter 2 2017	Uncertainty			Quarter 3 2017 to Quarter 4 2017	Uncertainty			Location Average ( $\mu\text{Ci/ml}$ )	N/A	N/A	10CFR 20 APP B Table 2 Values ( $\mu\text{Ci/ml}$ )
Nichols Ranch Project												
NCBM-3	4.00E-10	3.00E-11			4.30E-10	9.00E-11			4.15E-10			1.00E-10
NCBM-4	4.00E-10	3.00E-11			4.30E-10	9.00E-11			4.15E-10			1.00E-10
NCBM-5	7.00E-10	3.00E-11			4.10E-10	9.00E-11			5.55E-10			1.00E-10
NCBM-6	6.00E-10	3.00E-11			3.80E-10	9.00E-11			4.90E-10			1.00E-10
WFNR-2	1.50E-09	6.00E-11			5.40E-10	9.00E-11			1.02E-09			1.00E-10
NR-4 (North Wellfield Boundary)	6.00E-10	3.00E-11			4.60E-10	9.00E-11			5.30E-10			1.00E-10

MDA for all samples is 3.00E-10

 Green box indicates time due to semi-annual changeout.

\*Location not sampled during that period.

**Energy Fuels Inc.**  
**Appendix G**  
**Environmental Passive Gamma Radiation Monitoring**  
**2017**

<b>Location</b>	<b>1st Quarter (mrem/quarter) Gross</b>	<b>2nd Quarter (mrem/quarter) Gross</b>	<b>3rd Quarter (mrem/quarter) Gross</b>	<b>4th Quarter (mrem/quarter) Gross</b>	<b>Year Total (mrem)</b>	<b>Total - BKD (mrem)</b>
Nichols Ranch Project						
Control Badge	38.4	41.3	24.6	30.7	135.0	-13.0
NR-1(Nearest Resident)	40.1	46.2	30.4	39.2	155.9	7.9
NR-2 (Southern Boundary Downwind)	40.9	48.8	30.8	40.4	160.9	12.9
NR-3 (North Boundary Downwind)	42.0	46.1	30.0	34.8	152.9	4.9
NR-5 (Background Upwind)	40.7	41.3	29.8	36.2	148.0	0.0
NR-6 (West of CPP downwind)	38.3	44.9	28.4	35.8	147.4	-0.6
NR-7 (North East of CPP Downwind, boundary of the unreestricted area)	37.5	46.5	30.2	39.9	154.1	6.1

Energy Fuels Inc.  
Appendix H  
Effluent Program  
Particulate Data  
July through December 2017

Sample Location	Sample Date	Radionuclide	Concentration ( $\mu\text{Ci/ml}$ )	Error $\pm$ ( $\mu\text{Ci/ml}$ )	MDC ( $\mu\text{Ci/ml}$ )
CPP*	7/24/2017	U-Nat	2.32E-13	6.76E-14	2.32E-13
CPP*	8/15/2017	U-Nat	3.25E-13	1.02E-13	2.28E-13
Header House**	8/30/2017	U-Nat	6.35E-13	6.52E-13	2.27E-13
CPP*	9/27/2017	U-Nat	3.59E-13	3.34E-13	2.12E-13
CPP*	10/24/2017	U-Nat	2.26E-13	3.37E-14	2.12E-13
CPP*	11/21/2017	U-Nat	2.80E-13	7.83E-15	2.80E-13
CPP*	12/7/2017	U-Nat	1.34E-12	1.27E-12	2.81E-13
Header House**	12/19/2017	U-Nat	2.78E-13	4.57E-15	2.78E-13
DDW***	12/19/17****	U-Nat	1.41E-12	0.00E+00	1.41E-12

<b>Average CPP measurements</b>	4.61E-13	3.03E-13	2.41E-13
<b>Average Header House measurements</b>	4.57E-13	3.28E-13	2.52E-13
<b>Average DDW measurements</b>	1.41E-12	0.00E+00	1.41E-12

\*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).

\*\*\*\*Wells were logged as sampled on 12/19/17 but results are missing. Due to missing values the highest reported concentrations reported since 2015 (Sample taken 5/7/15) was used for completing effluent calculations.

**Energy Fuels Inc.**  
**Appendix I**  
**Effluent Program**  
**Rn-222 and Progeny Data**  
**July through December 2017**

<b>Sample Location</b>	<b>Sample Date</b>	<b>Concentration (Working Levels)</b>	<b>Error ±(Working Levels)</b>	<b>MDC (Working Levels)</b>
Header House**	7/20/2017	0.0142	0.0031	0.0142
CPP*	7/24/2017	0.0120	0.0010	0.0120
CPP*	8/15/2017	0.0125	0.0036	0.0105
Header House**	8/30/2017	0.0249	0.0017	0.0110
Recovery Wells****	8/31/2017	0.4402	1.1320	0.0147
DDW***	9/7/2017	0.0110	0.0000	0.0110
Header House**	9/7/2017	0.0130	0.0000	0.0130
CPP Tanks	9/11/2017	0.7221	N/A*****	0.0002
CPP*	9/27/2017	0.0137	0.0027	0.0137
CPP*	10/24/2017	0.0128	0.0007	0.0128
Header House**	10/26/2017	0.0120	0.0010	0.0120
CPP*	11/21/2017	0.0175	0.0084	0.0175
Recovery Wells****	11/22/2017	17.7564	51.4281	0.0133
Header House**	11/28/2017	0.0136	0.0040	0.0129
CPP*	12/7/2017	0.0147	0.0018	0.0147
Header House**	12/18/2017	0.0110	0.0010	0.0110
DDW***	12/18/2017	0.0135	0.0005	0.0135
CPP Tanks	12/18/2017	1.0373	N/A*****	0.0002
Header House**	12/30/2017	0.0090	0.0000	0.0090



**Energy Fuels Inc.**  
**Appendix I**  
**Effluent Program**  
**Rn-222 and Progeny Data**  
**July through December 2017**

<b>Average CPP measurements</b>	0.0139	0.0030	0.0135
<b>Average Header House measurements</b>	0.0140	0.0016	0.0119
<b>Average DDW measurements</b>	0.0123	0.0003	0.0123
<b>Average Recovery Wells</b>	9.0983	26.2801	0.0140
<b>Average CPP Tanks</b>	0.8797	N/A*****	0.0002

\*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 26 wells with a maximum number of operational recovery wells of 255 during the monitoring period.

\*\*\*\*\*No published way to perform uncertainty calculations with sampling method.

**Energy Fuels Inc.**  
**Appendix J**  
**Annual SERP Summary**  
**2017**

SERP No.	Date	SERP Topic	Evaluation Summary
SERP-2-2017	2/13/2017	Production Area #2	A SERP was held to review and assure that the requirements were all met for the production area 2 (PA-2) in accordance with the license application 5.7.8 and ensure items in Section 5.7.8.4 have been completed before bringing new wellfield online for production. As reference panel reviewed PA-1 Wellfield Package.
SERP-3-2017	3/21/2017	Revise resposnsibiltiéis of the ESH Manager in the TR	A SERP was held to review and update pages in the NRC License Application Technical Report to redefine the responsibilities of the ESH Manager. Due to the prior RSO's retirement, the ESH Managers responsibilities include being the RSO as well as the environmental supervisor as needed. As a result of retirement an end date for interim SERP-3-2016 must be established.
SERP-5-2017	8/24/2017	Review Qualifications for RST and RSO Designee.	A SERP was held to review and discuss the qualifications of personnel to perform the responsibilities as the RSO designee. Qualifications were determined by the NRC Regulatory Guide 8.31.
SERP-8-2017	10/31/2017	Review Qualifications for RST	A SERP was held to review and approve the qualifications and certifications for personnel to take on the responsibilities of RST. Qualifications decided from NRC Regulatory Guide and License Application requirements.

***Do not make corrections to this form after printing. Forms bearing strikeouts, ink changes, etc will not be accepted.***

**INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS**

Page 1 of 1

Date

MINE COMPANY NAME: Uranerz Energy Corporation

MINE NAME: Nichols Ranch ISR Project

License NO.: SUA-1597

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

**NOTES:**

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

Volume Number	Page, Map or other Permit Entry to be REMOVED	Page, Map or other Permit Entry to be ADDED	Description of Change
Volume I	Pages TR-202 through TR-204	Pages TR-202 through TR-204	Pages revised to include new positions and reporting structure.

SERP-3-2017

Revise Responsibilities of the  
ESH Manager in the TR

### Executive Vice President ISR Operations

The Executive Vice President ISR Operations (EVP) reports to the CEO and is directly responsible for all production activity at the site. In addition to production activities, the EVP is also directly responsible for ensuring that operations personnel comply with and implement industrial and responsible for radiation safety, and environmental protection programs. The EVP is also responsible for compliance with all federal and state regulations, license conditions, and reporting requirements. The EVP has the responsibility and authority to terminate immediately any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations. The EVP directly supervises the Mine Manager.

### Mine Manager

The Mine Manager reports directly to the EVP. All site operations, maintenance, construction, environmental health and safety, and support groups report to the Mine Manager. The Mine Manager is authorized to implement immediately any action to correct or prevent hazards. The Mine Manager has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations.

### Line Management

Line management reports directly to the Mine Manager. Line management is responsible for management oversight and direct supervision of activities including construction, operations, maintenance, and support for the respective functional area. Line management is responsible for line implementation of industrial and radiation safety, and environmental protection program requirements associated with the respective functional area. Line management is responsible for line conduct and enforcing compliance with management controls (e.g. operating procedures, radiation work permits, and ALARA requirements within the respective functional area). Line management has the authority to stop any activity, immediately if necessary, that is determined to be a threat to employee or public health, the environment, or a potential violation of state or federal regulations. Line management oversees all wellfield, production, and lab personnel.

### Senior Director Regulatory Affairs

The Senior Director Regulatory Affairs reports directly to the CEO. The Senior Director Regulatory Affairs is responsible to ensure support is provided to ISR as a regulatory resource. The Senior Director Regulatory Affairs has the authority to suspend, postpone, or modify any activity that is determined to be a threat to employees, public health, the environment or potentially a violation of state or federal regulations. The Senior Director Regulatory Affairs is responsible to oversee the preparation and submittal of permit and license applications to pertinent regulatory agencies. The Senior Director Regulatory Affairs also has the responsibility to inform and advise corporate management on matters involving regulatory items and to facilitate change implementation consistent with corporate and regulatory requirements.

### Manager Environment, Safety, and Health

The Manager Environment, Safety, and Health (ESH) reports directly to the Mine Manager, and indirectly to the Senior Director Regulatory Affairs and the EVP. This position has the responsibility and authority for, environmental, occupational safety and radiation safety programs, ensuring compliance with all applicable regulatory requirements. The Manager ESH ensures permit conditions, agency responses, regulatory notifications and reports are met. This position assists in the development and review of radiological and environmental sampling and analysis procedures and is responsible for routine auditing of the programs. The Manager ESH has no production related responsibilities. As such, the Manager ESH has the responsibility and authority to suspend, postpone, or modify any activity that is determined to be a threat to employees, public health, the environment or potentially a violation of state or federal regulations. Additionally, this position could fulfill the duties of the RSO and the environmental supervisor on an interim or permanent basis. If required to fulfill RSO duties, the position will meet the requirements of the NRC Regulatory Guide 8.31 for the RSO.

### Radiation Safety Officer

The Radiation Safety Officer (RSO) reports directly to the Manager ESH. The RSO is responsible for conducting the radiation safety program and for providing assistance in ensuring compliance with NRC regulations and license conditions applicable to worker health protection.

The RSO is responsible for overseeing the day-to-day operation of the radiation safety program and for ensuring that records required by NRC are maintained. The RSO has the responsibility and the authority to suspend, postpone, or modify, immediately if necessary, any activity that is determined to be a threat to employee or public health, the environment, or potentially a violation of state or federal regulations, including the ALARA program. The RSO has no production-related responsibilities. As such, the RSO has an indirect line to the Senior Director Regulatory Affairs<sup>s</sup>. The RSO supervises the Radiation Safety Technician(s).

#### Environmental Supervisor and Environmental and Radiation Safety Technicians

The Environmental Supervisor reports directly to the Manager ESH. The Environmental Technicians report to the Environmental Supervisor. The Radiation Safety Technicians report to the RSO. The Environmental Supervisor, Environmental Technicians and Radiation Safety Technicians assist the Manager ESH and the RSO with the implementation of the environmental monitoring and radiation safety programs. The Environmental Supervisor and Environmental and Radiation Safety Technicians are responsible for the orderly collection and recording of all data from environmental and radiological safety programs. The Environmental Supervisor and Environmental and Radiation Safety Technicians have no production-related responsibilities.

#### **5.1.2 ALARA**

The radiation safety and environmental programs at the Nichols Ranch ISR Project site will be implemented in the context of keeping personnel and environmental exposure to radiation and radioactive material as low as is reasonably achievable (ALARA).

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