



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

September 24, 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. As approved by Ron Linton, NRC Project Manager, an extension to this report was given in an e-mail dated 29 August 2018 stating the report must be submitted on or before 24 September 2018.

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,

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

BB/al

Attachment – January - June 2018 Semi-Annual Report

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



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

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

Semi-Annual and Annual Report

January - June 2018



Table of Contents

1	INTRODUCTION	1
2	OPERATIONAL MONITORING	1
2.1	Production Areas in Operation and Restoration.....	1
2.2	Long-Term Excursions	1
2.3	Disposal Well Volumes	1
2.4	Mechanical Integrity Tests.....	1
3	ENVIRONMENTAL MONITORING	1
3.1	Ground Water Monitoring	1
3.2	Surface Water Monitoring	2
3.3	Unplanned Releases	2
3.4	Sediment and Soil Sampling	2
3.5	Air Particulate, Radon, and Gamma Radiation Monitoring.....	2
3.6	Effluent Monitoring Program.....	3
3.7	Meteorological Data.....	7
4	PUBLIC DOSE.....	7
5	SAFETY AND ENVIRONMENTAL REVIEW PANEL (SERP) EVALUATIONS.....	7
6	RADIATION PROTECTION PROGRAM.....	8



List of Appendices

- Appendix A: Placeholder, Intentionally Left Blank
- Appendix B: Surface Water Quality Analysis
- Appendix C: Placeholder, Intentionally Left Blank
- Appendix D: Placeholder, Intentionally Left Blank
- Appendix E: Environmental Air Particulate Data
- Appendix F: Environmental Radon-222 and Progeny Data
- Appendix G: Environmental Passive Gamma Radiation Monitoring
- Appendix H: Effluent Program – Particulate Data
- Appendix I: Effluent Program – Radon-222 and Progeny Data
- Appendix J: Annual SERP Summary



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 first half 2018 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, 2018 through June 30, 2018. 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 April 23, 2018 and July 24, 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 which discusses the status of any long-term excursions. As reported in the Quarterly Reports referenced 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 will be reported in the second half semi-annual effluent report.

2.4 Mechanical Integrity Tests

License Condition 11.1(B) requires a Semi-Annual report which summarizes the mechanical integrity tests (MITs) performed. 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 the Technical Report (TR), 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. 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 will be reported in the second half 2018 semi-annual effluent report.

3.2 Surface Water Monitoring

In accordance with License Condition 11.1(D), Regulatory Guide 4.14 and the TR 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 those limits.

As discussed 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 TR 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 will be reported in the second half semi-annual effluent report.

3.5 Air Particulate, Radon, and Gamma Radiation Monitoring

In accordance with TR 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 ($7.20E-17$ $\mu\text{Ci/ml}$). The background concentration of radon is taken from averaging the concentration of radon for NR-5 for the period monitored ($2.40E-10$ $\mu\text{Ci/ml}$).

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

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

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

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

$$\text{CPP } (\mu\text{Ci}) = (4.90E^{-13} - 7.20E^{-17}) * 13,500 * 28,316 * 262,800 = 49.2 \mu\text{Ci}$$

$$\text{Header House } (\mu\text{Ci}) = (3.35E^{-13} - 7.20E^{-17}) * 1,275 * 28,316 * 262,800 = 3.18 \mu\text{Ci}$$

$$\text{DDW } (\mu\text{Ci}) = (3.12E^{-13} - 7.20E^{-17}) * 1,275 * 28,316 * 262,800 = 2.96 \mu\text{Ci}$$

$$\begin{aligned} \text{Total Effluents of U - Nat (period monitored)} &= 49.2 + 3.18 + 2.96 = 55.34 \mu\text{Ci} \\ &= 5.534 E^{-5} \text{ Ci of Natural Uranium} \end{aligned}$$

Total Effluents of Radon and its Progeny (period monitored)

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

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

CPP Tanks (μCi)

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

Header House (μCi)

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

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

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

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

$$\text{CPP } (\mu\text{Ci}) = [(0.0132 * 9.1E^{-8}) - 2.4E^{-10}] * 13,500 * 28,316 * 262,800 = 9.66 E^4 \mu\text{Ci}$$

$$\text{CPP Tanks } (\mu\text{Ci}) = [(1.3235 * 9.1E^{-8}) - 2.4E^{-10}] * 293 * 28,316 * 262,800 = 2.62 E^5 \mu\text{Ci}$$

$$\text{Header House } (\mu\text{Ci}) = [(0.0266 * 9.1E^{-8}) - 2.4E^{-10}] * 1,275 * 28,316 * 262,800 = 2.07 E^4 \mu\text{Ci}$$

$$\text{DDW } (\mu\text{Ci}) = [(0.0145 * 9.1E^{-8}) - 2.4E^{-10}] * 1,275 * 28,316 * 262,800 = 1.02 E^4 \mu\text{Ci}$$

$$\text{Recovery Wells } (\mu\text{Ci}) = [(7.1788 * 9.1E^{-8}) - 2.4E^{-10}] * 255 * 3,000 * 262,800 = 1.31 E^5 \mu\text{Ci}$$

Total Effluents of Radon and its Progeny (period monitored)

$$\begin{aligned}
 & = 9.66 E^4 \mu\text{Ci} + 2.62 E^5 \mu\text{Ci} + 2.07 E^4 \mu\text{Ci} + 1.02 E^4 \mu\text{Ci} + 1.31 E^5 \mu\text{Ci} = 5.21 E^5 \mu\text{Ci} \\
 & = \mathbf{0.521 \text{ Ci of Radon} - 222 \text{ and its Progeny.}
 \end{aligned}$$

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 TR 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. In accordance with 10 CFR 40.65 if quantities of radioactive material released during the reporting period are significantly above the licensee's design objectives the report shall cover those items. Uranerz is well below these design objectives therefore no further discussion is required.

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 2017 Annual ALARA Audit under a separate cover letter.

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 13 SERPs in 2018. A summary of SERPs performed during the annual report period are found in Appendix J. Due to the large number of page changes the page changes will be submitted under a separate cover letter.



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 September 2018 and the report shall be submitted under separate cover letter once received.

APPENDIX A

This Appendix
Intentionally Left Blank

Energy Fuels Inc.
Appendix B
Surface Water Quality Analysis
January through June 2018

Sample Location	Sample Date	Uranium-Natural (Total)			Radium 226				Lead 210				Thorium 230			
		Concentration ($\mu\text{Ci/ml}$)	Reporting Limit ($\mu\text{Ci/ml}$)	10 CFR 20 App B Table 2 Col. 2 ($\mu\text{Ci/ml}$)	Concentration ($\mu\text{Ci/ml}$)	Precision (\pm) ($\mu\text{Ci/ml}$)	MDC or RL ($\mu\text{Ci/ml}$)	10 CFR 20 App B Table 2 Col. 2 ($\mu\text{Ci/ml}$)	Concentration ($\mu\text{Ci/ml}$)	Precision (\pm) ($\mu\text{Ci/ml}$)	MDC or RL ($\mu\text{Ci/ml}$)	10 CFR 20 App B Table 2 Col. 2 ($\mu\text{Ci/ml}$)	Concentration ($\mu\text{Ci/ml}$)	Precision (\pm) ($\mu\text{Ci/ml}$)	MDC or RL ($\mu\text{Ci/ml}$)	10 CFR 20 App B Table 2 Col. 2 ($\mu\text{Ci/ml}$)
NRSSW (Cottonwood D Nichols)	22 May 18	3.62E-08	2.03E-10	3.00E-07	4.00E-10	1.00E-10	2.00E-10	6.00E-08	7.00E-10	3.00E-10	1.00E-09	1.00E-08	5.70E-09	1.40E-09	1.40E-09	1.00E-07
NRSSE (Cottonwood U Nichols)	22 May 18	2.99E-07	2.03E-10	3.00E-07	3.00E-10	1.00E-10	2.00E-10	6.00E-08	1.00E-08	7.00E-10	1.00E-09	1.00E-08	3.00E-10	2.00E-10	2.00E-10	1.00E-07
NRSSW (Cottonwood D Nichols)	Not sampled; self-sampler dry (checked 22 March 2018)															
NRSSE (Cottonwood U Nichols)	Not sampled; self-sampler dry (checked 22 March 2018)															

Notes:

MDC = Minimum Detectable Concentration

RL = Reporting Limit

NA = Not Applicable

APPENDIX C

This Appendix
Intentionally Left Blank

APPENDIX D

This Appendix
Intentionally Left Blank

Energy Fuels Inc.
Appendix E
Environmental Air Particulate Data
January through June 2018

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 include NA-4 Concentration Subtraction)
NA-1 Air Station Nearest Resident	1st Quarter	U-Nat	6.2E-17	*	1.0E-16	9E-14	0.02
		Th-230	8.1E-17	6.4E-17	1.0E-16	3E-14	-0.06
		Ra-226	1.4E-16	6.4E-17	1.0E-16	9E-13	0.01
		Pb-210	1.8E-14	1.0E-15	2.0E-15	6E-13	1.43
		Po-210	3.8E-15	1.7E-15	2.0E-15	9E-13	0.17
	2nd Quarter	U-Nat	6.4E-17	*	1.0E-16	9E-14	-0.04
		Th-230	8.7E-17	5.5E-17	1.0E-16	3E-14	-0.14
		Ra-226	1.5E-16	2.7E-17	1.0E-16	9E-13	0.00
		Pb-210	1.1E-14	1.6E-15	2.0E-15	6E-13	-0.83
		Po-210	3.0E-15	1.7E-15	2.0E-15	9E-13	-0.29
	3rd Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
	4th Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
NA-2 Air Station Downwind Southern Boundary	1st Quarter	U-Nat	4.4E-17	*	1.0E-16	9E-14	0.00
		Th-230	1.3E-16	5.8E-17	1.0E-16	3E-14	0.10
		Ra-226	1.1E-16	5.8E-17	1.0E-16	9E-13	0.01
		Pb-210	1.7E-14	9.6E-16	2.0E-15	6E-13	1.27
		Po-210	4.8E-15	1.7E-15	2.0E-15	9E-13	0.28
	2nd Quarter	U-Nat	2.1E-16	*	1.0E-16	9E-14	0.12
		Th-230	9.4E-17	5.7E-17	1.0E-16	3E-14	-0.12
		Ra-226	1.3E-16	2.8E-17	1.0E-16	9E-13	0.00
		Pb-210	1.2E-14	1.7E-15	2.0E-15	6E-13	-0.67
		Po-210	5.2E-15	2.1E-15	2.0E-15	9E-13	-0.04
	3rd Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
	4th Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					

Energy Fuels Inc.
Appendix E
Environmental Air Particulate Data
January through June 2018

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 include NA-4 Concentration Subtraction)
NA-3 Air Station Downwind North Boundary	1st Quarter	U-Nat	5.7E-17	*	1.0E-16	9E-14	0.01
		Th-230	9.1E-17	6.0E-17	1.0E-16	3E-14	-0.03
		Ra-226	7.9E-17	6.0E-17	1.0E-16	9E-13	0.00
		Pb-210	1.4E-14	1.2E-15	2.0E-15	6E-13	0.77
		Po-210	3.6E-15	1.5E-15	2.0E-15	9E-13	0.14
	2nd Quarter	U-Nat	4.9E-16	*	1.0E-16	9E-14	0.44
		Th-230	5.5E-17	5.5E-17	1.0E-16	3E-14	-0.25
		Ra-226	1.6E-16	5.5E-17	1.0E-16	9E-13	0.00
		Pb-210	1.4E-14	1.9E-15	2.0E-15	6E-13	-0.33
		Po-210	4.8E-15	2.1E-15	2.0E-15	9E-13	-0.09
	3rd Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
	4th Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
NA-4 Air Station Background Site	1st Quarter	U-Nat	4.6E-17	*	1.0E-16	9E-14	N/A Background Location
		Th-230	1.0E-16	5.5E-17	1.0E-16	3E-14	
		Ra-226	5.7E-17	1.8E-17	1.0E-16	9E-13	
		Pb-210	9.4E-15	7.9E-16	2.0E-15	6E-13	
		Po-210	2.3E-15	9.6E-16	2.0E-15	9E-13	
	2nd Quarter	U-Nat	9.8E-17	*	1.0E-16	9E-14	
		Th-230	1.3E-16	8.9E-17	1.0E-16	3E-14	
		Ra-226	1.2E-16	3.0E-17	1.0E-16	9E-13	
		Pb-210	1.6E-14	2.0E-15	2.0E-15	6E-13	
		Po-210	5.6E-15	2.4E-15	2.0E-15	9E-13	
	3rd Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
	4th Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					

Energy Fuels Inc.
Appendix E
Environmental Air Particulate Data
January through June 2018

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 include NA-4 Concentration Subtraction)
NA-5 Air Station Downwind West of CPP	1st Quarter	U-Nat	4.5E-17	*	1.0E-16	9E-14	0.00
		Th-230	0.0E+00	6.4E-17	1.0E-16	3E-14	-0.33
		Ra-226	0.0E+00	3.2E-17	1.0E-16	9E-13	-0.01
		Pb-210	9.4E-15	8.3E-16	2.0E-15	6E-13	0.00
		Po-210	3.2E-15	1.5E-15	2.0E-15	9E-13	0.10
	2nd Quarter	U-Nat	1.0E-16	*	1.0E-16	9E-14	0.00
		Th-230	0.0E+00	4.1E-17	1.0E-16	3E-14	-0.43
		Ra-226	1.2E-16	4.1E-17	1.0E-16	9E-13	0.00
		Pb-210	1.4E-14	2.2E-15	2.0E-15	6E-13	-0.33
		Po-210	3.7E-15	2.5E-15	2.0E-15	9E-13	-0.21
	3rd Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
	4th Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
NA-6 Air Station Downwind North East of CPP	1st Quarter	U-Nat	2.3E-16	*	1.0E-16	9E-14	0.20
		Th-230	0.0E+00	1.3E-16	1.0E-16	3E-14	-0.33
		Ra-226	7.0E-16	2.7E-16	1.0E-16	9E-13	0.07
		Pb-210	2.9E-14	5.3E-15	2.0E-15	6E-13	3.27
		Po-210	1.1E-14	5.8E-15	2.0E-15	9E-13	0.97
	2nd Quarter	U-Nat	1.0E-16	*	1.0E-16	9E-14	0.00
		Th-230	9.7E-17	5.7E-17	1.0E-16	3E-14	-0.11
		Ra-226	1.1E-16	2.9E-17	1.0E-16	9E-13	0.00
		Pb-210	1.1E-14	1.6E-15	2.0E-15	6E-13	-0.83
		Po-210	1.0E-14	2.8E-15	2.0E-15	9E-13	0.49
	3rd Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
	4th Quarter	U-Nat					
		Th-230					
		Ra-226					
		Pb-210					
		Po-210					
* 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 nd Quarter ($\mu\text{Ci/ml}$)	Uncertainty ($\mu\text{Ci/ml}$)	3 rd 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 ($\mu\text{Ci/ml}$)	N/A	N/A	10CFR 20 APP B Table 2 Values ($\mu\text{Ci/ml}$)		
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 ($\mu\text{Ci/ml}$)			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	N/A	N/A	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
January through June 2018

Location	1st Quarter (mrem/quarter) Gross	2nd Quarter (mrem/quarter) Gross	3rd Quarter (mrem/quarter) Gross	4th Quarter (mrem/quarter) Gross	Year Total (mrem)	Total - BKD (mrem)
Nichols Ranch Project						
Control Badge	35.9	44.2			80.1	-0.2
NR-1(Nearest Resident)	42.5	42.0			84.5	4.2
NR-2 (Southern Boundary Downwind)	44.8	48.1			92.9	12.6
NR-3 (North Boundary Downwind)	38.2	50.3			88.5	8.2
NR-5 (Background Upwind)	38.2	42.1			80.3	0.0
NR-6 (West of CPP downwind)	41.1	51.2			92.3	12.0
NR-7 (North East of CPP Downwind, boundary of the unrestricted area)	43.2	46.5			89.7	9.4

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

Sample Location	Sample Date	Radionuclide	Concentration (μCi/ml)	Error ±(μCi/ml)	MDC (μCi/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

Average CPP measurements	4.61E-13	3.03E-13	2.41E-13
Average Header House measurements	4.57E-13	3.28E-13	2.52E-13
Average DDW measurements	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

Sample Location	Sample Date	Concentration (Working Levels)	Error ±(Working Levels)	MDC (Working Levels)
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

Average CPP measurements	0.0139	0.0030	0.0135
Average Header House measurements	0.0140	0.0016	0.0119
Average DDW measurements	0.0123	0.0003	0.0123
Average Recovery Wells	9.0983	26.2801	0.0140
Average CPP Tanks	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
2018

SERP No.	Date	SERP Topic	Evaluation Summary
SERP-1-2017	1/31/2018	Install sample lines to CPP point Source Ventilation lines	This SERP was to discuss the addition of vent line to tops of IX vessels in the processing plant.
SERP-4-2017	1/22/2018	Updates for Organizational chart and responsibilities for officers of company.	In this SERP the panel met to update the NRC Vol I Chp 5 pgs TR-201-TR-204 along with figure. WDEQ/LQD Chp 3 pg MP-38
SERP-6-2017	1/9/2018	HCL Injection	This SERP Conduct test using HCL to improve well flow
SERP-7-2017	1/8/2018	Monitor Well MIT	Remove sentence in mine plan so monitor wells don't need MIT every 5 years
SERP-1-2018	2/1/2018	Soil and Sediment sample locations	Update sections in TR and LQD Mine Plan to ensure clarity of current compliance sampling locations with Reg Guide 4.14.
SERP-2-2018	9/24/2018	Plugging Wells	Deviate from the plugging procedure in Source Material License Application Volume I, Section 6.1.5 as an experiment
SERP-3-2018	2/20/2018	Site Facility Diagram Figures	This SERP was conducted to do figure Changes in WDEQ MP and NRC TR to add corrosion inhibitor and antiscalet
SERP-5-2018	3/27/2018	Section 1.0 Revisions	This SERP was to make minor revisions to Section 1.0 of the license application. Sections 1.1-1.4.
SERP-6-2018	6/18/2018	Section 3.0 Revisions	Request to make revisions to section 3.0 of the license application. Both administrave and technical changes.
SERP-7-2018	9/17/2018	Section 2.0 and 4.0 Revisions	This SERP request to make revisions to sections 2.0 and 4.0 of the license application. Both administrave and technical changes.
SERP-8-2018	9/18/2018	Section 5.0 Revisions	This SERP request is to make revisions to section 5.0 of the license application. Both administrave and technical changes.
SERP-9-2018	9/24/2018	Section 6.0 Revisions	Request to make revisions to section 6.0 of the license application. Both administrave and technical changes.
SERP-10-2018	7/17/2018	Section 7.0 Revisions	This request is to make revisions to section 7.0 of the license application. All changes made were accepted as administrave changes by the panel.