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LOST CREEK ISR, LLC

February 26, 2018

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Semi-Annual Effluent and Environmental Monitoring Report 2nd Half 2017
Lost Creek ISR Project License SUA-1598 Docket 40-9068

To Whom It May Concern:

The attached Effluent and Environmental Monitoring Report for the second half of 2017 has been submitted pursuant to Lost Creek ISR, LLC's (LCI) Lost Creek ISR Project License SUA-1598 License Condition 11.1(D) in accordance with NRC Regulatory Guide (RG) 4.14, 10 CFR 40.65, LCI's NRC License Application Technical Report (TR) Section 5.7.7, and License Amendment 4 Safety Evaluation Report.

Also included is the corrected Table 6a from the report for first half of 2017 that corrects the Effluent Concentration Limit for radon.

If you have any questions regarding this submittal please contact me at the Casper office.

Sincerely,

Michael D. Gaither
Manager EHS and Regulatory Affairs
Ur-Energy USA, Inc

Attachments: **Semi-Annual Effluent and Environmental Monitoring Report for 2nd Half 2017**
Corrected Table 6a (2017H1)

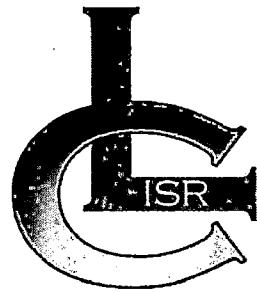
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SEMI-ANNUAL EFFLUENT AND ENVIRONMENTAL MONITORING REPORT

Lost Creek ISR Project



**LOST CREEK ISR, LLC
SWEETWATER COUNTY, WY**

**NRC License SUA-1598
Docket 40-9068**

July 1, 2017 to December 31, 2017

February 26, 2017



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1.0 INTRODUCTION

Environmental and effluent monitoring of air, water, and soil was conducted to quantify radionuclides and determine potential exposures as a result of operations at Lost Creek ISR, LLC's (LCI) Lost Creek ISR Project (LC-ISR) in Sweetwater County, Wyoming. Sampling and monitoring was performed during the reporting period consistent with NRC Regulatory Guide (RG) 4.14, as described in LCI's NRC License Application Technical Report (TR) Section 5.7.7, and as detailed in the LC-ISR Environmental Monitoring Program Standard Operating Procedures. The reporting period is July 1, 2017 through December 31, 2017.

Data from the additional monitoring schemes described in the Safety Evaluation Report to Amendment 4 of the NRC License dated March 18, 2016 are also included.

In accordance with monitoring requirements in License Condition 10.20, quantities of radionuclides in the injectate from the Class V injection system are calculated from the concentration results and included herein.

The sampling and monitoring is therefore divided into the following categories:

- Radiological particulates in air
- Non-routine surface water
- Groundwater
- Soils
- Direct (Gamma) Radiation
- Radon and Radon Progeny
- Class V Injectate

The operational monitoring data is provided on **Tables 1 through 7**. Sample locations are shown in **Figures 1 through 3**. Descriptions of the sampling locations associated with the monitoring categories are provided on the following summary tables:



Monitoring Category	Monitoring Location ID	Description
Radiological Particulates in Air; (Data Table 1) (Figure 3)	HV-2/E-13D	Located downwind approximately 50 ft to the east of the Plant. Highest expected concentration of effluents from operations.
	HV-3	Boundary monitor located approximately 3 miles upwind of the plant in the southwest corner on the edge of the site License boundary. Represents background.
	HV-4	Boundary monitor located downwind approximately 2.5 miles to the east on the site License boundary.
	HV-5	Boundary monitor located approximately 0.75 miles to northwest of the processing facility generally upwind of the Plant.
Surface Water (Data Table 2) (Figure 3)	Various Non-routine	Various locations of Autosamplers that may be used to collect samples as feasible.
Public Well Groundwater (Data Table 3) (Figure 3)	BLM-4451	Stock well (BLM Battle Spring Draw Well No. 4451) east of permit boundary
	BLM-4775	Stock well (BLM Boundary Well No. 4775) north east of permit boundary
	BLM-4777	Stock well (BLM Battle Spring Well No. 4777) south of permit boundary
	BLM-EEN	Stock well (BLM East Eagle Nest Draw Well) northwest of permit boundary
Soils (Data Table 4a & 4b)	HV-2 through HV-5	See description above
	Unplanned releases	Releases to soil at various locations
Passive Gamma Radiation (Data Table 5) (Figure 3)	PR-2	Co-located with HV-3 representing background
	PR-3	Co-located with HV-5
	PR-4	Located just to the north of the Plant
	PR-5	Co-located with HV-2
	PR-9	Located mid-site to sample area over the ore body within Mine Unit 1 approximately 0.5 mi S of the Plant.
	PR-10	Co-located with HV-4
Supplemental Gamma (Data Table 5) (Figure 2)	E10	SW corner Maintenance Building (Warehouse) – <i>Maximally exposed member of the public</i>
	E11	Just E of Maintenance Building
	E12	SW corner of Plant
	E13A	NE corner of Plant fence
	E13B	Just NE of Plant
	E13C	Downrange E of Plant area
	E13D	Same location as HV-2 and PR-5
	E13E	E side of Plant fence
	E13F	Just SE of Plant



Monitoring Category	Monitoring Location ID	Description
Passive Radon (Data Table 6a) (Figure 3)	E13G	SE corner of Plant fence
	PR-2	Co-located with HV-3 representing background
	PR-3	Co-located with HV-5
	PR-4	Located just to the north of the Plant
	PR-5	Co-located with HV-2
	PR-6	Located on the NE edge of the License boundary approximately 1.5 mi to the ENE of the Plant
	PR-9	Located mid-site to sample area over the ore body within Mine Unit 1 approximately 0.5 mi S of the Plant.
	PR-10	Co-located with HV-4
Supplemental Passive Radon (Data Table 6a) (Figure 1)	PR-12	Located on the south edge of the east leg of the License boundary approximately 1.5 mi ESE of the Plant
	E1	Main Vent in Plant Shop
	E7	Various Header Houses
	E8	Various Injection Wellhead
Supplemental Passive Radon (Data Table 6a) (Figure 2)	E9	Various Production Wellhead
	E10	SW corner Maintenance Building (Warehouse) – <i>Maximally exposed member of the public</i>
	E11	Just E of Maintenance Building
	E12	SW corner of Plant
	E13A	NE corner of Plant fence
	E13B	Just NE of Plant
	E13C	Downrange E of Plant area
	E13D	Same location as HV-2 and PR-5
	E13E	E side of Plant fence
Radon Effluent (Data Table 8) (Figure 1)	E13F	Just SE of Plant
	E13G	SE corner of Plant fence
	E2	Precipitation tanks vent
	E3	Eluate tanks vent
	E4	Waste water tanks vent
	E5	Resin water tanks vent
	E6	Shaker deck vent
	E14	RO System Tank
Radon Progeny (Data Table 6b)	E15	RO Permeate Tank
	E16	Class V Holding Tank
Class V Injectate (Table 7)	E1; E10 through E13G	Described above.
	Class V Composite	Class V Injection system monthly composite sample



2.0 RADIOLOGICAL PARTICULATES IN AIR

Operational air particulate sampling for LC-ISR was conducted at four locations HV-2 through HV-5. Samples were collected on glass fiber filter paper using F&J Specialty air sampling model DF-40L-8 and operating at a rate of approximately 30 L/min. Filters were typically changed weekly (as feasible considering winter limitations), batched, and submitted for quarterly composite analysis. The filters were sent to Energy Labs in Casper, WY for analysis of U-nat, Ra-226, Th-230, and Pb-210. Analytical data is provided on **Table 1a**.

All radionuclide concentrations at the HVs were significantly less than the Effluent Concentration Limit (ECL) and comparable to the background levels represented by HV3. All concentrations were below the ALARA constraint value of 20% of the ECL. The only notable result in concentration is for U-nat at HV2 just downwind of the Plant. The U-nat concentrations were consistent with previous reporting periods but were still noticeably, but only slightly, above background. The other parameter data were consistent with previous results, follow no apparent trends, and are significantly low. Additionally, the results for HV4 and HV5 also were generally consistent with previous data and background (HV3) results with the exception of Th-230 for the fourth quarter which was slightly elevated. However, the data follow no apparent trends and are significantly low.

Calibration of each air sampler flow rate is performed annually with an F&J Specialty air flow calibrator model CD-802V.2-1-O. The air flow calibrator is sent to the manufacturer annually for calibration.

Uranium particulates were sampled to characterize concentrations at the various downwind locations E10 through E13G. The results are provided on **Table 1b**. Samples were collected on glass fiber filter paper using F&J Specialty air sampling model DF-40L-8 and operating at a rate of approximately 30 L/min. Sample duration varied and ranged from 115 – 340 minutes. Filters were counted for alpha activity which was conservatively assumed as from uranium for determination of concentration. Due to the higher LLD resulting from the shorter sampling times compared to continuous monitoring, the uranium concentrations varied.

3.0 SURFACE WATER

As stated in TR Section 5.7.8.2, surface water samples are not routinely collected since surface water does not typically exist due to the ephemeral nature of drainages at the site. However, automatic storm water samplers are used to allow monitoring of runoff following any unplanned releases that significantly impact drainage. Analytical parameters that will be requested include suspended and dissolved U-nat, Ra-226, and if feasible Th-230. The analysis of Pb-210 and Po-210 required in RG 4.14 is typically not feasible due to the limited volume of sample.

Samples of storm water runoff were collected during the reporting period via autosampler at LC2R, LC3 and LC14. The sampler LC2R was replaced since the original was lost and LC14 was installed to monitor runoff upstream of MU1 drainage. The samplers were utilized to



monitor the runoff in the drainage that passes through MU1 to assess potential spill impacts. Only two parameters, U-nat and Ra-226, were analyzed due to the limited volume. Results are provided on **Table 2**. The results for U-nat and Ra-226 are slightly elevated compared to the pre-operational background values. The results are generally consistent with the upstream values of LC14 with the exception of dissolved uranium at LC3 which was slightly elevated.

4.0 PUBLIC GROUNDWATER

The public groundwater wells near the project area are Bureau of Land Management (BLM) wells used for stock watering purposes. Four BLM wells, BLM4451, BLM4775, BLM4777 and BLMEEN, are in operation intermittently and sampled quarterly if they are operating. As described in TR Section 5.7.8.2 *Private Well Monitoring* samples were analyzed for U-nat and Ra-226. However, going forward, the water will be analyzed for Th-230, Pb-210, and Po-210 in addition to uranium and Ra-226 in accordance with Regulatory Guide 4.14. Two of the wells were in operation during the reporting period (**Table 3**). Well BLM4451 which is along the east road has a notable concentration of uranium that is consistent with the concentration since prior to operation and is most likely naturally occurring.

5.0 SOILS

Soil sampling is conducted annually during operations in accordance with RG 4.14 typically in the spring. No soil samples were collected during the reporting period.

Effluent to soil from reportable unplanned releases is quantified on **Table 4**. Net concentration of uranium and Ra-226 is the result of analysis of impacted soil minus the average pre-operational background values.

6.0 DIRECT RADIATION

Gamma radiation is measured on a quarterly basis at the passive radiation (PR) sampling locations PR-2 through PR-5, PR-9, and PR-10 and at Plant-area locations E10 through E13G. Four monitors, PR-2, PR-3, PR-5, and PR-10, are co-located with the air particulate sampling locations HV-2 through HV-5. Potential exposure rates were determined by the use of X9 Environmental/Low Level dosimetry badges supplied by Landauer or by direct measurement with Ludlum Model 19 instrument. The dosimeters were deployed at the PR locations and the retrieved dosimeters were sent to Landauer for analysis. Gamma exposure was measured with a Model 19 gamma detector at locations E10 through E13G.

The data is reported as a gross dose in mrem for the monitoring quarter and net exposure following subtraction of the background dosimeter value or background meter measurement at PR-2. The results of exposure measurement are provided in milliroentgens per quarter (mR/qtr) on **Table 5**. The gamma rates remain consistent with background levels demonstrating no significant increases due to operations. The results of PR-10 on the eastern boundary of the



project have been elevated from the other locations since monitoring began and may be due to mineralization trends in that area.

7.0 RADON AND RADON PROGENY

Passive Radon

Radon-222 (Rn-222) gas was quantified using Landauer Rapidos® long-term monitors equipped with a thoron-proof filter in order to measure only Rn-222. The detection limit specified by the manufacturer for Rapidos monitors is 0.11 pCi/L (1.08E-10 μ Ci/mL) over 90 days. Radon quantities in air are determined on a quarterly basis (**Table 6a**) using radon detectors PR-2 through PR-6, PR-9, PR-10 and PR-12. Four monitors, PR-2, PR-3, PR-5, and PR-10, are co-located with the air particulate sampling locations HV-2 through HV-5. Additionally, passive radon monitoring was conducted at the added wellfield locations E7 through E9 and the Plant area locations E10 through E13G. These supplemental Rn-222 results are included on **Table 6a**.

Results have been background subtracted by subtracting the PR-2 location data from the gross results of the locations. The radon concentrations for the PR locations are consistent with background levels with the exception of the elevated result for PR-6 and PR-12 in the third quarter which are anomalies likely due to the detector being on the ground. Otherwise, most of the passive radon concentrations were well below the ECL. The resulting concentrations over the ECL included PR-10 and PR-12 for the third quarter, E13A for the fourth quarter and the indoor or enclosed monitors E1, E7, E8, and E9 for both quarters.

Radon Progeny Sampling

Sampling to quantify radon progeny using the Modified Kusnetz method was conducted at the additional locations E7 through E13G. The results are provided reported on **Table 6b** in milliWorking Levels (mWL) of radon. The mWL were converted to μ Ci/mL using the 1WL = 100 pCi/L conversion factor.

8.0 CLASS V INJECTION

In accordance with License Condition 10.20, injectate from the permitted Class V injection system shall be monitored for radionuclide concentrations as specified in the UIC Permit on a periodic basis. Monthly composite samples were comprised from daily aliquots during system operation were collected to quantify the radionuclides in the injectate. The nuclide concentrations and discharge volumes are presented on **Table 7** and the radionuclide quantities in μ Ci were calculated therein. The system was off for most of the quarter to allow for the reverse osmosis system to be overhauled to facilitate a reduction in uranium and beta concentrations in the treated water.



9.0b EFFLUENT QUANTITY

LCI has committed to quantifying effluent from point and diffuse sources at locations E1 through E9. Radon and radon progeny are the primary constituents in the effluent from the Plant venting and wellfield sources. The summary of the quantity of various radionuclides is provided on **Table 8**.

Because the venting is from wet processes, uranium particulates were not measured from Plant venting or injection or production wells since there would be no particulate effluent. However, air particulates were sampled in several header houses to conservatively calculate potential uranium content. The calculation is conservative since the concentration of uranium is determined from the gross alpha activity on the filter which also includes alpha activity from radon progeny. The average of the activity concentration measurements per quarter was used to determine the effluent value.

The effluent values for locations E1 and E7 through E9 were determined from the passive radon measurements and also from direct radon measurement. Radon measurement was conducted three times per quarter at the effluent locations E2 through E6 and E14 through E16 using a Durridge RAD7 radon detector. The average concentration of the three measurements is provided for quarterly quantification. Radon progeny concentrations were determined, if not assumed to be in equilibrium with radon-222, by air sampling using the modified Kusnetz method and averaged for each quarter, if applicable.

The concentrations of radon are reported in uCi/mL and effluent quantities in both uCi and Ci of radon. Air flow volumes were calculated for each sample point.

The total effluent quantity, 4.1 Ci, for radon and radon progeny combined is significantly less than the projected effluent quantity for radon alone as listed on Table 6 of Attachment 7.2-1 of the Technical Report. To compare, the yearly average (over 9 years of operation) of radon effluent as projected by MILDOS was 240 Ci.

10.0 COMPLIANCE WITH PUBLIC DOSE LIMITS

The demonstration of compliance with public dose limits and determination of public doses downwind of the Plant is facilitated by the additional monitoring at downwind locations E10 through E13G. A total effective dose equivalent (TEDE) is calculated for two different scenarios for members of the public based on the data collected for the various locations near the Plant.

A theoretical TEDE is determined for a casual member of the public with an estimated residence time of 4 hours per year in areas near and around the Plant. The potentially maximum exposed member of the public is declared to be for a delivery driver at location E10 with residence time of 52 hours per year. The theoretical TEDE for those individuals is provided on **Table 9**. The calculations demonstrate that for each scenario, the public dose limit of 100 mrem/yr is not exceeded.



Effluent and Environmental Monitoring Report
2nd Half 2017
Lost Creek ISR Project SUA-1598

TABLES

Table 1a: Environmental - Radiological Air Particulate Data
2nd Half of 2017
Lost Creek ISR Project SUA-1598

Sample Location	Sample Period	Radio-nuclide	Conc.*	Error Estimate (Precision)	Lab MDC or RL	RG 4.14 LLD	ECL	% ECL**	Comments
			$\mu\text{Ci/mL}$	$\pm \mu\text{Ci/mL}$	$\mu\text{Ci/mL}$	$\mu\text{Ci/mL}$	$\mu\text{Ci/mL}$		
HV2	2017 Q3	U-nat	3.10E-15	---	1.00E-16	1.00E-16	9.00E-13	0.34%	
		Th-230	1.30E-16	5.20E-17	5.60E-17	1.00E-16	3.00E-14	0.43%	
		Ra-226	5.30E-16	3.40E-16	4.60E-16	1.00E-16	9.00E-13	0.06%	
		Pb-210	1.30E-14	4.60E-15	3.70E-15	2.00E-15	6.00E-13	2.17%	
	2017 Q4	U-nat	1.70E-15	---	1.00E-16	1.00E-16	9.00E-13	0.19%	
		Th-230	1.90E-16	6.80E-17	7.50E-17	1.00E-16	3.00E-14	0.63%	
		Ra-226	6.10E-16	3.00E-16	4.50E-16	1.00E-16	9.00E-13	0.07%	
		Pb-210	1.70E-14	5.90E-15	4.60E-15	2.00E-15	6.00E-13	2.83%	
HV3 (Background)	2017 Q3	U-nat	1.20E-16	---	1.00E-16	1.00E-16	9.00E-13	0.01%	
		Th-230	1.60E-16	6.60E-17	7.70E-17	1.00E-16	3.00E-14	0.53%	
		Ra-226	3.30E-16	8.20E-17	6.20E-17	1.00E-16	9.00E-13	0.04%	
		Pb-210	1.30E-14	4.80E-15	4.30E-15	2.00E-15	6.00E-13	2.17%	
	2017 Q4	U-nat	8.80E-17	---	1.00E-16	1.00E-16	9.00E-13	0.01%	
		Th-230	1.30E-16	5.80E-17	7.50E-17	1.00E-16	3.00E-14	0.43%	
		Ra-226	4.20E-16	1.00E-16	9.90E-17	1.00E-16	9.00E-13	0.05%	
		Pb-210	1.50E-14	5.10E-15	4.10E-15	2.00E-15	6.00E-13	2.50%	
HV4	2017 Q3	U-nat	1.00E-16	---	1.00E-16	1.00E-16	9.00E-13	0.01%	
		Th-230	1.40E-16	5.70E-17	6.90E-17	1.00E-16	3.00E-14	0.47%	
		Ra-226	3.20E-16	7.70E-17	5.50E-17	1.00E-16	9.00E-13	0.04%	
		Pb-210	8.60E-15	3.40E-15	3.60E-15	2.00E-15	6.00E-13	1.43%	
	2017 Q4	U-nat	6.70E-17	---	1.00E-16	1.00E-16	9.00E-13	0.01%	
		Th-230	6.70E-16	1.30E-16	1.50E-16	1.00E-16	3.00E-14	2.23%	
		Ra-226	3.50E-16	9.30E-17	8.50E-17	1.00E-16	9.00E-13	0.04%	
		Pb-210	1.60E-14	5.40E-15	3.60E-15	2.00E-15	6.00E-13	2.67%	
HV5	2017 Q3	U-nat	1.00E-16	---	1.00E-16	1.00E-16	9.00E-13	0.01%	
		Th-230	1.20E-16	4.70E-17	4.70E-17	1.00E-16	3.00E-14	0.40%	
		Ra-226	4.40E-16	9.70E-17	5.20E-17	1.00E-16	9.00E-13	0.05%	
		Pb-210	1.40E-14	4.70E-15	3.50E-15	2.00E-15	6.00E-13	2.33%	
	2017 Q4	U-nat	8.30E-17	---	1.00E-16	1.00E-16	9.00E-13	0.01%	
		Th-230	6.50E-16	1.20E-16	1.10E-16	1.00E-16	3.00E-14	2.17%	
		Ra-226	2.90E-16	7.70E-17	7.60E-17	1.00E-16	9.00E-13	0.03%	
		Pb-210	1.40E-14	4.80E-15	3.60E-15	2.00E-15	6.00E-13	2.33%	

* Background not subtracted

** The %ECL should be less than 20% to meet the 10 CFR 20.1101(d) ALARA constraint

MDC: Minimum detectable concentration

RL: Reporting Limit

LLD: Lower limit of detection RG 4.14

ECL: Effluent Concentration Limit (10 CFR 20 App B Table 2)

Table 1b: Uranium Air Particulate Data
2nd Half of 2017
Lost Creek ISR Project SUA-1598

Sample Location	Sample Period	Radio-nuclide	Alpha Concentration	Calculated LLD	RG 4.14 LLD	10CFR20 DAC	% DAC	Potential Dose (100% occupancy)	Comments
			$\mu\text{Ci}/\text{mL}$	$\mu\text{Ci}/\text{mL}$	$\mu\text{Ci}/\text{mL}$	$\mu\text{Ci}/\text{mL}$		$\mu\text{rem}/\text{qtr}$	
E10 (Max public)	2017 Q3	U-nat	3.06E-12	7.67E-13	1.00E-16	3.00E-10	1.0%	55.9	
	2017 Q4	U-nat	7.75E-14	6.44E-13	1.00E-16	3.00E-10	0.0%	1.4	
E11	2017 Q3	U-nat	8.12E-13	7.67E-13	1.00E-16	3.00E-10	0.3%	14.8	
	2017 Q4	U-nat	1.94E-13	6.44E-13	1.00E-16	3.00E-10	0.1%	3.5	
E12	2017 Q3	U-nat	2.58E-13	7.67E-13	1.00E-16	3.00E-10	0.1%	4.7	
	2017 Q4	U-nat	6.44E-13	6.44E-13	1.00E-16	3.00E-10	0.2%	11.7	
E13A	2017 Q3	U-nat	1.11E-13	7.67E-13	1.00E-16	3.00E-10	0.0%	2.0	
	2017 Q4	U-nat	6.44E-13	6.44E-13	1.00E-16	3.00E-10	0.2%	11.7	
E13B	2017 Q3	U-nat	5.50E-13	7.17E-13	1.00E-16	3.00E-10	0.2%	10.0	
	2017 Q4	U-nat	6.59E-13	6.44E-13	1.00E-16	3.00E-10	0.2%	12.0	
E13C	2017 Q3	U-nat	3.32E-13	7.67E-13	1.00E-16	3.00E-10	0.1%	6.1	
	2017 Q4	U-nat	1.94E-13	6.44E-13	1.00E-16	3.00E-10	0.1%	3.5	
E13D	2017 Q3	U-nat	3.67E-14	7.17E-13	1.00E-16	3.00E-10	0.0%	0.7	
	2017 Q4	U-nat	1.20E-12	6.44E-13	1.00E-16	3.00E-10	0.4%	21.9	
E13E	2017 Q3	U-nat	1.03E-11	7.67E-13	1.00E-16	3.00E-10	3.4%	187.2	
	2017 Q4	U-nat	3.49E-13	6.44E-13	1.00E-16	3.00E-10	0.1%	6.4	
E13F	2017 Q3	U-nat	2.25E-12	7.67E-13	1.00E-16	3.00E-10	0.8%	41.1	
	2017 Q4	U-nat	7.75E-13	6.44E-13	1.00E-16	3.00E-10	0.3%	14.1	
E13G	2017 Q3	U-nat	1.44E-12	7.67E-13	1.00E-16	3.00E-10	0.5%	26.3	
	2017 Q4	U-nat	6.44E-13	6.44E-13	1.00E-16	3.00E-10	0.2%	11.7	

ECL: Effluent Concentration Limit (10 CFR 20 App B Table 2)

LLD: Lower limit of detection RG 4.14

Table 2: Surface Water Sample Data
2nd Half 2017
Lost Creek ISR Project SUA-1598

Sample Location	Sample Date	Sample Type	Radio-nuclide	Measured Conc.	Error Estimate (Precision)	Lab MDC or RL	RG 4.14 LLD	Comments
				$\mu\text{Ci}/\text{mL}$	$+\text{- } \mu\text{Ci}/\text{mL}$	$\mu\text{Ci}/\text{mL}$	$\mu\text{Ci}/\text{mL}$	
LC2A	11/2/2017	Storm Water	U-nat, diss	8.34E-11		2.01E-10	2.00E-10	
			Ra-226, diss	5.90E-09	1.20E-09	2.00E-10	2.00E-10	
			Th-230	--	--	--	2.00E-10	Insufficient sample volume
			Pb-210	--	--	--	2.00E-10	Insufficient sample volume
			Po-210	--	--	--	2.00E-10	Insufficient sample volume
LC3	10/5/2017	Storm Water	U-nat, diss	9.38E-10	--	2.01E-10	2.00E-10	
			U-nat, susp	8.98E-09	--	2.01E-10	2.00E-10	
			Ra-226, diss	5.00E-10	2.00E-10	2.00E-10	2.00E-10	
			Ra-226, susp	4.10E-09	1.80E-09	1.90E-09	2.00E-10	
			Th-230	--	--	--	2.00E-10	Insufficient sample volume
			Pb-210	--	--	--	2.00E-10	Insufficient sample volume
LC14	11/2/2017	Storm Water	U-nat, diss	1.48E-11		2.01E-10	2.00E-10	
			Ra-226, diss	1.90E-09	5.00E-10	2.00E-10	2.00E-10	
			Th-230	--	--	--	2.00E-10	Insufficient sample volume
			Pb-210	--	--	--	2.00E-10	Insufficient sample volume
			Po-210	--	--	--	2.00E-10	Insufficient sample volume

RL: Reporting Limit

LLD: Lower Limit of Detection

Table 3: Groundwater Sample Data
2nd Half 2017
Lost Creek ISR Project SUA-1598

Sample Location	Sample Date	Radionuclide	Measured Conc.	Error Estimate (Precision)	Lab MDC or Reporting Limit (RL)	RG 4.14 LLD	ECL	% ECL	Comments
			$\mu\text{Ci/mL}$	$\pm \mu\text{Ci/mL}$	$\mu\text{Ci/mL}$	$\mu\text{Ci/mL}$	$\mu\text{Ci/mL}$		
BLM4451	8/7/2017	U-nat (diss)	5.54E-07	--	2.03E-10	2.00E-10	3.00E-07	185%	Not operating
		U-nat (susp)	1.33E-07	--	2.03E-10	2.00E-10	3.00E-07	44%	
		Ra-226 (diss)	5.10E-09	1.00E-09	2.00E-10	2.00E-10	6.00E-08	9%	
		Ra-226 (susp)	2.00E-10	2.00E-10	3.00E-10	2.00E-10	6.00E-08	0%	
		U-nat (diss)	--	--	--	2.00E-10	3.00E-07	--	
		U-nat (susp)	--	--	--	2.00E-10	3.00E-07	--	
		Ra-226 (diss)	--	--	--	2.00E-10	6.00E-08	--	
		Ra-226 (susp)	--	--	--	2.00E-10	6.00E-08	--	
BLM4775	8/7/2017	U-nat (diss)	1.90E-08	--	2.03E-10	2.00E-10	3.00E-07	6%	Not operating
		U-nat (susp)	4.47E-09	--	2.03E-10	2.00E-10	3.00E-07	1%	
		Ra-226 (diss)	1.50E-09	4.00E-10	2.00E-10	2.00E-10	6.00E-08	3%	
		Ra-226 (susp)	5.00E-10	2.00E-10	3.00E-10	2.00E-10	6.00E-08	1%	
		U-nat (diss)	--	--	--	2.00E-10	3.00E-07	--	
		U-nat (susp)	--	--	--	2.00E-10	3.00E-07	--	
		Ra-226 (diss)	--	--	--	2.00E-10	6.00E-08	--	
		Ra-226 (susp)	--	--	--	2.00E-10	6.00E-08	--	
BLM4777	2017Q3	U-nat (diss)	--	--	--	2.00E-10	3.00E-07	--	Not operating
		U-nat (susp)	--	--	--	2.00E-10	3.00E-07	--	
		Ra-226 (diss)	--	--	--	2.00E-10	6.00E-08	--	
		Ra-226 (susp)	--	--	--	2.00E-10	6.00E-08	--	
		U-nat (diss)	--	--	--	2.00E-10	3.00E-07	--	
		U-nat (susp)	--	--	--	2.00E-10	3.00E-07	--	
		Ra-226 (diss)	--	--	--	2.00E-10	6.00E-08	--	
		Ra-226 (susp)	--	--	--	2.00E-10	6.00E-08	--	
BLMEEN	2017Q3	U-nat (diss)	--	--	--	2.00E-10	3.00E-07	--	Not operating
		U-nat (susp)	--	--	--	2.00E-10	3.00E-07	--	
		Ra-226 (diss)	--	--	--	2.00E-10	6.00E-08	--	
		Ra-226 (susp)	--	--	--	2.00E-10	6.00E-08	--	
		U-nat (diss)	--	--	--	2.00E-10	3.00E-07	--	
		U-nat (susp)	--	--	--	2.00E-10	3.00E-07	--	
		Ra-226 (diss)	--	--	--	2.00E-10	6.00E-08	--	
		Ra-226 (susp)	--	--	--	2.00E-10	6.00E-08	--	

Italics: Indicates non-detect. Number represents detection limit

ECL: Effluent Concentration Limit from 10 CFR 20 Appendix B Table 2

Table 4: Effluent to Soil from Reportable Unplanned Releases
2nd Half 2017
Lost Creek ISR Project SUA-1598

Release ID	Release Date	Net Release Volume gal	Radio-nuclide	Net Conc.*	Units	Quantity	Comments		
						Ci			
HH1-6			U-nat	6.6	mg/kg	1.49E-02			
			Ra-226	15.0	pCi/g	4.99E-02			
HH1-10			U-nat	0	mg/kg	0.00E+00			
			Ra-226	3.6	pCi/g	6.37E-04			
TOTAL				U-nat		1.49E-02 Ci			
				Ra-226		5.05E-02 Ci			

*Background subtracted from analytical results

Table 5: Gamma Exposure Data
2nd Half 2017
Lost Creek ISR Project SUA-1598

Sample Location	Period	Method	Gross	Net*	Comments
			Exposure mrem/qtr	Exposure mrem/qtr	
PR-2 (HV3) (Background)	2017Q3	Dosimeter	60.1	0.0	
	2017Q4	Dosimeter	55.7	0.0	
PR-3 (HV5)	2017Q3	Dosimeter	59.6	0.0	
	2017Q4	Dosimeter	54.5	0.0	
PR-4	2017Q3	Dosimeter	68.1	8.0	
	2017Q4	Dosimeter	60.1	4.4	
PR-5/E13D (HV2)	2017Q3	Dosimeter	73.0	12.9	
	2017Q4	Dosimeter	63.3	7.6	
PR-9	2017Q3	Dosimeter	65.9	5.8	
	2017Q4	Dosimeter	66.3	10.6	
PR-10 (HV4)	2017Q1	Dosimeter	70.6	10.5	
PR-10 Dup	2017Q1	Dosimeter	76.2	16.1	
	RPD		8		
PR-10 (HV4)	2017Q2	Dosimeter	74.8	19.1	
PR-10 Dup	2017Q2	Dosimeter	72.8	17.1	
	RPD		3		
PR-2 (HV3) (Background)	2017Q3	Model 19	52.6	0.0	
	2017Q4	Model 19	52.6	0.0	
E10 (Max exposed public)	2017Q3	Model 19**	63.5	11.0	
	2017Q4	Model 19**	46.0	0.0	
E11	2017Q3	Model 19**	63.5	11.0	
	2017Q4	Model 19**	54.8	2.2	
E12	2017Q3	Model 19**	54.8	2.2	
	2017Q4	Model 19**	54.8	2.2	
E13A	2017Q3	Model 19**	54.8	2.2	
	2017Q4	Model 19**	48.2	0.0	
E13B	2017Q3	Model 19**	76.7	24.1	
	2017Q4	Model 19**	72.3	19.7	
E13C	2017Q3	Model 19**	54.8	2.2	
	2017Q4	Model 19**	54.8	2.2	
E13D (PR-5/HV2)	2017Q3	Model 19**	76.7	24.1	
	2017Q4	Model 19**	67.9	15.3	
E13E	2017Q3	Model 19**	67.9	15.3	
	2017Q4	Model 19**	72.3	19.7	
E13F	2017Q3	Model 19**	70.1	17.5	
	2017Q4	Model 19**	65.7	13.1	
E13G	2017Q3	Model 19**	59.1	6.6	
	2017Q4	Model 19**	54.8	2.2	

RPD: Relative Percent Difference

* Net exposure = gross minus background (PR-2)

** Measurements averaged for the quarter

Table 6a: Passive Radon (Rn-222) Data
2nd Half 2017
Lost Creek ISR Project SUA-1598

Sample Location	Period	Conc. μCi/mL	Net* Conc. μCi/mL	Error Estimate +/- μCi/mL	ECL† μCi/mL	% ECL	Comments
PR-2 (HV-3) (Background)	2017Q3	1.20E-09	0.00E+00	1.90E-10	1.00E-10	0%	
	2017Q4	1.50E-09	0.00E+00	2.20E-10	1.00E-10	0%	
PR-3 (HV-5)	2017Q3	1.00E-09	-2.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.00E-09	-5.00E-10	1.70E-10	1.00E-10	0%	
PR-4	2017Q3	1.00E-09	-2.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.40E-09	-1.00E-10	2.20E-10	1.00E-10	0%	
PR-5 (HV-2)/E-13D	2017Q3	9.70E-10	-2.30E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.00E-09	-5.00E-10	1.90E-10	1.00E-10	0%	
PR-6	2017Q3	4.70E-09	3.20E-09	6.00E-10	1.00E-10	3200%	Found on ground
	2017Q4	9.70E-10	-5.30E-10	1.70E-10	1.00E-10	0%	
PR-9	2017Q3	1.30E-09	1.00E-10	1.90E-10	1.00E-10	100%	
	2017Q4	1.60E-09	1.00E-10	2.50E-10	1.00E-10	100%	
PR-10 (HV-4)	2017Q3	1.40E-09	2.00E-10	2.20E-10	1.00E-10	200%	
PR-10 Dup	2017Q3	1.40E-09	2.00E-10	2.20E-10	1.00E-10	200%	
RPD	0						
PR-10 (HV-4)	2017Q4	1.60E-09	1.00E-10	2.50E-10	1.00E-10	100%	
PR-10 Dup	2017Q4	1.60E-09	1.00E-10	2.50E-10	1.00E-10	100%	
RPD	0						
PR-12	2017Q3	7.30E-09	6.10E-09	9.00E-10	1.00E-10	6100%	Found on ground
	2017Q4	1.50E-09	0.00E+00	2.20E-10	1.00E-10	0%	
E1 (Plant Indoor)	2017Q3	2.30E-09	1.10E-09	3.30E-10	1.00E-10	1100%	
	2017Q4	2.20E-09	7.00E-10	3.30E-10	1.00E-10	700%	
E7 (Header House)	2017Q3	1.02E-08	9.03E-09	1.50E-09	N/A	N/A	Average of 3 HH
	2017Q4	1.13E-08	9.78E-09	1.61E-09	N/A	N/A	Average of 4 HH
E8 (Injection Well)	2017Q3	2.18E-07	2.17E-07	1.10E-08	N/A	N/A	Average of 2 wells
	2017Q4	4.64E-08	4.49E-08	8.00E-09	N/A	N/A	Average of 2 wells
E9 (Production Well)	2017Q3	1.59E-07	1.58E-07	2.75E-10	N/A	N/A	Average of 2 wells
	2017Q4	6.79E-08	6.67E-08	1.34E-08	N/A	N/A	Average of 2 wells
E10 (Max exposed public)	2017Q3	1.10E-09	-1.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.20E-09	-3.00E-10	1.90E-10	1.00E-10	0%	
E11	2017Q3	1.10E-09	-1.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.30E-09	-2.00E-10	2.20E-10	1.00E-10	0%	
E12	2017Q3	8.60E-10	-3.40E-10	1.70E-10	1.00E-10	0%	
	2017Q4	8.60E-10	-6.40E-10	1.70E-10	1.00E-10	0%	
E13A	2017Q3	1.00E-09	-2.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.70E-09	2.00E-10	2.50E-10	1.00E-10	200%	
E13B	2017Q3	1.10E-09	-1.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.30E-09	-2.00E-10	2.20E-10	1.00E-10	0%	
E13C	2017Q3	1.20E-09	0.00E+00	1.90E-10	1.00E-10	0%	
	2017Q4	1.20E-09	-3.00E-10	1.90E-10	1.00E-10	0%	
E13E	2017Q3	1.10E-09	-1.00E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.30E-09	-2.00E-10	2.20E-10	1.00E-10	0%	
E13F	2017Q3	9.70E-10	-2.30E-10	1.70E-10	1.00E-10	0%	
	2017Q4	1.20E-09	-3.00E-10	1.90E-10	1.00E-10	0%	
E13G	2017Q3	1.30E-09	1.00E-10	1.90E-10	1.00E-10	100%	
	2017Q4	1.20E-09	-3.00E-10	1.90E-10	1.00E-10	0%	

* Net is conc. minus background (PR-2)

† Effluent Concentration Limit (ECL) from 10 CFR 20 Appendix B Table 2 (Rn-222)

Table 6b: Radon Progeny (Kusnetz) Data
2nd Half 2017
Lost Creek ISR Project SUA-1598

Sample ID	Period	Conc.	Conc.	Comments
		mWL	$\mu\text{Ci/mL}$	
E7	2017Q3	30.94	3.09E-09	Header house quarterly average
	2017Q4	26.05	2.61E-09	Header house quarterly average
E8	2017Q3	5.46	5.46E-10	Injection well quarterly average
	2017Q4	8.47	8.47E-10	Injection well quarterly average
E9	2017Q3	5.49	5.49E-10	Production well quarterly average
	2017Q4	8.35	8.35E-10	Production well quarterly average
E10 (max exposed public)	2017Q3	9.10	9.10E-10	
	2017Q4	3.74	3.74E-10	
E11	2017Q3	6.27	6.27E-10	
	2017Q4	4.13	4.13E-10	
E12	2017Q3	6.35	6.35E-10	
	2017Q4	2.33	2.33E-10	
E13A	2017Q3	12.67	1.27E-09	
	2017Q4	3.20	3.20E-10	
E13B	2017Q3	5.34	5.34E-10	
	2017Q4	7.67	7.67E-10	
E13C	2017Q3	9.37	9.37E-10	
	2017Q4	3.77	3.77E-10	
E13D	2017Q3	4.43	4.43E-10	
	2017Q4	2.98	2.98E-10	
E13E	2017Q3	18.81	1.88E-09	
	2017Q4	2.72	2.72E-10	
E13F	2017Q3	3.67	3.67E-10	
	2017Q4	2.77	2.77E-10	
E13G	2017Q3	17.16	1.72E-09	
	2017Q4	3.66	3.66E-10	

Table 7: Class V Injectate
2nd Half 2017
Lost Creek ISR Project SUA-1598

Sample ID	Sample Date	Radionuclide (dissolved)	Measured Conc.	Error Estimate (Precision)	Lab MDC or Reporting Limit	Discharge Volume	Radionuclide Quantity	Comments	
			pCi/L	+/- pCi/L	pCi/L	L	µCi		
Class V Comp	Jul 2017	Gross alpha, adj.	11.6	21.2	1.9	1.44E+06	1.66E+01		
		Gross beta	41.8	4.8	4.0	1.44E+06	6.00E+01		
		U-nat (mg/L)	0.141	--	0.0003	1.44E+06	2.02E-01		
		Ra-226	0.3	0.1	0.2	1.44E+06	4.31E-01		
		Ra-228	2.3	1.1	1.6	1.44E+06	3.30E+00		
		Pb-210	2.3	1	1.2	1.44E+06	3.30E+00		
		Po-210	0.3	0.6	0.9	1.44E+06	4.31E-01		
		Th-230	0.05	0.08	0.1	1.44E+06	7.18E-02		
Class V Comp	Aug 2017	Gross alpha, adj.	---	---	---	1.48E+06	0.00E+00		
		Gross beta	---	---	---	1.48E+06	0.00E+00		
		U-nat (mg/L)	---	---	---	1.48E+06	0.00E+00		
		Ra-226	---	---	---	1.48E+06	0.00E+00		
		Ra-228	---	---	---	1.48E+06	0.00E+00		
		Pb-210	---	---	---	1.48E+06	0.00E+00		
		Po-210	---	---	---	1.48E+06	0.00E+00		
		Th-230	---	---	---	1.48E+06	0.00E+00		
Class V Comp	Sep 2017	Gross alpha, adj.	---	---	---	0.00E+00	0.00E+00		
		Gross beta	---	---	---	0.00E+00	0.00E+00		
		U-nat (mg/L)	---	---	---	0.00E+00	0.00E+00		
		Ra-226	---	---	---	0.00E+00	0.00E+00		
		Ra-228	---	---	---	0.00E+00	0.00E+00		
		Pb-210	---	---	---	0.00E+00	0.00E+00		
		Po-210	---	---	---	0.00E+00	0.00E+00		
		Th-230	---	---	---	0.00E+00	0.00E+00		
Class V Comp	Oct 2017	Gross alpha, adj.	---	---	---	0.00E+00	0.00E+00		
		Gross beta	---	---	---	0.00E+00	0.00E+00		
		U-nat (mg/L)	---	---	---	0.00E+00	0.00E+00		
		Ra-226	---	---	---	0.00E+00	0.00E+00		
		Ra-228	---	---	---	0.00E+00	0.00E+00		
		Pb-210	---	---	---	0.00E+00	0.00E+00		
		Po-210	---	---	---	0.00E+00	0.00E+00		
		Th-230	---	---	---	0.00E+00	0.00E+00		
Class V Comp	Nov 2017	Gross alpha, adj.	---	---	---	0.00E+00	0.00E+00		
		Gross beta	---	---	---	0.00E+00	0.00E+00		
		U-nat (mg/L)	---	---	---	0.00E+00	0.00E+00		
		Ra-226	---	---	---	0.00E+00	0.00E+00		
		Ra-228	---	---	---	0.00E+00	0.00E+00		
		Pb-210	---	---	---	0.00E+00	0.00E+00		
		Po-210	---	---	---	0.00E+00	0.00E+00		
		Th-230	---	---	---	0.00E+00	0.00E+00		
Class V Comp	Dec 2017	Gross alpha, adj.	8.0	6.9	2	1.21E+06	9.65E+00		
		Gross beta	24.4	3.1	2.8	1.21E+06	2.94E+01		
		U-nat (mg/L)	0.037	--	0.0003	1.21E+06	4.43E-02		
		Ra-226	0.8	0.3	0.2	1.21E+06	9.65E-01		
		Ra-228	0.5	1.1	1.7	1.21E+06	6.03E-01		
		Pb-210	3.5	1.4	1.5	1.21E+06	4.22E+00		
		Po-210	0.1	0.4	0.9	1.21E+06	1.21E-01		
		Th-230	0.09	0.1	0.2	1.21E+06	1.09E-01		
TOTALS for 2017H2			Gross alpha, adj.			2.63E+01			
			Gross beta			8.94E+01			
			U-nat (mg/L)			2.47E-01			
			Ra-226			1.40E+00			
			Ra-228			3.90E+00			
			Pb-210			7.52E+00			
			Po-210			5.51E-01			
			Th-230			1.80E-01			

**Table 8: Effluent Quantity
2nd Half of 2017
Lost Creek ISR Project SUA-1598**

Sample Location	Sample Period	Radio-nuclide	Air Volume	Measured or Average Conc.	Quantity	Quantity	Comments
				mL/qtr			
E1 (Shop Vent)	2017 Q3	U-nat	1.83E+14	-1.87E-13	-3.43E+01	0.000	50000 cfm
		Rn-222	1.83E+14	1.10E-09	2.02E+05	0.202	
		Rn Prog.	1.83E+14	1.46E-09	2.68E+05	0.268	Kusnetz
	2017 Q4	U-nat	1.83E+14	6.20E-13	1.14E+02	0.000	50000 cfm
		Rn-222	1.83E+14	7.00E-10	1.28E+05	0.128	
		Rn Prog.	1.83E+14	1.26E-09	2.31E+05	0.231	Kusnetz
E2 (Precip. Tanks)	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	4.71E+10	5.44E-09	2.56E+02	0.000	
		Rn Prog.	---	---	2.56E+02	0.000	Assumed equil. w/ Rn-222
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	3.08E+10	2.03E-07	6.24E+03	0.006	
		Rn Prog.	---	---	6.24E+03	0.006	Assumed equil. w/ Rn-222
E3 (Eluate Tanks)	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	4.12E+10	5.46E-08	2.25E+03	0.002	
		Rn Prog.	---	---	2.25E+03	0.002	Assumed equil. w/ Rn-222
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	3.05E+10	2.71E-08	8.26E+02	0.001	
		Rn Prog.	---	---	8.26E+02	0.001	Assumed equil. w/ Rn-222
E4 (Waste Water Tanks)	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	5.87E+09	2.42E-06	1.42E+04	0.014	
		Rn Prog.	---	---	1.42E+04	0.014	Assumed equil. w/ Rn-222
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	3.48E+10	3.03E-06	1.05E+05	0.105	
		Rn Prog.	---	---	1.05E+05	0.105	Assumed equil. w/ Rn-222
E5 (Resin Water Tanks)	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	0.00E+00	1.01E-07	0.00E+00	0.000	
		Rn Prog.	---	---	0.00E+00	0.000	Assumed equil. w/ Rn-222
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	1.62E+11	8.54E-07	1.38E+05	0.138	
		Rn Prog.	---	---	1.38E+05	0.138	Assumed equil. w/ Rn-222
E6 (Shaker Deck)	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	6.74E+10	4.46E-08	3.00E+03	0.003	
		Rn Prog.	---	---	3.00E+03	0.003	Assumed equil. w/ Rn-222
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	8.57E+10	3.94E-07	3.38E+04	0.034	
		Rn Prog.	---	---	3.38E+04	0.034	Assumed equil. w/ Rn-222
E7 (Header House)	2017 Q3	U-nat	2.94E+12	1.42E-12	4.17E+00	0.000	800 cfm
		Rn-222	2.94E+12	9.03E-09	2.65E+04	0.027	
		Rn Prog.	2.94E+12	2.67E-09	7.85E+03	0.008	Kusnetz
	2017 Q4	U-nat	2.94E+12	1.28E-11	3.75E+01	0.000	800 cfm
		Rn-222	2.94E+12	9.78E-09	2.87E+04	0.029	
		Rn Prog.	2.94E+12	3.01E-09	8.84E+03	0.009	Kusnetz
E8 (Injection Well) 702 Injectors	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	1.83E+07	2.17E-07	2.79E+03	0.003	65 gal of air/day
		Rn Prog.	1.83E+07	2.97E-10	3.82E+00	0.000	Kusnetz
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	1.83E+07	4.49E-08	5.78E+02	0.001	65 gal of air/day
		Rn Prog.	1.83E+07	9.65E-10	1.24E+01	0.000	Kusnetz
E9 (Production Well) 339 Producers	2017 Q3	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	2.46E+05	1.58E-07	1.32E+01	0.000	65 gal of air
		Rn Prog.	2.46E+05	3.39E-10	2.83E-02	0.000	Kusnetz
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	Zero effluent
		Rn-222	2.46E+05	6.67E-08	5.56E+00	0.000	65 gal of air
		Rn Prog.	2.46E+05	7.62E-10	6.35E-02	0.000	Kusnetz

Table 8: Effluent Quantity
2nd Half of 2017
Lost Creek ISR Project SUA-1598

Sample Location	Sample Period	Radio-nuclide	Air Volume	Measured or Average Conc.		Quantity μCi	Quantity Ci	Comments	
				mL/qtr	$\mu\text{Ci}/mL$				
E14 (RO Tank)	2017 Q3	U-nat	N/A	N/A	N/A	N/A	N/A	Zero effluent	
		Rn-222	1.11E+11	4.89E-09	5.42E+02	0.001	0.001	Assumed equil. w/ Rn-222	
	2017 Q4	Rn Prog.	---	---	5.42E+02	0.001	0.001	Zero effluent	
		U-nat	N/A	N/A	N/A	N/A	N/A	Assumed equil. w/ Rn-222	
		Rn-222	1.14E+11	6.20E-07	7.06E+04	0.071	0.071	Zero effluent	
E15 (Perm Tank)	2017 Q3	Rn Prog.	---	---	7.06E+04	0.071	0.071	Assumed equil. w/ Rn-222	
		U-nat	N/A	N/A	N/A	N/A	N/A	Zero effluent	
	2017 Q4	Rn-222	1.02E+10	2.94E-08	2.98E+02	0.000	0.000	Assumed equil. w/ Rn-222	
		Rn Prog.	---	---	2.98E+02	0.000	0.000	Zero effluent	
		U-nat	N/A	N/A	N/A	N/A	N/A	Assumed equil. w/ Rn-222	
E16 (Class V Tank)	2017 Q3	Rn-222	3.05E+10	1.08E-05	3.28E+05	0.328	0.328	Zero effluent	
		Rn Prog.	---	---	3.28E+05	0.328	0.328	Assumed equil. w/ Rn-222	
	2017 Q4	U-nat	N/A	N/A	N/A	N/A	N/A	Zero effluent	
		Rn-222	2.25E+10	3.21E-05	7.22E+05	0.722	0.722	Assumed equil. w/ Rn-222	
		Rn Prog.	---	---	7.22E+05	0.722	0.722	Zero effluent	
TOTAL				U-nat		0.0 Ci			
				Rn-222		2.0 Ci			
				Rn Prog.		2.1 Ci			

Table 9: Theoretical TEDE for Members of the Public Near the Plant
2nd Half 2017
Lost Creek ISR Project SUA-1598

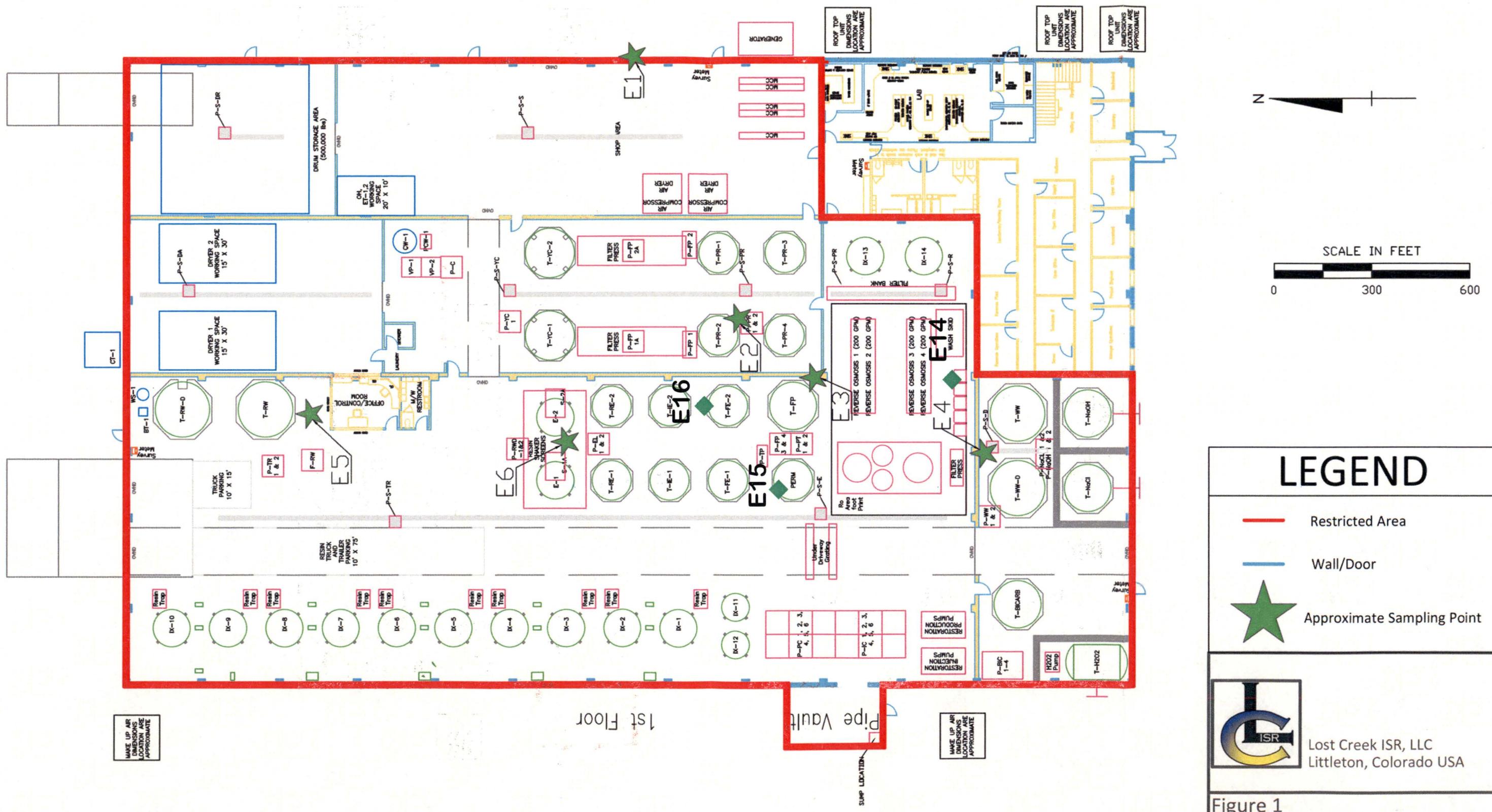
Sample Location	Period	Radon Dose	Radon Progeny Dose	Gamma Dose Rate	Unat Dose	Theoretical Quarterly Dose (100% Occupancy)	Theoretical Public TEDE* (4hr Occupancy)	Theoretical TEDE* of Max Exposed Public (52hr Occupancy)	Comments
		mrem/qtr	mrem/qtr	mrem/qtr	mrem/qtr	mrem/qtr	mrem/yr	mrem/yr	
E10 (Max exposed public)	2017Q3	0.0	151.0	11.0	55.9	217.8	0.26	3.3	
	2017Q4	0.0	62.1	0.0	1.4	63.5			
E11	2017Q3	0.0	5.4	11.0	14.8	31.2	0.04	---	
	2017Q4	0.0	3.6	2.2	3.5	9.3			
E12	2017Q3	0.0	5.5	2.2	4.7	12.4	0.03	---	
	2017Q4	0.0	2.0	2.2	11.7	16.0			
E13A	2017Q3	0.0	11.0	2.2	2.0	15.2	0.20	---	
	2017Q4	190.3	2.8	0.0	11.7	204.8			
E13B	2017Q3	0.0	4.6	24.1	10.0	38.8	0.07	---	
	2017Q4	0.0	6.6	19.7	12.0	38.4			
E13C	2017Q3	0.0	8.1	2.2	6.1	16.4	0.02	---	
	2017Q4	0.0	3.3	2.2	3.5	9.0			
E13D	2017Q3	0.0	3.8	24.1	0.7	28.6	0.06	---	
	2017Q4	0.0	2.6	15.3	21.9	39.8			
E13E	2017Q3	0.0	16.3	15.3	187.2	218.8	0.23	---	
	2017Q4	0.0	2.3	19.7	6.4	28.4			
E13F	2017Q3	0.0	3.2	17.5	41.1	61.8	0.08	---	
	2017Q4	0.0	2.4	13.1	14.1	29.7			
E13G	2017Q3	95.1	14.8	6.6	26.3	142.8	0.15	---	
	2017Q4	0.0	3.2	2.2	11.7	17.1			

*Projected from the half-year dose rate



Effluent and Environmental Monitoring Report
2nd Half 2017
Lost Creek ISR Project SUA-1598

FIGURES



LEGEND

Restricted Area

Wall/Door



Lost Creek ISR, LLC
Littleton, Colorado USA

Figure 1
Lost Creek Plant Monitoring
for Compliance with 10CFR40.65

Scale: 1:300

Drawn By: JHC

Issued / Revised: 01-15-2015

Drawing Name: Lost Creek Plant Sampling Points DWG

File Path: S:\GIS\Lost Creek\Plant\



LEGEND

ACCESS ROAD



Approximate Sampling Point



Lost Creek ISR, LLC
Littleton, Colorado USA

Figure 2 Monitoring Plan to Demonstrate Compliance with LC 12.10B

Scale: 1:300

Drawn By: JHC

Issued / Revised: 01-16-2015

Drawing Name: External Monitoring Sites.dwg

File Path: S:/GIS/LostCreek/Monitoring Sites

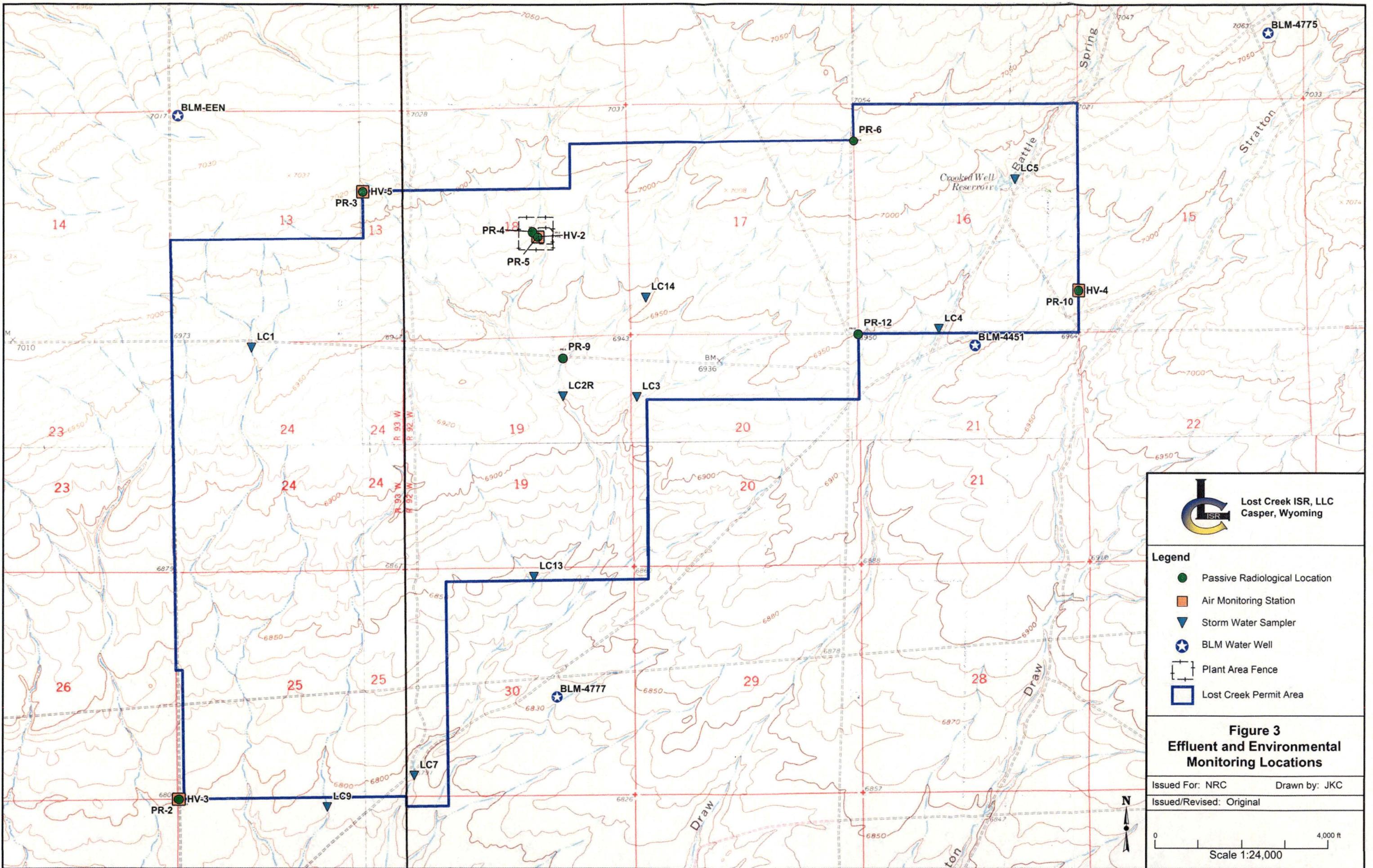


Table 6a: Passive Radon (Rn-222) Data
1st Half 2017
Lost Creek ISR Project SUA-1598

Sample Location	Period	Deploy Days	Gross Conc.	Error Estimate	Daily Conc.	Net* Daily Conc.	ECL†	% ECL	Comments
			µCi/mL-qtr	+/-. µCi/mL-qtr	µCi/mL	µCi/mL	µCi/mL	µCi/mL	
PR-1 (HV1)	2017Q1	89	5.90E-08	9.00E-09	6.63E-10	-1.10E-09	1.00E-10	-1103%	
	2017Q2	---	---	---	---	---	---	---	Discontinued monitoring site
PR-2 (HV-3) (Background)	2017Q1	81	1.43E-07	2.00E-08	1.77E-09	0.00E+00	1.00E-10	0%	
	2017Q2	93	7.10E-08	1.40E-08	7.63E-10	0.00E+00	1.00E-10	0%	
PR-3 (HV-5)	2017Q1	84	9.70E-08	1.40E-08	1.15E-09	-6.11E-10	1.00E-10	-611%	
	2017Q2	93	6.10E-08	1.10E-08	6.56E-10	-1.08E-10	1.00E-10	-108%	
PR-4	2017Q1	82	9.30E-08	1.40E-08	1.13E-09	-6.31E-10	1.00E-10	-631%	
	2017Q2	92	5.90E-08	1.10E-08	6.41E-10	-1.22E-10	1.00E-10	-122%	
PR-5 (HV-2)/E-13D	2017Q1	82	8.30E-08	1.10E-08	1.01E-09	-7.53E-10	1.00E-10	-753%	
	2017Q2	92	6.80E-08	1.40E-08	7.39E-10	-2.43E-11	1.00E-10	-24%	
PR-6	2017Q1	---	---	---	---	1.00E-10	---	---	Missing
	2017Q2	94	4.1E-08	1.1E-08	4.4E-10	-3.27E-10	1.00E-10	-327%	Found on ground
PR-7	2017Q1	84	8.90E-08	1.40E-08	1.06E-09	-7.06E-10	1.00E-10	-706%	
	2017Q2	93	6.50E-08	1.40E-08	6.99E-10	-6.45E-11	1.00E-10	-65%	
PR-8	2017Q1	84	1.71E-07	2.30E-08	2.04E-09	2.70E-10	1.00E-10	270%	
	2017Q2	93	6.66E-07	8.30E-08	7.16E-09	6.40E-09	1.00E-10	6398%	Found on ground
PR-9	2017Q1	82	1.22E-07	1.60E-08	1.49E-09	-2.78E-10	1.00E-10	-278%	
	2017Q2	92	6.80E-08	1.40E-08	7.39E-10	-2.43E-11	1.00E-10	-24%	
PR-10 (HV-4)	2017Q1	89	1.06E-07	1.60E-08	1.19E-09	-5.74E-10	1.00E-10	-574%	
PR-10 Dup	2017Q1	89	1.32E-07	1.80E-08	1.48E-09	7.20E-10	1.00E-10	720%	
RPD		22							
PR-10 (HV-4)	2017Q2	93	8.80E-08	1.60E-08	9.46E-10	-8.19E-10	1.00E-10	-819%	
PR-10 Dup	2017Q2	93	8.40E-08	1.40E-08	9.03E-10	1.40E-10	1.00E-10	140%	
RPD		5							
PR-11	2017Q1	84	1.11E-07	1.60E-08	1.32E-09	-4.44E-10	1.00E-10	-444%	
	2017Q2	93	7.50E-08	1.40E-08	8.06E-10	4.30E-11	1.00E-10	43%	
PR-12	2017Q1	84	9.00E-08	1.40E-08	1.07E-09	-6.94E-10	1.00E-10	-694%	
	2017Q2	93	2.05E-07	2.90E-08	2.20E-09	1.44E-09	1.00E-10	1441%	Found on ground
E1 (Plant Effluent)	2017Q1	89	3.23E-07	4.10E-08	3.63E-09	1.86E-09	1.00E-10	1864%	
	2017Q2	93	1.80E-07	2.50E-08	1.94E-09	1.17E-09	1.00E-10	1172%	
E7 (Header House)	2017Q1	82	5.07E-07	6.10E-08	6.18E-09	4.42E-09	N/A	N/A	HH1-7
	2017Q2	93	5.34E-07	6.80E-08	5.74E-09	4.98E-09	N/A	N/A	HH1-3
	2017Q2	93	2.15E-06	3.87E-07	2.31E-08	2.23E-08	N/A	N/A	HH1-9
E8 (Injection Well)	2017Q1	82	2.47E-05	4.94E-06	3.01E-07	2.99E-07	N/A	N/A	1I266
	2017Q1	89	2.82E-05	unk	3.16E-07	3.15E-07	N/A	N/A	1I501
	2017Q2	70	2.77E-05	5.55E-06	3.96E-07	3.95E-07	N/A	N/A	1I119
	2017Q2	71	2.77E-05	5.54E-06	3.90E-07	3.89E-07	N/A	N/A	1I373
E9 (Production Well)	2017Q1	82	2.82E-05	unk	3.43E-07	3.42E-07	N/A	N/A	1P135
	2017Q1	89	2.82E-05	unk	3.16E-07	3.15E-07	N/A	N/A	1P339
	2017Q2	70	2.82E-05	unk	4.02E-07	4.01E-07	N/A	N/A	1P195

Table 6a: Passive Radon (Rn-222) Data
1st Half 2017
Lost Creek ISR Project SUA-1598

Sample Location	Period	Deploy Days	Gross	Error	Daily	Net*	Daily	ECL†	% ECL	Comments
			Conc. μCi/mL-qtr	Estimate +/- μCi/mL-qtr	Conc. μCi/mL	Conc. μCi/mL	Conc. μCi/mL	Conc. μCi/mL		
E10 (Max exposed public)	2016Q3	84	8.80E-08	1.40E-08	1.05E-09	-7.18E-10	1.00E-10	-718%		
	2016Q4	93	5.40E-08	1.10E-08	5.81E-10	-1.83E-10	1.00E-10	-183%		
E11	2016Q3	84	1.04E-07	1.60E-08	1.24E-09	-5.27E-10	1.00E-10	-527%		
	2016Q4	93	6.10E-08	1.10E-08	6.56E-10	-1.08E-10	1.00E-10	-108%		
E12	2016Q3	84	8.10E-08	1.10E-08	9.64E-10	-8.01E-10	1.00E-10	-801%		
	2016Q4	93	4.80E-08	1.10E-08	5.16E-10	-2.47E-10	1.00E-10	-247%		
E13A	2016Q3	82	1.06E-07	1.60E-08	1.29E-09	-4.73E-10	1.00E-10	-473%		
	2016Q4	92	7.00E-08	1.40E-08	7.61E-10	-2.57E-12	1.00E-10	-3%		
E13B	2016Q3	84	8.10E-08	1.40E-08	9.64E-10	-8.01E-10	1.00E-10	-801%		
	2016Q4	93	5.40E-08	1.10E-08	5.81E-10	-1.83E-10	1.00E-10	-183%		
E13C	2016Q3	84	1.04E-07	1.60E-08	1.24E-09	-5.27E-10	1.00E-10	-527%		
	2016Q4	93	6.10E-08	1.10E-08	6.56E-10	-1.08E-10	1.00E-10	-108%		
E13E	2016Q3	82	9.90E-08	1.40E-08	1.21E-09	-5.58E-10	1.00E-10	-558%		
	2016Q4	92	6.40E-08	1.10E-08	6.96E-10	-6.78E-11	1.00E-10	-68%		
E13F	2016Q3	82	9.70E-08	1.40E-08	1.18E-09	-5.83E-10	1.00E-10	-583%		
	2016Q4	92	7.10E-08	1.40E-08	7.72E-10	8.30E-12	1.00E-10	8%		
E13G	2016Q3	82	1.04E-07	1.60E-08	1.27E-09	-4.97E-10	1.00E-10	-497%		
	2016Q4	92	5.90E-08	1.10E-08	6.41E-10	-1.22E-10	1.00E-10	-122%		

* Net is daily conc. minus background (PR-2)

† Effluent Concentration Limit (ECL) from 10 CFR 20 Appendix B Table 2 (Rn-222)

Note: Required LLD is 1E-10 uCi/mL (RG 4.14). LLD of Rapidos detector is 1.08E-10 uCi/mL

unk: Unknown - Result beyond track-etch threshold for error determination