Linton, Ron

From: Scott Schierman (USA - Casper) <Scott.Schierman@uranium1.com>
Sent: Friday, September 28, 2018 7:03 PM
To: Linton, Ron
Cc: Poston-Brown, Martha
Subject: [External_Sender] Corrected Semi-Annual Effluent Report for 2nd Half 2017
Attachments: WC 2nd Half semiannual report Corrected March 2017 final 9.298.18.pdf

Ron

Please find the corrected 2nd Half of 2017 effluent report for Willow Creek.

Regards,

Scott Schierman |**HSE Manager/RSO**
Uranium One Americas, Inc. (U1 Americas)
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September 28, 2018

Mr. Ron Linton, Project Manager
Office of Nuclear Material Safety and Safeguards
MS T-88F5, 11545 Rockville Pike
Rockville, MD 20852-2738

Subject: License SUA-1314
Docket No. 040-08502
Willow Creek Project
Semi-Annual Effluent and
Environmental Monitoring Report

Dear Mr. Linton:

Uranium One has revised its semi-annual report submitted on March 9, 2018 for the reporting period of July 1, 2017 through December 31, 2017 to correct data submittal errors for the Public Dose calculations and YC stack sampling emissions.

Please contact me should you have any questions regarding this report.

Sincerely,

Scott Schierman
RSO

Uranium One USA. Inc.
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Casper, Wyoming 82601
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March 9, 2018

U.S. Nuclear Regulatory Commission
Ms. Andrea Kock, Deputy Director
Decommissioning & Uranium Recovery Licensing Directorate
Division of Waste Management & Environmental Protection
Office of Federal and State Materials &
Environmental Management Programs
11545 Rockville Pike
Rockville, MD 20852-2738

Subject: License SUA-1314
Docket No. 040-08502
Willow Creek Project
Semi-Annual Effluent and
Environmental Monitoring Report

Dear Ms. Kock:

In accordance with 10 CFR 40.65 and per license conditions 12.1 and 12.3 of Source Materials License SUA-1341, please find enclosed the Semi-Annual Effluent and Environmental Monitoring Report for the period of July 1 through December 31, 2017. Additionally, the annual land use survey report is included within this report.

Please contact me should you have any questions regarding this report.

Sincerely,

Scott Schierman
RSO

cc: Document Control NRC
R.Kukura
G. Kruse

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March 9, 2018

Attn: Document Control Desk Director
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Rockville, MD 20852-2738

Rockville, MD 20852-2738

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Please contact me should you have any questions regarding this report.

Sincerely,

Scott Schierman
RSO

cc: Andrea Kock NRC
R.Kukura U1
G. Kruse U1

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Willow Creek ISR Project
License Number SUA-1341
Docket No.040-08502

Semi-Annual Report

July 01, 2017 through December 31, 2017

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1.0 INTRODUCTION

In accordance with Sections 12.1 and 12.3 of the Nuclear Regulatory Commission (NRC) Source License No. SUA-1341, Uranium One USA, Inc. hereby submits the 2016 Semi-Annual Effluent and Monitoring Report. This document summarizes the required operational and environmental monitoring activities conducted at the Irigaray (IR) and Christensen Ranch (CR) projects from July 1, 2017 through December 31, 2017.

2.0 OPERATIONAL MONITORING

2.1 Activities Summary

The operational plan forward for 2018 involves the cessation of injection in the operating wellfields with limited production and sustaining a recovery bleed sufficient to maintain a cone of depression towards the wellfields. Maintenance activates includes the 5-year mechanical integrity testing (MIT) of well casings in Mine Unit 7, 8 and 10 (as per regulatory requirements), replacement of flow meters and electronics where necessary in all wellfield module buildings. This work continues to allow for limited wellfield production during 2018.

2.2 Excursion Well Status

Zero wells were on excursion status during the reporting period from July 1, 2017 to December 31, 2017.

2.3 Groundwater Volumes Injected and Recovered

During this reporting period, an overall average wellfield bleed of 4.5% was maintained. A total of 588,763,039 gallons were injected and 616,467,409 gallons were recovered during this period. This data is summarized in Appendix A Table 1 of this report.

2.4 Injection Manifold Pressures

Injection manifold pressures at the CR project are limited to 140 psi during wellfield operations and 168 psi during maintenance tasks, as per License Condition 11.1. Injection manifold pressures are continuously logged by pressure chart recorders located in every wellfield module building. The data from these logs are summarized in Table 2 of Appendix A. During the second half of 2017, the injection pressures in the wellfields exceeded the 140 psi limit on 17 instances. These exceedances were attributed to unexpected shutdowns of other module buildings, which are located in the same wellfield, due to power loss or outages. These psi spikes typically are instantaneous and returns to normal pressures below 140 psi in a matter of seconds.

2.5 Summary of Mechanical Integrity Testing (MIT)

During the report period, Mechanical Integrity Tests (MIT's) were completed on a total of 319 wells. The MIT's were completed using the "Two Packer Pressurized Test Method" approved in Permit No. 478. Of the total 319 MIT's that were performed, there were 3 failures.

The MIT's were completed in the following areas:

Location	Number MIT's	Number Failures
Mine Unit 8	63	0
Mine Unit 10	469	3

Uranium One has plugged 1 of the 3 identified wells that failed MIT in Mine Units 10. The remaining wells were converted to a recovery well or are scheduled for plugging and abandonment.

3.0 Restoration

3.1 Christensen Ranch:

All groundwater restoration activities, including stabilization monitoring, ended at Christensen Ranch Mine Units 2 through 6 on May 30, 2005. The results of all wellfield restoration were compiled into a report and submitted to the WDEQ and NRC on April 8, 2008. On October 23, 2012 in NRC's technical Evaluation Report (TER) listed their basis for denying restoration completeness. Uranium One submitted responses to the October 23, 2012 NRC comments regarding Christensen Mine Unit 2-6 restoration on September 11, 2015. NRC is currently reviewing the September 11, 2015 response package.

3.2 Irigaray:

Irigaray groundwater restoration activities and stabilization monitoring were conducted from 1990 to 2002. The "Wellfield Restoration Report Irigaray Mine" was submitted to the WDEQ in July of 2004. The WDEQ-LQD approved restoration of Irigaray Mine Units 1-9 via correspondence dated November 1, 2005. After an independent review, Irigaray restoration approval was received from the NRC in correspondence dated September 20, 2006. The Final Decommissioning Report for Irigaray Mine Units 1-9 was submitted to the NRC on August 7, 2015. Confirmation sampling related to the August 7, 2015 Final Decommissioning Report was performed by ORISE under NRC direction during the July 26-28, 2016 site inspection. Uranium One based on ORISE comments conducted a new gamma survey of the Irigaray Mine Unit 1-9 grids and collected additional verification soil samples from the highest 10% grids as specified in the approved reclamation plan. In October 2017 NRC made a visit to observe grid radiological surveys and conduct spilt verification sampling from a portion of the grids sampled.

4.0 ENVIRONMENTAL MONITORING

4.1 Regional Ranch Wells

Five stock watering and domestic water wells are located within two kilometers of Christensen Ranch mining area, and one is located near Irigaray. Routine quarterly groundwater samples were collected from these six regional ranch wells. The samples were analyzed for Uranium, Thorium-230, Radium-226, Lead-210 and Polonium-210 for both suspended and dissolved parameters. All parameters are in line with historical data presented in Table 5.23 of the SUA-1341 License Renewal Application. Sampling was consistent with the requirements of License Condition 11.3 and Section 5.8 of the License Renewal Application. This data is summarized in Table 3 of Appendix A.

4.2 Surface Water Monitoring

During the reporting period Surface Water samples were collected across the Willow Creek Project. Willow Creek is the only source of surface water present within and adjacent to the permit boundaries of both the IR and CR projects. Willow Creek is an ephemeral stream which was sampled on a quarterly basis. Three sample locations are designated at both project sites; upstream, downstream and within the permit boundary.

The Powder River is also sampled annually at the Brubaker Ranch, which is approximately 4.5 miles downstream from its confluence with Willow Creek. Sample location IR-9 is located where Willow Creek meets up with the Powder River.

During the sampling period all surface water locations that are sampled quarterly were below the 10 CFR Appendix B Table 2 Effluent Concentrations.

The surface water sampling for the second half 2017 is summarized in Table 4 of Appendix A.

4.3 Summary of Spills

There was one reportable spill during the reporting period. Emails, written notifications, and summary reports were submitted to the NRC and WDEQ regarding these events and will not be duplicated in this report.

4.4 Soil Sampling

Annual soil sampling at the Willow Creek environmental locations occurred during the previous reporting period. The samples were taken from 5 locations at the Irigaray Project and 4 locations from the Christensen Project. Sampling locations coincide with air particulate stations and radon stations. The soil was analyzed for uranium, radium-226, lead-210, and thorium.

4.5 Vegetation Sampling

Annual vegetation sampling at the Willow Creek environmental locations occurred during the previous reporting period of January 01, 2017 through June 30, 2017. The samples were taken from 5 location at the Irigaray project and 4 locations at the Christensen Project. Uranium One. Comparing the vegetation results to historical averages as are presented in Table 5.15 of the SUA 1341 License Renewal Application no upward trends were noted and all samples were within natural variances of the historical averages.

5.0 AIR MONITORING

5.1 Dryer Stack Emissions

One semi-annual Dryer Stack Emission test was performed during the report period. A summary of the yellowcake dryer stack emissions for 2017 are provided in Table 7 of Appendix A, along with graphs showing historical trends.

Environmental Airborne Radionuclides

During dryer operations, continuous airborne radionuclide sampling is required at the five specified environmental air sampling locations at the IR project. The yellowcake dryer was in operation during the third and fourth quarters of 2017. The stations used to monitor airborne radionuclides and are located as follows:

- IR-1 Downwind of Restricted Area
- IR-3 Upwind of Restricted Area
- IR-5 is located at Brubaker Ranch
- IR-6 is the background location

- IR-13 is the employee house trailer and is considered the maximally exposed individual.

Air Particulate samples are collected weekly and then composited quarterly for analysis by an outside laboratory.

Environmental Radon Monitoring

Radon gas is monitored continuously at the six environmental air locations surrounding the Irigaray Project, and five locations surrounding the Christensen Ranch Project. Passive outdoor radon detectors are exchanged quarterly and sent to Landauer for analysis. The data is shown in Table 8 of Appendix A. Data is given as raw data without subtracting the background location. Comparing the data to historical data presented in 5.11 and 5.12 of the SUA 1341 License Renewal Application the data is all below or within historical values.

5.2 Environmental Gamma Radiation Monitoring

Passive gamma radiation is monitored continuously at six environmental air locations surrounding the Irigaray Project and at five locations surrounding the Christensen Ranch Project. Dosimeters are exchanged and analyzed quarterly by the Landauer Dosimetry Services, a NVLP accredited company. A summary of the data is presented in Table 9 of Appendix A. The data seems to be consistent with values presented in Tables 5.19 and 5.20 of the SUA-1341 License Renewal Application.

5.3 Effluent Released from Willow Creek Activities

As part of the 10 CFR 40.65 effluent monitoring requirements the licensee must specify the quantity of each of the principle radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous six months. Additionally we are required under License Condition 11.3 to quantify the principal radionuclides from all point and diffuse sources. Under this license condition methods for estimating quantity of radionuclides emitted from a facility need to be verified by NRC before implementation. Once verification is achieved by the NRC these estimations will be made and reported under this section of the report.

6.0 PUBLIC DOSE

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

Additionally, 10 CFR 20.1302 requires licensees to show compliance to these dose limits by:

1. Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit or
2. Demonstrate

1. The annual average concentration of radioactive material released in gaseous and liquid effluent at the boundary of the unrestricted area do not exceed the values specified in table 2 of appendix B
2. If an individual were continuously present in an unrestricted area, the dose from the external sources would not exceed 0.002 rem (0.02 mSv) in an hour and 0.05 rem (0.5 mSv) in a year.

Uranium One will demonstrate compliance to the public dose requirements by performing a dose assessment for the individual predicted to be the maximally exposed individual. Uranium One predicts that the highest exposed individual would be operators staying in the man camps off shift. Operators working at Uranium One typically work four shifts of 12 hours and on four shifts off. This equates to a conservative three nights per week spent in workforce housing. For the year this equates to a total of 1872 hours spent in workforce housing.

Dose to individuals at the workforce housing are monitored using Closed alpha-track high sensitivity detector, OSL environmental dosimeters, and airborne particulate sampling. The concentration is equated to dose using the following equation.

$$D = DCF \sum_{i} C_i F_i T_i$$

Where

D = annual dose (mrem/yr);
DCF =dose conversion factor
C_i = annual average concentration at the receptor location i;
F_i = equilibrium factors for receptor location I used for radon; and
Ti = occupancy time factor (fraction of year) for receptor location i

Dose conversion factors are established by taking effluent concentration limits in 10 CFR 20 Appendix B, Table 2, and using the annual dose limit of 100mrem/yr. Taking the annual dose limit and dividing by the effluent concentration limit will provide the dose conversion factor. Dose conversion factors for radon will be calculated using the daughters present with the 100% equilibrium.

External gamma radiation will be determined through the use of Landauer environmental dosimeters. A dosimeter will be placed at each maximally exposed individual location. Dose will be assigned to each receptor.

The calculated dose to the highest member of the public for 2017 is shown on page 4 of Table 10 in Appendix A of this report. The highest public dose for 2017 is calculated at 29.17 mrem for the off-shift Irigaray operators and 13.78 mrem for the off-shift Christensen satellite and wellfield operators.

7.0 SAFETY AND ENVIRONMENTAL EVAULATIONS

Per License Condition 9.4E Uranium One shall furnish, in an annual report to the NRC, a description of such changes, tests, or experiments, including a summary of the evaluations

made by the safety and environmental evaluation panel (SERP). Uranium One completed no SERP during the 2nd half 2017 reporting period.

8.0 Other

8.1 ALARA REVIEW

As required by License condition 12.3 the licensee shall submit the results of the annual review of the radiation protection program content and implementation performed in accordance with 10CFR20.1101(c). ALARA audit was submitted with the January to June, 2017 semi-annual effluent.

8.2 Land Use Survey

The primary use of surrounding lands at both IR and CR project continues to be rural sheep and cattle ranching. Livestock actively graze these lands, but fencing prevents access to the evaporation ponds, plant sites, and wellfields.

The secondary use of surrounding lands continues to be petroleum production from wells dispersed throughout the region. The closest oil well at the CR project is located approximately one third of a mile west of the CR plant. The closest oil wells at the IR site are located approximately one half mile east of proposed MU 9 wellfield.

Over the past several years (2001-2017) some additional interest has developed in the immediate areas of the IR and CR projects in the development of coal bed methane (CBM) gas. Several CBM wells are located within a half mile of Uranium facilities.

The nearest residence to the IR site is 4 miles to the north (the Brubaker Ranch) and the nearest residence to CR is the John Christensen Ranch located 3 miles southeast of the CR plant site. Both are ranch housing with a population of six or less.

Land use surveys are conducted on an annual basis to verify the use of surrounding lands is consistent with previous assessments. These assessments are used in determining survey locations and which individuals may be potentially affected by Uranium One's activities.

There were no new wells permits applied for through the State Engineers Office during 2017 within two kilometers of the Willow Creek permit boundary. A copy of the land use survey for water rights table is included in Appendix B Land Use survey. Additionally a map is provided that is updated annually that shows the oil and gas activities around the site.

8.3 Daily Walk Through Inspections

Daily walk through inspections are done at the Willow Creek central processing and satellite plant as per license condition 11.5 to determine that radiation control practices are being implemented appropriately. A summary of these inspections are in Appendix A Table 11.

During the second half of 2017 at the Irigaray central processing plant when no personnel were on site during the weekends or holidays all doors and gates were locked and secured.

APPENDIX A

Tables 1-12

MU 5-2 Monthly Totals Date	Production (gallons)	Injection (gallons)	Bleed (gallons)	% Bleed
July 2017	187,200	0	187,200	100.0 %
August 2017	374,400	0	374,400	100.0 %
September 2017	316,320	0	316,320	100.0 %
October 2017	322,560	0	322,560	100.0 %
November 2017	401,520	0	401,520	100.0 %
December 2017	322,560	0	322,560	100.0 %
Totals	**1,924,560**	**0**	**1,924,560**	**100.0 %**

MU 7 Monthly Totals Date	Production (gallons)	Injection (gallons)	Bleed (gallons)	% Bleed
July 2017	1,383,936	0	1,383,936	100.0 %
August 2017	565,792	0	565,792	100.0 %
September 2017	7,613,996	6,808,656	805,340	10.6 %
October 2017	13,554,319	13,198,344	355,975	2.6 %
November 2017	21,925,257	20,820,993	1,104,264	5.0 %
December 2017	17,467,613	16,745,536	722,077	4.1 %
Totals	**62,510,913**	**57,573,529**	**4,937,384**	**7.9 %**

MU 8 Monthly Totals Date	Production (gallons)	Injection (gallons)	Bleed (gallons)	% Bleed
July 2017	37,182,028	35,954,765	1,227,263	3.3 %
August 2017	39,765,048	37,679,619	2,085,429	5.2 %
September 2017	34,087,525	32,994,229	1,093,296	3.2 %
October 2017	32,412,717	30,786,798	1,625,919	5.0 %
November 2017	38,521,578	36,847,773	1,673,805	4.3 %
December 2017	30,538,775	29,250,965	1,287,810	4.2 %
Totals	**212,507,671**	**203,514,149**	**8,993,522**	**4.2 %**

MU 10 Monthly Totals				
Date	Production (gallons)	Injection (gallons)	Bleed (gallons)	% Bleed
July 2017	62,070,799	60,516,928	1,553,871	2.5 %
August 2017	69,990,042	67,748,574	2,241,468	3.2 %
September 2017	48,138,221	46,313,763	1,824,458	3.8 %
October 2017	49,863,764	47,418,965	2,444,799	4.9 %
November 2017	61,621,097	59,633,674	1,987,423	3.2 %
December 2017	47,840,342	46,043,457	1,796,885	3.8 %
Totals	**339,524,265**	**327,675,361**	**11,848,904**	**3.5 %**

Overall Monthly Totals				
Date	Production (gallons)	Injection (gallons)	Bleed (gallons)	% Bleed
July 2017	100,823,963	96,471,693	4,352,270	4.3 %
August 2017	110,695,282	105,428,193	5,267,089	4.8 %
September 2017	90,156,062	86,116,648	4,039,414	4.5 %
October 2017	96,153,360	91,404,107	4,749,253	4.9 %
November 2017	122,469,452	117,302,440	5,167,012	4.2 %
December 2017	96,169,290	92,039,958	4,129,332	4.3 %
Overall Totals	**616,467,409**	**588,763,039**	**27,704,370**	**4.5 %**

Table 2 - Christensen Ranch Weekly Maximum Injection Pressures per Module Building

Mine Unit 7

Weekly Maximum injection Pressure (Maximum Permissible 140 psi)						
Week Ending	Module 7-1	Module 7-2	Module 7-3	Module 7-4	Module 7-5	Module 7-6
7/8/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
7/15/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
7/22/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
7/29/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
8/5/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
8/12/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
8/19/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
8/26/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
9/2/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
9/9/2017	No Injection	No Injection	No Injection	No Injection	No Injection	No Injection
9/16/2017	No Injection	No Injection	100	110	146	No Injection
9/23/2017	No Injection	No Injection	74	120	140	No Injection
9/30/2017	No Injection	No Injection	125	79	135	No Injection
10/7/2017	No Injection	No Injection	129	65	135	No Injection
10/14/2017	No Injection	No Injection	123	68	125	No Injection
10/21/2017	No Injection	No Injection	138	72	133	No Injection
10/28/2017	No Injection	No Injection	130	100	135	No Injection
11/4/2017	No Injection	No Injection	129	80	136	No Injection
11/11/2017	No Injection	No Injection	124	83	130	No Injection
11/18/2017	No Injection	No Injection	133	94	129	No Injection
11/25/2017	No Injection	No Injection	133	98	134	No Injection
12/2/2017	No Injection	No Injection	135	100	125	No Injection
12/9/2017	No Injection	No Injection	130	90	120	No Injection
12/16/2017	No Injection	No Injection	134	89	125	No Injection
12/23/2017	No Injection	No Injection	133	90	124	No Injection
12/30/2017	No Injection	No Injection	135	112	134	No Injection

Table 2 - Christensen Ranch Weekly Maximum Injection Pressures per Module Building

Mine Unit 8

	Weekly Maximum injection Pressure (Maximum Permissible 140 psi)					
Week Ending	Module 8-1	Module 8-2	Module 8-3	Module 8-4/5	Module 8-6	Module 8-7
7/8/2017	134	No Injection	105	130	124	139
7/15/2017	134	105	111	110	108	123
7/22/2017	120	125	110	106	96	117
7/29/2017	130	125	110	110	100	115
8/5/2017	132	120	110	105	110	118
8/12/2017	133	121	65	25	111	84
8/19/2017	133	130	95	66	125	115
8/26/2017	130	130	100	55	125	115
9/2/2017	135	153	153	120	134	159
9/9/2017	136	130	122	108	128	130
9/16/2017	136	141	133	121	130	140
9/23/2017	138	135	122	114	130	130
9/30/2017	134	134	116	120	120	137
10/7/2017	135	132	81	121	125	130
10/14/2017	138	130	90	135	124	130
10/21/2017	136	138	122	135	134	134
10/28/2017	135	135	95	127	134	135
11/4/2017	135	134	100	116	134	134
11/11/2017	136	131	110	115	134	135
11/18/2017	137	143	109	118	134	137
11/25/2017	148	134	115	125	133	137
12/2/2017	149	146	125	129	131	149
12/9/2017	140	136	124	130	138	138
12/16/2017	130	135	125	125	130	134
12/23/2017	130	135	125	125	130	131
12/30/2017	135	135	124	149	184	137

Table 2 - Christensen Ranch Weekly Maximum Injection Pressures per Module Building

Mine Unit 8 (Cont.) and Mine Unit 5-2

	Weekly Maximum injection Pressure (Maximum Permissible 140 psi)					
Week Ending	Module 8-8	Module 8-9		Module 5-2		
7/8/2017	130	105		No Injection		
7/15/2017	115	115		No Injection		
7/22/2017	116	110		No Injection		
7/29/2017	135	100		No Injection		
8/5/2017	125	105		No Injection		
8/12/2017	130	105		No Injection		
8/19/2017	158	108		No Injection		
8/26/2017	120	105		No Injection		
9/2/2017	149	130		No Injection		
9/9/2017	136	125		No Injection		
9/16/2017	139	119		No Injection		
9/23/2017	139	118		No Injection		
9/30/2017	127	108		No Injection		
10/7/2017	126	110		No Injection		
10/14/2017	132	103		No Injection		
10/21/2017	137	110		No Injection		
10/28/2017	125	105		No Injection		
11/4/2017	No Injection	117		No Injection		
11/11/2017	No Injection	103		No Injection		
11/18/2017	No Injection	118		No Injection		
11/25/2017	No Injection	125		No Injection		
12/2/2017	No Injection	120		No Injection		
12/9/2017	No Injection	115		No Injection		
12/16/2017	No Injection	110		No Injection		
12/23/2017	No Injection	106		No Injection		
12/30/2017	No Injection	107		No Injection		

Table 2 - Christensen Ranch Weekly Maximum Injection Pressures per Module Building

Mine Unit 10

	Weekly Maximum injection Pressure (Maximum Permissible 140 psi)					
Week Ending	Module 10-1	Module 10-2	Module 10-3	Module 10-4	Module 10-5	Module 10-6
7/8/2017	77	125	90	115	126	126
7/15/2017	85	125	74	56	95	104
7/22/2017	77	125	75	65	105	120
7/29/2017	96	130	76	110	123	124
8/5/2017	74	125	123	120	115	125
8/12/2017	140	125	120	115	114	72
8/19/2017	139	125	137	119	135	130
8/26/2017	135	130	121	120	100	120
9/2/2017	135	130	123	120	120	120
9/9/2017	135	125	124	116	108	120
9/16/2017	140	130	125	110	100	124
9/23/2017	100	130	130	106	82	121
9/30/2017	90	126	125	75	117	125
10/7/2017	86	124	130	61	134	125
10/14/2017	127	134	134	70	133	125
10/21/2017	126	129	135	94	134	132
10/28/2017	132	126	130	96	132	130
11/4/2017	135	125	131	100	132	130
11/11/2017	133	125	133	98	131	130
11/18/2017	136	133	137	107	138	130
11/25/2017	136	130	133	116	152	130
12/2/2017	137	135	132	120	135	130
12/9/2017	138	127	134	118	130	135
12/16/2017	133	119	133	125	128	164
12/23/2017	133	119	125	125	130	135
12/30/2017	138	124	132	126	161	138

Sample Location	Christensen Ranch House #3					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	1.03E-08	NA	3.4	1.39E-08	NA	4.6
Uranium (Suspended)	3.00E-10	NA	0.1	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	1.10E-09	1.00E-10	1.8	1.00E-09	1.00E-10	1.7
Radium-226 (Suspended)	3.00E-10	1.00E-10	0.5	ND	NA	NA
Lead-210 (Disolved)	1.10E-09	4.00E-10	11.0	1.50E-09	3.00E-10	15.0
Lead-210 (Suspended)	5.10E-09	5.00E-10	51.0	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Christensen Ranch Ellendale #4					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	5.00E-10	NA	0.2	1.20E-09	NA	0.4
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	8.00E-10	1.00E-10	1.3	3.00E-10	1.00E-10	0.5
Radium-226 (Suspended)	ND	NA	NA	2.00E-10	1.00E-10	0.3
Lead-210 (Disolved)	1.20E-09	4.00E-10	12.0	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Christensen Ranch Willow Corral #32					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	ND	NA	NA	7.00E-10	NA	0.2
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	4.00E-10	1.00E-10	0.7	ND	NA	NA
Radium-226 (Suspended)	ND	NA	NA	ND	NA	NA
Lead-210 (Disolved)	ND	NA	NA	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Christensen Ranch First Artesian #1					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	ND	NA	NA	7.00E-10	NA	0.2
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	ND	NA	NA	ND	NA	NA
Radium-226 (Suspended)	ND	NA	NA	3.00E-10	1.00E-10	0.5
Lead-210 (Disolved)	1.10E-09	5.00E-10	11.0	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	2.00E-09	8.00E-10	5.0	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Christensen Ranch Middle Artesian					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	1.12E-08	NA	3.7	1.69E-08	NA	5.6
Uranium (Suspended)	4.00E-10	NA	0.1	3.60E-09	NA	1.2
Thorium-230 (Disolved)	ND	NA	NA	3.00E-10	1.00E-10	0.3
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	3.00E-10	1.00E-10	0.5	ND	NA	NA
Radium-226 (Suspended)	ND	NA	NA	4.00E-10	1.00E-10	0.7
Lead-210 (Disolved)	2.00E-09	5.00E-10	20.0	ND	NA	NA
Lead-210 (Suspended)	3.20E-09	5.00E-10	32.0	3.10E-09	3.00E-10	31.0
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	1.10E-09	6.00E-10	2.8	ND	NA	NA

Sample Location	Christensen Ranch Del Gulch Lower #13					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	ND	NA	NA	ND	NA	NA
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	4.00E-10	1.00E-10	0.7	ND	NA	NA
Radium-226 (Suspended)	ND	NA	NA	ND	NA	NA
Lead-210 (Disolved)	ND	NA	NA	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	1.30E-09	6.00E-10	3.3	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Irigaray Willow #2					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	ND	NA	NA	7.00E-10	NA	0.2
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	4.00E-10	1.00E-10	0.7	2.00E-10	1.00E-10	0.3
Radium-226 (Suspended)	ND	NA	NA	2.00E-10	1.00E-10	0.3
Lead-210 (Disolved)	ND	NA	NA	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	1.20E-09	7.00E-10	3.0	ND	NA	NA

LLD's

Uranium	2.0E-10 µCi/ml
Thorium-230	2.0E-10 µCi/ml
Radium-226	2.0E-10 µCi/ml
Lead-210	1.0E-9 µCi/ml
Polonium-210	1.0E-9 µCi/ml

ND = NON DETECTABLE
NA= NOT APPLICABLE

***10 CFR 20 Appendix B Table 2 values**

Uranium	3.0E-7 µCi/ml
Thorium-230	1.0E-7 µCi/ml
Radium-226	6.0E-8 µCi/ml
Lead-210	1.0E-8 µCi/ml
Polonium-210	4.0E-8 µCi/ml

Sample Location	Irigaray-9					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	DRY	NA	NA	7.6E-09	NA	2.5
Uranium (Suspended)	DRY	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	DRY	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	DRY	NA	NA	ND	NA	NA
Radium-226 (Disolved)	DRY	NA	NA	ND	NA	NA
Radium-226 (Suspended)	DRY	NA	NA	ND	NA	NA
Lead-210 (Disolved)	DRY	NA	NA	ND	NA	NA
Lead-210 (Suspended)	DRY	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	DRY	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	DRY	NA	NA	ND	NA	NA

Sample Location	Irigaray-14					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	1.0E-08	NA	3.4	1.6E-09	NA	0.5
Uranium (Suspended)	3.0E-10	NA	0.1	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	2.0E-10	1.0E-10	0.3	2.0E-10	1.0E-10	0.3
Radium-226 (Suspended)	4.0E-10	1.0E-10	0.7	4.0E-10	1.0E-10	0.7
Lead-210 (Disolved)	2.1E-09	8.0E-10	21.0	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Irigaray-17					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	2.1E-08	NA	7.0	2.2E-08	NA	7.3
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	1.0E-09	1.0E-10	1.7	ND	NA	NA
Radium-226 (Suspended)	ND	NA	NA	3.0E-10	1.0E-10	0.5
Lead-210 (Disolved)	ND	NA	NA	ND	NA	NA
Lead-210 (Suspended)	ND	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Christensen Ranch GS-01					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	DRY	NA	NA	DRY	NA	NA
Uranium (Suspended)	DRY	NA	NA	DRY	NA	NA
Thorium-230 (Disolved)	DRY	NA	NA	DRY	NA	NA
Thorium-230 (Suspended)	DRY	NA	NA	DRY	NA	NA
Radium-226 (Disolved)	DRY	NA	NA	DRY	NA	NA
Radium-226 (Suspended)	DRY	NA	NA	DRY	NA	NA
Lead-210 (Disolved)	DRY	NA	NA	DRY	NA	NA
Lead-210 (Suspended)	DRY	NA	NA	DRY	NA	NA
Polonium-210 (Disolved)	DRY	NA	NA	DRY	NA	NA
Polonium-210 (Suspended)	DRY	NA	NA	DRY	NA	NA

Sample Location	Christensen Ranch GS-03					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	2.3E-08	NA	7.7	4.5E-08	NA	14.9
Uranium (Suspended)	ND	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	ND	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	ND	NA	NA	ND	NA	NA
Radium-226 (Disolved)	6.0E-10	1.0E-10	1.0	5.0E-10	1.0E-10	0.8
Radium-226 (Suspended)	ND	NA	NA	7.0E-10	1.0E-10	1.2
Lead-210 (Disolved)	1.5E-09	5.0E-10	15.0	ND	NA	NA
Lead-210 (Suspended)	1.0E-09	4.0E-10	10.0	ND	NA	NA
Polonium-210 (Disolved)	ND	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	ND	NA	NA	ND	NA	NA

Sample Location	Christensen Ranch CG-05					
Radionuclide	3rd Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*	4th Q (µCi/ml)	Uncertainty (±µCi/ml)	% of EFF Conc*
Uranium (Disolved)	DRY	NA	NA	3.7E-08	NA	12.5
Uranium (Suspended)	DRY	NA	NA	ND	NA	NA
Thorium-230 (Disolved)	DRY	NA	NA	ND	NA	NA
Thorium-230 (Suspended)	DRY	NA	NA	ND	NA	NA
Radium-226 (Disolved)	DRY	NA	NA	ND	NA	NA
Radium-226 (Suspended)	DRY	NA	NA	2.0E-10	1.0E-10	0.3
Lead-210 (Disolved)	DRY	NA	NA	ND	NA	NA
Lead-210 (Suspended)	DRY	NA	NA	ND	NA	NA
Polonium-210 (Disolved)	DRY	NA	NA	ND	NA	NA
Polonium-210 (Suspended)	DRY	NA	NA	ND	NA	NA

The **Annual Powder River** Sample was obtained on June 22, 2017 and Previously Reported in the 1st Half of 2017 Semi-Annual Effluent and Monitoring Report.	**Sample Location**	**Powder River (Annual)**		
	Radionuclide	**(µCi/ml)**	**Uncertainty (±µCi/ml)**	**% of EFF Conc***
	Uranium (Disolved)	2.8E-09	NA	0.9
	Uranium (Suspended)	ND	NA	NA
	Thorium-230 (Disolved)	ND	NA	NA
	Thorium-230 (Suspended)	ND	NA	NA
	Radium-226 (Disolved)	2.0E-10	1.0E-10	0.3
	Radium-226 (Suspended)	3.0E-10	1.0E-10	0.5
	Lead-210 (Disolved)	1.1E-09	3.0E-10	11.0
	Lead-210 (Suspended)	1.5E-09	5.0E-10	15.0
	Polonium-210 (Disolved)	ND	NA	NA
	Polonium-210 (Suspended)	ND	NA	NA

LLD's

Uranium	2.0E-10 µCi/ml
Thorium-230	2.0E-10 µCi/ml
Radium-226	2.0E-10 µCi/ml
Lead-210	1.0E-9 µCi/ml
Polonium-210	1.0E-9 µCi/ml

ND = NON DETECTABLE
NA= NOT APPLICABLE

***10 CFR 20 Appendix B Table 2 values**

Uranium	3.0E-7 µCi/ml
Thorium-230	1.0E-7 µCi/ml
Radium-226	6.0E-8 µCi/ml
Lead-210	1.0E-8 µCi/ml
Polonium-210	4.0E-8 µCi/ml

Uranium One USA, Inc.

IRIGARAY PROJECT

IR-1 (Downwind of Restricted Area)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	7.60E-06	*NA
Thorium-230	1.00E-06	3.00E-07
Radium-226	1.90E-06	2.00E-07
Lead-210	1.80E-06	4.00E-07

IR-3 (Upwind of Restricted Area)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	1.23E-05	*NA
Thorium-230	6.00E-07	2.00E-07
Radium-226	1.10E-06	2.00E-07
Lead-210	ND	NA

IR-4 (North Road - Background)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	7.00E-07	*NA
Thorium-230	5.00E-07	2.00E-07
Radium-226	9.00E-07	2.00E-07
Lead-210	2.20E-06	7.00E-07

IR-5 (Irigaray Ranch - Nearest Resident)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	6.00E-07	*NA
Thorium-230	4.00E-07	2.00E-07
Radium-226	8.00E-07	1.00E-07
Lead-210	1.50E-06	4.00E-07

IR-6 (Ridge Road S.E.)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	6.00E-07	*NA
Thorium-230	4.00E-07	1.00E-07
Radium-226	6.00E-07	2.00E-07
Lead-210	ND	NA

CHRISTENSEN PROJECT

AS-1 (Table Mountain - Background)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	7.00E-07	*NA
Thorium-230	5.00E-07	2.00E-07
Radium-226	8.00E-07	2.00E-07
Lead-210	1.10E-06	4.00E-07

AS-5A (CR Plant Upwind S.E.)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	1.40E-06	*NA
Thorium-230	6.00E-07	2.00E-07
Radium-226	1.00E-06	2.00E-07
Lead-210	1.40E-06	4.00E-07

AS-5B (CR Plant Downwind N.W.)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	1.30E-06	*NA
Thorium-230	7.00E-07	2.00E-07
Radium-226	1.30E-06	2.00E-07
Lead-210	ND	NA

AS-6 (Christensen Ranch - Nearest Resident)		
	(µCi/g)	Uncertainty (±µCi/g)
Uranium	1.20E-06	*NA
Thorium-230	9.00E-07	2.00E-07
Radium-226	1.00E-06	2.00E-07
Lead-210	2.10E-06	5.00E-07

RL's (µCi/g): Uranium = 2.0E-7
Thorium-230 = 2.0E-7
Radium-226 = 2.0E-7
Lead-210 = 2.0E-7

Analyses performed by Inter-Mountian Labs (IML), Sheridan, Wyoming
*The activity for uranium is a mathematical calculation based on a chemical analysis, therefore, no precision estimate (error) is given.
The Inter-Mountain Lab reporting limit (RL) are based on the weight of the samples.

IRIGARAY PROJECT

IR-1 (Downwind of Restricted Area)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	3.4E-04	*NA
Thorium-230	1.2E-05	3.0E-07
Radium-226	2.3E-05	2.0E-07
Lead-210	7.2E-05	4.0E-07

IR-3 (Upwind of Restricted Area)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	6.0E-03	*NA
Thorium-230	3.8E-06	3.2E-06
Radium-226	4.1E-06	2.1E-06
Lead-210	2.4E-04	1.8E-05

IR-4 (North Road - Background)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	3.1E-05	*NA
Thorium-230	2.9E-06	2.5E-06
Radium-226	9.2E-06	1.6E-06
Lead-210	2.7E-04	1.7E-05

IR-5 (Irigaray Ranch - Nearest Resident)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	5.3E-04	*NA
Thorium-230	ND	NA
Radium-226	2.0E-05	1.7E-05
Lead-210	9.8E-04	NA

IR-6 (Ridge Road S.E.)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	4.4E-05	*NA
Thorium-230	ND	NA
Radium-226	9.7E-06	4.5E-06
Lead-210	1.7E-04	1.6E-05

CHRISTENSEN PROJECT

AS-1 (Table Mountain - Background)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	2.2E-06	*NA
Thorium-230	3.0E-07	6.0E-07
Radium-226	9.6E-06	1.7E-06
Lead-210	6.0E-05	9.8E-06

AS-5A (CR Plant Upwind S.E.)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	2.9E-06	*NA
Thorium-230	3.8E-06	4.3E-06
Radium-226	1.7E-05	2.2E-06
Lead-210	7.9E-05	1.1E-05

AS-5B (CR Plant Downwind N.W.)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	1.6E-05	*NA
Thorium-230	4.8E-06	5.5E-06
Radium-226	8.8E-06	2.3E-06
Lead-210	8.4E-05	1.2E-05

AS-6 (Christensen Ranch - Nearest Resident)		
	(µCi/kg)	Uncertainty (±µCi/kg)
Uranium	ND	*NA
Thorium-230	9.0E-07	8.0E-07
Radium-226	1.1E-05	1.8E-06
Lead-210	1.9E-04	1.8E-05

LLD's (µCi/kg) **Uranium = 2.0E-7**
Thorium-230 = 2.0E-7
Radium-226 = 5.0E-8
Lead-210 = 1.0E-6

Analyses performed by Inter-Mountian Labs (IML), Sheridan, Wyoming
*The activity for uranium is a mathematical calculation based on a chemical analysis, therefore, no precision estimate (error) is given.
The Inter-Mountain Lab reporting (LLD's) are based on the weight of the samples.

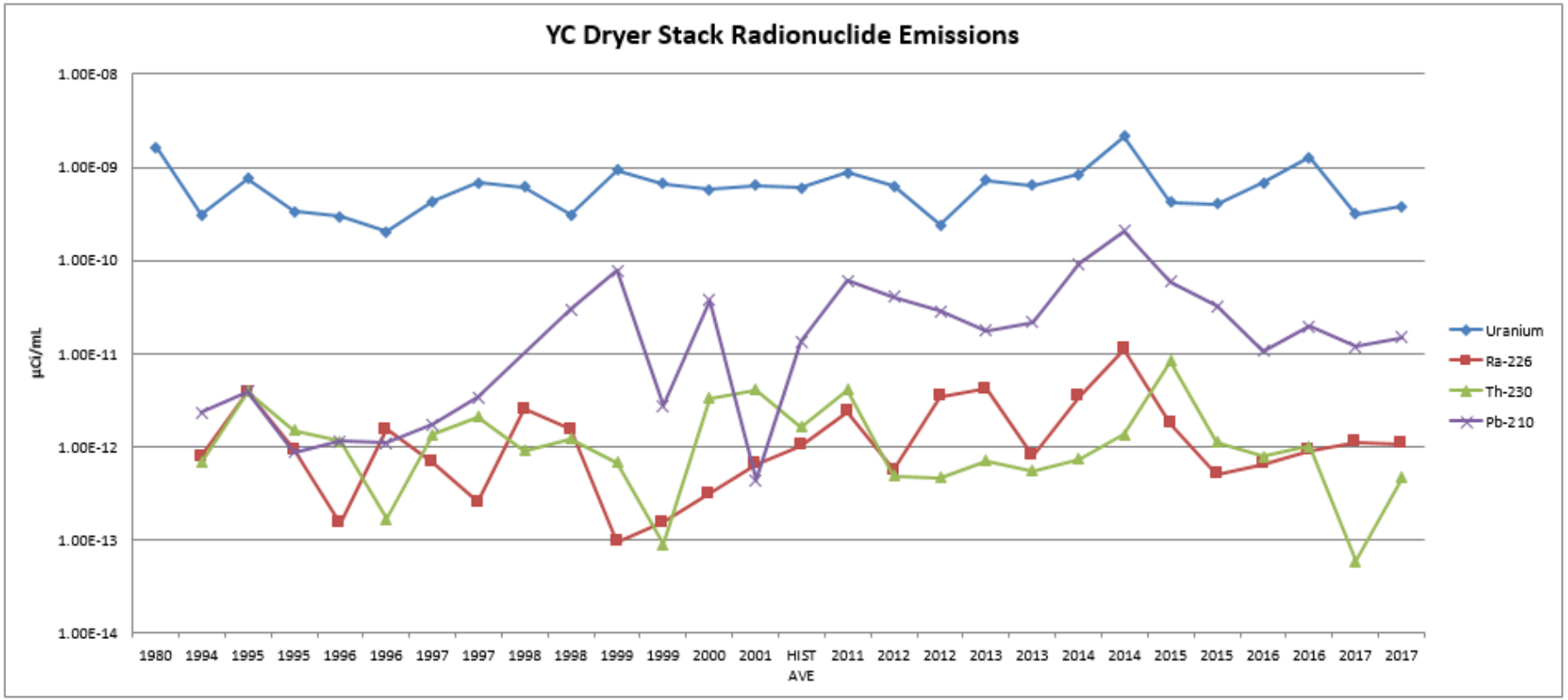
Location	3rd Quarter µCi/ml (2017)	Uncertainty ± µCi/ml	4th Quarter µCi/ml 2017	Uncertainty ± µCi/ml	Location Average 2016	10 CFR APP B Table 2
IRIGARAY PROJECT						
IR-1 (Downwind of Restricted Area)	4.10E-10	6.00E-11	6.50E-08	e-10	3.27E-08	1.00E-10
IR-3 (Upwind of Restricted Area)**	5.10E-10	5.00E-11	4.60E-10	8.00E-11	4.85E-10	1.00E-10
IR-4 (North Road)	4.60E-10	6.00E-11	5.40E-10	7.00E-11	5.00E-10	1.00E-10
IR-5 (Irigaray Ranch)	4.30E-10	4.00E-11	1.10E-09	5.00E-11	7.65E-10	1.00E-10
IR-6 (Ridge Road - S.E. - Background)	3.00E-10	6.00E-11	5.90E-10	9.00E-11	4.45E-10	1.00E-10
IR-13 (IR Employee House Trailer)	4.10E-10	5.00E-11	5.40E-10	4.00E-11	4.75E-10	1.00E-10
IR-14 (IR Employee House Trailer inside)	4.90E-10	5.00E-11	1.00E-09	4.00E-11	8.50E-01	1.00E-10
CHRISTENSEN PROJECT						
AS-1 (Table Mountain - Background)	2.20E-10	5.00E-11	1.20E-09	5.00E-11	7.10E-10	1.00E-10
AS-5A (CR Plant Upwind S.E.)	6.20E-10	5.00E-11	4.10E-10	4.00E-11	5.15E-10	1.00E-10
AS-5B (CR Plant Downwind N.W)	3.80E-10	4.00E-11	4.10E-10	5.00E-11	3.95E-10	1.00E-10
AS-6 (Christensen Ranch)	3.50E-10	5.00E-11	4.60E-10	5.00E-11	4.05E-10	1.00E-10
AS-7 (CR Employee House Trailer)*	3.20E-10	4.00E-11	4.30E-10	5.00E-11	3.75E-10	1.00E-10
AS-8 (CR Employee House Trailer inside)*	3.50E-10	4.00E-11	4.10E-10	5.00E-11	3.80E-10	1.00E-10
AS-9 (Mine Unit 7)	1.60E-10	4.00E-11	4.30E-10	5.00E-11	2.95E-10	1.00E-10
AS-10 (CR Wellfield Module 8-6)	3.50E-10	4.00E-11	3.50E-10	5.00E-11	3.50E-10	1.00E-10
AS-11 (Water Tank)	3.00E-10	4.00E-11	3.80E-10	5.00E-11	3.40E-10	1.00E-10
AS-12 (Mine Unit 10)	3.80E-10	4.00E-11	4.30E-10	5.00E-11	4.05E-10	1.00E-10
AS-13 (Substation)	3.20E-10	1.80E+00	0.00E+00	5.00E-11	1.60E-10	1.00E-10

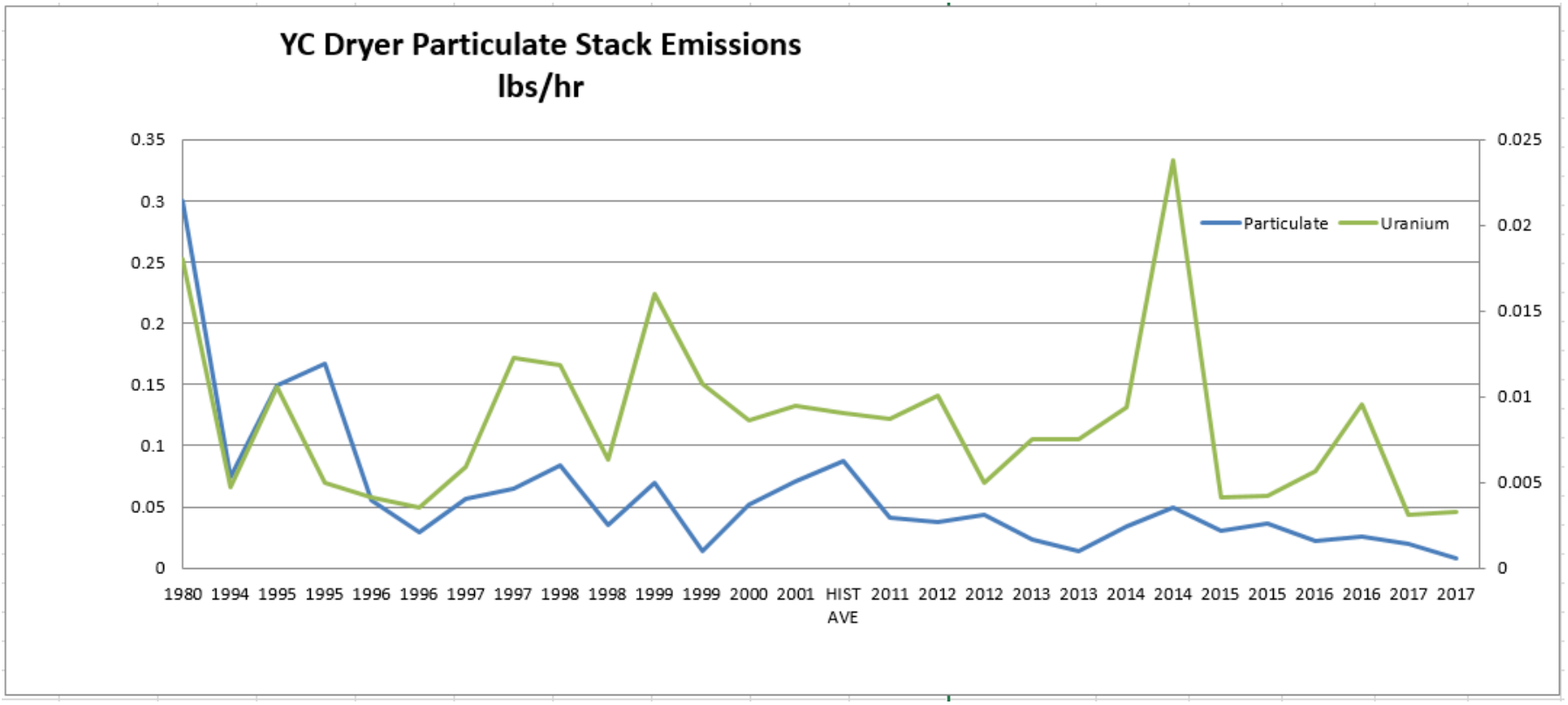
AS-13 Detector missing 4th quarter
LLD = 0.06 pCi/l

SUMMARY OF STACK EMISSIONS SURVEY RESULTS
Irigaray Dryer and Packaging Circuit

Time	Total Particulates	U3O8 Emissions	Unat. Released	Unat. Uncertainty	Th-230 Released	Th-230 Uncertainty	Ra-226 Released	Ra-226 Uncertainty	Pb-210 Released	Pb-210 Uncertainty
	lbs/hour (% limit)	lbs	Ci	Ci	Ci	Ci	Ci	Ci	Ci	Ci
Jan-June, 2017	0.020 (6.67%)	5.4	1.40E-03	NA	5.94E-06	9.94E-07	5.01E-06	4.28E-07	5.34E-05	5.64E-06
July-December 2017	0.008 (2.67%)	9.6	2.47E-03	NA	3.03E-06	3.50E-07	7.16E-06	3.45E-07	9.80E-05	3.07E-06
Total		15.1	3.87E-03		8.98E-06		1.22E-05		1.51E-04	
	Permit Limit 0.30									

COMMENTS: YC Dryer ran for 1734 hours for the first half of 2017. YC Dryer ran for 2928 hours for the second half of 2017. These numbers are utilized to determine the relase from the Irigaray YC drying and packaging operations for the above radionuclides.


YC Dryer Stack Radionuclide Emissions
µCi/mL
1.00E-08
1.00E-09
1.00E-10
1.00E-11
1.00E-12
1.00E-13
1.00E-14
1980
1994
1995
1995
1996
1996
1997
1997
1998
1998
1999
1999
2000
2001
HIST AVE
2011
2012
2012
2013
2013
2014
2014
2015
2015
2016
2016
2017
2017
Uranium
Ra-226
Th-230
Pb-210


YC Dryer Particulate Stack Emissions
lbs/hr
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.025
0.02
0.015
0.01
0.005
0
Particulate
Uranium
1980 1994 1995 1995 1996 1996 1997 1997 1998 1998 1999 1999 2000 2001 HIST AVE 2011 2012 2012 2013 2013 2014 2014 2015 2015 2016 2016 2017 2017

3rd Quarter 2017 Data				
	Uranium µCi/ml	Th-230 µCi/ml	Ra-226 µCi/ml	Pb-210 µCi/ml
IR-1 Downwind	5.4E-15	0.0E+00	2.1E-16	2.6E-14
Uncertainty	NA	N/A	1.3E-16	9.2E-16
%of Pt, App. B Effluent Limit	6.0%	0.0%	0.0%	4.3%
IR-3 Upwind	1.8E-14	1.2E-16	2.4E-16	1.2E-14
Uncertainty	NA	8.8E-17	1.3E-16	7.9E-16
%of Pt, App. B Effluent Limit	20.0%	0.4%	0.0%	2.0%
IR-5 Brubaker Ranch	4.8E-16	0.0E+00	1.3E-16	3.4E-14
Uncertainty	NA	1.4E-16	1.1E-16	1.2E-15
%of Pt, App. B Effluent Limit	0.5%	0.0%	0.0%	5.7%
IR-6 Background	6.9E-16	1.8E-16	2.7E-16	1.5E-14
Uncertainty	NA	1.1E-16	1.6E-16	9.7E-16
%of Pt, App. B Effluent Limit	0.8%	0.6%	0.0%	2.5%
IR-13 Employee House Trailer	1.1E-15	0.0E+00	1.7E-16	1.2E-13
Uncertainty	NA	N/A	1.5E-16	2.2E-15
%of Pt, App. B Effluent Limit	1.2%	0.0%	0.0%	20.0%

4th Quarter 2017 Data				
	Uranium µCi/ml	Th-230 µCi/ml	Ra-226 µCi/ml	Pb-210 µCi/ml
IR-1 Downwind	4.3E-15	0.0E+00	1.2E-16	7.5E-14
Uncertainty	NA	N/A	7.5E-17	1.3E-15
%of Pt, App. B Effluent Limit	4.8%	0.0%	0.0%	12.5%
IR-3 Upwind	1.8E-14	0.0E+00	2.5E-16	1.6E-14
Uncertainty	NA	NA	1.3E-16	8.5E-16
%of Pt, App. B Effluent Limit	20.0%	0.0%	0.0%	2.7%
IR-5 Brubaker Ranch	5.3E-16	0.0E+00	1.6E-16	9.1E-15
Uncertainty	NA	NA	9.0E-17	8.1E-16
%of Pt, App. B Effluent Limit	0.6%	0.0%	0.0%	1.5%
IR-6 Background	2.9E-15	0.0E+00	1.6E-16	4.6E-15
Uncertainty	NA	0.0E+00	1.9E-16	8.2E-16
%of Pt, App. B Effluent Limit	3.2%	0.0%	0.0%	0.8%
IR-13 Employee House Trailer	1.7E-15	0.0E+00	1.8E-16	8.4E-15
Uncertainty	NA	NA	8.9E-17	6.7E-16
%of Pt, App. B Effluent Limit	1.9%	0.0%	0.0%	1.4%

2017 Summary (Averages)				
	U (µCi/ml)	Th-230 (µCi/ml)	Ra-226 (µCi/ml)	PB-210 (µCi/ml)
IR-1	4.9E-15	0.0E+00	1.7E-16	5.1E-14
IR-3	6.9E-14	6.0E-17	2.5E-16	1.4E-14
IR-5	5.1E-16	0.0E+00	1.5E-16	2.2E-14
IR-6	1.8E-15	1.3E-16	2.2E-16	9.8E-15
IR-13	1.4E-15	0.0E+00	1.8E-16	6.4E-14

10 CFR Pt. 20, App. B, Effluent Limits (uCi/ml)
Uranium = 9.0E-14 (Y)
Th-230 = 3.0E-14 (Y)
Ra-226 = 9.0E-13 (W)
Pb- 210 = 6.0E-13 (D)

Lab LLD's
Uranium = 1.0E-16
Th-230 = 1.0E-16
Ra-226 = 1.0E-16
Pb-210 = 2.0E-15

0 or N/D =Non Detectable

Location	3rd Quarter 2017 mrem/quarter	4th Quarter 2017 mrem/quarter	Location Average 2017 mrem/quarter	Year to Date Total 2017 mrem/quarter
IRIGARAY PROJECT				
Control	48.8	42.9	NA	NA
IR-1 (Downwind of Restricted Area)*	0	7.7	3.9	7.7
IR-3 (Upwind of Restricted Area)	25.7	29.7	27.7	55.4
IR-4 (North Road)	5.5	6.1	5.8	11.6
IR-5 (Irigaray Ranch)	1.4	2.9	2.2	4.3
IR-6 (Ridge Road S.E. - Background)	5.7	3.6	4.7	9.3
IR-13 (I.R. Employee House Trailer)	5.1	4.6	4.9	9.7
IR-14 (I.R. Employee House Trailer inside)	0.3	1.9	1.1	2.2
Quarterly Average	6.2	8.1	7.2	7.2
*Location IR-1 3rd quarter lost badge				
CHRISTENSEN PROJECT				
AS-1 (Table Mountain - Background)	4	3	3.5	7.0
AS-5A(CR Plant Upwind S.E.)	0.0	11.6	5.8	11.6
AS-5B (CR Plant Downwind N.W.)	5	3.1	4.1	8.1
AS-6 (Christensen Ranch)	0.0	9.1	4.6	9.1
AS-7 (C.R. Employee House Trailer)	-0.1	2.7	1.3	2.6
AS-8 (C.R. Employee House Trailer inside	-19.3	-11.6	-15.5	-30.9
AS-9 (Mine Unit 7)	1.4	6.8	4.1	8.2
AS-10 (C.R. Wellfield Module 8-6)	9.8	13.1	11.5	22.9
AS-11 (Water Tank)	1.7	0.8	1.3	2.5
AS-12 (Mine Unit 10)	3.0	3.7	3.6	14.5
AS-13 (Substation)*	3.3	4.5	3.9	7.8
Quarterly Average	1.8	5.9	3.8	3.8
*Location AS-5 & AS-6 3RD quarter lost badge				

Location	3rd Quarter 2017 mrem/quarter	4th Quarter 2017 mrem/quarter	Location Average 2017 mrem/quarter	Year to Date Total 2017 mrem/quarter
IRIGARAY PROJECT				
Control	48.8	42.9	NA	NA
IR-1 (Downwind of Restricted Area)*	0	7.7	3.9	7.7
IR-3 (Upwind of Restricted Area)	25.7	29.7	27.7	55.4
IR-4 (North Road)	5.5	6.1	5.8	11.6
IR-5 (Irigaray Ranch)	1.4	2.9	2.2	4.3
IR-6 (Ridge Road S.E. - Background)	5.7	3.6	4.7	9.3
IR-13 (I.R. Employee House Trailer)	5.1	4.6	4.9	9.7
IR-14 (I.R. Employee House Trailer inside)	0.3	1.9	1.1	2.2
Quarterly Average	6.2	8.1	7.2	7.2
*Location IR-1 3rd quarter lost badge				
CHRISTENSEN PROJECT				
AS-1 (Table Mountain - Background)	4	3	3.5	7.0
AS-5A(CR Plant Upwind S.E.)	0.0	11.6	5.8	11.6
AS-5B (CR Plant Downwind N.W.)	5	3.1	4.1	8.1
AS-6 (Christensen Ranch)	0.0	9.1	4.6	9.1
AS-7 (C.R. Employee House Trailer)	-0.1	2.7	1.3	2.6
AS-8 (C.R. Employee House Trailer inside	-19.3	-11.6	-15.5	-30.9
AS-9 (Mine Unit 7)	1.4	6.8	4.1	8.2
AS-10 (C.R. Wellfield Module 8-6)	9.8	13.1	11.5	22.9
AS-11 (Water Tank)	1.7	0.8	1.3	2.5
AS-12 (Mine Unit 10)	3.0	3.7	3.6	14.5
AS-13 (Substation)*	3.3	4.5	3.9	7.8
Quarterly Average	1.8	5.9	3.8	3.8
*Location AS-5 & AS-6 3RD quarter lost badge				

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Uranium One USA, Inc. - Willow Creek Project
2017 Semi-Annual Effluent and Monitoring Report
Public Dose - Radon

	IR-13 Irigaray Man Camp Site			
QTR./YEAR	Man Camp Radon uCi/mL	Bkg uCi/mL	Net uCi/mL	Annual Dose Mrem
1st Qtr.	4.9E-10	2.2E-10	2.7E-10	7.3
2nd Qtr.	4.9E-10	3.0E-10	1.9E-10	5.1
3rd Qtr.	4.9E-10	3.0E-10	1.9E-10	5.1
4th Qtr.	1.0E-09	5.9E-10	4.1E-10	11.1
		2017 TOTAL		28.6

	AS-7 Christensen Man Camp Site			
QTR./YEAR	Man Camp Radon uCi/mL	Bkg. uCi/mL	Net uCi/mL	Annual Dose Mrem
1st Qtr.	3.0E-10	2.4E-10	6.0E-11	1.6
2nd Qtr.	4.6E-10	1.6E-10	3.0E-10	8.1
3rd Qtr.	3.5E-10	2.2E-10	1.3E-10	3.5
4th Qtr.	4.1E-10	1.2E-09	0.0E+00	0.0
		2017 TOTAL		13.2

Background for Irigaray is IR-6 (Ridge Road SE)

Background for Christensen Site is AS-1 (Table Mountain)

(Rn-222 dtrs present = 1 E-10 µCi/ml = 50 mr/yr)

For Radon

$$D = DCF \sum_i C_i F_i T_i$$

Where:

D=annual dose (TEDE) (mrem/yr)

DCF= dose conversion factor for Rn-222 in equilibrium (i.e 100%) with Rn-222 progeny $\frac{mrem \cdot ml}{\mu Ci \cdot yr}$

Ci= annual average concentration of Rn-222 in air (µCi/ml) at receptor location i

Fi=radon progeny equilibrium factor (fraction) for receptor location i

Ti= occupancy time factor (fraction of a year) for receptor location i

Dose assignment was based on 36 hours per week of offshift time spent in mancamp over a 13 week period per quarter. [36 hrs. X 13 weeks = 468 hours/quarter] [1872 hours/year]

Therefore the following equation to determine potential dose at the mancamp is applicable

24 hr/d x 7 d/wk = 168 hr/wk 168 hr/wk x 52 wk/yr = 8736 hrs/yr

1872 hrs/yr at the mancamp 1872 hr/yr/8736 hrs/yr = 0.2143 x 100 = **21.43% of time spent as time receiving a Public Dose**

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Uranium One USA, Inc. - Willow Creek Project
2017 Semi-Annual Effluent and Monitoring Report
Public Dose - Gamma

	IR-13 Irigaray Man Camp Site			
QTR./YEAR	Man Camp mR	Bkg mR	NET mR	ANNUAL DOSE Mrem
1st Qtr.	-2.1	-1.6	0.0	0.0
2nd Qtr.	4	5.8	0.0	0.0
3rd Qtr.	0.3	5.7	0.0	0.0
4th Qtr.	1.9	3.6	0.0	0.0
		2017 TOTAL		0.0

	AS-7 Christensen Man Camp Site			
QTR./YEAR	Man Camp mR	Bkg mR	NET mR	ANNUAL DOSE Mrem
1st Qtr.	-4.6	3.3	0.0	0.0
2nd Qtr.	-6.3	-3.3	0.0	0.0
3rd Qtr.	-19.3	4	0.0	0.0
4th Qtr.	-11.6	3	0.0	0.0
		2017 TOTAL		0.0

Background for Christensen site is AS-1 (Table Mountain) ,Background for the Irigaray site is IR-6 (Ridge Road)

Dose assignment was based on 36 hours per week spent in mancamp over a 13 week period per quarter. [36 hrs. X 13 weeks = 468 hours/quarter] [1872 hours/year]

* Where negative numbers are reported no dose is assigned

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Uranium One USA, Inc. - Willow Creek Project
2017 Semi-Annual Effluent and Monitoring Report
Public Dose - Airborne Radionuclide

2017 IRIGARAY MAN CAMP PUBLIC ENVIRONMENTAL AIRBORNE RADIONUCLIDE DOSE ASSIGNMENT

1st Quarter 2017		IR-13 Irigaray Site			2nd Quarter 2017		IR-13 Irigaray Site		
Sample Period	Radionuclide	Air Conc. uCi/mL	Bkg uCi/mL	Net uCi/mL	Sample Period	Radionuclide	Air Conc. uCi/mL	Bkg uCi/mL	Net uCi/mL
1/1/17 thru 3/31/17	Unat	2.3E-15	1.4E-15	8.5E-16	4/1/17 thru 6/30/17	Unat	1.4E-15	5.8E-16	8.2E-16
1/1/17 thru 3/31/17	Th-230	ND	NA	0.0E+00	4/1/17 thru 6/30/17	Th-230	N/D	N/D	0.0E+00
1/1/17 thru 3/31/17	Ra-226	ND	NA	0.0E+00	4/1/17 thru 6/30/17	Ra-226	N/D	N/D	0.0E+00
1/1/17 thru 3/31/17	Pb-210	1.3E-14	2.3E-15	1.1E-14	4/1/17 thru 6/30/17	Pb-210	8.1E-15	2.0E-15	6.1E-15

3rd Quarter 2017		IR-13 Irigaray Site			4th Quarter 2017		IR-13 Irigaray Site		
Sample Period	Radionuclide	Air Conc. uCi/mL	Bkg uCi/mL	Net uCi/mL	Sample Period	Radionuclide	Air Conc. uCi/mL	Bkg uCi/mL	Net uCi/mL
7/1/17 thru 9/30/17	Unat	1.2E-15	6.9E-16	4.6E-16	10/1/17 thru 12/31/17	Unat	1.7E-15	2.9E-15	-1.2E-15
7/1/17 thru 9/30/17	Th-230	N/D	1.8E-16	0.0E+00	10/1/17 thru 12/31/17	Th-230	N/D	ND	0.0E+00
7/1/17 thru 9/30/17	Ra-226	1.7E-16	2.7E-16	-1.0E-16	10/1/17 thru 12/31/17	Ra-226	1.8E-16	1.6E-16	2.0E-17
7/1/17 thru 9/30/17	Pb-210	1.2E-13	1.5E-14	1.1E-13	10/1/17 thru 12/31/17	Pb-210	8.4E-15	4.6E-15	3.8E-15

2017			
Conc µCi/ml	10 CFR Effluent Limit	% Effluent Conc.	DOSE Mrem
2.3E-16	2.0E-12	0.00	0.001
0.0E+00	3.0E-14	0.00	0.000
-2.0E-17	9.0E-13	0.000	0.000
3.1E-14	6.0E-13	0.05	0.550
	2017 TOTAL		**0.551**

There is no environmental airborne radionuclide sampling performed at the Christensen Satellite Facility.
Dryer Operations were performed during the 2 nd, 3 rd and 4 th Quarters in 2017.
Dose assignment was based on 36 hours per week of offshift time spent in mancamp over a 13 week period per quarter. [36 hrs. X 13 weeks = 468 hours/quarter] [1872 hours/year]

For Airborne Particulate

$$D = DCF \sum_{i} C_i T_i$$

Where:
D=annual dose (TEDE) (mrem/yr)
DCF= dose conversion factor

$$\frac{mrem * ml}{\mu Ci * yr}$$

Ci= annual average concentration in air (µCi/ml) at receptor location i
Ti= occupancy time factor (fraction of a year) for receptor location i

Table 10
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Uranium One USA, Inc. - Willow Creek Project
2017 Semi-Annual Effluent and Monitoring Report
Public Dose - Airborne Radionuclide

2017 PUBLIC DOSE SUMMARY

	Irigaray Site			
YEAR	Radon	Gamma	Airborne Particulate	Annual Public Dose Mrem
2017	28.6	0.0	0.551	**29.17**

	Christensen SatelliteSite			
YEAR	Radon	Gamma	Airborne Particulate*	Annual Public Dose Mrem
2017	13.2	0.00	0.551	**13.78**

* There is no environmental airborne radionuclide sampling performed at the Christensen Satellite Facility, utilized data from Irigaray Site to be a conservative estimate.

Table 11
Uranium One USA, Inc. - Willow Creek Project
2017 Semi-Annual Effluent and Monitoring Report, 2nd Half
Daily Walk-Through Inspections

Irigaray Site				Christensen Site			
Date: Week	**YES**	**NO**	**COMMENTS**	**Date: Week**	**YES**	**NO**	**COMMENTS**
1/1/2017	X			1/1/2017	X		
1/8/2017	X			1/8/2017	X		
1/15/2017	X			1/15/2017	X		
1/22/2017	X			1/22/2017	X		
1/29/2017	X			1/29/2017	X		
2/5/2017	X			2/5/2017	X		
2/12/2017	X			2/12/2017	X		
2/19/2017	X			2/19/2017	X		
2/26/2017	X			2/26/2017	X		
3/5/2017	X			3/5/2017	X		
3/12/2017	X			3/12/2017	X		
3/19/2017	X			3/19/2017	X		
3/26/2017	X			3/26/2017	X		
4/2/2017	X			4/2/2017	X		
4/9/2017	X			4/9/2017	X		
4/16/2017	X			4/16/2017	X		
4/23/2017	X			4/23/2017	X		
4/30/2017	X			4/30/2017	X		
5/7/2017	X			5/7/2017	X		
5/14/2017	X			5/14/2017	X		
5/21/2017	X			5/21/2017	X		
5/28/2017	X			5/28/2017	X		
6/4/2017	X			6/4/2017	X		
6/11/2017	X			6/11/2017	X		
6/18/2017	X			6/18/2017	X		
6/25/2017	X			6/25/2017	X		
7/2/2017	X			7/2/2017	X		
7/9/2017	X			7/9/2017	X		
7/16/2017	X			7/16/2017	X		
7/23/2017	X			7/23/2017	X		

Table 11
Uranium One USA, Inc. - Willow Creek Project
2017 Semi-Annual Effluent and Monitoring Report, 2nd Half
Daily Walk-Through Inspections

Irigaray Site				Christensen Site			
Date: Week	**YES**	**NO**	**COMMENTS**	**Date: Week**	**YES**	**NO**	**COMMENTS**
7/30/2017	X			7/30/2017	X		
8/6/2017	X			8/6/2017	X		
8/13/2017	X			8/13/2017	X		
8/20/2017	X			8/20/2017	X		
8/27/2017	X			8/27/2017	X		
9/3/2017	X			9/3/2017	X		
9/10/2017	X			9/10/2017	X		
9/17/2017	X			9/17/2017	X		
9/24/2017	X			9/24/2017	X		
10/1/2017	X			10/1/2017	X		
10/8/2017	X			10/8/2017	X		
10/15/2017	X			10/15/2017	X		
10/22/2017	X			10/22/2017	X		
10/29/2017	X			10/29/2017	X		
11/5/2017	X			11/5/2017	X		
11/12/2017	X			11/12/2017	X		
11/19/2017	X			11/19/2017	X		
11/26/2017	X			11/26/2017	X		
12/3/2017	X			12/3/2017	X		
12/10/2017	X			12/10/2017	X		
12/17/2017	X			12/17/2017	X		
12/24/2017	X			12/24/2017	X		

Table 12
Page of 1 of 1
Uranium One USA, Inc-Willow Creek Project
2015 Semi-Annual Effluent and Monitoring Report, 2nd half
SERP Summary

SERP No.	Date	SERP Topic	Evaluation Summary
16-01	-----	Delayed not conducted.	Not Conducted
16-02	10-23-15	Reprocessing YC Scrubber Solids	Laboratory Data demonstrated chemical compatibility

- **SERP 16-01 was delayed not conducted**

APPENDIX B

2015 Land Use Figure

2017 Land Use Survey Water Right Search Results

Irigaray

T45N R77W		T 44N R77W		T46N R76W	
Section	Water Right Date	Section	Water Right Date	Section	Water Right Date
2	2010	31	2007	28	2009
3	2011	32	2010	31	2007
4	2007	33	2011	32	2011
5	2010	34	2008	33	2011
6	2003				
7	None				
8	2009				
9	2013				
10	2007				
11	2007				
12	2011				
13	2007				
14	2014				
15	2007				
16	2013				
17	None				
18	1964				
19	2006				
20	2010				
21	2007				
22	2011				
31	2007				
32	2006				
33	1996				
34	2007				

Christensen

T44N R76W		T44N R77W		T45N R76W		T45N R77W	
Section	Water Right Date	Section	Water Right Date	Section	Water Right Date	Section	Water Right Date
1	None	1	2014	17	2006	12	2011
2	None	2	2014	18	2011	13	2007
3	2011	3	2010	19	2011	14	2014
4	2011	4	2007	20	2011	15	2007
5	2009	9	2011	21	2011	22	2011
7	2009	10	2006	26	2012	23	2011
8	2011	11	2011	27	2011	24	2013
6	2009	12	2011	28	2011	25	2013
9	2011	13	2007	29	1978	26	2006
10	2011	14	2010	30	2013	27	2006
11	None	15	2007	31	1995	28	2010
12	None	23	2010	32	2007	33	1996
13	2013	24	2010	33	2011	34	2007
14	1960	25	2010	34	2007	35	2012
15	None			35	2013	36	2016
16	2011			36	2005		
17	2007						
18	2007						
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Legend

- Mine Units - Active
- Mine Units - Inactive
- Mine Units - Future Proposed
- Site Facilities
- Man Camp
- CBMWells
- Pumping Unit
- Other

U1 Permit Boundary
- Current
- Future Proposed

Controlled Areas
- Controlled
- Restricted

Isodose Contours
Counts - mrem
- < 2
- 2 - 3
- 3 - 4
- 4 - 5
- > 5

N

0 0.75 1.5 Kilometers

1:33,600

907 N. Poplar St. Suite 260, Casper, Wy 82601 (307) 234-8235

Willow Creek Project

CBM Well Locations
2 km Buffer

Johnson County, Wyoming

Date: 2/13/2018 | By: Penny Aurelius | Checked By:

Rev No.	Description	Date	By

Figure: 2

Coordinate System:
NAD 1927 StatePlane Wyoming East Central FIPS 4904
Projection: Transverse Mercator
Datum: North American 1927
False Easting: 500000.0000
False Northing: 0.0000
Central Meridian: -107.3333
Scale Factor: 0.9999
Latitude Of Origin: 40.5000
Units: Foot US

Document Path: C:\Users\rcas-05\Desktop\CBM_Locations.mxd