



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

January 30, 2017

MEMORANDUM TO: Bill Von Till, Chief  
Uranium Recovery Licensing Branch  
Division of Decommissioning, Uranium Recovery  
and Waste Programs  
Office of Nuclear Materials Safety and Safeguards

FROM: Ron Linton, Project Manager */RA/*  
Uranium Recovery Licensing Branch  
Division of Decommissioning, Uranium Recovery  
and Waste Programs  
Office of Nuclear Materials Safety and Safeguards

SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION STAFF REVIEW,  
URANIUM ONE USA, INC., WILLOW CREEK PROJECT, SEMI-  
ANNUAL EFFLUENT AND ENVIRONMENTAL MONITORING  
REPORTS FOR THE REPORTING PERIODS: JULY 1, 2014  
THROUGH DECEMBER 31, 2014; JANUARY 1, 2015 THROUGH  
JUNE 30, 2015; JULY 1, 2015 THROUGH DECEMBER 31, 2015;  
AND JANUARY 1, 2016 THROUGH JUNE 30, 2016, MATERIALS  
LICENSE SUA-1341, DOCKET NO. 04008502 (CLOSES CAC  
L00779, L00794, L00814, L00827)

Uranium One USA, Inc., submitted to the U.S. Nuclear Regulatory Commission (NRC), the above listed reports. The reports are available in the Agencywide Documents Access and Management System at package Accession No. ML15105A137, Accession No. ML15245A339, package Accession No. ML16095A072, and package Accession No. ML16246A013, respectively.

The NRC staff review of these reports are contained in the enclosed NRC Staff Review Report. The NRC Staff Review Report has been reviewed by the Willow Creek Project NRC Project Manager and Hydrogeologist and Senior NRC Health Physicist. The NRC staff observations and suggestions for follow up items are provided below. The NRC staff may follow up on items in this NRC Staff Review Report during future inspections.

Enclosure: NRC Staff Review Report

cc: Luke McMahan, PG. (WDEQ)  
Ryan Schierman (WDEQ)  
Scott Schierman (Uranium One)

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**NRC STAFF REVIEW REPORT  
REVIEW OF SEMI-ANNUAL EFFLUENT AND ENVIRONMENTAL  
MONITORING REPORTS AND ALARA AUDITS  
JULY 1, 2014 THROUGH DECEMBER 31, 2014  
JANUARY 1, 2015 THROUGH JUNE 30, 2015  
JULY 1, 2015 THROUGH DECEMBER 31, 2015  
JANUARY 1, 2016 THROUGH JUNE 30, 2016  
URANIUM ONE USA, INC., WILLOW CREEK PROJECT**

DATE: January 30, 2017

DOCKET NO.: 04008502

LICENSEE: Uranium One USA, Inc.

SITE: Willow Creek Project, Wyoming

PROJECT MANAGER: Ron Linton

TECHNICAL REVIEWERS: David Brown, Ron Linton

**Introduction**

Uranium One USA, Inc., (Uranium One or the licensee), submitted to the U.S. Nuclear Regulatory Commission (NRC), the following reports:

- Willow Creek ISR Project, Semi-Annual Report, July 1, 2014 through December 31, 2014, Agencywide Documents Access and Management System (ADAMS), package Accession No. ML15105A137.
- Willow Creek ISR Project, Semi-Annual Report, January 1, 2015 through June 30, 2015, and 2014 Annual ALARA Audit Report, ADAMS Accession No. ML15245A339.
- Willow Creek ISR Project, Semi-Annual Report, July 1, 2015 through December 31, 2015, ADAMS package Accession No. ML16095A072.
- Willow Creek ISR Project, Semi-Annual Report, January 1, 2016 through June 30, 2016, and 2015 Annual ALARA Audit Report, ADAMS Accession No. ML16246A013.

The above listed reports are reviewed individually in this NRC Staff Review Report.

Enclosure

## Applicable Requirements

The Semi-Annual Report is required by License SUA-1341, License Condition (LC) 12.1, and Title 10 of the *Code of Federal Regulations* (10 CFR) Part 40.65. LC 12.1 states:

*Effluent and environmental monitoring program results provided in the semi-annual report and in accordance with 10 CFR 40.65, "Effluent monitoring reporting requirements," shall be reported in the format shown in Table 3 of Regulatory Guide 4.14, (Rev. 1) entitled, "Sample Format for Reporting Monitoring Data." The report shall also include injection rates, recovery rates and injection manifold pressure, status of well fields in operation (including last date of lixiviant injection), status of well fields in restoration and restoration progress, status of any long term excursions, and a summary of mechanical integrity tests during the reporting period.*

### **Review of Willow Creek ISR Project, Semi-Annual Report, July 1, 2014 through December 31, 2014 dated February 28, 2015, ADAMS Accession No. ML15105A137.**

#### *Section 2.0 - Operational Monitoring*

- a. Uranium One reported it continues to recover uranium from five Mine Units (MU), 5-2, 7, 8, 10A, and 10B, and produce uranium loaded resins at the Christensen Ranch (CR) Satellite facility. Uranium resins are transported to the Irigaray (IR) Central Processing Plant for elution and production of yellowcake. The licensee reported no well fields are currently undergoing restoration. Well 7MW27 was confirmed in excursion status on December 31, 2014. The excursion has been corrected and the well is off excursion.
- b. Uranium One reported that a total of 1,505,948,089 gallons were injected and 1,490,127,845 gallons were recovered from operational mine units with an overall wellfield bleed of 1.1 percent during this reporting period. The NRC staff notes the licensee reported the results incorrectly (reversed) in the Semi-Annual Report Section 2.3, but reported the values correctly in Appendix A, Table 1, as 1,505,948,089 gallons produced (recovered) and 1,490,127,845 gallons injected.
- c. This bleed rate is in consistent with commitments made in the License Renewal Application, Section 3.3.3.4 (ADAMS Accession No. ML120820095) that an approximately one-percent bleed will be maintained and as tied down in LC 9.3.
- d. Uranium One reported the following bleed rates for each mine unit in production:
  - MU-5-2 semi-annual Total 2.2%
  - MU-7 semi-annual Total 1.2 %
  - MU-8 semi-annual Total 0.7%
  - MU-10A semi-annual Total 1.2%
  - MU-10B semi-annual Total 1.2%

- e. The NRC staff reviewed the Uranium One USA, Inc., Willow Creek Project, Annual Report for Wyoming Department of Environmental Quality (WDEQ) Permit to Mine No. 478, for July 1, 2014 to June 30, 2015 (ADAMS Package Accession No. ML15252A327) and notes that the production and injection values submitted to the NRC do not equal the production and injection values submitted to the WDEQ for the months from July 2014 to December 2014. For one example, MU-10B production total for July 2014 is stated as 76,377,048 gallons in the Semi-Annual Report and 60,663,744 in the WDEQ Annual Report, which is approximately a 21% reporting discrepancy. The NRC staff suggests that the licensee determine which values are correct and if the values reported in the Semi-Annual Report are incorrect, that the Semi-Annual Report be corrected and updated.
- f. Appendix A, Table 2, of the Semi-Annual Report, shows weekly maximum injection pressures. The licensee identified eight occasions when the 140 psi pressure limit was exceeded and provided explanations for the pressure spikes. All exceedances were a result extremely cold weather conditions.
- g. The licensee stated that mechanical integrity tests (MIT) were completed for 46 wells total, 44 in MU-7 and two in MU-8. Two wells failed MIT in MU-8. The licensee plans to repair the wells and retest them during the 3rd quarter of 2014. The licensee is assessing whether the wells need to be abandoned or can be repaired.

#### *Section 4.0 - Environmental Monitoring*

- a. The licensee reported six stock and domestic water wells are sampled within two kilometers of the CR and IR sites. The results are reported in Table 3. The NRC staff notes there are seven sample locations reported in Table 3. All constituents were below effluent concentration limits. The NRC staff reviewed the results in Table 3, Appendix A, of the report and agrees the samples are below effluent concentration limits.
- b. The licensee reported that seven surface water samples were taken. All samples were reported as below the 10 CFR Appendix B Table 2 Effluent Concentrations, with the exception of suspended sediment samples within the Powder River sample taken approximately 4.5 miles downstream of the confluence of Willow Creek with the Powder River. The licensee notes that the suspended sediment samples are not elevated at sampling location IR-9 that is located at the confluence of Willow Creek with Powder River. The NRC staff reviewed the results in Table 4, Appendix A, of the report and agrees the samples are below effluent concentration limits with the exception as noted by the licensee.
- c. The licensee stated that three reportable spills (greater than 420 gallons) occurred during this report period. The licensee indicated the spills were reported to the NRC and WDEQ and did not provide further details in the report. The NRC staff notes that three spills were reported during the reporting period: module 4-2 spill reported on July 28, 2014; module 4-2 spill reported on August 15, 2014; plant manifold spill reported July 15, 2014.

- d. The licensee reported in Table 5 of Appendix A the results of nine vegetation samples taken in during the previous reporting period, but reported during this reporting period, since the results were not available until after the previous report was published. The licensee reported no upward trends were noted and all samples were within natural variances of the historical averages.

#### *Section 6.0, Public Dose*

- a. The description of the dose conversion factor at the top of page 7 is incorrect. The dose factor used by Uranium One is calculated by dividing 50 mrem/year (the basis for the 10 CFR 20, Appendix B, Table 2 values) by the effluent concentration for radon-222 with daughters present ( $1\text{E-}10$   $\mu\text{Ci/ml}$ ). The correct unit for the dose factor is mrem-mL per  $\mu\text{Ci-year}$ .
- b. The NRC staff observed the following errors in Table 1, Public Dose (which incorrectly identifies the period of compliance as calendar year 2015, rather than 2014).
  - 1. Uranium One used incorrect values for annual average background concentrations for thorium-230, radium-226, and lead-210.
  - 2. For radon, the dose value, which is obtained by multiplying the annual average concentration with background subtracted by the dose conversion factor, should be 50 mrem, not 5 mrem.
  - 3. See comments below on Table 9. The calculation of the accumulated external dose is incorrect. The annual average value should be 28.9 mrem, and the background value should be 29.8 mrem. The background-subtracted annual average value should be zero (0) mrem.
  - 4. Uranium One did not apply an occupancy factor to the final dose.
- c. The NRC staff observed the following errors in Table 2, Public Dose (which also incorrectly identifies the period of compliance as 2015, rather than 2014).
  - 1. Uranium One used incorrect values for annual average background concentrations for thorium-230, radium-226, and lead-210.
  - 2. For radon, the correct value for the annual average radon concentration is  $4.75\text{E-}10$   $\mu\text{Ci/ml}$ , not  $1.5\text{E-}10$   $\mu\text{Ci/ml}$ . The annual average concentration with background subtracted should be  $-1.25\text{E-}10$   $\mu\text{Ci/mL}$ , not  $1\text{E-}10$   $\mu\text{Ci/mL}$ .
  - 3. The calculation of the accumulated external dose is incorrect. The annual average value should be 10.3 mrem, and the background value should be 16.6 mrem.
- d. Table 6, Environmental Radon Monitoring
  - 1. Except for location AS-1 (Table Mountain – Background), the values of 2014 location average for all CR samples are incorrect.
- e. Table 9, Environmental Gamma Radiation Monitoring
  - 1. The value for IR-13 location average 2014 (mrem/quarter) is incorrect. The NRC staff calculated 7.2 mrem/quarter, not 11.8 mrem/quarter.
  - 2. The values for Year-to-Date Total 2014 for all IR Project samples (IR-1, IR-3, IR-4, IR-5, IR-6, IR-13) are incorrect. The units are incorrect (should be mrem per

year, not mrem per quarter). The values appear to be totals for just the first two quarters of 2014.

3. The values for Year-to-Date Total 2014 for all CR samples (AS-1, AS-5A, AS-5B, AS-6, AS-7) are incorrect. The NRC staff could not figure out how Uranium One arrived at these values.

#### *Section 7.0 - Safety and Environmental Review Summary*

- a. Uranium One completed four safety and environmental evaluation panels (SERP) during the reporting period. The Report lists seven SERP reviews, however, two were dated prior to the reporting period, and one was dated after the reporting period. The purpose of SERP are summarized by the licensee in Appendix A, Table 10 of the Semi-Annual Report.

#### *Section 8.0 – Other*

- a. The licensee reported the primary use of surrounding lands at both IR and CR continues to be rural sheep and cattle ranching. The licensee reported petroleum wells within 1/3 mile west of the CR plant and 1/2 mile of the IR site. The licensee reported six coal bed methane wells were installed in 2014 near the site.

### **Review of Willow Creek ISR Project, Semi-Annual Report, January 1, 2015 through June 30, 2015, and 2014 Annual ALARA Audit Report dated August 31, 2015, ADAMS Accession No. ML15245A339.**

#### *Section 2.0 – Operational Monitoring*

- a. The licensee reported that production operations occurred at MU-7, MU-8, MU-5-2, MU-10A, and MU-10B. No wells were reported on excursion status. The overall bleed rate reported was 1.9%. This bleed rate is consistent with commitments made in the Licensee Renewal Application, Section 3.3.3.4. The licensee reported exceeding the 140 psi injection pressure nine times during the reporting period. The licensee provided explanations for each instance of over pressurization.
- b. In Section 2.5, the licensee reported 46 MITs completed during the reporting period with corresponding records contained in Attachment A. Attachment A is missing from the Semi-Annual Report. Additionally, the table in Section 2.5 shows 19 MIT's completed in MU-7, two completed in MU-8, and two completed in MU-10, for a total of 23 MITs completed, which is 23 less than stated.

#### *Section 4.0 – Environmental Monitoring*

- a. The licensee reported six stock and domestic water wells are sampled within two kilometers of the CR and IR sites. The results are reported in Table 3. As discussed previously, the NRC staff notes there are seven sample locations reported in Table 3. All constituents were below effluent concentration limits.

- b. The licensee reported that seven surface water samples were taken. All samples were reported as below the 10 CFR Appendix B Table 2 Effluent Concentrations. The NRC staff reviewed the results in Table 4, Appendix A, of the report and agrees the samples are below effluent concentration limits.
- c. The licensee stated that one reportable spill (greater than 420 gallons) occurred during this report period. The NRC staff confirms that the spill was reported to the NRC via e-mail on March 11, 2015, and in a letter dated March 30, 2015.
- d. The licensee reported in Table 5 of Appendix A the results of nine vegetation samples taken in during the previous reporting period. The licensee reported two samples were higher than historic values and were resampled. These samples will be reported in the next Semi-Annual Report.

#### *Section 6.0 – Public Dose*

- a. The NRC staff identified numerous errors in the public dose assessment and reporting of environmental monitoring data in the Semi-Annual Report, July 1, 2014 through December 31, 2014 dated February 28, 2015, as described above. However, the independent auditors who prepared the 2014 Annual ALARA Audit Report, which was attached to this report, did not identify any of the NRC staff identified errors in the public dose assessment and reported environmental monitoring data. For future annual ALARA audits, Uranium One should consider asking auditors to perform a detailed review of data and calculations supporting the annual public dose assessment.

#### *Section 7.0 - Safety and Environmental Review Summary*

- b. Uranium One completed one SERP during the reporting period. The purpose of the SERP is summarized by the licensee in Appendix A, Table 10 of the Semi-Annual Report.

### **Review of Willow Creek ISR Project, Semi-Annual Report, July 1, 2015 through December 31, 2015, dated February 28, 2016. ADAMS package Accession No. ML16095A072.**

#### *Section 2.0 - Operational Monitoring*

- a. During the reporting period, the licensee reported a total of zero gallons were injected and 14,749,748 gallons were recovered during the reporting period, resulting in a 100% bleed. The NRC staff notes that a bleed was maintained in all wellfields except for MU-5. In NRC inspection report 040-08502/16-001 dated August 26, 2016 (ADAMS Accession No. ML16243A088), Uranium One was cited with a severity level IV violation for failing to maintain a bleed in Wellfield 5-2 between mid-June 2015 and July 28, 2016.
- b. During the reporting period, one well was confirmed on excursion. The NRC staff confirmed the excursion report was submitted to the NRC in a letter dated July 31, 2015. The well was reported off excursion in a letter to the NRC dated September 24, 2015.



- c. The licensee reported that 186 MITs were performed and there were 31 failures.

#### *Section 4.0 - Environmental Monitoring*

- a. The licensee reported six stock and domestic water wells are sampled within two kilometers of the CR and IR sites. The results are reported in Table 3. As discussed previously, the NRC staff notes there are seven sample locations reported in Table 3. All constituents were reported as below effluent concentration limits. However, Table 3, CR Middle Artesian sample location shows Lead-210 (Suspended) as 151% of the 10 CFR 20 Appendix B Table 2 value. The NRC staff notes this sample was reported as 12% of the limit in the July – December 2014 Semi-Annual Report and 90% of the limit in the January – June 2015 Semi-Annual Report.
- b. The licensee reported that seven surface water samples were taken. All samples were reported as below the 10 CFR Appendix B Table 2 Effluent Concentrations. The NRC staff reviewed the results in Table 4, Appendix A, of the report and agrees the samples are below effluent concentration limits.
- c. The licensee reported one reportable spill during the reporting period. The NRC staff was notified of the spill in a release report dated December 28, 2015.

#### *Section 6.0 – Public Dose*

- a. Section 6.0, Public Dose
  - 1. The description of the dose conversion factor at the middle of page 5 is incorrect. The dose factor is calculated by dividing 50 mrem/year (the basis for the 10 CFR Part 20, Appendix B, Table 2 values) by the effluent concentration for radon-222 with daughters present (1E-10  $\mu$ Ci/ml).
- b. The NRC staff observed the following errors in Table 1, Public Dose.
  - 1. Uranium One used incorrect values for annual average background concentrations for thorium-230, radium-226, and lead-210.
  - 2. For radon, the annual average concentration with background subtracted is zero, not 1E-10  $\mu$ Ci/mL.
  - 3. The values of annual average external dose and annual average background location external dose are missing from Table 1. It is not clear how Uranium One arrived at a background-subtracted Annual Average Accumulated External Dose of 0.48 mrem.
- c. The NRC staff observed the following errors in Table 2, Public Dose.
  - 1. Uranium One used incorrect values for annual average background concentrations for thorium-230, radium-226, and lead-210.
  - 2. For radon, the annual average concentration with background subtracted is 1.75E-10  $\mu$ Ci/mL, not 1E-10  $\mu$ Ci/mL. The values of annual average external dose and annual average background location external dose are the same (i.e., 0.7 mrem) in Table 2. It is not clear how Uranium One arrived at a background-subtracted Annual Average Accumulated External Dose of 0.7 mrem.

*Section 7.0 - Safety and Environmental Review Summary*

- a. Uranium One completed one SERP during the reporting period. The purpose of the SERP is summarized by the licensee in Appendix A, Table 10 of the Semi-Annual Report.

*Section 8.0 - Other*

- a. The Semi-Annual Report states there is a land use survey included as a separate document. The Semi-Annual Report Section 8.2 states that the land use survey is included in Appendix B. The land use survey was not either a separate attachment or contained in Appendix B. There is a 2015 Land Use Figure included, however, the figure is titled "Controlled/Restricted Areas and does not show land uses. Uranium One updated the report in a letter dated October 26, 2016 (ADAMS Accession No. ML17010A403). The licensee included an attachment titled Appendix B, Land Use Survey.

**Review of Willow Creek ISR Project, Semi-Annual Report, January 1, 2016 through June 30, 2016, and 2015 Annual ALARA Audit Report, ADAMS Accession No. ML16246A013.**

*Section 2.0 - Operational Monitoring*

- a. The licensee reported limited production occurred in MU-8. During the reporting period, the licensee reported an overall wellfield bleed was maintained at 8.4%. A total of 162,526,477 gallons were injected and 177,345,105 gallons were recovered. The NRC staff notes that a bleed was maintained in all wellfields except for MU-5. In the NRC inspection report 040-08502/16-001 dated August 26, 2016 (ADAMS Accession No. ML16243A088), Uranium One was cited with a severity level IV violation for failing to maintain a bleed in Wellfield 5-2 between mid-June 2015 and July 28, 2016.
- b. No manifold injection pressures were reported to exceed 140 psi, which is the reporting limit.
- c. During the reporting period, two wells were confirmed on excursion. The NRC staff confirmed the excursion reports were submitted to the NRC in a letters dated May 5, 2016, and June 2, 2016. The well reported on excursion May 5, 2016, was reported off excursion in a letter to the NRC dated June 2, 2016.
- d. In Section 2.5, the licensee reported 208 MITs were performed and there were 14 failures. The table in Section 2.5 shows 180 MITs completed in MU-7, 227 completed in MU-8, and one completed in MU-2, for a total of 408 MITs completed. The table in Section 2.5 shows 200 more MITs completed than previously stated. The licensee grouted 39 wells during the reporting period.

#### *Section 4.0 - Environmental Monitoring*

- a. The licensee reported six stock and domestic water wells are sampled within two kilometers of the CR and IR sites. The results are reported in Table 3. As discussed previously, the NRC staff notes there are seven sample locations reported in Table 3. All constituents were reported as below effluent concentration limits. The NRC staff observes that the CR Middle Artesian sample location that reported Lead-210 (Suspended) as 151% of 10 CFR Part 20 Appendix B Table 2 value during the last reporting period was reported at 14% of the reporting limit during this reporting period.
- b. The licensee reported that seven surface water samples were taken. All samples were reported as below the 10 CFR Appendix B Table 2 Effluent Concentrations. The NRC staff reviewed the results in Table 4, Appendix A, of the report and agrees the samples are below effluent concentration limits.
- c. The licensee reported one reportable spill during the reporting period. The NRC staff cannot find written a notification of a reportable spill in ADAMS during the reporting period.
- d. The licensee reported vegetation samples for uranium values at sample location IR-3 are higher than historic values and are currently being evaluated and potentially re-sampled. The NRC staff notes sample location IR-3 was reported as higher than historic values in the January 1, 2015 through June 30, 2015. The licensee should further investigate the sampling and data reported from IR-3 to determine the cause of the sample values that are higher than historic values.

#### *Section 6.0 – Public Dose*

- a. The NRC staff identified numerous errors in the public dose assessment and reporting of environmental monitoring data in the Semi-Annual Report, July 1, 2015 through December 31, 2015 dated February 28, 2016, as described above. However, the independent auditors who prepared the 2015 Annual ALARA Audit Report, which was attached to this report, did not identify any of the NRC staff identified errors in the public dose assessment and reported environmental monitoring data. For future annual ALARA audits, Uranium One should consider asking auditors to perform a detailed review of data and calculations supporting the annual public dose assessment.

#### *Section 7.0 - Safety and Environmental Review Summary*

- a. Uranium One completed one SERP during the reporting period. The purpose of the SERP is summarized by the licensee in Appendix A, Table 10 of the Semi-Annual Report.