



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

July 5, 2016

Mr. Scott Schierman  
Sr. Health Safety and Environmental Specialist  
Uranium One, USA, Inc.  
907 N. Poplar Street, Suite 260  
Casper, WY 82601

SUBJECT: URANIUM ONE, USA, INC., WILLOW CREEK PROJECT, ACCEPTANCE  
REVIEW AND REQUEST FOR ADDITIONAL INFORMATION, IRIGARAY MINE  
UNITS 1-9 FINAL STATUS DECOMMISSIONING REPORT (TAC NO. L00791)

Dear Mr. Schierman:

By letter dated August 7, 2015, Uranium One, USA, Inc. (Uranium One) submitted the Irigaray Mine Units 1-9 Final Status Decommissioning Report for its Willow Creek operations. The report was made publicly available on August 27, 2015, and was placed in the U.S. Nuclear Regulatory Commission's (NRC's) Agencywide Documents Access and Management System (ADAMS). The report can be found at ADAMS Accession Package No. ML15231A096.

The NRC staff and staff contractor, ORAU, has reviewed the report and finds it acceptable for a detailed technical review. ORAU has provided comments and a request for additional information (RAI) on the Irigaray Mine Units 1-9 Final Status Decommissioning Report which are provided in the enclosure. The NRC staff and contractor plans to perform an independent verification survey to be conducted on-site with NRC Headquarters and/or NRC Region IV staff. The verification survey will be coordinated with Uranium One. We are available to meet with you to discuss the review, as needed. NRC staff requests responses to the comments and RAI's within 30 days of receipt of this letter.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of ADAMS. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

S. Schierman

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If you have any questions concerning this letter, please contact me, either by telephone at (301) 415-7777, or by e-mail at [Ron.Linton@nrc.gov](mailto:Ron.Linton@nrc.gov).

Sincerely,

*/RA/*

Ron C. Linton, Project Manager  
Uranium Recovery Licensing Branch  
Division of Decommissioning, Uranium Recovery,  
and Waste Programs  
Office of Nuclear Material Safety  
and Safeguards

Enclosure:  
ORAU Comments and RAI

Docket No. 040-08502  
License No. SUA-1341

cc: Luke McMahan, PG (WDEQ-LQD)  
Tim Vitkus (ORAU)

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<b>DATE:</b>	6/15/16	6/ 16 /16	6/ 29 /16	6/30/16	7/5/16

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**ORAU Review of the Final Status Decommissioning Report Supporting Release of  
Mine Units 1 through 9 and Two Associated Buildings at the Irigaray  
Site for Unrestricted Future Use;  
Willow Creek Project, Johnson County, Wyoming**

**General Comment:**

The final status decommissioning report (FSDR) was reviewed against commitments provided in the site's approved decommissioning plan (DP), including revisions. The specific references are:

1. COGEMA Mining, Inc. Decommissioning Plan for Irigaray and Christensen Ranch Projects; December 19, 2000.
2. COGEMA Mining, Inc. Submittal of Additional Information for December, 2000 Decommissioning Plan, COGEMA Mining, Inc., June 15, 2001.
3. COGEMA Mining, Inc., Missing Attachments for the June 15, 2001 Submittal, June 18, 2001.
4. COGEMA Mining, Inc. Clarifications to COGEMA Mining, Inc. Decommissioning Plan, Revised June 2001, August 31, 2001.
5. Environmental Restoration Group, Inc. Final Status Decommissioning Report Supporting Release of Mine Units 1 through 9 And Two Associated Buildings at the Irigaray Site For Unrestricted Future Use; August 2015.

The ORAU independent review determined that the implementation of the final status survey, as documented in the FSDR, in most cases followed the proposed cleanup and/or verification procedures and commitments described in the DP for both soils and buildings. However, there were several discussions within the FSDR where the DP specific commitments could not be met. The DP general commitments regarding the surface scan coverage, types of radiation measurements, and sampling, were also reviewed and compared with the FSS implementation. ORAU recognizes the unique nature of uranium recovery facilities relative to their large land area sizes, and the historical methods used for demonstrating compliance with unrestricted release limits. One primary example is the fundamental land area compliance unit of 100 m<sup>2</sup> for land areas as required in 10 CFR § 40 Appendix A, Criterion 6 (6) and reliance upon gamma radiation scans of each 100 m<sup>2</sup> area coupled with a gamma count rate action level. The land areas are then generally only sampled within anomalous areas. Furthermore, the DP and final status survey as implemented for the Large Building and the Shed adapted components of the radiological survey and assessment processes described in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Specifically for buildings, survey units were established based on classification, population sample sizes were based on the requirements of the non-parametric Sign test, and the data subsequently assessed using the Sign test.

The DP did not require or base land area final status survey design on MARSSIM guidance. Essentially, the design was a non-statistical design with a single decision unit—all mine units combined—without consideration for contamination potential, spill history, or other factors. As presented in the DP, the gamma count rates for all 100 m<sup>2</sup> gridblocks were to be ranked and the top 10% sampled to ensure cleanup limits are satisfied. If any one composite sample exceeded

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the cleanup limit, a second set of 10% of the grid blocks was to be sampled. Section 4.1 of the FSDR identified two grids where the limit was exceeded. The FSDR did not indicate that a second 10% of grid blocks sample population was collected, as stated in the DP.

For data assessment and deciding if the area satisfied the release limits, the DP proposed a parametric data assessment. However, Section 5 of the FSDR discusses the applicability of the Sign test as a method of justifying compliance with the cleanup criteria in addition to the benchmark dose evaluation, and the results of the application of the test. However, there were no specific data quality objectives provided that could be used to evaluate the appropriateness or acceptability of either data assessment method. Furthermore, use of the Sign test represents a modification to the DP commitments.

There were several technical concerns identified with the final survey approach that was ultimately implemented. Where applicable, both the FSDR and DP sections are cited in the request for additional information (RAI) listed below.

#### **RAI No. 1**

FSDR Section 4; FSDR page 8

Related DP Sections: Sections 7.2; DP Appendix E, Standard Operating Procedure (SOP) D-3

#### **Comment/Description of Deficiency:**

Failure to follow the DP and SOP D-3 referenced in the DP. The DP states an additional 10 percent of the 100 m<sup>2</sup> grids will be sampled if a regulatory exceedance is found in the initial 10 percent of grid samples.

#### **Comment Basis:**

The DP states in Section 7.2:

The sampling program detailed in SOP D-3 provides an added level of assurance that the gamma action level conservatively predicts that an area meets the cleanup criteria. The average count rate for the 100 m<sup>2</sup> grid blocks within the two areas of each site is calculated. The grid blocks are ranked according to the average count rate and the top ten percent of the grid blocks are sampled according to the procedure. If any of these grid blocks fail verification by soil sampling and analysis, the second ten percent of the grid blocks are sampled, and so on. A final statistical test is done to assure that the mean of the sample results, at the 95 percent confidence level, is below the cleanup criteria.

The FSDR states in Section 4.1:

A color-coded map showing the spatial distribution of average Ra-226 concentrations in surface soils (0-15 cm depth) within 100 m<sup>2</sup> survey grid boxes is shown in Figure A3. Among all Mine Units, only 1 survey grid box, located in Mine Unit 1, exceeded the 7-pCi/g gross cleanup criterion for Ra-226 in surface soils (Figure A3). The initial average soil Ra-226 concentration in this grid box was 60.7 pCi/g with an average U-nat concentration of 37.3 pCi/g.

Figure A5 shows sum-of-fractions values for the combined Ra-226 and U-nat soil concentrations occurring within each sampled survey grid box. Among all Mine Units, only 2 samples exceeded the sum-of-fractions criterion (unity), both of which occurred in Mine Unit 1 (Figure A5). One of these samples, corresponding to the post-cleanup results for the remediated box described above, had a sum-of-fractions value of 1.49 while the other only slightly exceeded the sum-of-fractions limit (the calculated result was 1.14).

It appears that since there was an exceedance of the regulatory standard in two sample grids as reported in the FSDR, the second ten percent of the grid blocks should have been sampled as stated in the DP.

**Proposed Path Forward/Action Request:**

Provide a second set of soil samples covering 10% of the grid blocks since two grid blocks exceeded the clearance limit per the DP.

**RAI No. 2**

**FSDR/DP Section:**

FSDR Section 3 and 4.1; FSDR pages 5, 10 and 11

Related DP Sections: Sections 2.3 and 7; DP Appendices A and E

**Comment/Description of Deficiency:**

The statistical basis for selecting 10 percent of the grid blocks for sampling is unclear.

**Comment Basis:**

It is understood that the approved DP specified that 10 percent of the land area grids would be selected for soil sampling based on the results of gamma surface scans and that the selected grids would be those with the highest reported gamma radiation levels. The gamma surface scans provided the qualitative gamma action level assessment of the full population of 100 m<sup>2</sup> areas. However, additional information is necessary to provide assurance that the 10 percent of grids subjected to composite sampling would demonstrate both the acceptability of the 25,000 cpm gamma action level and confidence that all or a high percentage of all grids satisfied the release limits if they were to also be sampled. The following deficiencies were noted:

1. The DP also specified that the statistical evaluation would be via the parametric Student's t-test to determine if the mean was less than the release limit. Ultimately during the final status survey, judgmental and random locations were selected for sampling and the non-parametric Sign test suggested to statistically test the data. An evaluation was not provided that adequately addressed the impact to decision making of not ranking the gamma radiation levels in all grid blocks and ensuring the highest 10 percent were sampled. It is not clear from a comparison of FSDR Figures A2 and A3 that the locations with highest quantified Ra-226 concentrations, were associated with those grids exhibiting the highest color-coded gamma radiation levels. Also, as discussed in RAI No. 1, a second set of grids were not sampled when one was found to exceed the clearance limit of the grids would satisfy decision-making requirements and there is no discussion of the number of samples needed for the statistical decision.

2. Essentially, neither of the proposed approaches would be considered appropriate when each fundamental compliance unit is 100 m<sup>2</sup> in lieu of the insufficient correlation and because further investigations of a second 10% sample population was not performed.
3. Both the random and judgmental samples were included in the statistical assessment. Judgmental samples should not be included in statistical decisions.

**Proposed Path Forward/Action Request:**

Conduct a retrospective evaluation of the sample data to determine the probability that the number of random samples collected was adequate to demonstrate at an acceptable confidence level that a significant proportion of the 100 m<sup>2</sup> compliance units—i.e. >95 percent per the DP—would be found to satisfy the release limits. Alternatively, justify the appropriateness of the sample planning parameters, decision units, and decision rules that were implemented.

Ensure statistical decisions are made without including judgmental data. Judgmental data should be evaluated independently.

**RAI No. 3**

**FSDR/DP Section:**

FDSR Section 4.1, page 8

**Comment/Description of Deficiency:**

The first paragraph of the section discusses a survey grid box in Mine Unit 1 that was remediated. The discussion indicates that although the Ra-226 was reduced, it appears that the U-nat concentration increased.

**Comment Basis:**

The increased U-nat concentration after remediation—although less than the cleanup limit—is an anomalous result that warrants further discussion to ensure a burial area had not been encountered. The mechanism for increasing concentrations of U-nat with depth was not discussed. There was no discussion of an investigation or additional sampling to ensure that higher levels exceeding the cleanup limit would not be encountered.

**Proposed Path Forward/Action Request:**

Provide additional discussion of this anomaly.

**RAI No. 4****FSDR/DP Section:**

FDSR, Section 4.1, pages 9, 10 and 11

**Comment/Description of Deficiency:**

The first full sentence on Page 9 states: "This recognition is consistent with NRC guidance to base radium benchmark dose modeling...and is also consistent with the data analysis procedure specified in the approved Decommissioning Plan..." Pages 10 and 11 provide the data assessment conclusions regarding the sampled population and conclusions reached for all areas.

As discussed in RAI Comment No. 2, the data analysis procedure applied is likely not appropriate to the release decision criterion as 100 percent of the 100 m<sup>2</sup> were not quantitatively assessed; only qualitative surveys were performed.

Furthermore, the justification for the single decision population—i.e. Mine Units 1 through 9, collectively, is unclear.

**Comment Basis:**

Although as noted on page 10 of the FSSR, applying parametric data assessments to highly skewed data would likely not have been appropriate, the data analysis and assessment did not follow the commitments of the DP. Additionally, simply applying MARSSIM-based statistical methods for the data assessment phase to survey data that were not planned for in accordance with the MARSSIM data quality objectives may or may not be defensible without additional justification. Special consideration in the justification would be the reasons as to why the site was not classified based on contamination potential and having a single decision unit boundary versus individual survey units.

**Proposed Path Forward/Action Request:**

Provide additional technical justification as to the appropriateness of land area data assessments to a final status survey that was not designed or implemented in accordance with the MARSSIM guidance. Alternatively, provide other appropriate non-parametric data assessments.

**RAI No. 5****FSDR/DP Section:**

FDSR, Section 4.2, page 12

**Comment/Description of Deficiency:**

The report does not provide the number of samples collected from trenches within Mine Unit 6. The remaining mine unit trench sampling discussions include the number of samples collected.

**Comment Basis:**

Consistent information for all areas investigated is to be provided to ensure DP commitments have been met,

**Proposed Path Forward/Action Request:**

Provide the number of samples collected from trenches within Mine Unit 6.

**RAI No. 6****FSDR/DP Section:**

FDSR Section 5, page 14

**Comment/Description of Deficiency:**

The application of the non- parametric Sign test may or may not be appropriate to demonstrate compliance for the entire land area. First an evaluation should be performed as to whether the land area should be subdivided into smaller populations based on contamination potential. Second, the appropriate compliance unit is determined and other additional considerations are assessed— e.g., a compliance unit of 100 m<sup>2</sup> and acceptable proportion confidence level, a more current survey unit compliance area in accordance with MARSSIM, or some other method. Third and last, an appropriate data assessment can be selected.

**Comment Basis:**

The final status survey was not planned following the recommendations in MARSSIM. Therefore, applying the statistical methods provided in MARSSIM may not be appropriate or result in the same decision for individual survey units. Similarly, applying a statistical assessment that is more applicable to the type of survey that was implemented, may have also lead to a different decision than the one presented in the report.

**Proposed Path Forward/Action Request:**

Perform additional evaluations and select a defensible data assessment method for demonstrating compliance. The resolution of other referenced comments would ultimately resolve this issue.

**RAI No. 7****FSDR/DP Section:**

FDSR Report B, Section 2; page 18  
Related DP Sections, Section C.4.2, Page C-9

**Comment/Description of Deficiency:**

The stated number of measurements for a Class 2 structural survey unit is six. It was determined that this number of measurements was not appropriately determined within the DP. The DP adapted MARSSIM guidance to plan the final status surveys of the Large Building and the Shed. Within the DP, the licensee based the number of required measurements for Class 2 structures based on a Type I error or 0.2. The default Type I error—i.e., the regulators' error of incorrectly rejecting the null hypothesis—is 0.05. Changing the Type I error from the default value is not consistent with the approved DP.

NOTE: FSDR Report B. Section 2.2.1, states that eight measurements were performed per wall, for a total of 16 measurements for the two lower wall Class 2 survey units of the Large Building.

**Comment Basis:**

Assurance must be provided that the surveys planned and ultimately implemented for the site structures were based on an acceptable Type I error.

**Proposed Path Forward/Action Request:**

Provide additional information regarding the “as implemented” release survey to ensure decision errors were appropriately planned for in determining the required number of measurements in Class 2 building survey units.

**RAI No. 8****FSDR/DP Section:**

FDSR Report B Section 2 and Appendix B-1 Table 2; pages 19 and 37-41.  
Related DP Sections; Section C.4.1 and C.4.2, Pages C-8 and C-9

**Comment/Description of Deficiency:**

The last sentence of Section 2 FDSR Report B states that static beta measurements were made at a minimum of three locations per building survey unit, pursuant to the DP. The DP states that these beta measurements will be made at random locations.

Because of the expected attenuation of the alpha radiation, the preferred measurement method would have been beta surface activity levels. The DP does provide a discussion regarding the basis for selecting alpha measurements as the primary quantification process for demonstrating compliance with the release limit of 1,000 dpm/100 cm<sup>2</sup>. However, there remains a potential that surface activity has been underestimated. Rather than selecting random locations for beta activity assessment, the recommendation should have been to perform the beta measurements at judgmental locations where elevated alpha radiation was detected but determined to be less than the release limit. Provided that an acceptable beta efficiency had been established that represented the alpha fraction of potential contamination and if the calculated beta activity levels also supported that the release limit was satisfied, then the necessary confidence could be established that residual contamination had been appropriately represented.

**Comment Basis:**

Based on an essentially equivalent alpha-to-beta decay ratio for processed U-nat, alpha, alpha-plus-beta, or beta-only measurements could be performed to quantify the U-nat surface activity in terms of the alpha activity. The calibration efficiency for the applicable measurement method is established in terms of the fraction of total uranium alpha activity each decay represents. When the calibration is performed correctly, the surface activity that is calculated would then be in terms of the alpha activity and theoretically each of the measurement types should result in comparable quantified values.

In reviewing the surface activities for scanning measurements provided in Table 2, the alpha- to-beta surface activity levels do not appear comparable and potentially indicate an underestimation of the alpha activity relative to the respective beta activity. There are other potential causes for the differences. However, the report does not provide an assessment of the observed difference nor

were the data for the random beta static measurements provided for comparison with the alpha result at each location.

**Proposed Path Forward/Action Request**

Provide additional information to support that the alpha surface activity levels accurately represent the final status contamination levels on structural surfaces and the beta radiation measurement results in accordance with 10 CFR § 40.42 (j)(i).

**RAI No. 9**

**FSDR/DP Section:**

FSDR Section 2.2.1 and 3.2.1 Biased Measurements Subsections, pages 21 and 24.

**Comment/Description of Deficiency:**

The text of the two Biased Measurement sections is unclear regarding the floor trenches within the Large Building. On page 21, the narrative is interpreted to mean that the trenches were included in a Class 3 survey unit comprised of various unrelated items and structures. The page 24 discussion indicates that the trench was contaminated above the release limits, but is unclear as to what transpired. The text states it was not reclassified as a Class 2 area. However, reclassification to a Class 2 would not have been appropriate if any single measurement exceeded the release limit. There is also a statement regarding the surface area of the trench being small compared with the 100 m<sup>2</sup> survey unit. It is unclear which survey unit is being referenced, the Class 3 unit that the trenches were initially included in, or one of the Class 1 floor survey units.

The narrative does not indicate whether the trenches were remediated prior to being filled with concrete or the final radiological status of the trenches.

**Comment Basis:**

There is insufficient information provided regarding the trench.

**Proposed Path Forward/Action Request**

Provide additional clarifying information regarding the assessment of the trenches and the final status of trench surfaces prior to being filled with concrete.