



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
1600 E. LAMAR BLVD  
ARLINGTON, TX 76011-4511

April 20, 2017

Thomas Wohlford  
Closure Manager  
Homestake Mining Company of California  
P.O. Box 98  
Grants, NM 87020

SUBJECT: NRC INSPECTION REPORT 040-08903/2016-001 AND NOTICE OF VIOLATION

Dear Mr. Wohlford:

This letter refers to the U.S. Nuclear Regulatory Commission (NRC) inspection conducted from August 24-25, 2016, at your Ambrosia Lake facility in Cibola County, New Mexico. This inspection was an examination of activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures, representative records, observations of activities, and interviews with personnel.

The preliminary inspection findings were presented to you and your staff at the conclusion of the onsite inspection. The final inspection results were presented to you by telephone on April 20, 2017, after the NRC completed its review of your methodology for measuring and calculating the radon flux emanating from the two onsite tailings piles. The enclosed report presents the results of this inspection.

Based on the results of this inspection, the NRC has determined that one Severity Level IV violation of NRC requirements occurred. The violation involves your failure to collect a sufficient number of radon flux samples, correctly calculate the radon flux average value, and maintain the radon flux below the standard specified in the license and regulations for the large tailings pile. The violation was evaluated in accordance with the NRC's Enforcement Policy. The current Enforcement Policy is included on the NRC's Web site at <https://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The violation is cited in the enclosed Notice of Violation (Notice) and the circumstances surrounding it are described in detail in the subject inspection report. The violation is being cited in the Notice because it was identified by the NRC staff.

Although your staff responded to this issue by letter dated September 8, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16253A143), the NRC has determined that your response did not fully address the violation. Therefore, you are required to respond to this letter and should follow the instructions specified in the enclosed Notice when preparing your response. If you have additional information that you believe the NRC should consider, you may provide it in your response to the Notice. The NRC review of

your response to the Notice will also determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

The NRC inspectors found another example of a previously identified violation. The violation involved your failure to prevent the injection of water into the alluvial aquifer during 2015 that exceeded the groundwater protection standards, a violation of License Condition 35 requirements. Details about this violation are provided in Section 4.2 of the enclosed inspection report. This violation is the same as the second apparent violation discussed in the NRC's letter to Homestake Mining dated October 4, 2016 (ADAMS Accession No. ML16251A526), but covers a different time frame. This new example does not change the safety significance or the regulatory concern arising out of the initial violation. In addition, the corrective actions for the apparent violation are described in the NRC's Confirmatory Order dated March 28, 2017 (ADAMS Accession No. ML17060A752). Therefore, no new enforcement action is issued in this report.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter, its enclosures, and your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's ADAMS, accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy or proprietary information so that it can be made available to the Public without redaction.

Should you have any questions concerning this inspection, please contact Dr. Robert Evans at 817-200-1234 or the undersigned at 817-200-1191.

Sincerely,

*/RA/*

Ray L. Kellar, P.E., Chief  
Fuel Cycle and Decommissioning Branch  
Division of Nuclear Materials Safety

Docket No. 040-08903  
License No. SUA-1471

Enclosures:

1. Notice of Violation
2. NRC Inspection Report 040-08903/2016-001

cc w/encls:

Michelle Hunter, New Mexico Environment Department  
Santiago Rodriguez, New Mexico Environment Department  
Dr. April Gil, U.S. Department of Energy

NRC INSPECTION REPORT 040-08903/2016-001 AND NOTICE OF VIOLATION DATED  
APRIL 20, 2017

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## NOTICE OF VIOLATION

Homestake Mining Co. of California  
Grants, New Mexico

Docket No. 040-08903  
License No. SUA-1471

During a U.S. Nuclear Regulatory Commission (NRC) inspection conducted from August 24-25, 2016, one violation of NRC requirements was identified. In accordance with the NRC's Enforcement Policy, the violation is listed below:

10 CFR Part 40, Appendix A, Criterion 6A(2) requires, in part, that the Commission may approve a licensee's request to extend the time for performance of milestones related to emplacement of the final radon barrier if the Commission finds that the licensee has adequately demonstrated in the manner required in paragraph (2) of Criterion 6 that releases of radon-222 do not exceed an average of 20 picocuries per meter-squared second ( $\text{pCi}/\text{m}^2\text{s}$ ). If the delay is approved on the basis that the radon releases do not exceed 20  $\text{pCi}/\text{m}^2\text{s}$ , a verification of radon levels, as required by paragraph (2) of Criterion 6, must be made annually during the period of delay.

10 CFR Part 40, Appendix A, Criterion 6(2) requires, in part, that the licensee shall verify through appropriate testing and analysis that the design and construction of the final radon barrier is effective in limiting releases of radon-222 to a level not exceeding 20  $\text{pCi}/\text{m}^2\text{s}$  averaged over the entire pile or impoundment using the procedures described in 40 CFR Part 61, Appendix B, Method 115, or another method of verification approved by the Commission as being at least as effective in demonstrating the effectiveness of the final radon barrier.

40 CFR Part 61, Appendix B, Method 115 (2.1.1), requires, in part, that a single set of radon flux measurements may be made, or if the owner or operator chooses, more frequent measurements may be made over a one year period. The mean radon flux from the pile shall be the arithmetic mean of the mean radon flux for each measurement period.

40 CFR Part 61, Appendix B, Method 115 (2.1.2), requires, in part, that the mean radon flux shall be determined for each individual region of the pile. For mill tailings after disposal, the pile shall be considered to consist of only one region.

40 CFR Part 61, Appendix B, Method 115 (2.1.3), requires, in part, that for a mill tailings pile after disposal which consists of only one region, a minimum of 100 measurements are required.

Contrary to the above, in August 2015, the licensee: failed to verify through appropriate testing and analysis that the radon releases do not exceed 20  $\text{pCi}/\text{m}^2\text{s}$ ; failed to ensure that a single set of radon flux measurements may be made, or if the owner or operator chooses, more frequent measurements may be made over a one year period; and failed to have the required minimum 100 measurements for a mill tailings pile after disposal which consists of only one region. Specifically, the average radon-222 release from the interim cover area of the large tailings pile was 50.04  $\text{pCi}/\text{m}^2\text{s}$ , an arithmetic mean radon flux that was greater than the 20  $\text{pCi}/\text{m}^2\text{s}$  requirement. Further, the licensee used data results that were greater than one year old in its 2015 radon flux calculation. In addition, the licensee collected only 64 measurements from the large tailings pile and 36

measurements from the small tailings pile; although, a minimum of 100 measurements were required for each tailings pile.

This is a Severity Level IV violation (NRC Enforcement Policy Section 6.7).

Pursuant to the provisions of 10 CFR 2.201, Homestake Mining Company of California is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, Region IV, 1600 East Lamar Blvd., Arlington, TX 76011-4511, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violation, or, if contested, the basis for disputing the violation or severity level; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken; and (4) the date when full compliance will be achieved. Your response may reference or include previous docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued requiring information as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, United States Nuclear Regulatory Commission, Washington, DC 20555-0001.

Your response will be made available electronically for public inspection in the NRC Public Document Room or in the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>. To the extent possible, your response should not include any personal privacy or proprietary information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request withholding of such material, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information will create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information).

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days of receipt.

Dated this 20<sup>th</sup> day of April 2017

**U.S. NUCLEAR REGULATORY COMMISSION  
Region IV**

Docket: 040-08903

License: SUA-1471

Report: 040-08903/2016-001

Licensee: Homestake Mining Co. of California

Facility: Grants Reclamation Project

Location: Cibola County, New Mexico

Dates: August 24-25, 2016

Inspectors: Robert J. Evans, PhD, PE, CHP, Senior Health Physicist  
Fuel Cycle and Decommissioning Branch  
Division of Nuclear Materials Safety

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Materials Decommissioning Branch  
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Accompanied by: Jeffery A. Whited, Project Manager  
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Office of Nuclear Material Safety and Safeguards

Approved by: Ray L. Kellar, P.E., Chief  
Fuel Cycle and Decommissioning Branch  
Division of Nuclear Materials Safety

Attachment: Supplemental Inspection Information

## EXECUTIVE SUMMARY

Homestake Mining Co.  
NRC Inspection Report 040-08903/2016-001

This inspection was a routine, announced inspection of decommissioning activities being conducted at the former Homestake Mining mill in Cibola County, New Mexico. In summary, the licensee was conducting decommissioning activities in accordance with license and regulatory requirements, with one exception as described below.

### Management Organization and Controls

- The licensee staffed all management-level positions and provided sufficient staff for the work in progress. The licensee conducted routine audits and site inspections in accordance with license and regulatory requirements. (Section 1.2)

### Radiation Protection/Operator Training

- The licensee implemented a radiation protection program that met the requirements of 10 CFR Part 20 and the license. Occupational exposures were small fractions of the regulatory limits. Bioassay sampling and contamination survey results indicate that the licensee was controlling contamination. The licensee maintained instrument calibrations in accordance with the license. The licensee provided radiation protection training to employees and contractors as required by regulations and the license. (Section 2.2)

### Radioactive Waste Management

- Through site tours, the inspectors concluded that the licensee was operating and maintaining the impoundments, ponds, and related equipment in accordance with procedural requirements. The inspectors identified a violation involving the licensee's failure to collect a sufficient number of samples, correctly calculate the radon flux, and maintain the radon flux release rate from the large tailings pile below the standard specified in regulations. (Section 3.2)

### Effluent Control and Environmental Protection

- The licensee established groundwater and environmental monitoring programs as required by the license. The environmental and groundwater monitoring reports were submitted to the NRC as required by the license. An additional example of a violation was identified related to the licensee's failure to meet the groundwater protection standards at Sampling Point 2 (SP2) prior to discharging the liquid effluent to the environment. Corrective actions are currently being performed to address the previously identified violation. The licensee continued to conduct land use surveys as required by the license. (Section 4.2)

## Report Details

### **Site Status**

The Homestake facility was a conventional uranium mill that operated from 1958-1990. The mill was decommissioned in 1993-1994, and cleanup of the wind-blown tailings was completed in 1995. Tailings generated from milling operations were placed in two piles, a large tailings pile and a small tailings pile.

The side slopes of the main tailings pile have been covered with a permanent radon barrier and erosion protection layer. An interim cover is being maintained on top of the large tailings pile. Two lined evaporation ponds are situated on top of the small tailings pile. The remainder of the small tailings pile is covered with an interim cover. In addition, two water collection ponds were constructed adjacent to the small tailings pile. A third evaporation pond was constructed in 2011 to the north of the main tailings pile.

Activities completed at the site since the previous inspection include expansion of the zeolite and reverse osmosis systems, placement of extra groundwater cleanup wells into service, and completion of the main pipeline required to support the additional groundwater cleanup flowrates. At the time of the inspection, the licensee continued to operate the groundwater restoration systems, and the licensee continued to dispose of wastewater through enhanced evaporation in three evaporation ponds on a seasonal basis.

### **1 Management Organization and Control (88005)**

#### **1.1 Inspection Scope**

The inspectors reviewed the licensee's oversight and control of licensed activities.

#### **1.2 Observations and Findings**

##### **a. Site Staffing**

The inspectors reviewed site staffing to ensure that the licensee had sufficient staff to implement licensed requirements. At the time of the inspection, site staffing consisted of eight individuals including the closure manager/radiation protection administrator (radiation safety officer), site supervisor, four utility operators, and a community relations specialist. The position of senior project engineer was dissolved, and the position of hydrogeologist was open.

Contractors were used to supplement the site staff. The contractors drilled wells, constructed and modified systems and structures, installed piping, conducted electrical work, and conducted routine site maintenance. Consultants were used as necessary to implement portions of the radiation protection, training, environmental monitoring, and annual audit programs. The licensee estimated that it had about 20 contractors on site on any given day. In summary, the licensee had sufficient staff for implementing the requirements of the license.

b. Routine Site Audits, Inspections and Reports

Title 10 CFR 20.1101(c) requires the licensee to conduct annual radiation protection program reviews. License Condition (LC) 32 provides the audit requirements, and LC 42 requires the licensee to submit a copy of the audit to the NRC in the annual report. Further, LC 35.E requires the licensee to complete an annual performance review by March 31<sup>st</sup> of each year. The licensee submitted the annual performance review for 2015 to the NRC by letter dated March 31, 2016 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML16103A424, ML16103A425, and ML16103A426).

A third-party contractor conducted the annual As Low As Reasonably Achievable (ALARA) audit on behalf of the licensee in December 2015. The auditor did not identify any findings but provided four recommendations. The inspectors concluded that the annual ALARA audit was a comprehensive, independent review of the licensee's radiation protection program.

License Condition 22 states, in part, that inspections shall be documented. The licensee conducted daily inspections of the water systems including evaporation ponds, collection ponds, spray systems, leak detection sumps, embankment conditions, and impoundment toe sumps. The licensee maintained records of these inspections.

The licensee conducted annual inspections of the tailings impoundment and ponds in accordance with the requirements of LC 12. The results of these inspections were provided in Appendix E to the annual report dated March 31, 2016. The annual inspection was conducted in October 2015. The inspector, a registered professional engineer, concluded that the tailings impoundment and evaporation ponds were in generally good condition and were being maintained with operating limits. The inspector recommended rill management and grade control to help control erosion of the small tailing pile, evaporation ponds, and the interim cover of the large tailings pile.

License Condition 23 requires, in part, that standard operating procedures be established for all operational activities involving radioactive materials. In addition, written procedures must be established for environmental monitoring, bioassay analysis, and instrument calibrations. The inspectors reviewed the licensee's procedure list and selected procedures. The procedures are maintained in the licensee's Homestake Manual of Standard Practices. The licensee reviewed the procedures annually, most recently in October 2015. In summary, the inspectors determined that site procedures had been adequately established and implemented.

c. Implementation of the Performance-Based License

License Condition 16 allows the licensee to use a risk-informed, performance-based approach to determine if proposed changes to licensed site activities, or any new activities, could result in an environmental impact greater than that evaluated in the current licensing basis for the site. The licensee did not approve any new Safety and Environmental Review Panel (SERP) evaluations since the last inspection.

### 1.3 Conclusions

The licensee staffed all management-level positions and provided sufficient staff for the work in progress. The licensee conducted routine audits and site inspections in accordance with license and regulatory requirements.

## **2 Radiation Protection/Operator Training (83822/88010)**

### 2.1 Inspection Scope

The inspectors reviewed the licensee's radiation protection and training programs to verify compliance with 10 CFR Part 20 and license requirements.

### 2.2 Observations and Findings

The licensee's Manual of Standard Practices provides instructions for implementing the various aspects of the radiation protection program. At the time of the inspection, the radiation protection program consisted of occupational dose assessments, bioassays, contamination surveys, radiation work permits, instrument calibrations, and worker training. Based on the limited work in progress, the licensee previously suspended the respiratory protection and breathing zone air sampling programs, and the licensee discontinued internal dose assessments.

External occupational exposures were monitored using optically-stimulated dosimeters that were exchanged quarterly. The inspectors reviewed the licensee's records for 2015-2016. In 2015, the licensee monitored 319 employees and contractors. The highest recorded exposure was 0.011 rem with a regulatory limit of 5.0 rem; although, the licensee's records indicate that several dosimeters were documented as lost. During the first half of 2016, there were no detectable doses assigned to site workers.

The licensee implemented an extensive bioassay program which included semi-annual collection of urine samples for analysis of uranium content. In 2015, the licensee collected and an offsite laboratory analyzed about 700 bioassay samples including blanks and spiked samples. All sample results were less than the lowest action level. One sample was identified with a detectable amount of uranium, but below the lowest action level. The licensee's staff conducted a review and concluded that the sample was either contaminated or was a laboratory anomaly. Overall, the licensee's bioassay results confirmed that site workers' intake of uranium was being effectively controlled by the licensee.

The contamination control program requirements are provided in LCs 14 and 32. The licensee conducted contamination surveys of clean areas, equipment releases, and under certain conditions, when personnel exited the site. The inspectors reviewed the licensee's survey results for 2015-2016. No removable contamination was identified during the surveys in excess of the action levels. In addition, the licensee maintained records of leak tests conducted on certain sealed sources. These tests were conducted in January 2016, and the results indicate that no sealed source was leaking. The results of the licensee's survey program indicated that the site did not have widespread contamination problems.

License Condition 24 specifies the requirements for radiation work permits. During 2016, the licensee issued one radiation work permit for work on the drive unit of clarifier No. 2. The radiation work permit included protective equipment requirements. The records indicate that the workers conducted radiological surveys after completion of the work, and no worker was identified as contaminated. The records indicate that the licensee had effectively controlled this maintenance work activity.

License Conditions 22, 23, and 32 provide instructions for conducting and recording instrument calibrations. The inspectors selectively reviewed the licensee's calibration records and determined that survey instruments were being routinely calibrated. The available instrumentation included meters to measure ambient gamma radiation, surface contamination, and removable contamination levels. The inspectors observed survey meters in service during the inspection, and the survey meters appeared operable with up-to-date calibrations.

Training requirements for site workers are provided in 10 CFR 19.12 as well as LCs 22, 23, and 32. In addition, the licensee's Manual of Standard Practices stated that proper training will be provided to all personnel who will be exposed to occupational radiation. The licensee developed a spreadsheet to track worker training. The licensee's records indicate that it provided orientation and initial training to new employees/contractors. The licensee conducted annual refresher training to site workers in December 2015. Safety meetings were conducted weekly that included various safety topics and procedure changes. Although the licensee has not shipped any radioactive material recently, two individuals had up-to-date function-specific training as required by the U.S. Department of Transportation for shipment of radioactive material. Finally, the radiation protection administrator received 40-hour, biennial training at an offsite location in March 2015.

### 2.3 Conclusions

The licensee implemented a radiation protection program that met the requirements of 10 CFR Part 20 and the license. Occupational exposures were small fractions of the regulatory limits. Bioassay sampling and contamination survey results indicate that the licensee was controlling contamination. The licensee maintained instrument calibrations in accordance with the license. The licensee provided radiation protection training to employees and contractors as required by regulations and the license.

## **3 Radioactive Waste Processing, Handling, Storage, and Transportation (88035)**

### 3.1 Inspection Scope

The inspectors interviewed licensee representatives, toured the site, and reviewed applicable records to determine if the licensee had established and maintained an effective program for managing radioactive wastes.

### 3.2 Observations and Findings

#### a. Site Tours

The inspectors toured the site and observed the large tailings pile, small tailings pile, evaporation ponds, and reverse osmosis building. The inspectors observed the status of

the zeolite system and associated ponds, the reverse osmosis equipment, and enhanced evaporation systems. All systems appeared to be controlled by the licensee in accordance with site procedures. No significant erosion was identified during the tours. Site fences, gates, and postings were being maintained.

During site tours, the NRC inspectors conducted radiological surveys using a Ludlum Model 19 microRoentgen survey meter (NRC No. 015518, calibrated to radium-226, calibration due date of July 13, 2017). With a background of 10 microRoentgen per hour ( $\mu\text{R/hr}$ ), the ambient gamma radiation levels on top of the large tailings pile in the vicinity of the zeolite ponds was at or near background levels. The ambient gamma exposure rate in the reverse osmosis building was noted to be at or below background levels. The highest measurement, 400  $\mu\text{R/hr}$ , was identified at the edge of evaporation pond No. 1. This pond is located within the radiologically restricted area and is not accessible to members of the public. In summary, no area was identified that required posting as a radiation area.

b. Review of Annual Radon Flux Measurements

License Condition 36.E states, in part, that the licensee will verify compliance with the radon flux standard of 20 picocuries per square meter-second ( $\text{pCi/m}^2\text{s}$ ) by performing an annual radon flux survey on the two tailings piles. As part of the assessment, the licensee is required to sample the radon flux concentrations at 100 points. In August-September 2015, the licensee collected 64 sample points from the large tailings pile and 36 sample points from the small tailings pile. The licensee reported the results to the NRC in Appendix F to the annual report dated March 31, 2016 (ML16103A425).

The initial sample results for 2015 indicate that the average radon flux for the large tailings pile was 22.28  $\text{pCi/m}^2\text{s}$ . In the interim cover area of the large tailings pile, the average radon flux was 50.04  $\text{pCi/m}^2\text{s}$ . In response to these sample results, the licensee increased the thickness of the interim cover in the areas exhibiting elevated gamma radiation and radon flux measurements. After additional cover material was placed on the large tailings pile, the licensee resampled three of 64 sample points. Following resampling and recalculation, the average radon flux measurement decreased to 19.64  $\text{pCi/m}^2\text{s}$ .

In addition to the 2015 sample results, the inspectors reviewed the licensee's radon flux measurements for 2004-2014. The inspectors noted that the average radon flux rate emanating from the large tailings pile slightly exceeded the radon flux standard in 2004, 2006, 2011, 2014, and 2015. One potential reason for the exceedances may be related to repeated windblown loss of interim cover material from the large tailings pile. In response to each exceedance, the licensee took corrective actions including addition of replacement soil onto the interim cover.

During the August 2016 inspection, the inspectors voiced concerns about the licensee's implementation of LC 36.E, including the repeat exceedances of the radon flux standard. The licensee responded to this inspection finding by letter dated September 8, 2016 (ML16253A143). The licensee planned to add approximately 15,000 cubic yards of material on top of the large tailings pile, in an effort to reduce the ambient gamma radiation levels. This action should also reduce the radon flux emanation rate. Further, the licensee stated in its letter that it would place a layer of larger-sized aggregate material over the interim cover to protect it from windblown erosion. The inspectors

reviewed the licensee's proposed corrective actions and concluded that it is unclear whether the additional soil and erosion protection material will be effective in reducing the radon flux emanation rate in the future. The inspectors will review the licensee's implementation of the corrective actions specified in its September 8, 2016, letter during future inspections.

After the conclusion of the onsite inspection, inspectors conducted a detailed review of the licensee's methodology for measuring and calculating the radon flux. Since 2004, the licensee collected samples from the interim cover areas of the two tailings piles. The licensee averaged these sample results with samples collected in 1994-1995 on the side slopes. The licensee reported the weighted average flux to the NRC on an annual basis. For 2015, the average radon flux rate on the interim cover area of the large tailings pile was 50.04 pCi/m<sup>2</sup>s. When averaged with the samples collected in 1994-1995 from the side slopes, the radon flux for the entire pile dropped to an average of 22.28 pCi/m<sup>2</sup>s, prior to implementation of corrective actions.

The inspectors questioned whether the licensee's methodology for calculating the weighted average radon flux was in compliance with regulatory and license requirements. Title 10 CFR Part 40, Appendix A, Criterion 6(2) states, in part, that licensees shall verify through appropriate testing and analysis that the design and construction of the radon barrier is effective in limiting releases of radon-222 to a level not exceeding 20 pCi/m<sup>2</sup>s averaged over the entire pile or impoundment using the procedures described in 40 CFR Part 61, Appendix B, Method 115. Section 2.1.7 of Method 115 states, in part, that the mean radon flux for each region of the pile shall be calculated by summing all individual flux measurements for the region and dividing by the total number of flux measurements for that region. Based in part on a lack of NRC guidance for measuring and calculating the radon flux emanating from interim covers, the NRC staff previously accepted the licensee's flux measurement and calculation methodology since 2004, when LC 36.E was added to the license.

However, the NRC staff reevaluated the regulatory requirements in detail. Title 10 CFR Part 40, Appendix A, Criterion 6A(2) states, in part, that the Commission may approve a licensee's request to extend the time for performance of milestones related to emplacement of the final radon barrier if the Commission finds that the licensee has adequately demonstrated in the manner required in paragraph (2) of Criterion 6 that releases of radon-222 do not exceed an average of 20 pCi/m<sup>2</sup>s. If the delay is approved on the basis that radon releases do not exceed 20 pCi/m<sup>2</sup>s, a verification of radon levels, as required by paragraph (2) of Criterion 6, must be made annually during the period of delay. (License Condition 36.A(3) provides the milestone extension period for placement of the final radon barrier on the large and small tailings piles.) In other words, Criterion 6A(2) stipulates that an *annual* verification has to be conducted during the period of delay using the instructions provided in Method 115.

The inspectors compared the licensee's radon flux sampling program, in use since 2004, to the instructions provided in Method 115. Method 115, "2.1.1 Frequency of Flux Measurement," states that a single set of radon flux measurements may be made or more frequent measurements may be made over a one year period. Method 115 (2.1.1) also states that the mean radon flux from the pile shall be the arithmetic mean of the mean radon flux for each measurement period. In summary, Method 115 requires the use of current data versus historical data. Instead, the licensee used an area-weighted average calculation that included both current measurements collected from the interim

cover areas and historical measurements that were collected on the side slopes in 1994-1995. The licensee's use of radon flux measurements that were greater than a year old was identified as a violation of Criterion 6A(2) requirements.

The inspectors reviewed how the licensee calculated the mean radon flux. Method 115, "2.1.2 Distribution of Flux Measurements," states in part that the mean radon flux shall be determined for each individual region of the pile....For mill tailings after disposal the pile shall be considered to consist of only one region. The licensee used a weighted average calculation, but the inspectors concluded that the licensee's calculation was inconsistent with the instructions provided by Method 115. Method 115 does discuss the use of an area-weighted average for multiple regions on a pile. However, the large tailings pile at Homestake was not an operating pile and was considered by NRC staff to be "after disposal." Thus, the large tailings pile must be considered as a single region per Method 115 requirements, and area-weighted averaging is not applicable. The area-weighted averaging methodology used by the licensee since 2004 is inconsistent with the requirements of Method 115 for tailings piles after disposal.

Method 115, "2.1.3 Number of Flux Measurements," states in part that for a mill tailings pile after disposal which consists of only one region a minimum of 100 measurements are required. Because Method 115 does not allow for historical measurements, the requirement to obtain 100 measurements from a single region means that there must be 100 current measurements per tailings pile. The licensee collected only 64 samples on the large tailings pile and 36 samples on the small tailings pile in 2015. This is inconsistent with the Method 115 requirement for the minimum number of sampling locations. The licensee's failure to collect a minimum of 100 measurements on each of the two tailings piles was identified as a violation of Criterion 6A(2) requirements.

As noted earlier, the licensee's average sample result in 2015 for the interim cover area for the large tailings pile was 50.04 pCi/m<sup>2</sup>s. The licensee cannot use the data collected in 1994-1995 from the side slopes because this data is over a year old. Thus, the arithmetic mean of the mean radon flux for the 2015 measurement period for the large tailings pile was 50.04 pCi/m<sup>2</sup>s, a sample result that exceeded the 20 pCi/m<sup>2</sup>s standard. The licensee's exceedance of the flux standard for the large tailings pile was identified as a violation of Criterion 6A(2) requirements.

### 3.3 Conclusions

Through site tours, the inspectors concluded that the licensee was operating and maintaining the impoundments, ponds, and related equipment in accordance with procedural requirements. Through site tours, the inspectors concluded that the licensee was operating and maintaining the impoundments, ponds, and related equipment in accordance with procedural requirements. The inspectors identified a violation involving the licensee's failure to collect a sufficient number of samples, correctly calculate the radon flux, and maintain the radon flux release rate from the large tailings pile below the standard specified in regulations.

## **4 Effluent Control and Environmental Protection (88045)**

### **4.1 Inspection Scope**

The inspectors reviewed the licensee's effluent and environmental protection programs to ensure compliance with license and regulatory requirements.

### **4.2 Observations and Findings**

#### **a. Effluent and Environmental Monitoring**

License Conditions 10, 15, and 23 specify the environmental monitoring program requirements. Details about the program are provided in the licensee's Manual of Standard Practices. The program consisted of air particulate, radon gas, and direct radiation sampling, (The licensee received NRC approval to discontinue soil and vegetation sampling in 1996.) The inspectors compared the program in operation at the time of the inspection to the requirements specified in the license. In summary, the inspectors confirmed that the licensee was implementing the environmental monitoring program as required by the license.

License Condition 15 requires the licensee to report the results of the environmental monitoring program to the NRC. The NRC inspectors reviewed the semi-annual environmental monitoring reports for 2015 (ML15247A048, ML15247A076, and ML16089A363) and the data used in the development of the reports. The inspectors also reviewed some of the environmental monitoring data for the first half of 2016, although the semi-annual report for this time frame was submitted after the conclusion of the onsite inspection.

The licensee conducted air particulate sampling at seven locations including two nearest residences and one background location. The licensee also measured ambient gamma radiation levels at eight locations, and the licensee measured ambient radon gas concentrations at nine locations. The licensee conducted calculations of potential dose to a member of the public using this sampling information.

The licensee's records indicate that air particulates remained at or below 5-percent of the applicable limit in 2015 with most results less than 1-percent of the limits. Radon ranged from 0.7-1.6 picocuries per liter, consistent with 2014 sample results. Direct radiation levels ranged from 53-77 millirems per half-year at the various sample points, similar to 2014 sample results.

Using these sample results, the licensee conducted a public dose assessment. The licensee reported the results of the dose assessment for 2015 in Attachment 5 to its letter dated February 28, 2016 (ML16089A363). However, the NRC staff requested additional information about the licensee's 2014 public dose assessment by letter dated December 16, 2015 (ML15264B052). The licensee responded to the NRC's request by letter dated January 19, 2016 (ML16033A407). Because the NRC's program office is currently evaluating this open issue, the inspectors did not evaluate the licensee's calculated doses for compliance with the annual public dose limit of 100 millirems per year as specified in 10 CFR 20.1301(a).

The NRC inspectors also reviewed the annual irrigation report, submitted to the NRC by letter dated April 13, 2016 (ML16120A021). The licensee has been submitting this report to the NRC on a voluntary basis since 2000. The results of the report show that irrigation practices at the site have little to no threat to human health and safety due to the uranium and selenium levels in the soil.

b. Groundwater Monitoring

License Condition 35 requires the licensee to implement a groundwater compliance monitoring program to assess the performance of the groundwater restoration program. This program included sampling of the groundwater for comparison to groundwater protection standards as provided in the license. With regards to reporting, License Condition 15 requires the licensee to include the sample results for the point of compliance wells (D1, X, and S4) and background well (P) in the semi-annual effluent and environmental monitoring reports. License Condition 35.E requires the licensee to submit a performance review of the groundwater corrective action program to the NRC by March 31<sup>st</sup> of each year.

The licensee submitted the semi-annual reports for 2015 to the NRC by letters dated August 26, 2015 (ML15247A048 and ML15247A076), and February 28, 2016 (ML16089A363). The annual performance review for 2015 was submitted to the NRC by letter dated March 31, 2016 (ML16103A424, ML16103A425, and ML16103A426). The annual performance review included the sample results for all wells. The NRC staff reviewed these routine reports during the inspection and discussed the sample results with licensee representatives.

The licensee collected samples from the point of compliance wells in 2015 and analyzed the samples for the constituents specified in the license. The licensee also reported the results in the annual and semi-annual reports. The inspectors compared the licensee's sample results to the groundwater protection standards provided in the license for point of compliance Wells D1, X, and S4. Selected radiological and non-radiological standards continue to be exceeded; although, the NRC staff concluded that the groundwater restoration program continues to make progress towards cleanup of the groundwater.

c. Groundwater Corrective Action Program

License Condition 35.C specifies that the licensee shall implement the groundwater corrective action program with the objective of returning the concentrations of molybdenum, selenium, thorium-230, uranium, vanadium and other constituents to the site standards listed in the license. License Condition 35.E requires the licensee to submit an annual performance review of the corrective action program. The inspectors reviewed the licensee's most recent annual performance review and discussed the results of the review with licensee representatives. The inspectors also reviewed the licensee's recent changes to the groundwater corrective action program. In addition, the inspectors observed the status of the operating equipment during site tours. In summary, the licensee continued to implement and expand the corrective action program in accordance with license requirements.

The licensee provided three sources of clean water for the groundwater corrective action program. The clean water sources included the reverse osmosis system outlet, zeolite

system outlet, and well water from nearby aquifers. The design capacity of the reverse osmosis systems was 1,200 gallons per minute (gpm), and the capacity of the zeolite systems was 1,500 gpm. Aquifer water from four offsite wells was used, as needed, to supplement the onsite systems. At the time of the inspection, the licensee was injecting 1,500 gpm, including 900 gpm from offsite wells and 600 gpm from onsite sources.

The licensee presented system operational information in the semi-annual reports. The inspectors reviewed the data presented in the two semi-annual reports for 2015 (ML15247A048, ML15247A076, and ML16089A363). The reports provided a summary of the groundwater treatment operational flow rates for 2015.

The licensee recently completed pilot tests for use of tripolyphosphate as an alternative groundwater treatment system. This system would supplement the corrective action program. At the time of the onsite inspection, the licensee completed the second phase of pilot testing to demonstrate the efficiency of treatment on a larger scale. In this pilot test, tripolyphosphate was injected into the alluvial aquifer, inside the site hydraulic barrier, reacting with dissolved uranium to form uranium phosphate mineral precipitates. This chemical reaction should create a barrier to uranium movement through the groundwater. The licensee considered these test results to be promising and may request, by license amendment, that the treatment method be placed into service to supplement the corrective action program. The licensee presented the results of the pilot tests to the NRC by letter dated October 3, 2016 (ML16351A351).

The inspectors also reviewed the licensee's sampling of water being injected into the ground as part of the corrective action program. License Condition 35.C states, in part, that composite samples from Sample Point 2 (SP2) will be taken monthly and analyzed for uranium and molybdenum. These sample results are indicative of the quality of water being injected into the ground and includes the mixture of reverse osmosis-treated, zeolite-treated, and fresh water prior to injection. The results of the licensee's samples, collected in 2015, were provided in the licensee's annual performance review dated March 31, 2016 (ML16103A424, ML16103A425, and ML16103A426). The water quality data results are presented in Table 2.1-3 of the report.

The inspectors noted that the samples collected at SP2 exceeded the alluvial aquifer groundwater protection standard for uranium (0.16 milligrams per liter) three times in 2015. The samples also exceeded the molybdenum standard (0.1 milligrams per liter) six times. The sample was a composite sample, indicating that the licensee could have injected water that exceeded the groundwater protection standards for a significant percentage of time in 2015. The inspectors concluded that the groundwater protection standards, listed in License Condition 35.B, were applicable at sample point SP2. The licensee's failure to provide injection water that met the groundwater protection standards was identified as a violation of License Condition 35.C with nine examples.

By letter dated September 8, 2016 (ML16253A143), the licensee responded to this inspection finding. The licensee noted that:

The exceedances occurred during a time of significant upgrades and changes to the [reverse osmosis] plant, which included changes in the delivery, routing and compositing of treated and fresh water, as well as changes to the zeolite [water treatment system], which included new piping configurations and various attempts to optimize pH conditioning, and the regeneration process.

Fortunately, with the majority of the [water treatment system] upgrades completed and the expectation of more consistent [reverse osmosis] operation, the consistency of the treated water quality is expected to improve. To that end, no exceedances of compliant water standards at SP2 have been recorded during 2016.

In its September 8, 2016, letter, the licensee proposed several corrective actions to prevent recurrence of the exceedances including procedure updates. The licensee committed to update procedures to take certain actions if a SP2 sample result exceeds a groundwater protection standard. If an exceedance is confirmed, the licensee will take certain actions including system adjustments, repairs or equipment replacement. The licensee also committed to take other long-term corrective actions to enhance its monitoring and oversight of the water treatment systems.

However, this violation of License Condition 35 requirements is another example of the second apparent violation as presented in the NRC's letter to the licensee dated October 4, 2016 (ML16251A526), except that the time frame is different. As discussed in the NRC's Confirmatory Order dated March 28, 2017 (ML17060A753), the licensee agreed to report any future exceedances at SP2 and to report the corrective actions taken in response to these exceedances. The Confirmatory Order also requires operational adjustments at the reverse osmosis system, within 30 days of the Confirmatory Order, to ensure compliance with the groundwater protection standards. In addition, License Condition 35 and the sampling requirements were changed concurrently with the issuance of the Confirmatory Order. The NRC staff will review the implementation of the licensee's corrective actions as part of its review of the Confirmatory Order.

d. Annual Land Use Survey

License Condition 42 specifies that a land use survey be conducted and presented in the annual report to the NRC. The most recent land use survey was included as Appendix E to the annual report dated March 31, 2016 (ML16103A426). The land use survey included a review of occupied residences and verification of sources of water. The report noted that two lots were irrigated in 2015 using non-contaminated sources of water. Further, areas to the south and west within the site boundary were seasonally used for livestock grazing. In summary, the inspectors confirmed that the licensee conducted the land use survey and reported the results to the NRC as required by the license.

4.3 Conclusions

The licensee established groundwater and environmental monitoring programs as required by the license. The environmental and groundwater monitoring reports were submitted to the NRC as required by the license. An additional example of a violation was identified related to the licensee's failure to meet the groundwater protection standards at SP2 prior to discharging the liquid effluent to the environment. Corrective actions are currently being performed to address the previously identified violation. The licensee continued to conduct land use surveys as required by the license.

## **5 Exit Meeting Summary**

The inspectors presented the preliminary inspection results to the licensee's representatives at the conclusion of the onsite inspection on August 25, 2016. The final inspection results were presented to the licensee's representative by telephone on April 20, 2016, after NRC review of the licensee's method for conducting the annual radon flux survey and resultant calculation of average radon flux. During the inspection, the licensee did not identify any information reviewed by the inspectors as proprietary that was included in the report.

## **SUPPLEMENTAL INSPECTION INFORMATION**

### PARTIAL LIST OF PERSONS CONTACTED

#### Licensee

C. Farr, Operations Manager, Environmental Restoration Group, Inc.  
M. Schierman, Senior Health Physicist, Environmental Restoration Group, Inc.  
J. Toepfer, Closure Manager & RSO

#### New Mexico Environment Department

B. Pearson, Environmental Scientist, Ground Water Quality Bureau

### INSPECTION PROCEDURES (IPs) USED

IP 83822	Radiation Protection
IP 88005	Management Organization and Controls
IP 88010	Operator Training/Retraining
IP 88035	Radioactive Waste Processing, Handling, Storage, and Transportation
IP 88045	Effluent Control and Environmental Protection

### ITEMS OPENED, CLOSED AND DISCUSSED

#### Opened

040-08903/1601-01 VIO Exceedance of radon flux limit from large tailings pile

#### Closed

None

#### Discussed

None

### LIST OF ACRONYMS USED

ADAMS	Agencywide Documents Access and Management System
ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
IP	Inspection Procedure
LC	License Condition
NRC	U.S. Nuclear Regulatory Commission
pCi/m <sup>2</sup> s	picocuries per meter-squared second
RSO	Radiation Safety Officer
SERP	Safety and Environmental Review Panel
URI	Unresolved Item
VIO	violation