



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

May 09, 2014

MEMORANDUM TO: Docket File WM-00058

THROUGH: Linda L. Howell, Acting Director
Division of Nuclear Materials Safety

FROM: Robert J. Evans, Ph.D., P.E., C.H.P., Senior Health Physicist **/RA/**
Repository and Spent Fuel Safety Branch
Division of Nuclear Materials Safety

SUBJECT: NRC OBSERVATIONAL SITE VISIT AT THE SHIPROCK, NEW
MEXICO DISPOSAL SITE

On March 26-27, 2014, a U.S. Nuclear Regulatory Commission (NRC) Region IV inspector conducted an observational site visit at the U.S. Department of Energy's (DOE) Shiprock Disposal Site in San Juan County, New Mexico. This site visit was conducted in accordance with NRC guidance dated September 7, 2012 (ML12213A418). The purpose of the site visit was to observe DOE's routine, semi-annual groundwater sampling efforts at the Shiprock site. Enclosed to this memorandum is the NRC's trip report for this observational site visit.

In summary, the DOE representatives conducted the semiannual groundwater sampling in accordance with guidance provided in the "Final Ground Water Compliance Action Plan for Remediation at the Shiprock, New Mexico, UMTRA Site" dated July 2002. No significant regulatory issues or safety concerns were identified during the site visit.

CONTACT: Robert J. Evans, RIV/DNMS
817-200-1234

Docket: WM-00058

Enclosure: NRC Trip Report

cc w/encl: Deb Steckley, Site Manager
U.S. Department of Energy
Office of Legacy Management
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Grand Junction, CO 81503

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U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket: WM-00058

Report: WM-00058/14-001

Licensee: U.S. Department of Energy

Facility: Shiprock Disposal Site

Location: San Juan County, Colorado

Date: March 26-27, 2014

Inspector: Robert J. Evans, Ph.D., P.E., C.H.P., Senior Health Physicist
Repository and Spent Fuel Safety Branch
Division of Nuclear Materials Safety

Approved by: Linda L. Howell, Acting Director
Division of Nuclear Materials Safety

Attachment: Photographs of the Shiprock Disposal Site

Enclosure

NRC Trip Report

1 Background

Kerr-McGee constructed and operated a mill at the Shiprock site from 1954-1963. Vanadium Corporation of America subsequently purchased the mill and operated it until 1968. The site consisted of approximately 230 acres leased from the Navajo Nation. Control of the site reverted back to the Navajo Nation when the lease expired in 1973. Limited decommissioning activities were conducted during 1968-1973. Additional decommissioning work was conducted from 1975-1980 under the direction of the U.S. Environmental Protection Agency.

In 1983, the U.S. Department of Energy (DOE) and the Navajo Nation entered into an agreement for site cleanup. The DOE conducted surface reclamation work in 1985-1986. By 1986, all tailings and contaminated material from offsite properties were encapsulated in a disposal cell which was constructed on top of the original tailings piles. The DOE submitted a Long-Term Surveillance Plan for the Shiprock site to the U.S. Nuclear Regulatory Commission (NRC) in 1994. The Shiprock site was subsequently granted a general license in September 1996 by the NRC under the provisions of 10 CFR 40.27.

The site is geographically divided into two parts—the upper level terrace and the lower level floodplain. The disposal cell is located in the eastern terrace area, and the San Juan River runs adjacent to the floodplain area. Past milling operations resulted in contamination of the local groundwater including the floodplain alluvial aquifer and terrace subsurface areas. Groundwater contamination occurred as a result of infiltration of milling fluids into the subsurface areas, in addition to the leaching of ore and uranium mill tailings by both rainwater and mill water. The DOE developed a compliance strategy to monitor and actively remediate the groundwater. This compliance strategy is described in DOE's "Final Ground Water Compliance Action Plan for Remediation at the Shiprock, New Mexico UMTRA Site" dated July 2002. The NRC approved this proposed plan by letter dated May 12, 2003.

In accordance with the 2002 Groundwater Compliance Action Plan (GCAP), the contaminants of concern include ammonia, manganese, nitrate, selenium, strontium, sulfate, and uranium. Based on groundwater modeling and previous sample results, the GCAP indicates that the highest uranium concentrations in the groundwater can be found in the terrace area northwest of the disposal cell, along the escarpment between the terrace and the floodplain, and in the floodplain area north of the disposal cell.

The DOE established three compliance strategies to monitor and remediate the groundwater contamination. The first strategy was active remediation in the eastern portion of the terrace area. The second strategy was the application of supplemental cleanup standards in the western portion of the terrace area. The third strategy was natural flushing in conjunction with active remediation in the floodplain area. In all three areas, DOE committed to monitor the groundwater on a routine basis, in part, to determine the effectiveness of the three compliance strategies.

Since the 2002 GCAP was issued, DOE constructed several enhancements to remediate or capture the groundwater. These enhancements were primarily constructed in 2005-2006. In the floodplain, DOE constructed two culvert extraction wells, two

subsurface collection trenches, and a seep collection system. In the terrace area, DOE installed 10 extraction wells and interceptor drains in two local washes. In addition, telemetry systems were installed on certain wells to provide data logging and remote monitoring capabilities.

During the observational site visit, the DOE representatives stated that, since 2003, they have noted a decrease in contaminant concentrations in the floodplain wells due to the trenches that were installed at the base of the escarpment between the upper level terrace and the lower level floodplain. In addition, DOE has noted a decrease in the groundwater levels due to phase-out of irrigation in the western properties concurrent with extraction of groundwater from the terrace area.

In 2005, DOE updated its groundwater conceptual model, in part, to provide recommendations for improvement of the strategies presented in the GCAP. The DOE plans to update this conceptual model in the near future, in part, to support proposed changes to the NRC-approved GCAP.

To support disposal of extracted groundwater, DOE installed an 11-acre solar evaporation pond adjacent to the disposal cell in the eastern terrace area. The pond is designed to receive water from various extraction wells and collection trenches around the site. The design capacity of the pond was 25 gallons per minute for seven years, and 20 gallons per minute for 40 years. If necessary, an enhanced evaporation system was available using drain lines located on the banks of the pond. The DOE's records indicate that approximately 14.8 million gallons groundwater was extracted from the terrace and floodplain areas from April 2011-March 2012. (At the time of the observational site visit, DOE had not submitted the 2013 annual performance report to the NRC.)

2 Site Status

The DOE established a routine inspection program at the Shiprock disposal site. A local representative inspects the groundwater restoration system several times a week using the guidance provided in DOE's "Groundwater Remediation System Inspections, Maintenance, and Repair Procedures" dated March 2012. The onsite representative documented these routine inspections on a log sheet. This inspection program helped to ensure that the site remained properly secured. The inspection program also ensured that any pump failures or line leaks were identified and isolated in a timely manner. According to DOE staff, these inspections have identified some maintenance problems in the past, including pipe leaks that required repair. In addition, local DOE representatives conducted weekly site inspections in conjunction with representatives from the Navajo Nation. The inspector noted that the DOE contractors maintained a spill response procedure which included staff responsibilities and step-by-step response instructions. During the site tours, the inspector noted that the site appeared to be properly secured and posted with locked gates, intact fences, and caution signs.

The inspector reviewed the groundwater remediation equipment in service at the site. At the time of the inspection, the terrace groundwater remediation system included nine groundwater extraction wells, two collection drains in two washes, and a terrace drainage channel diversion structure. The floodplain groundwater remediation system included two groundwater extraction wells, a seep collection drain, and two collection trenches. All extracted groundwater was being pumped to the evaporation pond.

The inspector reviewed recent groundwater and surface water sample results and compared these results to the water quality standards. In particular, the inspector compared recent water sample results to the groundwater and surface water quality standards for uranium. The U.S. Environmental Protection Agency's maximum contaminant level for uranium in groundwater is 0.044 milligrams per liter. The Navajo Nation established a surface water quality standard of 0.035 milligrams of uranium per liter of water.

The inspector reviewed the sample results presented in the "March 2013 Groundwater and Surface Water Sampling at the Shiprock, New Mexico, Disposal Site" dated June 2013. (At the time of the inspector's site visit, the September 2013 sample results had not been submitted to the NRC; although, DOE planned to submit these sample results to the NRC in the near future.) The highest uranium concentration, 6.5 milligrams per liter, was collected from well 0817, located west of the tailings disposal cell. All river samples were less than the maximum contaminant level for uranium. Background in the floodplain ranged from about 0.02 to 0.03 milligrams per liter with a maximum contaminant level of 0.044 milligrams per liter. (The background wells in the terrace areas are sampled for water level only.)

The 2002 GCAP provides the requirements for surface and groundwater monitoring including sampling locations and analytical requirements. These instructions are provided in Appendix B to the GCAP. The inspector compared the current surface and groundwater monitoring points against the requirements provided in the GCAP. In summary, the DOE conducts more sampling than required by the GCAP.

The GCAP lists 62 total sampling points including four background, 38 terrace, 11 floodplain, and nine surface sample points. (The four background locations are dry and cannot be sampled.) At the time of the March 2014 observational site visit, DOE representatives planned to sample 157 of 159 locations including 138 wells and 19 surface water locations. (Ten wells are sampled for water level only; two additional wells will not be sampled for various reasons.) In other words, approximately 100 sampling points were added over time for various reasons.

The DOE submitted a technical evaluation to the NRC in March 2013 that addresses the current sampling regime at the Shiprock site. This technical evaluation report, "Optimization of Sampling at the Shiprock, New Mexico, Site," offers three recommendations. The first recommendation is to reduce the sampling frequency from semi-annual to annual. The second recommendation is to reduce the number of sampling locations. The third recommendation is to eliminate dry wells from the sampling regime and sample certain wells for water level only.

By letter dated June 17, 2013, the NRC acknowledged receipt of the optimization report but reminded DOE that actual changes to the sampling regime would require prior NRC review and concurrence. The inspector noted that the March 2013 technical report only provides recommendations for reduced monitoring versus changes in compliance strategies. During the March 2014 site visit, DOE representatives stated that proposed changes to the 2002 GCAP are forthcoming. These changes may include alterations in compliance strategies, based on updated modeling data and recent sampling results.

3 Site Observations and Findings

Contractors for DOE conducted groundwater sampling at the Shiprock disposal site twice per year. The most recent sampling event occurred during March 24-27, 2014. The contractors were required to conduct sampling in accordance with the requirements provided in the 2002 GCAP and the "Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites." The GCAP provides the instructions for the locations that will be sampled and the analytical and measurement requirements at each location. The Sampling and Analysis Plan provides the instructions for physically collecting the samples and the quality assurance requirements.

To support each sampling event, DOE contractors developed work instructions that summarized the work to be performed. The inspector reviewed the work instructions for the March 2014 sampling. Prior to physically conducting work, the contractors conducted a job safety briefing to ensure that the work was being conducted in a safe manner.

The inspector observed DOE contractor staff conducting different types of sampling using different types of collection equipment. In summary, the contractors collected the samples at the locations specified in the work plan. The inspector noted that the contractors measured the field parameters as specified in the Sampling and Analysis Plan including well water level, pH, conductivity, and turbidity. The contractors measured these parameters using calibrated equipment. The samples were filtered and preserved, and the sampling equipment was cleaned, as necessary, in accordance with Sampling and Analysis Plan requirements. The inspector also observed a daily operational check of the sampling equipment and confirmed that the equipment met the acceptance criteria established in the Sampling and Analysis Plan.

The inspector discussed the quality assurance requirements with DOE representatives. The Sampling and Analysis Plan provides the quality assurance requirements for field sampling. These requirements include collection of field duplicates, equipment blanks, and trip blanks. The DOE staff collected one blank and eight duplicates, consistent with the requirements specified in the Sampling and Analysis Plan for 157 sample points.

The training requirements for samplers are provided in the Sampling and Analysis Plan. The inspector discussed these training requirements with the DOE contractors. The contractors were aware of DOE's training requirements. The inspector was unable to confirm that each individual was properly trained, but the contractors demonstrated thorough knowledge of the tasks being performed.

The inspector observed the status of the 11-acre evaporation pond, in part, to ensure that it was being operated in accordance with guidance provided in the GCAP. During the site visit, a DOE representative stated that the inflow ranged from 25-35 gallons per minute, a flow rate that exceeded the long-term design capacity of the pond. To keep from overflowing the pond, DOE secured inflow from one of the trenches in the springtime to minimize flow into the pond. At the time of the site visit, the evaporation pond was in service, and the amount of water in the pond was below the 2-foot freeboard limit specified in the GCAP.

The inspector also observed DOE's phytoremediation efforts, a type of bioremediation program. Phytoremediation is the use of plants to prevent the movement of pollutants.

Certain types of plants were planted near the disposal cell on the terrace level to determine if they can be used to control the movement of contaminated groundwater. This program was started in 2006 with the assistance of students from a local college. The results of this experimental program were not available during the onsite visit.

On March 27, 2014, the DOE site manager issued a partial stop-work order due to concerns about the safety of the crew from previous gunshots into the work area. The DOE contractors suspended work in certain areas, pending DOE review of the safety hazards. Section 7.0 of the September 1994 Long-Term Surveillance Plan provides instructions for conducting contingency inspections in response to unusual events. Further, Section 9.0 provides instructions for corrective actions. Both sections include instructions that DOE will notify the NRC and submit an assessment report to the NRC within 60 days after the problem is identified. At the conclusion of the onsite visit, the DOE representatives had not completed their review of this unusual event. If the DOE determines that the incident that prompted the stop-work order is reportable to the NRC, the DOE will submit a report to the NRC accordingly.

The NRC inspector measured the ambient gamma exposure rates using a Ludlum Model 2401-S microRoentgen meter calibrated to cesium-137 (NRC No. 079765, calibration due date of 11/07/14). The background exposure rates ranged from 8-10 microRoentgens per hour ($\mu\text{R/hr}$). The exposure rates at various locations around the site were found to be at background levels. In summary, no residual radioactive contamination or naturally occurring radioactivity was identified adjacent to the disposal cell.

4 Conclusions

The DOE's contractors conducted the sampling work in accordance with guidance provided in the 2002 GCAP and the Sampling and Analysis Plan. The inspector confirmed that the DOE's contractor had implemented the procedure requirements for sample collection, calibration checks, filtration, preservatives, and quality assurance. The samplers appeared to be knowledgeable about the tasks being performed.

The DOE has increased the sampling program significantly since 2002, but DOE is currently reconsidering its sampling program at the Shiprock site. Also, DOE is reviewing the 2002 GCAP for its current effectiveness. The DOE plans to submit a revised GCAP to the NRC in the future, after it has updated the groundwater model and reviewed recent data results.

5 Meeting Summary

The NRC inspector participated in planning meetings with the DOE site manager and site contractor prior to the site visit. During this meeting, the participants discussed topics such as site status, inspection plan, and potential hazards.

6 Persons Contacted

D. Atkinson, Sampler, S. M. Stoller Corp.

G. Baer, Sampler, S. M. Stoller Corp.

L. Benally, Jr., Senior Environmental Specialist, Navajo AML Reclamation

S. Campbell, Environmental Monitoring Operations Lead, S. M. Stoller Corp.

A. Kleinrath, Program Manager, DOE, Office of Legacy Management
A. Kuhlman, Sampler, S. M. Stoller Corp.
D. Miller, Site Lead, S. M. Stoller Corp.
J. Nofchissey, Environmental Specialist, Navajo AML Reclamation
J. Price, Sampler, S. M. Stoller Corp.
D. Steckley, Site Manager, DOE, Office of Legacy Management
J. Trevino, Sampler, S. M. Stoller Corp.

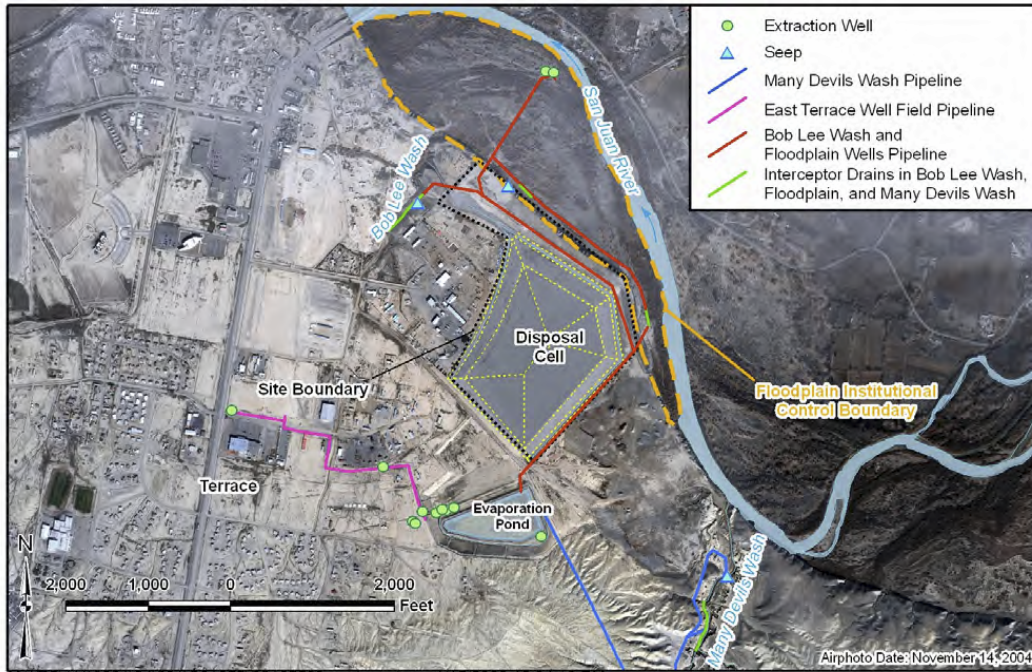


Figure 1: Aerial overview of Shiprock disposal site (from DOE's Fact Sheet, <http://www.lm.doe.gov/Shiprock/Documents.aspx>)



Figure 2: Water flow into solar evaporation pond



Figure 3: Groundwater sampling at well with telemetry device in floodplain



Figure 4: Phytoremediation test plot with Shiprock disposal cell in background