



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

August 12, 2015

MEMORANDUM TO: Docket File WM-00072

THROUGH: Ray L. Kellar, P.E., Chief */RA/*
Repository and Spent Fuel Safety Branch
Division of Nuclear Materials Safety

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

SUBJECT: OBSERVATIONAL SITE VISIT AT SPOOK DISPOSAL SITE

On July 8, 2015, an inspector from the U.S. Nuclear Regulatory Commission's (NRC) Region IV Office conducted an observational site visit at the U.S. Department of Energy's (DOE) Spook disposal site in Converse County, Wyoming. This site visit was conducted in accordance with the guidance provided in the NRC's Memorandum dated April 17, 2012 (ADAMS accession number ML120930240). The purpose of the site visit was to observe DOE's routine, annual inspection of the Spook disposal site. Enclosed to this memorandum is the NRC's trip report for this site visit.

In summary, DOE conducted the annual inspection in accordance with the requirements specified in the NRC-accepted Long-Term Surveillance Plan dated January 1993 (ML15217A677). The surface area of the subsurface disposal cell appeared to be in excellent condition with no slumping or significant onsite erosion. No regulatory issues or safety concerns were identified during the site visit.

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Enclosure:
NRC Trip Report

cc: W. Dam, Site Manager
DOE Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503

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

Docket: WM-00072

Report: WM-00072/15-001

Licensee: U.S. Department of Energy

Facility: Spook Disposal Site

Location: Converse County, Wyoming

Date: July 8, 2015

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

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

Attachment: Photographs Taken at the Spook Disposal Site

Enclosure

NRC Trip Report

1 Background

The Wyoming Mining and Milling Company operated a uranium ore upgrade facility at the Spook site in Converse County, Wyoming, from 1962-1965. The concentrated slurry precipitate that was produced at the Spook site was shipped to the Western Nuclear Split Rock mill in Jeffrey City, Wyoming, for further processing. The operation of the upgrade facility produced tailings material and waste solutions. The tailings were stored on the ground or within an open pit mine. The solutions were disposed in the tailings or an acid pond situated adjacent to the upgrade facility.

Prior to remediation, the Spook site consisted of an open pit mine containing tailings, mine overburden material, several small ore piles, an acid pond, and miscellaneous waste debris. The U.S. Department of Energy (DOE) and the State of Wyoming signed a cooperative agreement in 1984 to remediate the site. Surface remediation began in the spring of 1989 and was completed in the fall of 1989. The DOE stabilized all contaminated wastes at the bottom of the open pit. The State of Wyoming backfilled the pit with mine overburden material, contoured the surface, and reseeded all disturbed areas. The U.S. Nuclear Regulatory Commission (NRC) subsequently concurred with the completion of the remedial action by letter dated March 4, 1992 (ML15217A677).

The acid pond, located adjacent to the Spook upgrade facility, was also remediated. This work was conducted as a vicinity property cleanup project, although the waste material was disposed in the open mine pit with the rest of the mill wastes. The acid pond remediation efforts included excavating the pond to a depth of about 20 feet and backfilling the pond with uncontaminated material. Approximately 41,202 cubic yards of excavated pond material was placed in the mine pit. The NRC subsequently approved the remedial action completion report by letter dated April 4, 1991 (ML15218A425).

The Spook disposal cell is unique because it is located entirely underground in a former open-pit uranium mine. The disposal cell footprint occupies approximately 5 acres of the 13.5-acre site. The mine was approximately 1,600-feet long, 500-feet wide, and 100-feet deep. The contaminated material was encapsulated in the south-central section of the pit. The disposal cell contains approximately 440,000 tons (315,000 cubic yards) of contaminated waste material containing 125 curies of radium-226.

The base of the disposal cell consists of a 3-foot thick layer of low-permeability material. The maximum height of the waste material in the cell is 54 feet. The underground cover placed over the wastes included a 1.5-foot thick radon barrier and a 10-foot thick high-permeability material layer to minimize water infiltration into the cell. Depending on location, the depth of the mine overburden ranges from 49-65 feet over the disposal cell. Disturbed surface areas were contoured and reseeded to protect the site from erosion.

The Spook disposal cell is classified as a Title I site under the Uranium Mill Tailings Radiation Control Act of 1978. The DOE maintains long-term custody of the site under the U.S. Nuclear Regulatory Commission's (NRC's) general license requirements of 10 CFR 40.27. The Long-Term Surveillance Plan (LTSP) explains how DOE will fulfill the general license requirements specified in 10 CFR 40.27. The final LTSP for the Spook disposal site was issued in January 1993 (ML15217A677). Records indicate that

the NRC subsequently accepted the LTSP by letter dated September 21, 1993; although, the NRC inspector could not locate a copy of this acceptance letter.

2 Site Status

The operation of the Spook upgrade facility resulted in the contamination of the shallow groundwater beneath the site. The plume extends approximately 2,500-feet down-gradient of the pit. Records indicate that the upper aquifer contains both natural and mine-related chromium, nitrate, radium, selenium, and uranium in concentrations above background.

Because of poor water quality and low yield, the water in the upper aquifer is not a current or potential future source of drinking water. Water supply wells in the vicinity of the Spook site obtain groundwater from deeper aquifers for domestic and stock watering use. The shallow groundwater is classified as limited use (Class III), in part, because of naturally occurring uranium and selenium in the groundwater. The groundwater compliance strategy for the upper-most aquifer is no remediation with the application of supplemental standards as allowed by 40 CFR 192.21(g) and 40 CFR 192.11(e). In accordance with the chosen compliance strategy, groundwater monitoring is not required at the Spook disposal site. By letter dated October 9, 1997 (ML15218A429), the NRC accepted the DOE's conclusions about the shallow groundwater.

The DOE plans to release the former acid pond property, which was remediated in the early 1990s, and disposition the parcel to the landowner whose property surrounds the site. The DOE also plans to allow animal grazing on the site by the adjacent landowner.

Permanent site features include eight boundary monuments, three survey monuments, two site markers, 10 perimeter warning signs, and one site entrance sign. The Spook site is not fenced and does not have a site access gate. The LTSP requires DOE to inspect the Spook disposal site once every calendar year. The DOE inspectors typically observe the status of site features during each annual inspection.

The DOE conducted the last site inspection on June 30, 2014. At that time, the disposal site was noted to be in excellent condition. The DOE inspectors did not identify surface settlement on the 13.5-acre site. The vegetation over the cell was healthy and indistinguishable from vegetation growing on the remainder of the site and the surrounding ranch land. Three damaged perimeter signs were identified; otherwise, no maintenance issues were identified which required follow up action.

3 Site Observations and Findings

The DOE staff conducted the annual inspection on July 8, 2015. The purposes of the annual inspection are to confirm the integrity of the visible features of the site, to identify changes in conditions that may affect site integrity, and to determine the need for maintenance or additional inspection and monitoring. Detailed instructions for implementing the annual inspection are provided in Section 6 of the LTSP.

The LTSP requires the DOE inspectors to observe and evaluate the site and all areas immediately adjacent to the site. To conduct the annual inspection, DOE and its contractors created an inspection checklist. The checklist included requirements to inspect the disposal cell surface area as well as site features such as boundary

monuments, survey monuments, site markers, perimeter signs, and entrance sign. The NRC inspector observed the DOE site inspectors implementing the site-specific checklist.

The NRC inspector observed that the surface of the disposal cell and surrounding areas appeared to be in excellent condition. No erosion or slumping was observed on or around the area of the underground cell. Vegetation appeared indistinguishable from the surrounding areas. Stable surface erosion (gullies) existed in an area northeast of the disposal site, but these features did not have an observable impact on the disposal site itself. Oil and gas development and operations continued in areas around the site, but there were no operations immediately adjacent to the site.

The checklist includes a requirement to review the status of a water supply well adjacent to the property. The DOE's 2014 inspection report noted that the well was not in service, and the controls for the well had been destroyed. The NRC inspector noted that the water supply well, designated as Spook #1, was not in service during the 2015 inspection and appeared to be inoperable. The power supply and controls for pump operation were not connected to the pump.

The NRC inspector conducted radiological surveys using a Ludlum Model 19 microRoentgen survey meter (NRC No. 015546, calibration due date of 07/22/15, calibrated to radium-226). With a background of 13-15 microRoentgens per hour ($\mu\text{R/hr}$), as measured on the access road to the site, measurements within the 13.5-acre property ranged from 17-30 $\mu\text{R/hr}$. The NRC inspector noted that the ambient gamma radiation measurements across the site slightly exceeded background levels, most likely due to residual mine overburden at the site containing naturally occurring radioactive material.

The NRC inspector also noted that the area of the water supply well, located adjacent to the disposal site, measured between 80-150 $\mu\text{R/hr}$. After discussing this finding with DOE staff, the NRC inspector concluded that the elevated measurements were most likely the result of residual naturally occurring radioactive material that was brought to the surface during the drilling of the well.

4 Conclusions

The DOE inspectors conducted the site inspection in accordance with the site-specific checklist, LTSP, and 10 CFR 40.27 requirements. The surface area of the disposal cell appeared to be in excellent condition with no erosion or slumping. Stable erosion was identified in an area to the northeast of the disposal site, but this erosion had no impact on the disposal site. The NRC inspector identified slightly elevated ambient gamma radiation levels across the site, including the area of the water supply well, but these elevated measurements were attributed to naturally occurring radioactive material.

5 Meeting Summary

The NRC inspector participated in a pre-planning meeting with the DOE site manager and DOE representatives prior to the site inspection. During this meeting, the NRC and DOE representatives discussed topics such as site status, inspection plan, and potential physical hazards. The inspector discussed the final site observations with DOE staff at the conclusion of the onsite visit.

6 Persons Contacted

W. Dam, Site Manager, U.S. Department of Energy
R. Johnson, Title II Manager, Stoller Newport News Nuclear (SN3)
S. Kaufman, FUSRAP Technical Lead, Stoller Newport News Nuclear (SN3)
D. Traub, Project Manager, Stoller Newport News Nuclear (SN3)

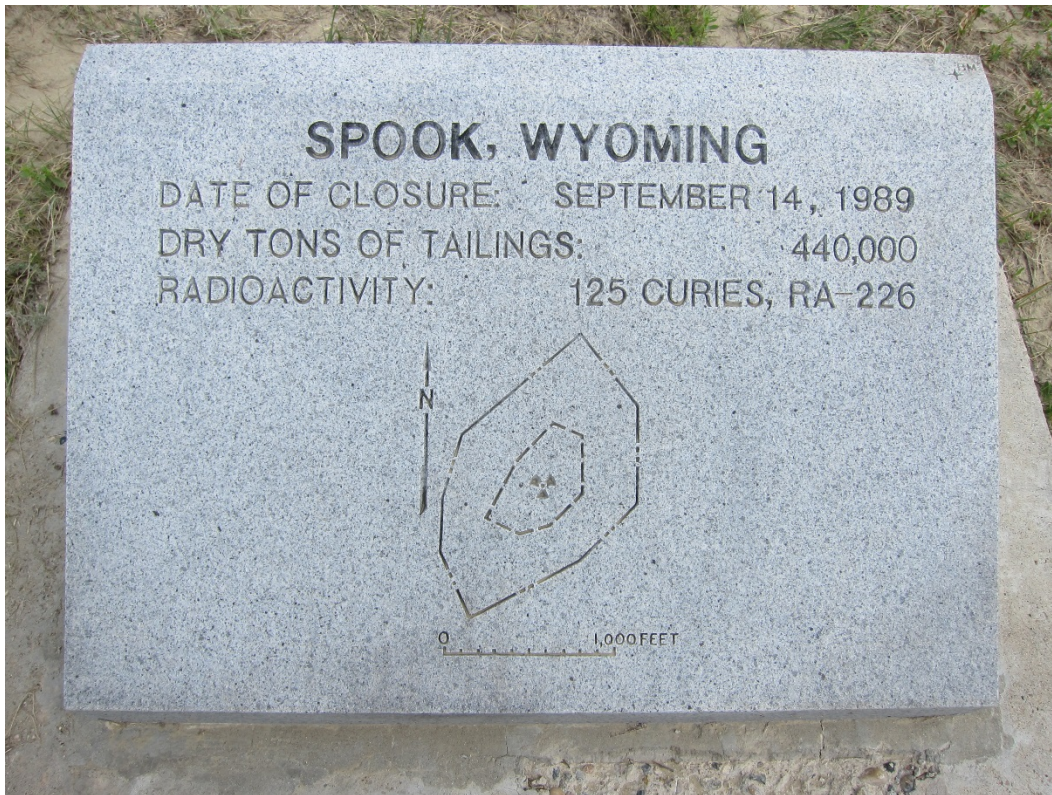


Figure 1: Spook disposal site marker



Figure 2: Spook disposal site, as seen from southwest corner looking northeast



Figure 3: Abandoned well; Spook disposal cell in background (looking west-northwest)



Figure 4: Perimeter sign P4 adjacent to stable erosion gully (looking southwest)