December 8, 2015

MEMORANDUM TO: Andrew Persinko, Acting Division Director
Division of Decommissioning, Uranium Recovery, and Waste Management
Office of Nuclear Material Safety and Safeguards

FROM: Douglas Mandeville, Acting Branch Chief ***/RA/***
Hans Arlt, Systems Performance Analyst
Division of Decommissioning, Uranium Recovery, and Waste Management
Office of Nuclear Material Safety and Safeguards

SUBJECT: TRIP REPORT

On November 4 and 5, 2015, staff from the Low Level Waste and Performance Assessment Branches within the Division of Decommissioning, Uranium Recovery, and Waste Management participated in a site visit to the Beatty, Nevada Disposal site. The purpose of the visit was to provide guidance to the State of Nevada on the final cover system after the October 18, 2015, event at the facility. A trip report documenting the staff's observations is enclosed.

Enclosure:
Trip Report

CONTACT: Douglas Mandeville, NMSS/DUWP
(301) 415-0724

December 8, 2015

MEMORANDUM TO: Andrew Persinko, Acting Division Director
Division of Decommissioning, Uranium Recovery, and Waste Management
Office of Nuclear Material Safety and Safeguards

FROM: Douglas Mandeville, Acting Branch Chief ***/RA/***
Hans Arlt, Systems Performance Analyst
Division of Decommissioning, Uranium Recovery, and Waste Management
Office of Nuclear Material Safety and Safeguards

SUBJECT: TRIP REPORT

On November 4 and 5, 2015, staff from the Low Level Waste and Performance Assessment Branches within the Division of Decommissioning, Uranium Recovery, and Waste Management participated in a site visit to the Beatty, Nevada Disposal site. The purpose of the visit was to provide guidance to the State of Nevada on the final cover system after the October 18, 2015, event at the facility. A trip report documenting the staff's observations is enclosed.

Enclosure:
Trip Report

CONTACT: Douglas Mandeville, NMSS/DUWP
(301) 415-0724

ADAMS Accession Number: **ML15328A093**

OFFICE	DUWP	DUWP	DUWP	DUWP
NAME	D. Mandeville	H. Arlt	C. McKenney	D. Mandeville
DATE	11/27/15	11/28/15	11/27/15	12/8/15

OFFICIAL RECORD COPY

BEATTY, NEVADA SITE VISIT
NOVEMBER 4-5, 2015
TRIP REPORT

BACKGROUND

The Beatty Radioactive Waste Disposal Site (Beatty site) lies a few miles south of the town of Beatty, Nevada, adjacent to Highway 95 in the Amargosa Desert in Nye County, on land owned by the State of Nevada. The site is located on unconsolidated deposits of alluvial sand, clay, silt, and gravel approximately 600 ft thick, formed by weathering action on the adjacent mountain ranges. Underlain by folded metamorphic and sedimentary bedrock, the site surface is approximately 2800 ft above sea level. A regional groundwater table lies at a depth between 260 and 330 ft below the surface in the alluvial soils. An intermittent river, the Amargosa River, lies five miles from the site and serves as the principal drainage channel in the area. The climate at the site is arid, with an average annual rainfall varying from 2.5 to 5.0 inches and a potential evaporation rate of approximately 100 inches per year.

In 1962, the Atomic Energy Commission licensed the Beatty facility, and in 1972, it transferred the primary responsibility of licensing and regulating activities at the site to the State of Nevada, which became an Agreement State at that time. Adjacent to the Beatty site is a chemical waste disposal facility and the two facilities are separated by a, at a minimum, 200 ft wide buffer zone. The chemical disposal facility is currently being operated by US Ecology. While US Ecology also operated the radioactive waste disposal facility, this facility closed operations in 1992. The Beatty site consists of 22 trenches of varying dimensions, ranging from 300 to 800 ft in length, 4 to 350 ft in width, and 6 to 50 ft in depth. These trenches were covered with a mixture of earth and gravel several feet thick after closure. A total of nearly 4.7 million cubic feet of waste has been disposed at the Beatty facility.

The Beatty area experienced a large rainfall event in early October 2015, followed by between 1 and 1.5 inches of rain between October 15 and October 19, 2015. On October 18, 2015, a crater developed at the edge of the facility. Material was ejected from the trench through the cover in accompaniment by orange-red flames and white smoke. The flames and smoke did not occur after October 18, 2015.

SITE VISIT

Following the creation of the crater, staff from the State of Nevada and the NRC held a teleconference to discuss the event. Staff from the State of Nevada asked if NRC staff with experience in engineered barrier design would be available to visit the site to provide advice on how the State should proceed. Consequently, on November 4th, NRC staff and staff from other organizations met at the Beatty site to discuss information relevant to the events of October 18th. Participants included the main organizer Jon Bakkedahl from Nevada's Radiation Control Program; Martin Azevedo and Peter Mulvihill, State of Nevada Fire Marshall; Matthew Clayton, Nye County Fire Training Officer; George Wehrly, Nye County Deputy Sheriff; Bob Marchand and Joe Weismann, US Ecology; MaryEllen Giampaoli, Environmental Compliance Specialist for Nye County; William "Bill" Nicosia, Department of Energy; and Brian Andraski,

United States Geological Survey. Karen Beckley, Manager of Nevada's Radiation Control Program, joined the inspection group on November 5th.

NRC staff spent the days of November 4th and 5th making observations at the site and damage to the Beatty site cover. The crater in Trench 14 was visible near the boundary of the site and, although no measurements were taken by NRC staff, was approximately 20 ft in diameter and several feet deep. It was created in the shallower portion of the trench and eleven drums were ejected from the crater. Some drums were ripped apart while others were crushed, but intact. The crater was created by a sequence of events on October 18th the consisted of white smoke, flames, violent expelling of material, material collapsing back into the crater, and subsequent cycle beginning again. The results of several surveys and samples taken at the site indicated that no radioactive material was exposed in or around the crater.

Crater in Trench 14 with remains of drums

Aside from the crater at the end of Trench 14, NRC staff observed several other issues related to the earthen barrier covering the trenches at the Beatty site including linear cracks near the edge of trenches, sinkhole-type openings, and areas of subsidence. Long linear cracks were observed along what appeared to be the edge of Trench 22. These cracks likely originated along the interface of the trench fill and the non-trench material and then propagated toward the surface.

Various hypotheses were proposed for the existence of the linear cracks: The linear cracks could result from differential settlement between the waste within the trench and native soil adjacent to the trench. It was also hypothesized that different properties of the trench material and the material outside the trench lead to differences in expansion and contraction rates between to the two material during periods of desiccation and rewetting. It was also mentioned that the Beatty area suffered from numerous smaller earthquakes with a magnitude range between 2 and 5 which could also contribute to either the cause or size of the cracks.

Linear cracks or fissures

Trench 20 had evidence of subsidence, however the subsidence was more similar to that of a sinkhole-type subsidence, i.e., no visible depression except for the holes on the surface. Subsurface cavities in the trenches may have formed and increased in size so that the cavity roof lost support and cover material near the surface fell downwards into the cavity. None of the small channels that formed during the rain event seemed to flow towards the sinkhole-type subsidence. The holes were deep and the bottom was not visible.

Sinkhole-type subsidence

In contrast, the large subsidence depression near the middle of Trench 14 had numerous rivulets from the surrounding cover terminate in it so that much of that water may have flowed into Trench 14 through the cracks that were visible around the depression, or by ponding and infiltration. The crater was downgradient from this depression, so it would have been possible for rainwater that had entered at the depression to have moved downgradient within the trench towards the waste at the end of Trench 14 near the boundary.

Large subsidence or depression

At the close-out meeting, participants discussed various types of engineered surface covers that should replace the current one. NRC staff recommended that the State of Nevada should consider temporary repairs to the existing cracks, subsidence areas, and crater. These areas could be backfilled with soil and graded to promote runoff and minimize the potential for water to penetrate the existing cover. NRC staff had observed that the polyethylene sheets had been spread over the crater and the larger subsidence depressions in and near Trenches 14 and 20 to shield them from the weather and potential new rainfall. NRC staff recommended incorporating the polyethylene sheets with a temporary cover, i.e., backfilling the depressions and holes and leaving the sheets in place to provide additional protection from water intrusion if another significant rainfall event were to occur and minimizing the potential of additional precipitation from reaching inside trenches. In addition, NRC staff recommended that the sodium hydroxide be removed from the surface of Trench 14 as soon as possible. Dissolution of sodium hydroxide is highly exothermic, and the resulting heat may cause heat burns or ignite flammables. Removal would reduce the chance of exposure at the ground surface and also avert sodium from seeping back down into the trench with waste.

The NRC staff recommended the State of Nevada consider the design and construction of a new, permanent engineered cover to be placed over the existing cover. Knowledge of the waste inventory of the Beatty disposal site is incomplete and additional waste with similar properties to the material that contributed to the October 18th event may be still present, e.g., alkali metals. Preventing precipitation from reaching such waste should be an important goal for the final engineered cover. To reach that goal, it will be important that the future engineered cover has a good surface water drainage system to prevent precipitation from accumulating on the cover and be able to move the water away from the disposal site. An engineered cover system would also need to be able to accommodate differential settlement. A thicker geomembrane in addition to an underlying layer of overburden on top of all the trenches should be able to withstand a certain amount of differential settlement. Current research indicates that geomembrane constructed out of high-density polyethylene (HDPE) is a good long-term component to have in an engineered barrier for purposes of preventing contact with water. For the geomembrane to function as intended, quality assurance during installation is critical and

care must be taken so that no defects occur during construction of the cover. Geomembranes with a sand drainage layer above it and a geosynthetic clay layer (GCL) below it could provide additional improved performance.