Innovative Approach for Technetium-99 Disposal Reduces Operational Impacts – 16460

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ABSTRACT

The Environmental Management Waste Management Facility (EMWMF) on the Oak Ridge Reservation began receiving and disposing waste with elevated technetium-99 (Tc-99) activities on November 11, 2013. Prior to receipt, the Tennessee Department of Environment and Conservation expressed concerns about potential releases of this highly mobile radionuclide into the environment and requested additional safeguards to minimize potential releases. Several additional requirements were negotiated to address these concerns and allow this waste lot to be safely disposed at EMWMF.

Because of the 130-cm (51-inch) annual average precipitation at the landfill, the potential release of Tc-99 (above the release criterion) to surface water during the EMWMF water management activities was of the greatest concern. The EMWMF Operations staff developed an innovative approach to resolve regulator concerns regarding disposal of low-level waste containing elevated levels of Tc-99 at EMWMF. This approach minimized the spread of contamination and the generation of water that contacted the Tc-99 waste.

Lessons learned and recommendations are being implemented for the next, more challenging elevated Tc-99 waste from the K-27 Building, currently scheduled for early 2016. These lessons learned are also applicable to other sites looking to minimize operational impacts from disposal of waste with elevated activities of Tc-99 or other highly mobile contaminants.

INTRODUCTION

The Environmental Management Waste Management Facility (EMWMF) recently completed receipt of waste containing elevated technetium-99 (Tc-99) contamination. This paper describes the approach taken to minimize the spread of this highly mobile contaminant, along with recommendations for future receipt of this waste type.

EMWMF is a key component of the cost-effective CERCLA Cleanup Program at the Oak Ridge Reservation (ORR). EMWMF began operations in 2002 and currently receives and disposes of Low-Level Waste, RCRA hazardous waste, Toxic Substances Control Act waste, and mixed waste generated from CERCLA actions at the ORR. No RCRA-listed hazardous waste or TRU waste is accepted for disposal at EMWMF.

Water management at EMWMF is a high priority component of the operations because of the 130-cm (51-inch) annual average precipitation received at the landfill. Water

that enters the leachate collection system is trucked via tanker for treatment at an ORR facility. Stormwater that contacts the waste, but does not enter the leachate collection system, is pumped to ponds and tanks, sampled, and then released if the water meets the release criteria. Water that does not meet the release criteria is trucked for treatment at an ORR water treatment facility.

DESCRIPTION AND DISCUSSION

Prior to 2013, Tc-99 contamination was not a significant part of the EMWMF waste stream. However, beginning in November 2013, demolition and disposal of the K-25 uranium processing facility purge cascade waste began, resulting in the generation of waste with elevated Tc-99 activities. Prior to receipt, the Tennessee Department of Environment and Conservation (TDEC) expressed concerns about potential releases of this highly mobile radionuclide into the environment and requested additional controls during disposal of this waste stream to minimize the potential for releases. In particular, the potential release of Tc-99 (above the release criterion) to surface water during the EMWMF water management activities was of the greatest concern.

Additional controls were negotiated to address these concerns and allow this waste lot to be disposed at EMWMF. The EMWMF Operations staff developed an innovative approach to implement controls, thereby resolving regulator concerns regarding disposal of waste containing elevated levels of Tc-99 at EMWMF. The EMWMF Operations approach enhanced the TDEC requirements and implemented additional controls during waste receipt, waste placement, and water management.

Prior to receipt of the elevated Tc-99 waste, the EMWMF Operations staff developed an approach to minimize the water that contacted this waste. To minimize stormwater running onto the waste, a bowl-shaped structure was constructed using non-elevated Tc-99 bulk waste as this waste was received (see Fig. 1). The bowl was approximately 64 meters (210 feet) by 76 meters (250 feet). The inside face of the berms was lined with compacted waste and/or clean fill to reduce the stormwater that could infiltrate into or away from the waste.

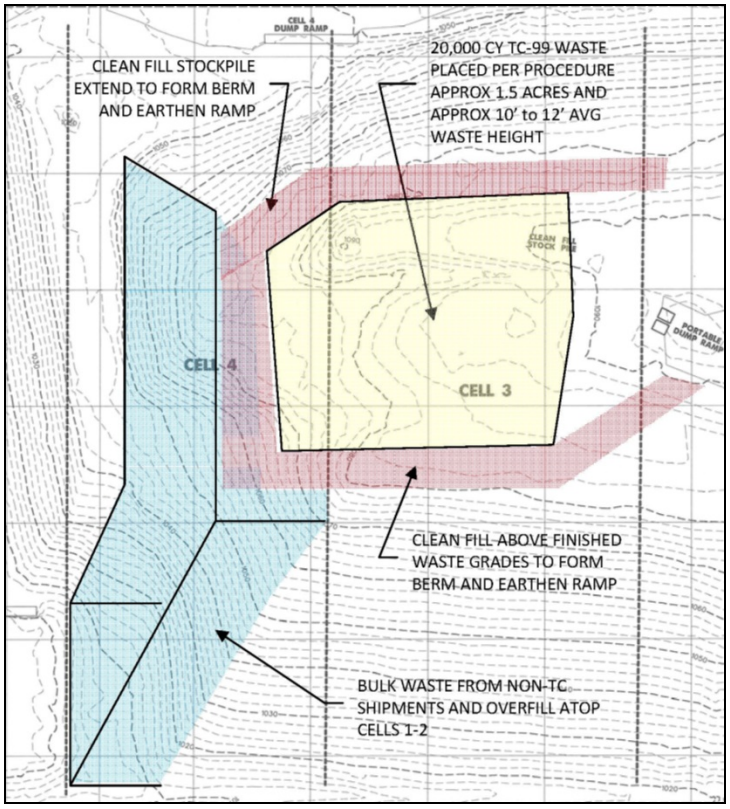

Fig. 1. Construction of the Tc-bowl.

This approach resulted in placing the elevated Tc-99 waste into a smaller, more localized area isolated from the rest of the disposal operations by the berms surrounding the Tc-bowl. Placement within the bowl reduced the amount of precipitation and stormwater entering the waste and directed the flow of the runoff away from the Tc-99 disposal area. Precipitation falling within the Tc-bowl and contacting this waste preferentially flowed downward towards the leachate collection system instead of the in-cell catchment.

TDEC requirements also included not disposing of elevated Tc-99 waste during periods of rain and placing a cover of 15 to 30 cm (6 to 12 inches) of soil (that has been tracked over by heavy equipment to compact the soil and to reduce infiltration) over the waste, daily. The EMWMF Operations staff added the following operational requirements:

- Prohibit waste disposal operations in the Tc-bowl when conditions are too muddy, whether or not it is raining.
- Maintain a slope on the Tc-99 dump-face to promote stormwater runoff and minimize waste contact with water.
- Maintain a small working face.

Dump trucks were lined with polyethylene bed liners to prevent inadvertent dispersion and to minimize the Tc-99 remaining in the empty trucks that could potentially be spread outside of the Tc-bowl. As an added benefit, the lined dump trucks were more effectively offloaded into the bowl without spreading contamination.

The elevated Tc-99 waste receipt was tightly controlled to minimize the opportunity to spread contamination. A clean roadway for the dump trucks was built along the outside of the Tc-bowl prior to the start of the elevated Tc-99 waste campaign, and the dump trucks remained on the clean roadway at all times to avoid picking up and spreading contamination. Trucks were dumped directly at the active area of the disposal, and the push paths and working face were kept as small as possible. Trucks were surveyed a short distance from the dump location within the radiologically controlled area to ensure contamination was not spread outside the dumping area.

Following an incident where Tc-99 waste fell onto the clean access road as the tailgate was lowered, spreading contamination within the disposal cell and causing the loss of several truck tires, the survey location was moved even closer to the dump area. Additional absorbent pigs were placed at the truck tail gates during loading to absorb dust-control moisture that collected in the bottom of the beds. No contamination was spread outside of the waste cells. Due to the nature of Tc-99, contamination was readily identified and removed from the Tc-bowl access roadway prior to restart of disposal operations.

Additionally, short turnaround monitoring of the water in the in-cell catchments and the leachate was conducted during the elevated Tc-99 campaign to provide an early warning if Tc-99 activities in water were rising to the levels that would prevent discharge to surface water. The additional monitoring showed that elevated Tc-99 activities were common following periods of heavy precipitation, and also following disruption of the soil cover over the Tc-99 waste. However, the activities in the landfill waste water remained below 15% of the Tc-99 discharge criterion of 24,000 picocuries per Liter (pCi/L).

CONCLUSIONS

Following completion of the disposal campaign, lessons learned and recommendations were identified and compiled. The key factors leading to the success in controlling the Tc-99 contamination were as follows:

- Construction of a bowl for the elevated Tc-99 waste that minimized the disposal area, minimized the amount of precipitation that fell onto the waste, and diverted precipitation and stormwater away from the waste.
- Maintaining a small working face and sloping the face to minimize pooling of water within the Tc-bowl. This configuration also directed the leachate more quickly to the leachate collection system.
- Construction of a clean access road for trucks with a nearby survey location to ensure contamination was not tracked out of the radiological area.

- Lining truck beds and placing absorbent pigs at the tail gates to control the spread of contamination during dumping.
- Maintaining a cover of fill material over the waste, particularly during periods of heavy precipitation.
- Performing additional landfill water monitoring as a guide to determining which events would lead to increased activities in the water and as an early warning if discharge criterion might be exceeded.

While maintaining a cover of non-Tc-99 waste is essential in minimizing the spread of contamination, the daily cover requirement resulted in extra work in a contamination area with no added benefit. Placing the daily soil cover increased worker exposure to hazards and Tc-99, required additional resources (fuel, personnel, clean clay), increased equipment wear and contamination, and consumed considerable air space—all with no significant benefit. Other operational practices are able to minimize water contacting the Tc-99 waste, meeting the intent of this requirement. Therefore, for future elevated Tc-99 waste campaigns, the cover will be placed when periods of precipitation greater than 1.25 cm (½ inch) per hour are forecasted and for longer periods of inactivity, such as for long holiday weekends.

These identified controls are being implemented for the next planned elevated Tc-99 waste campaign, currently scheduled for fiscal year 2016 (see Fig. 2). This approach is easily implemented for other sites to minimize the operational impacts from disposal of waste with higher activities of Tc-99 or other highly mobile contaminates.

Placement of the elevated Tc-99 waste within the constructed bowl effectively controlled mobilization of Tc-99. Using this approach, activities within the catchment water and the leachate were less than 15% of the 24,000 pCi/L release criteria.

Fig. 2. New Tc-Bowl Constructed for Upcoming Tc-99 Campaign.