Accelerating the Disposition of Transuranic Waste from LANL - 9495

Mark D. Shepard, Susan G. Stiger, and James A. Blankenhorn
Los Alamos National Laboratory
P.O. Box 1663, Los Alamos, NM 87545

George J. Rael
U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Site Office
3747 W. Jemez Road, Los Alamos, NM 87544

David C. Moody
U.S. Department of Energy, Carlsbad Field Office
4021 National Parks Highway, Carlsbad, NM 88220

ABSTRACT

This paper presents progress in dispositioning legacy and newly-generated transuranic waste (TRU) from ongoing missions at the Los Alamos National Laboratory (LANL). The plans for, and lessons learned, in dispositioning several hundred high-activity TRU waste drums are reviewed. This waste population was one of the highest risks at LANL. Technical challenges in disposition of the high-activity drums are presented. These provide a preview of challenges to be addressed in dispositioning the remaining 6,800 m^3 of TRU stored above ground and 2,400 m^3 of TRU waste that is "retrievably" stored below-grade. LANL is using subcontractors for much of this work and has formed a strong partnership with WIPP and its contractor to address this cleanup challenge.

BACKGROUND

LANL was established during World War II with a single mission – to design and build an atomic bomb. In the 65 years since, nuclear weapons physics, design and engineering have been the Laboratory's primary and sustaining mission. Experimental and process operations--and associated cleanout and upgrade activities--have generated a significant inventory of TRU waste that is stored at LANL's Technical Area 54, Material Disposal Area G (MDA G). When the Waste Isolation Pilot Plant (WIPP) opened its doors in 1999, LANL's TRU inventory totaled about 10,200 m^3, with a plutonium 239-equivalent curie (PE-Ci) content of approximately 250,000 curies. By December 2008, a total of about 2,300 m3 (61,000 PE-Ci) had been shipped to WIPP from LANL. This has resulted in a net reduction of about 1,000 m^3 of TRU inventory over that time frame.

As Figure 1 illustrates, about 75% of the inventory by volume and 50% of the activity is currently stored above grade in drums and boxes. Almost 30% of the aboveground inventory is in oversized boxes, some measuring as large as 25 ft x 8 ft x 10ft (L x W x H). The oldest of the aboveground containers is approaching 40 years old, so monitoring container integrity is a key ongoing activity.

LA-UR-09-00255

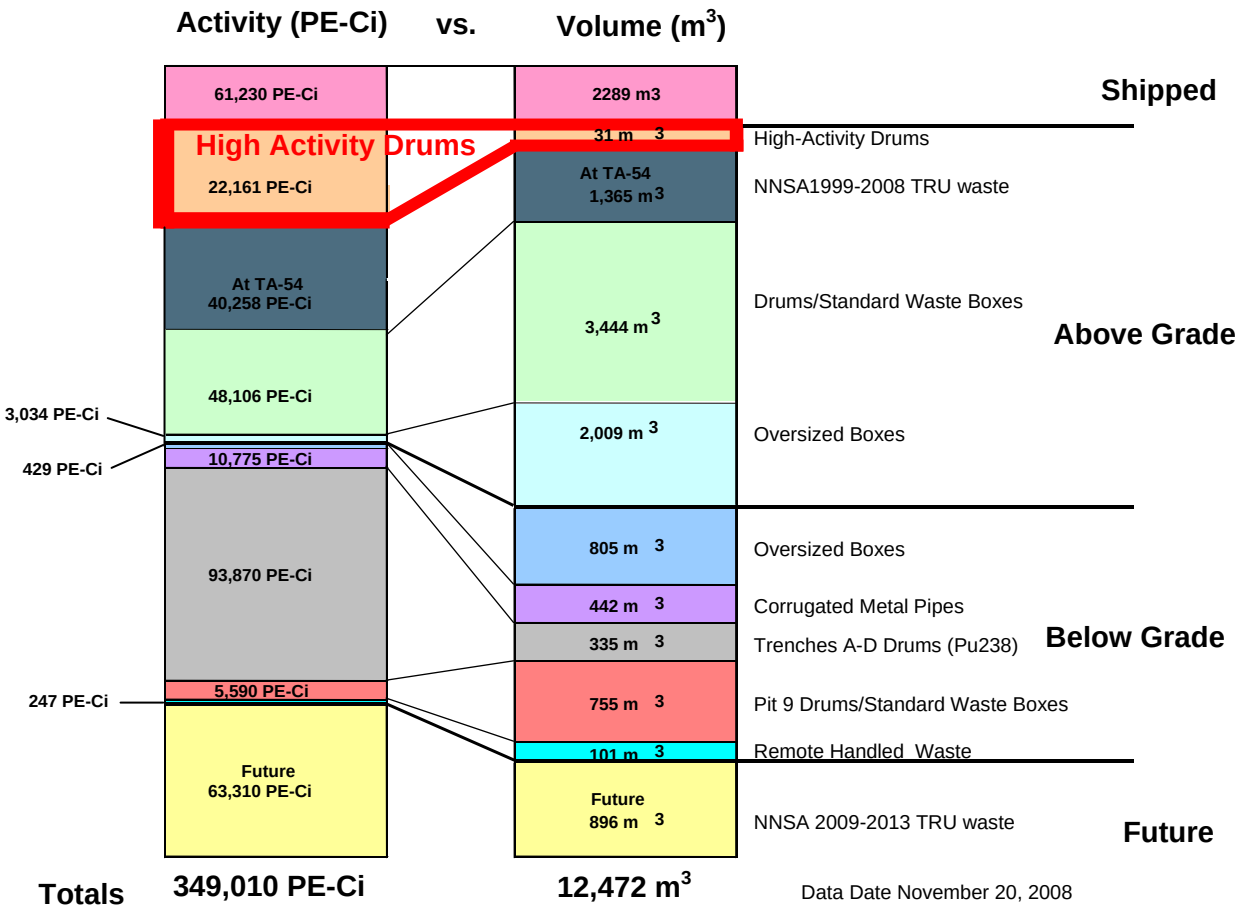

Figure 1. LANL's inventory of transuranic waste stored above- and below-grade. Volumes shipped represent March 1999 to November 2008. New TRU waste generation from 2009 through 2013 is based on current projections.

DISPOSITIONING LANL'S TRU WASTE BACKLOG

From a radioactive content standpoint, two populations of the legacy inventory are of particular interest – the aboveground high-activity drums and the below ground drums in Trenches A-D. The 325 high-activity drums, which contained waste principally from the heat source plutonium processing and recovery lines, represented 1% of the aboveground TRU inventory by volume, but 25% of that inventory by activity. All but 59 of the high-activity drums contained waste forms that had not been stabilized and were considered dispersible. Analyses of postulated accident scenarios involving these high-activity drums resulted in very high consequences because of the significant radioactive content and the proximity of the waste storage area to the LANL site boundary (< 200 m). The Cerro Grande fire, which burned more than 48,000 acres within and around LANL in May 2000, came within several hundred m of LANL's TA-54 waste storage area, heightening the focus on dispositioning these drums. A January 2007 Defense Nuclear Facilities Safety Board letter to DOE Secretary Samuel Bodman requested an expedited plan for shipping these drums offsite for disposal.

Complicating disposition of the high-activity drums was the fact that almost all of the drums required repackaging because they did not meet the WIPP Waste Acceptance Criteria for radioactive content or

contained items that are prohibited at WIPP. Repackaging these drums required a Hazard Category 2 nuclear facility, which was not available at LANL for this purpose. In late 2006 and early 2007, LANL conducted an expedited project to modify and upgrade an existing 30-year old glovebox facility to process the high-activity drums. This facility is known as the Waste Characterization Reduction and Repackaging Facility or WCRRF. Required upgrades included structural strengthening to enhance seismic performance, overall upgrading of the electrical systems, and improvements to ventilation, lightning protection and fire protection systems. The facility's glovebox measures 12-ft long by 3-ft wide by 32-in high which somewhat restricts sorting and repackaging operations. By mid-2007, with support from both the DOE Los Alamos Site Office and DOE Headquarters, the facility and crews had successfully passed a federal operational readiness review and repackaging operations began. The subsequent discovery of sealed inner containers in some of the drums, not addressed in the initial hazard analyses, and several overpacked unvented 55-gallon drums required additional analyses and modifications.

By May 22, 2008, all but 10 unvented high-activity drums had been repackaged, characterized, certified, and shipped to WIPP in cooperative efforts with both WIPP and their contractor, Washington TRU Solutions Central Characterization Project, that performs TRU characterization and certification activities at LANL. The remaining10 drums required venting before they could be repackaged – a capability that also did not exist at LANL. A small tent enclosure was installed in an existing storage dome, along with remotely-operated drum venting and HEPA filter equipment (Figure 2). Due to limitations on the existing fire protection systems and the unvented nature of the drums, non-sparking tools and extra grounding provisions were required.

Figure 2. Special facility and equipment capability was required to vent high-activity unvented drums before repackaging.

The LANL crew vented the final high-activity drums on October 2, 2008. The newly-vented drums were repackaged, characterized, certified, and shipped to WIPP by November 13, 2008, a notable risk

reduction accomplishment for LANL. As illustrated in Figure 3, the focused campaign to repackage and ship the high-activity drums to WIPP is one element of LANL's increased TRU disposition performance.

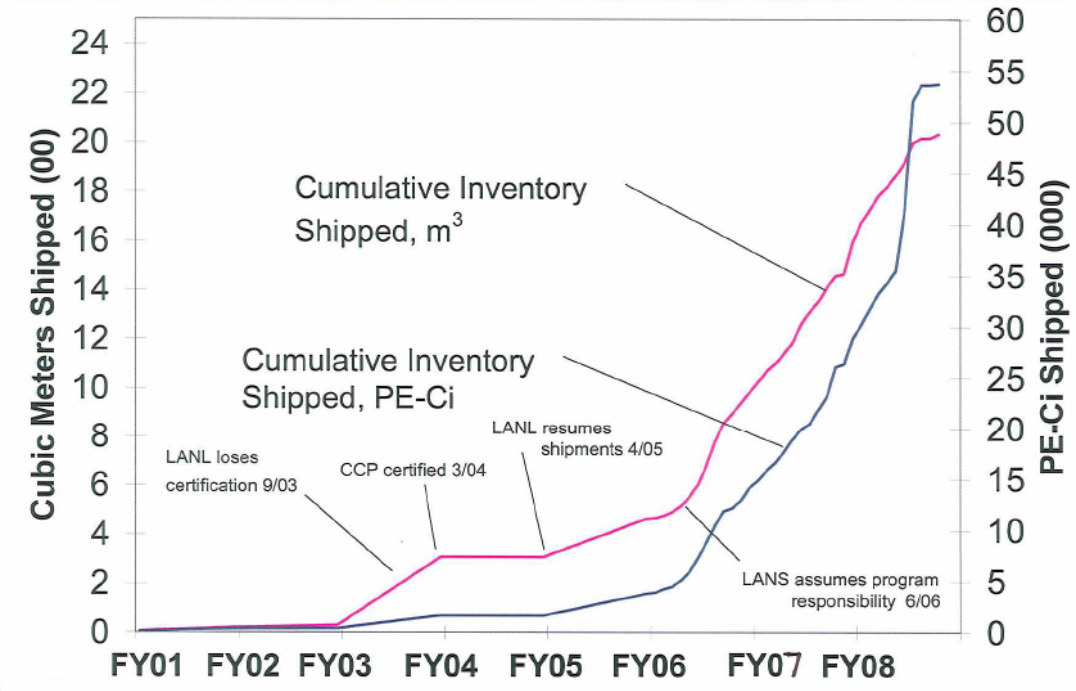

Figure 3. In the past two years, LANL has significantly increased the disposition of legacy TRU waste.

In mid-2008, recognizing that TRU disposition is on the critical path to required cleanup and closure of TA-54 MDA G under the New Mexico Consent Order, LANL and WIPP personnel developed a joint plan to accelerate disposition of the TRU stored aboveground. An Integrated Project Team (including personnel from the DOE Los Alamos Site Office, the DOE Carlsbad Field Office, LANL and Washington TRU Solutions Central Characterization Project), outlined expanded repack and characterization capabilities that would be required to support this disposition plan. Of the remaining drum inventory, more than 70% requires repackaging, a significantly higher percentage than other DOE sites. In addition, all of LANL's oversized boxes require size reduction and packaging into WIPP-compliant containers.

Planning and execution of the joint plan started in the first quarter of FY 2009 as additional funding was identified to seed the acceleration. Since most of the drummed waste requires repackaging, LANL decided to immediately increase utilization of existing repackaging lines located at the WCRRF and the Dome 231 Permacon in MDA G. An additional work shift was added at each line, which increased processing throughput for debris and non-cemented sludge waste forms. At the same time, a parallel effort is being initiated to equip and staff two additional repackaging lines in Area G. These additional lines are necessary to complete repackaging the balance of the debris and cemented sludge drums in inventory by the end of FY 2010.

In addition to the near-term actions, LANL is moving out on several new initiatives to assure feedstock availability and to prepare the project for FY 2010 and beyond. Chief among these is the planning and procurement of a size reduction, repackaging and remediation process line for oversize boxes. Subcontract award is targeted toward the end of FY 2009 so that engineering, fabrication, and installation can occur in FY 2010. The box repackaging line is conceptually envisioned as a temporary, modular

facility with full capability to dismantle and repackage LANL's oversized box inventory. This facility will be targeted for start-up in the first quarter of FY 2011. LANL will also begin planning for retrieval of below-grade waste inventories with the expectation of initiating the procurement process for this scope in early FY 2010.

Additional drum venting capability, as well as additional characterization equipment, a super-high-efficiency neutron counter for boxes, a real-time radiography (RTR) unit for boxes, and WIPP's mobile loading equipment and crews would be installed and certified under WIPP requirements. Associated authorization basis updates, training, and readiness reviews will also be required. With these modifications, production planning indicates the remaining aboveground inventory could be dispositioned in nominally three years, a significant improvement over the baseline plan.

OVERVIEW OF TRU RETRIEVABLY STORED BELOW GRADE

LANL's inventory of TRU waste retrievably stored below grade includes a very diverse compilation of waste forms and containers. Sixteen canisters of stabilized remote-handled TRU (RH-TRU) from hot cell cleanouts in the 1980s and early 1990's are awaiting final regulator approval for shipment to WIPP. Unlike most other DOE sites, the New Mexico Environment Department (NMED) regulates both the storage and processing of TRU waste at LANL under RCRA, as well as disposal activities at WIPP. This can create some added regulatory review steps to address factors such as changes in waste codes.

Trenches A-D at MDA G contain the population with the highest total PE-Ci activity level (a total of about 94,000 PE-Ci) of mostly plutonium-238 waste from production of Pu-238 heat sources. There are a total of 721 30-gallon drums contained within 363 concrete casks (2 drums/cask), with a total volume of 335 m^3. Historical waste emplacement in these trenches is shown in the upper left photograph of Figure 4. Retrieval of these drums will require extra controls to ensure aboveground material-at-risk limits in the nuclear safety authorization basis are not exceeded at the facility.

There are also a total of 158 corrugated metal pipes (CMPs) that contain cemented sludges that will require retrieval and processing so that they can be shipped to WIPP. These are shown in the upper right photograph of Figure 4. Each of the CMPs is about 30 inches in diameter, 20 feet long, and weighs 10 to 14,000 pounds. The CMPs have a total volume of about 440 m3 and contain total material at risk of about 11,000 PE-Ci.

Figure 4. LANL's backlog of TRU includes about 2,500 m3 of a variety of waste streams and containers retrievably stored below grade.

LANL has its own Pit 9, which contains 755 m3 of TRU waste drums and fiberglass-reinforced plywood (FRP) boxes containing oversize TRU waste such as gloveboxes (see lower photograph in Figure 4.) Pit 9 was excavated in 1974 and accepted waste until 1979. The waste is stored on an asphalt pad in the pit in an array of cells containing 30-, 55- and 85-gallon drums surrounded by the FRP boxes that were topped with a layer of plywood and heavy-duty plastic sheeting. A three-foot thick soil barrier was placed between cells. A plastic pipe was inserted into each cell for monitoring purposes and for ventilation. An interim cover of 3 feet of crushed tuff was placed over the cells after they were filled.

The 33 shafts that contain remote-handled waste present the most significant challenge in dispositioning LANL's remaining backlog inventory of TRU waste. This field of shafts contains remote-handled hot cell debris waste from the Chemistry and Metallurgical Research facility at LANL. The shafts are located in the eastern part of MDA G, which is also the location of multiple low-level waste disposal pits and shafts, several with significant transuranic isotope inventories. LANL's baseline includes retrieval and

processing of the 33 shafts for disposition at WIPP before final cleanup and closure of MDA G under the Consent Order, required by December 2015.

The 33 shafts are about 3 feet in diameter and 18 feet deep, and contain 8.5 inch diameter carbon steel pipe liners. The liners contain a total of 290 one-gallon steel and plastic cans that were gravity fed into the pipes at the time of emplacement. Until quite recently, it was believed that the annular spaces around the pipe liners were simply backfilled with native tuff materials; however, recent field inspections have revealed that 23 of the pipes have been encased in concrete. This significantly complicates retrieval, safety basis, transportation, and planned nuclear processing operations for ultimate WIPP disposal.

The 33 shafts contain a total of approximately 2,500 total curies and surface contact dose levels of the pipes are estimated to range up to 1200 Rem/hour. However, almost all of the activity is from fission products, not from long-lived transuranic isotopes. LANL is currently evaluating options for this waste stream. Qualifying the waste for shipment to WIPP would require the pipes to be opened, physical measurements made, and dose readings taken, all in support of transportation plans. Two options for retrieval are under consideration – retrieving and transporting the entire pipe and contents, or removing the inner cans from the pipes. The latter was the original planning basis, but has more recently come into question when it was discovered that many of the containers were plastic and in several cases the cans were forced into the shafts when they became stuck.

The Chemistry and Metallurgical Research (CMR) facility is the only existing facility at LANL that can be considered for processing waste retrieved from the 33 shafts for shipment to WIPP. This almost 60-year-old facility would require significant modifications to handle this waste stream, particularly the newly-discovered as-placed configuration. LANL is also evaluating the possibility of using mobile hot cell technology to support retrieval of this waste stream, as well as the possibility of in situ disposal, perhaps with stabilization, since the radiological inventory in the shafts represents less than 0.1% of the entire inventory of TRU isotopes in waste disposed at TA-54 MDA G.

COORDINATION WITH CLEANUP UNDER THE NEW MEXICO CONSENT ORDER

LANL's regulatory cleanup agreement, the Compliance Order on Consent or 'Consent Order', requires cleanup and closure of the portions of TA-54 MDA G that contain RCRA-regulated wastes disposed before the mid-1980s. Active waste storage units are regulated under a RCRA permit. Nearly all of those wastes are mixed waste, and the ultimate closure of MDA G for radiological purposes is regulated by DOE under its waste management orders and 40 CFR Part 191 environmental standards. Integrated plans to disposition the remaining stored TRU waste and to close MDA G under the New Mexico Consent Order, the RCRA permit, and in accordance with DOE's regulatory requirements for radioactive waste management facilities are under development.

A Corrective Measures Evaluation (CME) Report for MDA G at TA-54 was prepared and submitted to the New Mexico Environment Department for review in September 2008. The CME screens 12 corrective measures alternatives based on their ability to meet regulatory threshold and other qualitative screening criteria. Four of the 12 alternatives evaluated met the screening criteria and were retained:

- Monitoring and maintenance of the existing cover, combined with a soil vapor extraction system to remove vapor-phase volatile organic compounds,
- Construction of an engineered evapotranspiration cover, combined with a soil vapor extraction system,
- Partial waste excavation with ex situ treatment and disposal, monitoring and maintenance of an engineered evapotranspiration cover, and a soil vapor extraction system,

- Complete excavation and offsite disposal of all MDA-G waste, combined with a soil vapor extraction system.

The alternatives must meet the cleanup objectives of the Consent Order, RCRA closure standards, and DOE performance objectives for low-level waste disposal sites. The LANL recommended alternative is an engineered evapotranspiration cover, partial excavation of one of the waste pits, maintenance and monitoring, and a soil vapor extraction system. The NMED has required evaluation of additional alternatives and submittal of the additional information later this fiscal year. The NMED will develop a Record of Decision and proposed remedy based on its analysis of the CME that will be released for stakeholder and public review. The public review period is 6 months under the Consent Order, but the actual process is expected to be a year or more if there are requests for a public hearing, as expected.

The final TA-54 closure decisions will be based, in part, on the Performance Assessment and Composite Analysis for Area G. Final review of this document by DOE Headquarters was completed in October 2008 and release is expected in spring 2009. The analyses of closure with an evapo-transpiration cover indicate that peak mean doses for members of the public are less than pertinent performance objectives, and peak mean doses projected for all intruder scenarios fall within the 100/500 mrem/yr limits. As noted above, any such actions will be closely coordinated with closure actions required under RCRA and the Consent Order to ensure the remaining inventory of waste does not present an unacceptable future risk to LANL workers, the public, or the environment.