

## **Multi-Year Work Plan to De-Inventory TRU Waste Stored at LANL - 12121**

K. W. Johns-Hughes, J. S. Clemmons, K. M. Hargis, D. V. Christensen, and M. D. Shepard  
Los Alamos National Laboratory  
P.O. Box 1663, Los Alamos, New Mexico 87545

M. L. Bishop  
U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Site Office  
3747 W. Jemez Road, Los Alamos, NM 87545

### **ABSTRACT**

The Los Alamos National Laboratory (LANL) continues to accelerate disposition of transuranic (TRU) waste stored at its Technical Area 54 (TA-54) Area G waste management facility. The current focus is on complete removal of all non-cemented above-grade Legacy and newly-generated TRU waste that was in storage on October 1, 2011, by no later than June 30, 2014. This inventory of above-grade TRU is defined as 3,706 m<sup>3</sup> of material. Legacy TRU waste containers were placed into storage up to 40 years ago, and most of the older containers must be remediated to address compliance issues before the waste can be characterized, certified as meeting the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (WAC), and shipped for disposition. More than half of the remaining TRU waste volume stored above grade is contained within oversize boxes that contain waste items that must be repackaged or size reduced. Facilities and major types of equipment needed to remediate and characterize the TRU waste inventory are largely in place, but two additional oversize box processing lines are being implemented in 2012. Multiple work shifts are planned for most remediation lines in 2013. An integrated risk-based project management schedule for all disposition activities has been developed that is based on a “Solution Package” approach. Inventories of containers that have issues in common were compiled into about 15 waste categories and about 70 “Solution Packages” that identify all of the activities needed to disposition the inventory of TRU waste in storage. Scheduled activities include all precursor activities to begin remediation, remediation processing, characterization and certification to the WIPP WAC, and shipping of containers to WIPP. Processing of the 3,706 m<sup>3</sup> is projected to result in about 4,500 55-gallon (208L) drums and 1,000 standard waste boxes that will be shipped to WIPP. About 385 shipments from LANL to WIPP are projected before June 30, 2014, to ship these containers, at a rate of 5 to 6 shipments a week.

### **INTRODUCTION**

LANL began segregating and storing TRU waste generated in its nuclear material research and development activities in the early 1970's when the U.S. Atomic Energy Commission directed that its sites begin to segregate waste with “transuranium nuclides” and store it for future disposition in a deep geologic repository [1]. By the time that WIPP opened in 1999, LANL had built up an inventory of about 9,600 m<sup>3</sup> of TRU waste in storage at its TA-54 Area G waste management facility. Although LANL began shipping TRU waste when WIPP opened in 1999, volumes shipped during the first five years were very low and newly-generated TRU waste has continued to be received for storage. As of October 1, 2011, LANL had a total volume of TRU waste in storage at Area G of 6,935 m<sup>3</sup> with a plutonium 239-equivalent curie (PE-Ci) content of 187,684 curies. Of this total, about one-third (2,399 m<sup>3</sup> with an activity of 110,751 PE-Ci) is retrievably stored below grade in pits, trenches, and shafts and covered with soil. Figure 1 shows TRU waste storage domes and characterization equipment (right foreground) at Area G.



Fig. 1. Aerial photograph of TA-54 Area G (from the east).

The LANL TRU inventory is composed of a variety of waste forms (debris, sludges, cemented wastes, contaminated metal items, soils, etc.) and a variety of container sizes. Container sizes include 55 gallon drums, 30 gallon drums, drums overpacked into 85 gallon or 100 gallon drums, standard waste boxes (SWBs) with a capacity of  $1.89 \text{ m}^3$ , fiberglass-reinforced plywood (FRP) boxes of various sizes (some as large as  $57 \text{ m}^3$  in volume each), metal boxes of various sizes, and metal spheres up to about 1.8 m (6 feet) in diameter.

Most of the older containers have issues that require that the containers be remediated or repackaged before the containers can be characterized for shipment to WIPP. Issues include items that are prohibited at WIPP (such as free liquids, aerosol cans, and sealed containers greater than 4 L in size), unvented containers, containers that exceed activity or fissile gram equivalent (FGE) limits at WIPP, and containers that do not qualify for WIPP disposal. Only 55 gallon drums and SWBs can be shipped from LANL to WIPP at present, and TRU waste in other size containers must be repackaged into 55 gallon drums and SWBs. Very few (well below 1%) of the newly-generated TRU waste containers have issues and those containers go directly to characterization.

Figure 2 shows LANL TRU waste disposition by volume and activity by fiscal year through September 30, 2011, with a total volume of  $4,042 \text{ m}^3$  (107,322 PE-Ci) shipped from LANL to WIPP. An additional  $898 \text{ m}^3$  of TRU waste that was reclassified to mixed low level waste (MLLW) after assay of the waste containers showed levels of TRU isotopes less than 100 nanocuries/gram (nCi/g) was also shipped to commercial treatment and disposal at the Nevada National Security Site after treatment. Efforts to greatly accelerate TRU waste shipments began in 2006, and about 85% of the total disposition volume and 97.5% of the total activity of TRU waste has been shipped since that time. LANL has established new “records” for the number of its shipments to WIPP each of the past three years.

Only about  $16 \text{ m}^3$  of LANL TRU waste stored below grade has been shipped to WIPP to date, and this consisted of 16 canisters of remote-handled waste shipped in 2009. All other waste shipped from LANL to WIPP has been contact-handled waste (dose at the container surface less than 200 millirem per hour.)

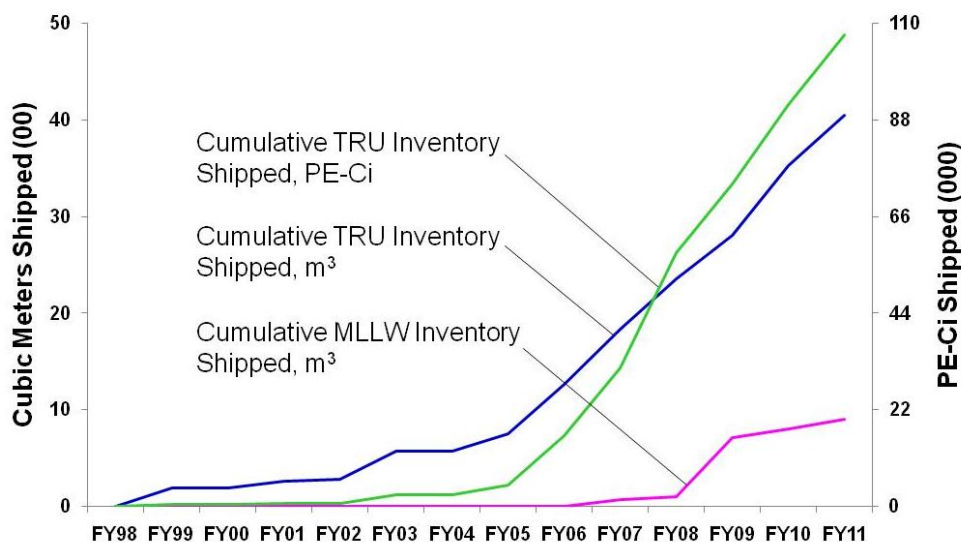


Fig. 2. LANL TRU waste disposition through September 30, 2011.

## TRU WASTE DISPOSITION STRATEGY

The LANL strategy over the past several years has been to develop and implement additional remediation, characterization, and shipping capabilities that are necessary to disposition the LANL TRU waste inventory [2]. This has included additional processing lines as well as upgrades in the nuclear safety basis for the capabilities to handle waste with higher PE-Ci content. LANL has also greatly improved availability of TRU waste disposition processes through systems upgrades, strict conduct of operations, greater emphasis on preventative maintenance (PM), and maintaining spare parts on hand for critical equipment.

As noted, most of the older TRU waste containers must be remediated before characterization for WIPP certification can begin, and remediation was a severe bottleneck to disposition in the past because only one facility was available to repackage drums and it had very low PE-Ci limits. That facility was upgraded in 2007 to process a group of drums with high Material at Risk (56-300 PE-Ci) of combustible waste, and was further upgraded to handle waste of the highest PE-Ci content remaining. Two additional process lines were established for drum remediation within Area G. One of those was converted to box processing in 2011 and is currently being upgraded for higher PE-Ci boxes. Figure 3 shows items from an oversize waste box being repackaged into a SWB. A second drum remediation line will be converted to box processing in 2012, also with the capability for higher PE-Ci boxes. A new box processing facility for very large boxes is also in development and scheduled to begin operations in 2012. A drum venting capability has been installed and readiness activities will be completed in early 2012.

The need for additional characterization capabilities was also identified and these have also been implemented. Characterization and certification of TRU waste containers for shipping to WIPP is conducted at LANL by the Central Characterization Project (CCP), which is a program provided under contract to WIPP through Washington TRU Solutions, LLC (WTS). The CCP services consist of acceptable knowledge (AK) compilation and reporting, data generation, project level validation and verification, records management and document control. Characterization equipment operated by CCP and its subcontractors at LANL consists of nondestructive examination (NDE) using real-time radiography (RTR) units, nondestructive



Fig. 3. Repackaging items in an oversize waste box.

assay (NDA) using High Efficiency Neutron Counter (HENC) units, and headspace gas sampling (HSG) and analysis, including SUMMA<sup>®</sup> sampling.

The CCP coordinates and supports audits by the Environmental Protection Agency (EPA) and the DOE Carlsbad Field Office to maintain certification of the TRU waste characterization and certification program, including audits for new or refurbished characterization equipment. When requested by LANL, the CCP also conducts pre-screening of containers to assist in determining remediation requirements for specific containers.

LANL has provided support to CCP in expanding capabilities for TRU waste characterization. These include refurbishment of a second RTR unit for NDE of drums and a new high-energy RTR (HE-RTR) unit for NDE of lead-lined drums and SWBs, a new Super-HENC unit for NDA of SWBs, and enhanced HSG sampling and analysis. Installation and readiness of all of the new characterization units have been completed, and audits for the new NDE and NDA equipment have been scheduled by CCP. Figure 4 shows a photograph of the new HE-RTR unit at LANL.



Figure 4. High-Energy RTR unit at LANL.



The CCP also provides transportation services for shipments to WIPP, and LANL supports the CCP in payload assembly and loading of the TRUPACT-II shipping casks. LANL has also received safety basis approvals to increase the PE-Ci capability at the shipping facility and for use of a mobile loading unit as a back-up to the current facility. The crane availability at the shipping facility was greater than 90% during the last fiscal year due to an enhanced PM program. LANL has also received funding for purchase of a replacement crane for the shipping facility in 2012.

## Detailed TRU Waste Disposition Schedule

During the past year, a detailed project management schedule for TRU waste disposition was developed based on use of a “Solution Package” approach. Issues have been identified for almost all containers of TRU waste in storage at Area G that require specific types of processing before the containers can undergo characterization for WIPP certification. The inventory of waste containers within major TRU waste categories was segregated into lists of container types that have issues in common so that the containers with the same type of issue are processed as a group. About 70 Solution Packages were developed to address the range of issues among the entire TRU waste inventory. Table I presents a summary of the waste categories and Solution Packages used in developing the schedule.

Table I  
Waste Categories and Solution Packages in the Waste Disposition Schedule

Waste Category	Solution Packages	Waste Category	Solution Packages
AG Debris Drums	>200 mR/Hr	BG Cement - Cans	Process Below Grade Containers
	Container Issues	BG Cement - Mono	Process Below Grade Containers
	Misc Issues	BG Solids	Process Below Grade Containers
	Multiple Issues	BG Trenches	Process Below Grade Containers
	NDA-Rad		
	NDA-Uncertainty		
	No Issues	BG Debris Drums	BG MLLW/LLW Drums
	Overweight		BG TRU Drums
	PID in Matrix		
	Tritium	AG Debris Boxes	Corrugated Metal Boxes
	Unvented		Haz Cat 3 Boxes 412 > 3.4 to < 8.2 m3
	WIPP WAC Issues		Haz Cat 3 Boxes 412 < 3.4 m3
AG Cement – Mono	CIN 01 Lead-Lined Monoliths		Haz Cat 3 Boxes 412 > 8.2 m3
	CIN 02		Large HC3 Boxes - Remediate in Place
	CIN Monoliths		Metal Boxes > 4x4x6
	Container Issues		MLLW Boxes < 8.2 m3
	Overweight		No Issues
	Unvented		Rad Boxes 412 > 3.4 to < 8.2 m3
			Rad Boxes 412 < 3.4 m3
AG Cement – Cans	Container Issues		Rad Boxes 412 > 8.2 m3
	Multiple Issues	BG Debris Boxes	BG Haz Cat 3 Boxes 412 < 8.2 m3
	NDA-Uncertainty		BG MLLW/LLW Boxes
	No Issues		BG TRU Boxes
	Overweight	BG CMPs	Process Below Grade Containers
	Unvented	BG HC3 Canisters	Process Below Grade Containers
AG Solids	>200 mR/Hr	BG Hot Cell Liners	Process Below Grade Containers
	Container Issues	BG RH 17	Process Below Grade Containers
	H-Gas Issues	NNG	New Newly Generated Waste
	Misc Issues		
	Multiple Issues		
	NDA-Rad		
	No Issues		
	PID in Matrix		
	Unvented		

The activities scheduled within each Solution Package include precursor activities to remediation of waste containers, the remediation or repackaging processing activities, and the characterization, certification, and shipping activities that follow remediation processing. Precursor activities include any needed facility modifications or equipment upgrades, procedure changes, nuclear safety basis changes, permitting changes, and drum venting. Characterization activities scheduled in each Solution Package consist of NDE in either the RTR or HE-RTR, NDA in either the HENC or SuperHENC, flammable gas analysis, and sampling of solids for RCRA analysis where needed. Where needed, prescreening of containers by CCP is also scheduled. This approach ensures that processing and characterization activities are aligned in the schedule. LANL worked closely with the CCP on development of the duration of activities for characterization, certification, and shipping.

Work at each of the remediation facilities is scheduled so that processing for the next Solution Package begins as soon as processing for the Solution Package in progress is completed. Processing of the next category of waste for a facility is scheduled as soon as the last Solution Package for a category of waste is completed. The schedule also includes remediation of some oversized boxes in place (In-Place Processing) because the condition and size of these boxes may not permit the boxes to be transported to one of the box processing lines.

## **WORK SCOPE CURRENTLY BEING EXECUTED**

The focus of the LANL TRU Program is currently on accelerating the disposition of TRU waste stored above grade, and LANL has committed to complete removal of all non-cemented above-grade Legacy TRU and newly-generated TRU waste stored in Area G as of October 1, 2011, by no later than June 30, 2014. This inventory of above-grade TRU waste is defined as 3,706 m<sup>3</sup> of material. LANL has also committed to complete removal of all newly-generated TRU received in Area G during Federal Fiscal Years 2012 and 2013 by no later than December 31, 2014. Processing of the 3,706 m<sup>3</sup> is projected to result in about 4,500 55-gallon drums and 1,000 SWBs that will be shipped to WIPP. These containers are projected to require a total of 385 shipments to WIPP. Shipments are projected at a rate of 5 to 6 a week for an estimated 43 weeks each year.

## **REFERENCES**

1. R. E. Hollingsworth, *Immediate Action Directive 0511-21, Policy Statement Regarding Solid Waste Burial*, U.S. Atomic Energy Commission, March 20, 1970.
2. M.D. Shepard, S.G. Stiger, J.A. Blankenhorn, G. Rael, and D. Moody, *Accelerating the Disposition of Transuranic Waste from LANL*, WM 2009 Conference, March 1-5, 2009.