Los Alamos National Laboratory Waste Management Program

G. M. Lopez-Escobedo, K. M. Hargis, C. R. Douglass
Los Alamos National Laboratory
PO Box 1663, Los Alamos, NM 87545
USA

ABSTRACT

Los Alamos National Laboratory's (LANL) waste management program is responsible for disposition of waste generated by many of the LANL programs and operations. LANL generates liquid and solid waste that can include radioactive, hazardous, and other constituents. Where practical, LANL hazardous and mixed wastes are disposed through commercial vendors; low-level radioactive waste (LLW) and radioactive asbestos-contaminated waste are disposed on site at LANL's Area G disposal cells, transuranic (TRU) waste is disposed at the Waste Isolation Pilot Plant (WIPP), and high-activity mixed wastes are disposed at the Nevada Test Site (NTS) after treatment by commercial vendors. An on-site radioactive liquid waste treatment facility (RLWTF) removes the radioactive constituents from liquid wastes and treated water is released through an NPDES permitted outfall. LANL has a very successful waste minimization program. Routine hazardous waste generation has been reduced over 90% since 1993. LANL has a DOE Order 450.1-compliant environmental management system (EMS) that is ISO 14001 certified; waste minimization is integral to setting annual EMS improvement objectives. Looking forward, under the new LANL management and operating contractor, Los Alamos National Security (LANS) LLC, a Zero Liquid Discharge initiative is being planned that should eliminate flow to the RLWTF NPDES-permitted outfall. The new contractor is also taking action to reduce the number of permitted waste storage areas, to charge generating programs directly for the cost to disposition waste, and to simplify/streamline the waste system.

INTRODUCTION

The LANL waste management system processes and disposes of all wastes that cannot be avoided while accomplishing the Laboratory's missions which are to develop and apply science and technology to:

1. Ensure the safety and reliability of the U.S. nuclear deterrent
2. Reduce the threat of weapons of mass destruction, proliferation, & terrorism
3. Solve national problems in defense, energy, environment, & infrastructure

Given the diverse nature of LANL's missions, many different waste types are generated. LANL solid wastes include transuranic (TRU), low-level (LLW), mixed low-level (MLLW), hazardous, industrial (New Mexico special waste, including asbestos), TSCA (PCBs and PCB-contaminated), infectious, and solid sanitary waste. Liquid wastes include caustic and acidic TRU, LLW, and industrial/sanitary wastewater. This paper focuses on radioactive and hazardous wastes, both liquid and solid. By volume, most of these wastes are generated from environmental clean-up, however the greater challenge is disposition of the wide range of small volume, unique wastes produced by laboratory and mission production activities.

LANL has some 400 waste-generating operations distributed over 40 square miles in the mountains of northern New Mexico. LANL's integrated waste management system to disposition this waste is operated by the Environmental Programs Directorate which is also responsible for legacy waste disposition, groundwater stewardship, contaminated facility Deactivation and Decommissioning (D&D), and environmental clean-up.

The hazardous and radioactive waste management system includes

1. waste management coordinators who work in the generator's' facilities providing waste characterization, packaging, and documentation support,
2. several permitted waste treatment, storage, and disposal facilities where waste is received and inspected for compliance with the LANL's "waste acceptance criteria" (non-compliant waste receives a non-conformance report which requires corrective actions be taken to eliminate the source of the non-compliance; in extreme cases non-compliance can result in revocation of generator authority to produce waste),
3. several waste processing facilities (RLWTF, TRU waste disposition, LLW compactor),
4. commercial vendor agreements for disposition of hazardous and mixed low-level waste, and
5. a low-level waste disposal landfill.

LANL's overall waste strategy is to avoid or minimize waste generation and compliantly manage waste that cannot be avoided. LANL divides waste into routine (from continuing operations) and non-routine (one-time, or project specific generation). Non-routine waste is generated by environmental clean-up, D&D, and construction projects. Most routine waste generation has been reduced 80-90% since 1993.

This paper is organized into solid and liquid waste sections with each section organized by waste type. This paper describes the waste system recently implemented by LANS, a limited liability corporation formed by the University of California, Bechtel, BWX Technologies, Inc., and Washington Group International. LANS became the LANL operating contractor on June 1, 2006. The paper also describes planned waste management improvements.

SOLID WASTE MANAGEMENT

Hazardous and Mixed-Low-Level Waste

LANL hazardous waste consists of RCRA-regulated spent chemicals, lead (frequently used for radiation shielding), and facility wastes (fluorescent lamps), TSCA (PCB wastes), New Mexico State Special wastes (asbestos), and infectious wastes. Non-routine hazardous wastes are primarily contaminated soil from environmental clean-up sites.

MLLW is generated by radiological and nuclear facilities that perform operations that use RCRA-hazardous and radioactive materials. In an effort to minimize the amount of MLLW generated during routine operations, LANL has eliminated all non-essential hazardous materials from radiological controlled areas and has greatly reduced MLLW at the site. Non-routine MLLW is generated during environmental clean-up and D&D.

Routine hazardous waste has been reduced from 300 metric tons in 1993 to 14.5 metric tons in 2005. The combined routine and non-routine waste volume was 1015 tons in fiscal year (FY) 2005. Routine MLLW volumes were 1.9 cubic meters in FY 2005; the combined routine and non-routine MLLW volume was 26 cubic meters.

Hazardous and MLLW are shipped for disposal through commercial contracts. LANL and other DOE sites occasionally combine hazardous or MLLW shipments to achieve cost savings on transportation.

Planned or implemented waste system improvements for these wastes include

- a 90% reduction in toxic release inventory since 1993,
- consolidation of waste management functions into a single organization,
- a reduction in the number of permitted waste management areas, and
- a business model change to charge waste generators for the full cost of the waste they generate.

Low-Level Radioactive Waste

LLW is generated at LANL's radiological and nuclear facilities, including LANL's environmental clean-up sites (largest LLW generation). LLW is currently disposed in LANL's on-site disposal cells at Technical Area (TA) 54, Area G. LANL currently only has about 1 year of disposal capacity in the current disposal cells. New LLW disposal cells are planned to be constructed and represent LANL's and DOE's preferred path to accommodate future LLW disposal. The new cells are proposed to be located in the Zone 4 and Zone 6 development areas and would allow disposal to continue for more than 50 years to support the site's mission. Zone 4 is located on Mesita del Buey, within TA-54, is slightly less than 30 acres, and runs eastward from TA-54, Area L to the footprint of the active disposal area of Area G. LANL also has the option of disposing of limited volumes of LLW at NTS or commercial sites.

LANL generated 325 cubic meters of routine LLW and a total combined LLW volume of 15,000 cubic meters in FY 2005.

LANL LLW disposal cells are typically 60 feet deep by 30 feet wide. Waste is emplaced in multiple layers within the disposal cells, clean soil separates each layer. Cells are unlined pits dug in narrow mesas whose soil is a compressed, welded volcanic ash from eruption of the nearby Jemez Mountains approximately 1.2 million years ago. Cells are unlined because of the dry desert climate and the high rate of evapotranspiration. Rainwater primarily evaporates or flows off the mesas into the canyons below. The regional aquifer is approximately 900 feet below the mesa top.

LLW system improvements include,

- installation of a 200 ton LLW compactor system that achieves approximately a 70% volume reduction for debris waste, and
- expansion of waste capacity by placing very low activity waste above the waste in some of the present LLW cells.

Fig. 1. LLW disposal cell

Transuranic Waste

TRU waste is primarily generated by the Plutonium Processing Facility and the RLWTF. In addition to the approximate 200 cubic meters of new TRU waste generated each year, LANL has approximately 6,500 cubic meters of stored TRU waste generated in previous years that is awaiting disposal. TRU waste disposition includes prescreening for activity level and for prohibited items, repackaging, if necessary, characterization for WIPP disposal, and shipment to WIPP. The DOE Carlsbad Field Office's Central Characterization Project provides on-site characterization and is the shipper of record. When the TRU inventory disposal is complete in 2012, the current TRU waste operations area will be closed as part of the environmental clean-up and closure of Area G and TRU waste operations will move to a new TRU waste processing facility near the Plutonium Facility.

LANL generated 63 cubic meters of routine TRU waste (includes mixed TRU) and a total combined TRU volume of 140 cubic meters in FY 2005.

Recent and planned TRU waste system improvements include,

- processing TRU waste into a compliant form at point of generation,
- performing most waste characterization as the waste is generated and packaged, and
- constructing a new TRU waste facility, planned for completion in 2011.

RADIOACTIVE LIQUID WASTE MANAGEMENT

The RLWTF collects non-hazardous, low-level radioactive liquid waste from 1,800 drains distributed throughout LANL. It also collects TRU liquid waste from the Plutonium Processing Facility (TA-55).

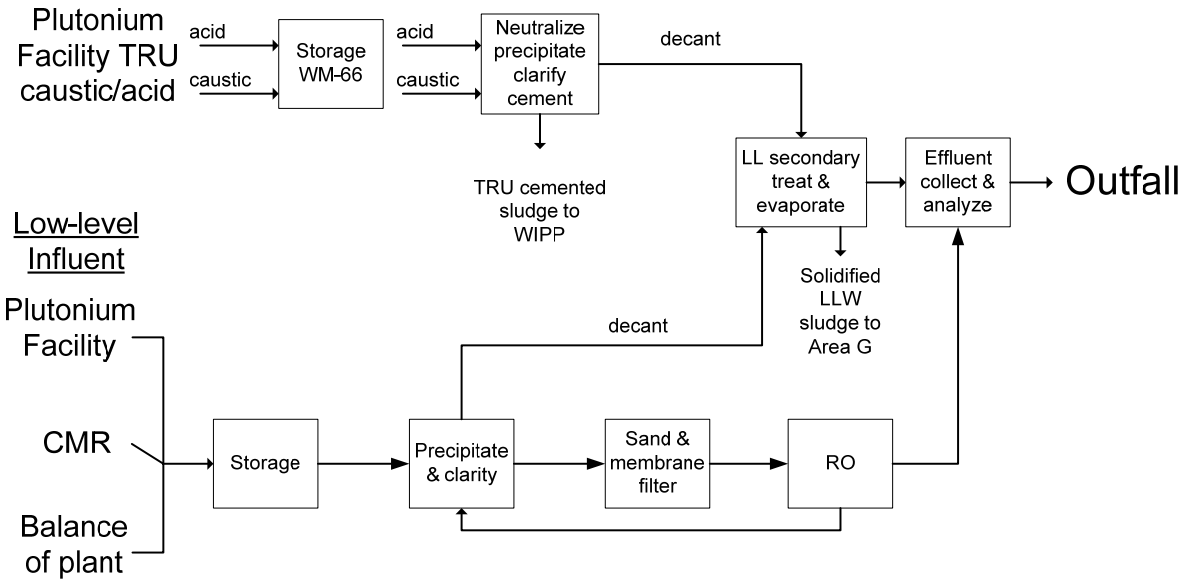

Fig. 2. RLWTF waste management system flowsheet

As shown in Figure 2, TRU liquids are pretreated before being combined with low-level liquids received from other LANL operations.

TRU liquid generation has varied considerably the past ten years depending on facility operating levels and mission requirements. Low-level liquid generation has steadily dropped since 1998 due to waste minimization initiatives.

Transuranic Liquid Waste Management

LANL's Plutonium Facility at TA-55 generates caustic and acidic waste streams from neutralized hydrochloric and nitric acid processing systems. Each year, up to 90,000 liters of acid and caustic wastes is collected in separate storage tanks at RLWTF, pH adjusted, and combined for treatment. The majority of the radioisotopes are then separated from the liquid by clariflocculation, with the solids being cemented/disposed as TRU waste, and the decanted liquid is transferred to the low-level liquid processing system's evaporator, described in the next section. As RLWTF is well beyond its design life, several initiatives are underway to improve operations until a replacement (called the "upgrade") facility comes on line in 2010. Recent and planned improvements include

- Upgrade of the Plutonium Processing Facility nitric acid system with an acid recycling column that enables nearly all acid to be recycled under normal operating conditions.

- Upgrade of the Plutonium Facility hydrochloric acid system with an acid recycling capability that will eliminate routine caustic waste,
- Replacement of the low-level influent storage tanks,
- Refurbishment of the TRU liquid waste storage tanks and processing systems, and
- Implementation of a new RLWTF or "upgrade" facility that will replace the aging liquid waste treatment systems in the existing RLWTF.

Low-Level Radioactive Liquid Waste Management

RLWTF's LLW processing system receives approximately 7 million liters/year from approximately1,800 separate radioactive drains through a below-grade collection system that services most of LANL's radioactive materials processing and research facilities. At RLWTF these wastes are commingled in collection tanks, and then the radioisotopes are removed through clariflocculation. The clarifier decant is further processed by membrane/sand filters and reverse osmosis (RO). The RO permeate is monitored, and then released through an NPDES-permitted outfall. The RO reject is recycled through the clarifier. The clarifier sludge is sent to an evaporator where it is partially de-watered. The evaporated water is condensed and released out the same outfall as the RO permeate. The remaining sludge is sent to a commercial vendor to complete water removal; a solidified LLW is returned to LANL for disposal at Area G.

Figure 3 shows the result of upstream radioactive liquid waste minimization by LANL generators; waste volumes have dropped from 20 million liters/year to approximately 7 million liters/year.

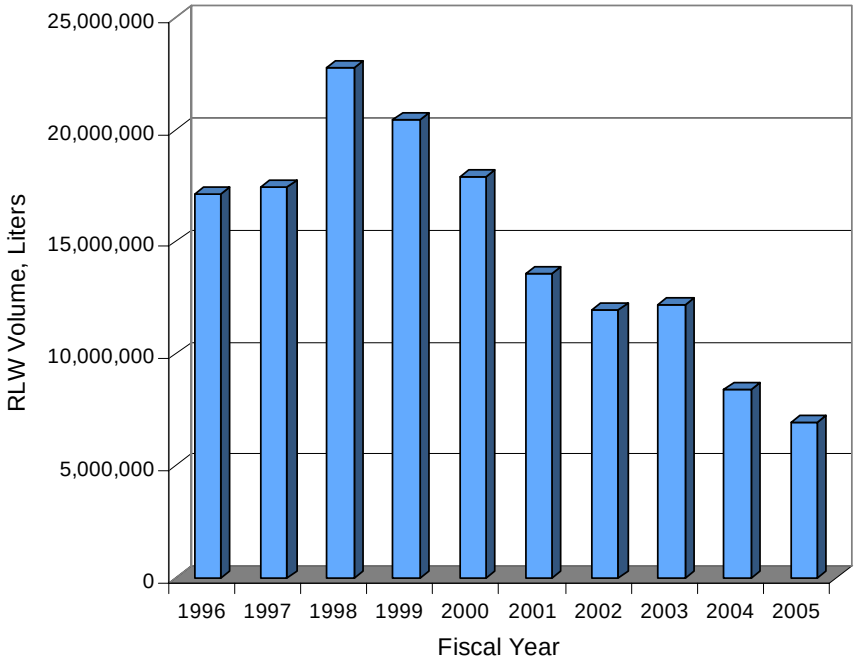

Fig. 3. RLWTF influent trend

During the past ten years the EPA and the New Mexico Environment Department have continuously reduced the maximum contaminant levels that RLWTF can release through the outfall to the environment—and they continue to add additional contaminants to the permit. Even stricter maximum contaminant levels are proposed for the near future. Consequently, LANL is evaluating a zero liquid discharge initiative to reuse the RLWTF waste water and reduce the routine flow to the environment to zero.

LANL tritium and Los Alamos Neutron Science Center accelerator operations also generate radioactive liquid wastes; the low activity and short-lived isotopes produced by these facilities allow this waste to be processed at the point of generation through decay and evaporation.

CONCLUSION

The goal of LANL's waste management system is to maintain a robust capability to dispose of the wide variety of wastes produced by the Laboratory's R&D and production missions. The first priority for accomplishing this goal is to integrate waste minimization into every activity, especially new processes and facilities, and to undertake strategic initiatives to eliminate those waste streams that are most vulnerable to environmental restrictions. The second priority is for LANL to continue to operate an integrated waste management system with both on and off site disposal capabilities to compliantly and cost-effectively disposition waste that cannot be avoided.

REFERENCES

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2. LANL, 2004, *SWEIS 2004 Yearbook,* LA-UR-05-6627.