LOW-LEVEL WASTE MANAGEMENT AT TA-55 AND THE CHEMISTRY AND METALLURGICAL RESEARCH FACILITY

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ABSTRACT

This paper compares low-level waste (LLW) management activities that are conducted by the Waste Management and Environmental Compliance Group (NMT-7) at two very different facilities within Los Alamos National Laboratory (LANL). NMT-7 was originally created to serve operations conducted at LANL's Plutonium Facility. Its work was expanded in 1998, to include support of operations at LANL's Chemistry and Metallurgy Research (CMR) Facility. LLW operations now provide waste disposal and recycling support/services to approximately 750 LANL U.S. Department of Energy, contractor, and union craft employees; all are tasked with minimizing waste and increasing recycling efforts. The Plutonium and CMR Facilities approach 20 and 50 years, respectively, of continuous operation. TA-55 was designed with consideration given to the weight that any particular area is capable of supporting (floor loading) and space for using material-handling equipment (e.g., forklifts). At the CMR Facility, use of forklifts and other equipment is hampered by incomplete knowledge of floor loading in all parts of the facility, as well as limited maneuvering space for using material-handling equipment. Routinely, bulky and heavy waste items must be loaded by hand or material-handling equipment. TA-55 was constructed with materials that are, for the most part, environmentally benign. The CMR Facility was constructed using materials that were readily available and common in the late 1940s. At both facilities, waste items are generated for which there is no recognized means for disposal because of a radioactive component associated with the waste item. At both facilities, making waste originators aware of the importance of thorough waste characterization for radioactivity and chemical constituents has been difficult because some waste originators have viewed waste management as a low-priority task.

INTRODUCTION

The low-level waste (LLW) operations conducted at Technical Area-55 (TA-55) and the Chemistry and Metallurgy Research (CMR) Facility at Los Alamos National Laboratory (LANL) cover all activities conducted in radiologically controlled "hot" areas; "cold" laboratories; and office, union crafts shops, and warehousing facilities. All waste management activities must be conducted in accordance with DOE, LANL, and federal regulations. Federal regulations include those promulgated under the Resource Conservation and Recovery Act (RCRA), 40 *Code of Federal Regulations* (CFR) Parts 260–299; and U.S. Department of Transportation (DOT) regulations, 49 CFR Parts 106–180. Laboratory regulations are driven by Laboratory Implementation Guidelines and Requirements (LIGs and LIRs, respectively), which include the LANL waste acceptance criteria (WAC) and guidelines established in Appendix F of the University of California's (UC's) contract with the DOE that governs operations at LANL, including waste handling and minimization. Operating groups have traditionally paid for waste management through an "overhead" system; waste is generated without regard to its disposition cost. There is no incentive to minimize waste generation as the cost is the same for all volumes generated. Site-specific criteria regarding worker safety, radioactive contamination prevention, and administrative and security issues also affect waste operations. Other effects on waste characterization issues are gamma spectroscopy, routine versus nonroutine, and lead times required for the approval of associated paperwork. With improved characterization capabilities, we recognize the effect of additional packaging requirements for shipment and disposal and, subsequently, add to the lead time required for approval to ship.

The CMR Facility and TA-55's Plutonium Facility-4 (PF-4) are nonreactor nuclear facilities at LANL that are owned by the DOE and operated by the UC. The Nuclear Materials Technology (NMT) Division is responsible for overseeing operations at the CMR Facility and TA-55. The NMT Division acquired CMR Facility operations in early 1998. Subsequently, LLW operations for NMT grew from providing service for about 300 people to about 750 people, including LANL employees, contract personnel, and union crafts.

The NMT Division Waste Management and Environmental Compliance Group's (NMT-7's) mission is to safely handle, package, ship, store, and document nuclear and nonnuclear hazardous and nonhazardous waste for LANL's nuclear materials. NMT-7 operations cover activities at two separate facilities: TA-55 and the CMR Facility

All waste management activities at TA-55 and the CMR Facility are governed by federal regulations, including 40 and 49 CFR (*Department of Transportation* and *Resource Conservation Recovery Act*, respectively), Toxic Substances Control Act (TSCA), the New Mexico Environment Department (NMED), and LIRs and LIGs. At LANL, the document that provides general guidance for waste management, packaging, shipping, and storage is a LIR that is most commonly referred to as the Waste Acceptance Criteria (WAC). This document is derived from 40 and 49 CFR, TSCA, and the WAC dictated by off-site land disposal entities.

Both facilities, as a result of maintenance or science, generate materials for which there is no path forward (i.e., currently, there is no environmentally acceptable means for disposing of the material as a waste). Both facilities face a certain degree of recalcitrance on the part of waste originators to accept waste management requirements. TA-55 has a rigid work control system in place that requires waste management review before work is initiated. The CMR Facility has mimicked TA-55's work control model.

Low-Level Waste Management at TA-55

TA-55 is a 20-year-old radioactive material processing facility with an approximately 150,000-ft^2 floor space. It is constructed of materials that are largely environmentally friendly, with items such as asbestos having been avoided. TA-55 is divided into "hot" and "cold" areas. Hot areas are those in which radioactive material is handled and from which LLW and low-level mixed wastes (LLMW) would be generated. Cold areas are laboratory, office, and crafts work areas, where no radioactive material is handled and the wastes generated therefrom are not ever expected to be mixed. The terms hot and cold will be used in this context throughout the body of this paper unless otherwise noted.

TA-55 LLW management (LLWM) personnel are directly responsible for handling and initiating disposal of compactible and noncompactible radioactively LLW, LLMW, hazardous, and transuranic nuclide (or TRU) oversized waste items. The LLW team routinely prepares 1455 kg (~9 m^3) of LLW per week and removes 20.4 m^3 of noncompactible waste per month from TA-55.

LLWM at TA-55 involves receiving waste that is initially based upon its being compactible or noncompactible. Compactible waste (room trash) consists of soft materials which are generated during the course of daily operations. This material may include latex gloves, personal protection clothing, paper, and plastic. Specifically excluded from this waste stream are chemicals, chemical containers, piping, and rigid items that an average person would not be able to compact by hand. Noncompactible waste includes items such as absorbed liquids (for which the generator can document a hazards analysis), concrete, metal, equipment, plastic, rubber, rags, Sheetrock, piping, empty containers, old furniture, and contamination prevention debris. Each burial container may contain a certain percentage of allowable items from designated waste matrices. The percentage allowed is determined and documented through use of the Waste Profile Form system. Items must be accompanied by a Health Physics Radiological

Materials Tag (radtag), indicating that a radiological control technician (RCT) has surveyed the item, and the results indicate that the item meets the radiological contamination criteria for LLW.

Room trash wastes are relatively straightforward in their disposition. Room trash is collected in each hot laboratory area in 1' × 1" x 2', plastic-lined cardboard boxes. Custodians are responsible for collecting full boxes and delivering them to an inspection area. LLWM personnel open each box, remove the plastic liner bag, inspect the contents for prohibited materials (e.g., chemical bottles and sections of piping), and return the bag to the box. Boxes that are found to contain prohibited materials are returned to the room in which they were generated for removal of offending items by the room owner. Boxes that pass inspection are placed on carts to await assay for radioactive material content. Once assayed, the boxes are collected into lots of 90 boxes for removal from the facility.

The facility was engineered with the knowledge of how much weight per square foot the structure and mechanical systems could tolerate. Perhaps not the primary consideration when the facility was designed, the weight tolerance allows the use of forklifts for moving heavy and/or bulky items within or between floor levels. Weight tolerance and spacing both allow more effective use of resources. As the facility continues to age and newer, more efficient processing systems are acquired, larger volumes of noncompactible waste are generated. By keeping burial boxes in rooms, the generating group minimizes the time personnel spend travelling to and from the normal waste collection area, and LLWM personnel can certify the waste and have it loaded for disposal in a shorter time than would normally occur. Without this option, waste certification (verifying that disposed items do not contain restricted materials), moving individual waste items to the routine waste collection area, and loading the burial box to capacity would require a minimum of three people over four hours. With the option, the process can be accomplished in one hour with the same number of people.

LOW-LEVEL WASTE MANAGEMENT AT CMR

The CMR Facility was constructed in 1952, to house analytical chemistry, plutonium and uranium chemistry and metallurgy, and some engineering and support functions. The facility was divided into seven wings that were connected by a 1/8-mile-long spinal corridor, and three floors: attic, main, and basement. In 1960, a ninth wing was added, bringing the total square footage of the facility to 550,000 ft^2, or 11.5 acres.

Most experimental and programmatic activities occur on the main floor in each wing. The attic space is used primarily for storage and air and utility supply. Gas manifolds and electrical panels service the laboratories on the main floor below. The basement houses some programmatic activities and facility support functions (e.g., laundry) services. However, most of the basement is dedicated to pump rooms, substations, and other equipment rooms. Filter towers located at the end of the wings. These house the filter plenum and other large pieces of mechanical equipment that are necessary for exhaust ventilation systems. The main and basement spaces of each wing are further divided into uncontrolled, office, and cold support areas, and radiological controlled (hot laboratory) areas.

Though once considered state-of-the-art, the CMR Facility is nearing the end of its original design life and is currently undergoing a major infrastructure upgrade that will extend the life of the facility through FY 2010. Its original materials of construction are not environmentally friendly—items such as asbestos, PCBs, and lead-solder must be disposed of. Laboratories and suites of laboratories are undergoing major reconfigurations as newer and more efficient analytical systems are acquired. Large and/or bulky waste handling at the CMR Facility is severely limited by the facility's age. The weight-per-square-foot that can be tolerated by the structure and mechanical systems does not allow the use of forklifts for moving heavy and/or bulky items within or between floor levels. The movement of heavy and/or bulky items is accomplished manually or by use of pallet jacks.

The CMR Facility waste management does not operate from a centralized location. Burial boxes are staged in the filter towers for waste items that can be sized, reduced, and easily managed. Waste generators must transport waste items to the waste collection areas, which are located in each wing. Although wings 2, 3, 4, 5, and 7 are identical in layout, each wing offers its own unique properties for handling waste. Waste generated from decommissioning and decontaminating laboratories is managed on a case-by-case basis. Large and/or bulky items that cannot be reduced must be packaged initially for transport down the spinal corridor. These prepackaged waste items are transported to one of two locations with equipment that can handle large packages.

Room trash wastes are relatively straightforward in their disposition. Room trash is collected in each hot laboratory area in 1' x 1" x 2', plastic-lined cardboard boxes. Custodians are responsible for collecting full boxes and delivering them to storage areas, getting the boxes released from "controlled" areas, and delivering them to the waste assay facility (WAF).

Room trash waste is combustible and must be stored using a method that minimizes the risk of combustion in the storage area. Full waste storage cabinets are transferred to inspection areas. CMR Facility waste management personnel open each waste box, remove the plastic liner bag, inspect the contents for prohibited materials (chemical bottles and sections of piping, for example), and return the bag to the box. Boxes that are found to contain prohibited materials are returned to the room where they were generated. Boxes that pass inspection are returned to the cabinets to await release and transport from the wing to the WAF for assay of radioactive material content.

Trash boxes that have been rejected and returned to their respective rooms offer their own unique waste-handling problems, mainly because waste originators are not accepting of waste management requirements.

CMR Facility waste management personnel have been responsible for packaging and managing approximately 250 m^3 of compactible and noncompactible waste annually.

WASTE MINIMIZATION

Efforts to recycle materials are made difficult by the requirement that, by radiological smear analysis in concert with operator knowledge, items for recycle must be free of contamination. Much of the equipment and material has been in place for many years. In many instances, it is impossible to certify that an item was never involved in a contamination event. This causes personnel to be reluctant to state that, by "acceptable knowledge," an item is free of contamination. This reluctance is compounded at the CMR Facility, which may house equipment dating back as far back as the 1950s and 1960s. Much of this equipment may contain materials that are not environmentally friendly.

Chemical substitution is another area in which steps have been taken to increase generator awareness of disposal issues. In one recent case, the generator stated that a non-RCRA-regulated chemical would be a good substitute for a RCRA-regulated material. However, the substitution is not allowable because programmatic quality assurance requirements mandate use of the RCRA chemical. In other cases, the generators are unwilling to substitute one chemical for another because safe operating procedures must be modified for such substitutions, creating more work. At the CMR Facility, chemicals might have been in storage for years, and the original researcher may no longer be available to supply the acceptable knowledge that would allow these chemicals to be discarded as nonhazardous, or "free-released."

IMPROVEMENTS

To more easily remove waste from the facility, we must continuously improve our ability to characterize waste. The first step has been to help generators understand the importance of taking good radiological measurements. In the past, a generator may have made an educated guess that a waste item fell within

low-level-waste criteria for alpha activity. Generators and RCTs must now *certify* that a waste falls into that category, and provide supporting documentation before waste items are removed from the point of generation. In addition, we are now performing gamma spectroscopy on each waste container before it is prepared for shipment. The gamma spectroscopy activities also allow us to pinpoint items that have been improperly characterized for radiological content. The new certification rules allow LANL personnel to properly classify waste containers for DOT shipping purposes, as well as to avoid shipping items that meet TRU waste criteria. The CMR Facility also depends on gamma spectroscopy to identify wastes that are improperly characterized; however, because of the age of the equipment being dismantled, generators remain reluctant to free-release waste items.

The new certification rules also improve LANL personnel'scapability to recycle items. By improving our knowledge of radiological activity, we are able to determine whether items are acceptable for segregation and size reduction at an on-site facility. We are now able to remove items—particularly electronics—from the facility for recycling. However, we are still hampered by generators who do not view waste management activity as an important facet of their job. Generators are requested, but not required, to remove mixed waste items (printed circuit boards) from equipment and then downsize racks that held multiple components. We send these items to another on-site facility, where material for recycling is further segregated and downsized for shipment to licensed recycling facilities. What has not been accomplished is convincing generators that they will see reduced costs for recycling if they spend a short amount of time doing some segregation on their own. This may change with the imposition of the recharge system this fiscal year because generating groups will be assessed for the costs associated with our recycling efforts at the CMR Facility.

Steps have also been taken to reduce the volume of mixed wastes leaving the facility by working with waste generators and crafts personnel to show them how mixed waste may be reduced at the point of generation. In some instances, this is as simple as telling pipefitters to cut piping as closely as possible to soldered joints. In others, it involves getting the generator to take a few extra minutes to remove regulated material from the remainder of a waste item. Efforts are, nevertheless, hindered by generators who do not believe that their time is best spent managing and reducing waste.

Waste processing operations (i.e., waste inspections, waste packaging, and "originator reluctance") at the CMR Facility mimic operations at TA-55. Personnel at the CMR Facility are hampered in their efforts to manage and transport waste items from source to final packaging. The age and layout of this facility has been our most difficult obstacle to overcome. Considerable effort and time are expended searching for newer and more efficient means of transportation and material handling.

CONCLUSIONS

Operations carried out at TA-55 and the CMR Facility share commonalties derived from the WAC and regulatory drivers. Operations at both facilities are hampered by a combination of factors: lack of coverage by radiation control technicians, low prioritization by waste originators for LLW activities, and the failure of waste originators to fully understand the impact of their waste disposal decisions. Waste volumes at TA-55 will be relatively easy to assign to specific operating groups as the majority of current waste holdings have been recently generated. However, the CMR Facility is trying to work off a backlog of waste boxes, some having been packaged and pending disposal for several years. This backlog will make it difficult to discern routine versus nonroutine waste generation, as well as to assign costs for disposal.

Also, with the introduction of direct charging for waste disposition beginning in October 1999, LANL operating groups and personnel may experience something of a "culture shock," which will emphasize the importance of minimizing waste. For the first time, operating groups will be required to pay for their waste based upon the volume they actually generate; there will be an incentive to reduce generated waste.

In the near future (one year or less), a system will be in place that will allow electronic filing of characterization paperwork at or near the point of waste generation, as well as allow for more rapid review and acceptance of wastes, and a reduction in the volume of paperwork required to conduct waste management activities. Other activities that will enhance recycling capabilities are currently in the pilot stage.