LOS ALAMOS NATIONAL LABORATORY SITE TREATMENT PLAN – A SUCCESSFUL WORK-OFF OF LEGACY MIXED LOW LEVEL WASTE

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ABSTRACT

This paper describes a systematic approach used at Los Alamos National Laboratory (LANL) to successfully work-off its backlog of legacy mixed waste. Over the past eight years, the strategy for managing legacy waste evolved from an initial approach that relied heavily on new facilities, mobile treatment units, and high up-front capital investments to an approach that emphasizes commercial capabilities, existing technologies, and partnership with the regulating community. LANL utilized Envirocare of Utah, Diversified Scientific Services, Inc. (DSSI), Waste Control Specialists (WCS), Allied Technology Group (ATG), and Perma-Fix of Florida to treat approximately 300 cubic meters of waste. LANL employed a Sort, Segregation, and Decontamination process to address suspect radioactive waste items. LANL worked with its regulator (the New Mexico Environment Department) to reclassify 250 cubic meters of solidified wastewater treatment sludge from RCRA waste to solid waste. Large metal items, such as lead-lined gloveboxes and lead-lined casks, were shipped to the Duratek Facility for decontamination, metal melt, and recycling. Certain surface-contaminated items were decontaminated on-site at LANL-operated decontamination facilities. LANL employed the WERF incinerator in Idaho Falls to work off organic liquids with high U-235 content. LANL instituted a formal process for managing waste with No Disposal Path and has even found alternatives for some of these waste streams (e.g. aerosol cans). To date, more than 90% of the mixed waste in storage at LANL has been treated and disposed. At the end of this Fiscal Year, LANL will have less than 50 cubic meters (from its original inventory of over 600 cubic meters) of legacy mixed waste left in storage and it is expected that the STP will be completed 3-4 years earlier than originally projected. By avoiding construction costs associated with new treatment facilities, reducing long-term storage and permitting costs, and applying innovative ways to reduce inventories, LANL has saved the Department of Energy over $120 million.

INTRODUCTION

On October 6, 1992, Congress passed the Federal Facilities Compliance Act (1) to address compliance by the United States Department of Energy (DOE) with the Land Disposal Restrictions (2) for the storage of mixed waste. The FFC Act required the DOE to submit a Site Treatment Plan (STP) for developing treatment capacities and technologies to treat all of its mixed waste.

In 1994, Los Alamos National Laboratory (LANL) had the equivalent of *approximately* 3000 55-gallon drums (over 600 cubic meters) of legacy mixed low level waste (MLLW) in storage (see Figure 1). No capability existed at either LANL or other locations in the United States for proper treatment and disposal of the waste.

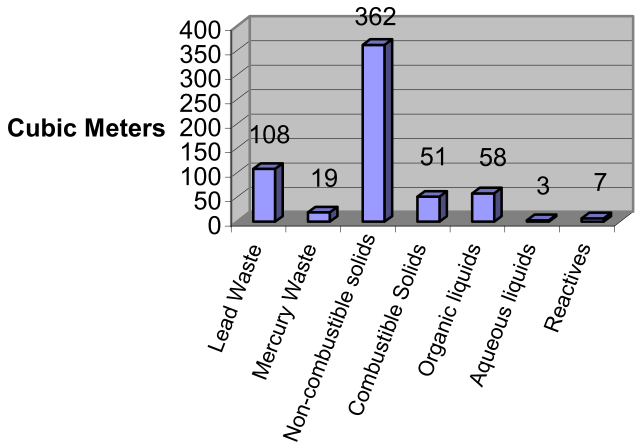

Fig. 1 – Initial LANL STP volumes by broad waste category

On March 31, 1995, DOE submitted its proposed STP to the New Mexico Environment Department (NMED) for the treatment of mixed waste at LANL. On October 4, 1995, the New Mexico Environment Department (NMED) issued a Federal Facility Compliance Order (FFCO) (3) to the Department of Energy (DOE) and its management and operating contractor, the University of California (UC) Regents. The FFCO required implementation of the Site Treatment Plan (STP) (4) for the treatment of MLLW at LANL. The STP was written to address treatment capabilities and technologies to treat all of LANL's mixed waste, regardless of the time it was generated. The original estimated year of completion for treatment and disposal of the MLLW in storage was 2006.

INITIAL STRATEGY

The Department of Energy – Albuquerque Operations Mixed Waste Treatment Plan (5) outlined the first approach in managing LANL's mixed waste inventory. This plan described several strategies but relied heavily on the design, construction, and permitting of mobile treatment skids. The initial strategy was logical at that time because treatment capacity in both the commercial and DOE sectors was limited or nonexistent. Also, DOE Order 5820.2A (6) specifically mandated that all low-level radioactive waste "shall be disposed on the site at which it is generated, if practical, or if on-site disposal capability is not available, at another DOE disposal facility."

The 1995 LANL STP contained enforceable milestones consisting of permit applications and notifications for the development of mobile treatment units for each of the treatability groups of mixed waste. In the first Compliance Plan Volume to the LANL Site Treatment Plan, specific activities that had to be performed in order to bring a new treatment technology on-site were explicitly called out and are presented in the following table:

Table I – Activities required under the STP to implement a new treatment technology

Process Step	Categories of Activities
1	Identify and Develop technology
2	Submit permit application to NMED; or
3	Submit a Notification of Intent to perform a treatability study to NMED
4	Initiate construction as specified by NMED
5	Commence systems testing
6	Begin treating mixed waste
7	Complete treatment of existing wastes to applicable regulatory standards

Examples of waste streams that were identified for on-site treatment in a mobile treatment unit included the following:

- Aqueous organic liquids
- Organic-contaminated combustible solids
- Combustible debris
- Noncombustible debris
- Water reactives
- PCB waste with RCRA components
- Liquid and solid oxidizers

It was not until June 12, 1996 under Revision 1.0 of the STP that off-site treatment was added as a parallel option for most waste streams. For each of the waste streams identified above, a new treatment technology would have to be developed and each of the steps identified in Table I would have to be completed. For example, for water reactive waste, a reactive metals treatment skid was identified as the preferred option with specific treatment milestones extending out to 2004.

The process for bringing on new technologies at best was lengthy and cumbersome. And with limited resources at the State of New Mexico to review permit documents, the likelihood of success was questionable.

FINAL STRATEGY

What evolved over the next seven years from the initial strategy in 1994 was a progression towards existing and innovative approaches. Long delays in the permit application process, the high cost of constructing new facilities to house costly treatment skids, and an overall increase in commercial mixed waste treatment and disposal capacity all played a major role in reshaping LANL's legacy mixed waste program.

The STP team performed a systematic analysis of each waste stream and actively pursued existing commercial and other DOE site options for treatment. Decisions were made to change the existing strategy and use those capabilities rather than to continue developing new facilities at LANL. This approach was approved by the NMED in 1998 in a formal revision of the STP Compliance Plan Volume (CPV). All references related to the construction, permitting and operation of on-site treatment skids were approved for removal from the CPV, and parallel options for on-site decontamination and on and off-site recycling were approved for inclusion in the STP.

The team also looked at ways to reduce the STP inventory by using a systematic approach to characterize covered waste that was only suspected of being both hazardous and radioactive.

LANL's strategy also includes using a proactive approach in meeting with NMED regulators. The STP team has established a cooperative relationship with NMED on STP issues. Meetings are conducted on an as needed basis to discuss ways to expedite treatment and disposal of covered waste that is pending approval for addition to the STP. In many cases, approvals have been obtained within the existing regulatory framework to expedite the treatment and shipment of covered wastes, rather than storing the waste for an additional year.

The following are detailed descriptions of some key components and innovative approaches employed by LANL to reduce its legacy mixed waste inventory.

Commercial Treatment, Storage, Disposal Facilities

Up until 1994, very few commercial or DOE mixed waste treatment, storage or disposal facilities existed in the country. Between 1994 and 2000, several new facilities came on line that were able to process a variety of waste types. Concurrent with this increase in commercial capacity, the Department of Energy – Albuquerque Field Office issued instructions for requesting exemption to DOE Order 5820.2A (the first guidance was issued in 1994). By the summer of 1995, LANL made its first off-site shipment of mixed waste to Diversified Scientific Services, Inc. (DSSI) in Kingston, Tennessee. Over the next five years, LANL would go on to ship waste to four other commercial facilities permitted and licensed to receive mixed waste. Figure 1 shows a chronology of waste shipments to commercial facilities.

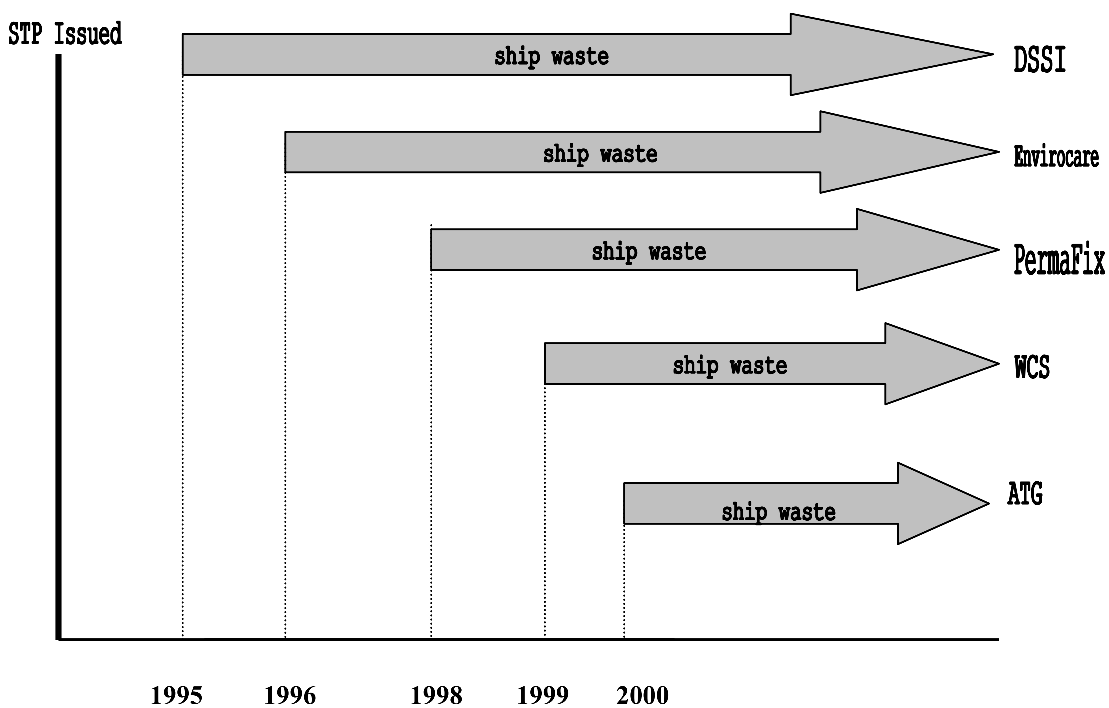

Fig. 2 – Chronology of waste shipments to commercial facilities

DSSI, a licensed and permitted industrial boiler, has assisted LANL in processing liquid organic waste streams (including lab packs) since 1995. Envirocare of Utah began receiving LANL waste in 1996 shortly after constructing their mixed waste treatment facility. Since then, LANL has ship contaminated soils and debris, and elemental lead to the Clive, Utah treatment and disposal facility. Perma-Fix of Florida has operated under a mixed waste permit that underwent considerable modification (adding additional treatment capability) in May, 2000. LANL has utilized Perma-Fix for heavy metal contaminated debris, aqueous and organic liquids, and organic-contaminated F-listed debris. Waste Control Specialists (WCS) came on to the mixed waste scene in November of 1997 with the receipt of their radioactive treatment and processing license from the Texas Health Department. LANL shipped water reactive waste to WCS during the early part of 1999. In April, 2000, LANL made its first shipment to the Allied Technology Group (ATG) facility in Richland, Washington. Organic- and heavy metal-contaminated debris wastes as well as F-listed sludges (from an Underground Storage Tank remediation project) were shipped to ATG for treatment.

Sort, Segregation, and Decontamination

The Sort, Survey, and Decontamination (SSD) Project was initiated under recommendations set forth in the DOE-Albuquerque Mixed Waste Treatment Plan (5). This plan recognized that large numbers of waste items had been classified as suspect radioactive waste solely because it had come from Radioactive Materials Management Areas (RMMA) in accordance with DOE policy.

Waste items for this project were specifically selected because process knowledge and generator interviews indicated that it was, in all likelihood, not radioactive. The objective of the SSD Project was to reduce LANL's mixed waste inventory through sorting, surveying, and sampling and analysis. This was accomplished by performing both direct surveys and sampling for volume contamination as appropriate. The work was performed in 1995 and 1996. Data results were analyzed during 1998 and 1999. A summary of the items found to be free of DOE-added radioactivity was prepared and presented to NMED for deletion of STP items in 1999. The State concurred with the findings and all items (532) were shipped off-site (to commercial non-licensed facilities) within 90 days as required by the FFCO.

On-site Decontamination

The compliance plan volume of the LANL Site Treatment Plan contains specific provisions for on-site decontamination using the LANL "Decontamination Trailer" or other means such as "dry sandblasting or hand-scrubbing".

The Decontamination Trailer at LANL is a forty-foot long trailer equipped with hepafiltered ventilation and pressure washing system capable of delivering silicon oxide or aluminum oxide grit to the surfaces of lead bricks, sheets, or other pieces. The totally enclosed system has a sump and submersible pump that recirculates the grit to keep waste generation volumes to a minimum. Eventually, the grit and water becomes ineffective (either because of reduced particle size or contamination) and is removed and solidified with portland cement.

The Mixed Waste Work-off team used this capability along with the highly skilled team from the Laboratory Decontamination Group to decontaminate over 60 tons of lead. Once decontaminated to DOE Surface Contamination Guidelines for Unrestricted Release (7) the lead was recycled through the local scrap metal market. This method proved advantageous from a cost standpoint over characterization and shipment to Envirocare of Utah (for macroencapulation).

Reclassification of Treatment Sludge

The Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area 50 is responsible for the collection and treatment of radioactively contaminated wastewater generated by Laboratory-related activities. To effectively manage this waste, separation processes such as reverse osmosis and evaporation are used to concentrate the radioactive constituents into solids. The solids or semi-solids (sludges) contain some free liquids, and are collected in drums and grouted for final disposition. Typically, unless analytical results show transuranic radionuclide concentrations greater than 100 nCi per gram, the disposition path for this waste is burial at the LANL low-level radioactive solid waste landfill.

For a period of time between the 1989 and 1993, a research laboratory at LANL discharged solvent waste to the RLWTF. As a precaution, to avoid any potential for illegal disposal of hazardous waste in a solid waste landfill, the Laboratory made the decision to label and store the drums as mixed waste pending further study. These drums were later added to the Site Treatment Plan.

In 1996, LANL submitted a comprehensive data package and justification to the State of New Mexico to consider these drums as non-hazardous low-level waste. LANL's position was that since the solvent discharged to the RLWTF constituted only a small fraction of the volume of wastewater entering the headworks of the facility, the final grouted sludge from the back end of the process could not be a listed solvent waste. Analytical data provided the evidence to show that the grouted sludge was not a characteristic hazardous waste.

In 1996, NMED granted permission to LANL to bury over 1300 drums of treatment sludge. The waste was subsequently removed from the Site Treatment Plan inventory.

Aerosol Cans

The approach implemented by LANL for aerosol cans is based on the scrap metal recycling regulations under 40 CFR 261.6. If aerosol cans are destined for scrap metal recycling, the process of emptying the cans is considered part of the recycling process, and therefore a treatment permit is not required. To empty the cans, LANL used a commercially available can puncturing system equipped with a carbon filter for absorbing organic vapors.

Because the cans are predominantly steel (as opposed to non-ferrous metals such as aluminum), they are very amenable to recycling. The licensed Duratek facility in Oak Ridge, Tennessee, operates a metal melt system that takes in contaminated steel, melts it, pours it into molds, and makes steel shield blocks for use in the DOE Complex.

It should be noted that the small amount of liquid drained from the cans during the puncturing process is managed as a RCRA waste. The volume reduction achieved through this process is quite dramatic. An initial 35-40 drums of unpunctured aerosol cans were processed into 1-2 partial drums of liquid.

Large Metal Items

For oversized metal items such as lead-lined gloveboxes, LANL realized that conventional treatment and disposal methods would not be practical. Items weighing in excess of several tons, could not be macroencapsulated (the EPA treatment technology for debris waste and radioactive lead solids) and LANL's own decontamination facilities did not have the necessary lifting and hoisting equipment to move heavy items around and repackage items. Instead, a facility capable of processing large heavy items that could realize the beneficial reuse of the metal made the most logical sense. For this, LANL pursued the Duratek Inc. facility (formerly SEG), located in Oak Ridge, Tennessee. Duratek operates a radioactive waste processing plant specializing in metal decontamination and recycling services. LANL has made four shipments of oversized metallic items from its STP inventory to Duratek. Figure 3 shows a lead-lined cask containing accelerator beam magnets that was shipped to Duratek in FY00.

Fig. 3. Lead-lined cask with accelerator beam magnets

WERF Incinerator

In the original Site Treatment Plan for LANL, Section 3.1.1 presented treatability groups for "thermal" treatment. One of those groups, "isopropyl alcohol (IPA) wastes", contained approximately 80 55-gallon drums of liquid. The chemical makeup of the drums consisted of isopropyl alcohol, potassium hydroxide, and water. In addition, the main radioactive component was enriched uranium. Based on analytical results, the U-235 activities presented problems for commercial facilities bounded by Special Nuclear Material (SNM) License limits of 350 grams. While the total quantity of U-235 in the containers did not exceed the commercial license limits, it did present special handling considerations and would require special inventory controls in order to stay under the 350 grams. As a result of these conditions, the price received from commercial facilities to process this waste was extremely high.

Constrained by its budget, LANL project personnel turned to the WERF incinerator at Idaho National Engineering Laboratory for assistance. LANL completed the approval process for access to the WERF incinerator and shipped the material to WERF in May of 1996. Because the WERF incinerator was a fully funded DOE initiative, LANL only had to absorb the costs for characterization, transportation, and disposal of residues. By using WERF, LANL saved the Department over $500k in treatment costs.

Management of Newly Generated Mixed Waste

One of the principle strategies (besides treatment and disposal) in reducing the inventory of legacy waste is preventing new additions to the inventory (i.e. waste from being added to the Site Treatment Plan). LANL's continuing research mission generates annual mixed waste volumes of 10-20 cubic meters. In order to prevent this new waste from being added to the STP, LANL put in place an aggressive program to manage newly generated waste.

Beginning in 1997, under its contract provisions with the Department of Energy (Appendix F), the University of California has a performance measure to treat and dispose of all newly generated mixed waste within 1 year. The STP only covers waste that remains in storage for greater than one year. Funded by Defense Programs, the Waste Management organization ships anywhere from 300-500 newly generated mixed waste items off-site for treatment each year. None of this waste ever ends up being reported in the annual STP update submitted to the State of New Mexico.

On October 30, 1998, the Environmental Management Division at LANL published a Notice (8) implementing a Defense Programs Policy guidance requiring formal approval from the DOE Operations Office (DOE/AL) to **generate waste with No Disposal Path**. This notice stated that any proposed processes that generate such waste couldn't begin operation until DOE approval is received. The notice also provides specific guidelines and criteria for requesting approval. This program has had a direct impact on the amount of "No Path Forward" waste that is generated each year at LANL.

SUMMARY AND CONCLUSIONS

By using existing resources and facilities and partnering both with commercial companies and the New Mexico Environment Department, LANL has been able to successfully work off their legacy mixed waste backlog. Not only has LANL achieved its original STP milestones, but also they are on track to complete all STP commitments 3-4 years earlier than originally projected. Figure 3 shows the progression from an initial inventory of greater than 600 cubic meters to the current inventory of 50 cubic meters.

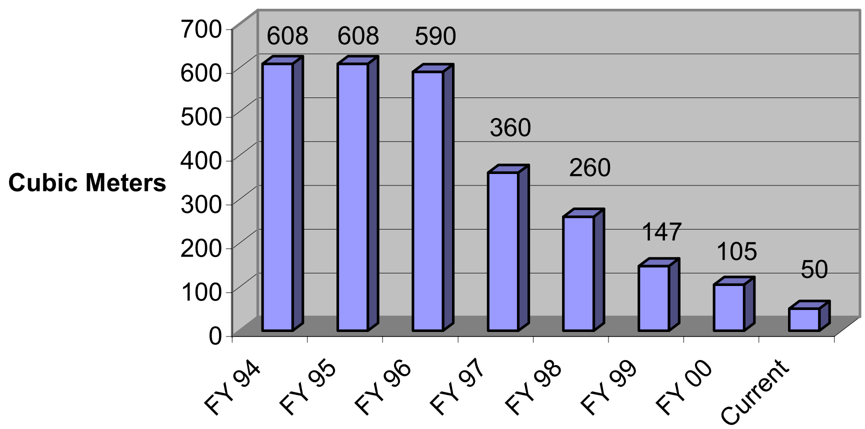

Fig. 3 – Volume of stored legacy mixed waste by fiscal year

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