Report

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John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Kieling:

SUBJECT: 2013 LANL HAZARDOUS WASTE MINIMIZATION REPORT

The Department of Energy/Los Alamos National Security, LLC, are pleased to submit the enclosed annual report on hazardous waste minimization activities. The report was prepared pursuant to the requirements of Section 2.9 of the Los Alamos National Laboratory Hazardous Waste Facility Permit and is required by the Permit to be submitted to the New Mexico Environment Department by December 1 for the previous year ending September 30.

The Permittees have made significant progress in minimizing hazardous waste as well as other waste types. By integrating pollution prevention and waste minimization into all operational activities more progress is expected in the future.

Should you have questions or require additional information, please contact Sonja Salzman at (505) 664-0106, ssalzman@lanl.gov or Patricia Gallagher at (505) 667-2278, patg@lanl.gov.

Sincerely,

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Sincerely,

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Attachment 1

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Robert L. Dodge
Division Leader
Waste Management Division
Los Alamos National Security, LLC
Operator

11/26/13
Date Signed

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List of Acronyms

ADEP	Associate Directorate of Environmental Programs
ADESH	Associate Directorate of Environment, Safety, and Health
ALARA	as low as reasonably achievable
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research facility
CRWSSDR	consolidated remote waste storage site disposal request
CWDR	chemical waste disposal request
D&D	decontamination and demolition
DOE	US Department of Energy
DP	Defense Programs
EMS	Environmental Management System
ENV-ES	Environmental Stewardship Group
EP	Environmental Programs Directorate
EP-CAP	Corrective Actions Projects
EPA	Environmental Protection Agency
ESH	Environment, Safety, and Health Directorate
FY	fiscal year
GIC	Green is Clean
ISO	International Organization of Standardization
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
LED	light-emitting diode
LLW	low-level waste
MDA	Material Disposal Area
MLLW	mixed low-level waste
MTRU	mixed transuranic waste
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyls
PPOA	Pollution Prevention Opportunity Assessment
R&D	Research and Development
RCA	radiological control area
RCRA	Resource Conservation and Recovery Act
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
TA	Technical Area
TRU	transuranic (waste)
TSDF	treatment, storage, and disposal facility
TWSR	TRU waste storage request
URWSSDR	universal remote waste storage site disposal request
WCATS	Waste Compliance and Tracking System
WIPP	Waste Isolation Pilot Plant
WMin/PP	Waste Minimization/Pollution Prevention (Program)
WPF	Waste Profile Form

1.0 Hazardous Waste Minimization Report

1.1 Introduction

Waste minimization and pollution prevention are inherent goals within the operating procedures of Los Alamos National Security, LLC (LANS). The US Department of Energy (DOE) and LANS are required to submit an annual hazardous waste minimization report to the New Mexico Environment Department (NMED) in accordance with the Los Alamos National Laboratory (LANL or the Laboratory) Hazardous Waste Facility Permit. The report was prepared pursuant to the requirements of Section 2.9 of the LANL Hazardous Waste Facility Permit. This report describes the hazardous waste minimization program (a component of the overall Waste Minimization/Pollution Prevention [WMin/PP] Program) administered by the Environmental Stewardship Group (ENV-ES). This report also supports the waste minimization and pollution prevention goals of the Environmental Programs Directorate (EP) organizations that are responsible for implementing remediation activities and describes its programs to incorporate waste reduction practices into remediation activities and procedures.

LANS was very successful in fiscal year (FY) 2013 (October 1-September 30) in WMin/PP efforts. Staff funded four projects specifically related to reduction of waste with hazardous constituents, and LANS won four national awards for pollution prevention efforts from the National Nuclear Security Administration (NNSA). In FY13, there was no hazardous, mixed-transuranic (MTRU), or mixed low-level (MLLW) remediation waste generated at the Laboratory. More hazardous waste, MTRU waste, and MLLW was generated in FY13 than in FY12, and the majority of the increase was related to MTRU processing or lab cleanouts. These accomplishments and analysis of the waste streams are discussed in much more detail within this report.

1.2 Background

In 1990, Congress passed the Pollution Prevention Act, which changed the focus of environmental policy from "end-of-pipe" regulation to source reduction and minimizing waste generation. Under the provisions of the Pollution Prevention Act and other institutional requirements for treatment, storage, and disposal of wastes, all waste generators must certify that they have a waste minimization program in place.

Specific DOE pollution prevention requirements are delineated in DOE Order 436.1, *Departmental Sustainability*, which was accepted into the LANS contract. The Order contains greenhouse gas emission reduction goals, energy and water conservation goals and places a strong emphasis on pollution prevention and sustainable acquisition. DOE Order 436.1 requirements are executed through the Laboratory's Environmental Management System (EMS). The Laboratory's EMS received third-party registration to the International Organization of Standardization (ISO) 14001:2004 standard in April 2006 and was recertified in February 2012. The EMS is subject to surveillance audits every six months. Pollution prevention and waste minimization are required elements of the ISO 14001:2004 standard and are evident throughout the EMS.

A list of key applicable regulatory drivers for the WMin/PP Program is presented below.

Federal Statutes and Executive Orders

- Resource Conservation and Recovery Act (RCRA);
- Pollution Prevention Act of 1990;
- Executive Order 12873, Federal Acquisition, Recycling, and Waste Prevention;
- Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention;
- Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management; and
- Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance.

Federal Regulations

- Code of Federal Regulations (CFR), Title 40, Parts 260–280, Hazardous Waste Management.

State of New Mexico Statutes

- New Mexico Hazardous Waste Act; and
- New Mexico Solid Waste Act.

State of New Mexico Regulations

- New Mexico Solid Waste Management Regulations, Title 20, Chapter 9, Part 1, New Mexico Administrative Code; and
- New Mexico Hazardous Waste Management Regulations, Title 20, Chapter 4, Part 1, New Mexico Administrative Code.

DOE Orders and Policies

- DOE Order 458.1, "Radiation Protection of the Public and the Environment";
- DOE Order 435.1, "Radioactive Waste Management";

- DOE Order 436.1, "Departmental Sustainability"; and
- Annual DOE Strategic Sustainability Performance Plan (DOE SSPP).

Directives and Policies

- Laboratory Governing Policy on Environment;
- SD 400, Environmental Management System Description;
- PD 400, Environmental Protection Program;
- P 401, Procedure to Identify, Communicate, and Implement Environmental Requirements;
- P 402, Environmental Communication Procedure;
- P 403, Environmental Aspects Identification Requirement;
- P 405, National Environmental Policy Act (NEPA), Cultural Resources, and Biological Resources Reviews;
- P 407, Water Quality;
- P 408, Air Quality Reviews;
- P 409, Waste Management; and
- P 412, Environmental Radiation Protection.

1.3 Purpose and Scope

The purpose of this report is to describe the waste minimization program that the Laboratory has implemented and maintained to reduce the volume and toxicity of hazardous wastes that it generates to minimize the threat to human health and the environment. This report discusses the methods and activities that are routinely employed to prevent or reduce waste generation, and the report documents FY13 waste generation quantities in comparison with FY12 quantities as well as significant waste minimization accomplishments. In most cases, waste minimization activities executed during FY13 will continue to occur during FY14 and beyond. This report also discusses the Laboratory Director's commitment to pollution prevention, specific elements of the Laboratory's WMin/PP programs, and the barriers to implementation of further significant reductions.

The report discusses institutional policies, goals, and training activities that address hazardous and mixed waste reduction. The report provides waste minimization information by the following waste types: hazardous waste, MTRU, and MLLW. The last section of this report provides a description of the waste minimization and pollution prevention activities associated with remediation wastes.

1.4 Requirements of the Operating Permit

Section 2.9 of the LANL Hazardous Waste Facility Permit requires that a waste minimization program be in place and that a certified report be submitted annually to NMED. The list of permit requirements in Table 1-1 corresponds with a section of this report that addresses the requirement. Changes from the previous year are noted throughout this report.

Table 1-1. LANL Hazardous Waste Facility Permit Section 2.9

Permit Requirement	Topic	Report Section
Section 2.9 (1)	Policy Statement	Section 2.1
Section 2.9 (2)	Employee Training and Incentives	Section 2.2
Section 2.9 (3)	Past and Planned Source Reduction and Recycling	Sections 2.4.1, 2.4.2, 3.4, 4.4, 5.4, 6.0
Section 2.9 (4)	Itemized Capital Expenditures	Section 2.4
Section 2.9 (5)	Barriers to Implementation	Sections 3.5, 4.5, 5.5, 6.5
Section 2.9 (6)	Investigation of Additional Waste Minimization Efforts	Sections 2.4, 3.4, 4.4, 5.4, 6.0, 6.4
Section 2.9 (7)	Waste Stream Flow Charts, Tables, and Analysis	Sections 2.3, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3 5.1, 5.2, 5.3, 6.2, 6.3
Section 2.9 (8)	Justification of Waste Generation	Sections 2.3, 6.0

1.5 Organizational Structure and Staff Responsibilities

The Laboratory Director, the Environmental Senior Management Steering Committee, and the Associate Director for Environment, Safety, and Health have oversight responsibilities and provide annual review of LANS' EMS, WMin/PP Program goals, and environmental performance. The Environmental Protection (ENV) Division has primary responsibility and oversight responsibilities for the WMin/PP Program as well as for the environmental remediation program waste minimization activities. The goal of the WMin/PP Program is to support core waste minimization activities and pollution prevention projects. Specific environmental remediation program waste minimization activities are discussed in Section 6.0.

The ENV-Environmental Stewardship Group (ENV-ES) is tasked to develop and manage the WMin/PP Program and the EMS. The EMS establishes both institutional waste minimization and pollution prevention objectives and targets and directorate-level environmental action plans that contain waste minimization and pollution prevention actions and other environmental improvement actions. ENV-ES provides:

- Oversight for WMin/PP Program implementation;

- A base of technical knowledge and resources for pollution prevention practices;
- Assistance identifying waste generation trends and pollution prevention opportunities;
- Recommendations for pollution prevention solutions and applications;
- Support in tracking and reporting pollution prevention successes and lessons learned, funding for pollution prevention projects, and;
- Assistance identifying and addressing WMin/PP Program implementation barriers.

The Waste Management Division provides all waste packaging, transporting, and disposal services at the Laboratory as well as all waste compliance support for Laboratory operations. The Waste Management Division is a key partner with ENV-ES in implementation of waste minimization projects and strategies.

2.0 Waste Minimization Program Elements

2.1 Governing Policy on Environment

LANS developed a prevention-based EMS, which was third-party certified to the ISO 14001:2004 standard in April 2006 by an independent ISO 14001 third-party registrar. The EMS was most recently recertified to the ISO 14001:2004 standard in February 2012. The Laboratory Governing Policy on Environment states:

> *"We are committed to act as stewards of our environment to achieve our mission in accordance with all applicable environmental requirements. We set continual improvement objectives and targets, measure and document our progress, and share our results with our workforce, sponsors, and public. We reduce our environmental risk through legacy cleanup, pollution prevention, and long-term sustainability programs."*

2.1.1 FY13 EMS Institutional Objectives

A required element of the ISO 14001:2004 standard is the establishment of environmental objectives with quantifiable and achievable targets. The Laboratory's Environmental Senior Management Steering Committee established the following objectives as part of the EMS for FY13:

1. **Clean the Past**

   a. Monitor to detect changes to water and soil, take appropriate actions and apply "defense in depth" strategy according to the requirements of the Compliance Order on Consent with NMED
   b. Protect surface water runoff through implementation of the Individual Storm Water Permit with EPA
   c. Ship waste to the Waste Isolation Pilot Plant (WIPP)
   d. Reduce volume of waste listed in Site Treatment Plan
   e. Footprint reduction and reduction of excess materials/ equipment/ liabilities

2. **Control the Present**

   a. Monitor for compliance
   b. Integrate environment with safety tools for common work control
   c. Reduce spills and leaks
   d. Implement sustainable acquisition
   e. Expand chemical re-use program
   f. Pollution Prevention with focus on problematic waste streams from all environmental media
   g. Fund no-exposure projects to reduce compliance liabilities

h. Improve access to government vehicles and fuel efficiency

3. Create a Sustainable Future

a. Site Sustainability Plan implementation, including:
   - Energy Intensity Reduction
   - Water Use Reduction
   - Greenhouse Gases with 10-Year Greenhouse Gas Reduction Plan
   - High-performance sustainable buildings
   - Design an Environmental "As Low As Reasonably Achievable" (ALARA) strategy for the Laboratory
   - Data Center Management
   - Regional and Local Planning
   - New Environmental / Sustainable Technologies

b. Long Term Environmental Stewardship and Sustainability Plan
   - Integrated Site Planning and use of the Decision Support Tool and the Public Communication Tool
   - Implement the "Integrating Strategies" of the Long Term Environmental Stewardship and Sustainability Plan (formally the 50 Year Environmental Stewardship Plan)

c. "Green" existing facilities through expansion of the Green Team concept beyond high-performance sustainable buildings

Pollution prevention is an integral part of the EMS, the annual LANL Site Sustainability Plan and the Long Term Environmental Stewardship and Sustainability Plan. The concept of ALARA is being championed to encourage pollution prevention across the Laboratory as a means to sustainability.

The WMin/PP Program is an integral part of the EMS and supports LANS in meeting the EMS objectives. The FY13 WMin/PP Program approach focused on:

- Baselining waste trends and identifying improvement targets at the directorate level;
- Conducting pollution prevention opportunity assessments (PPOAs) on key processes;
- Utilizing material substitution as appropriate;
- Integrating pollution prevention principles into the project planning process;
- Developing and delivering guidance to address waste generation behaviors for staff and subcontractors;
- Communicating waste minimization lessons learned to the employees;

- Dedicating waste minimization resources to assist with remedial actions;
- Improving chemical use and management;
- Sustainable acquisition;
- Improving management of materials to reuse materials and equipment to the greatest extent possible before final disposition; and
- Recycling and reusing materials.

2.2 Employee Training and Incentive Programs

Several employee training and incentive programs exist to identify and implement opportunities for recycling and source reduction of various waste types.

Training courses that address waste minimization and pollution prevention requirements include:

- General Employee Training;
- Waste Generator Overview;
- Radworker II; and
- EMS Environmental Awareness Training.

LANS requires generators to minimize waste and conduct preventive measure assessments in waste management guidance documents and in the work planning requirements under the Integrated Work Management Procedure (P 300).

In FY13, the Integrated Project Review Program provided a series of environmental permits and requirements briefings to several organizations to increase awareness of environmental concerns, including opportunities for waste minimization and prevention. Over twenty briefings were provided to several organizations including:

- Construction Safety personnel;
- Deployed Environmental Professionals;
- Capital Project Leaders; and
- Environment, Safety, and Health Managers.

In addition, the Integrated Project Review Program subject matter experts led the Environmental Protection Division effort to deliver environmental briefings to the newly formed Deployed Services Division (of ADESH directorate) managers including the division leader, deputy division leader, group leaders, team leaders, and others. These organizations have responsibilities related to work planning, subcontractor support and oversight, WMin/PP Program efforts, EMS, and more.

The Permits and Requirements Identification system is a tool to assist personnel in identifying, managing, and complying with environment, safety, and health requirements that may impact project planning and execution. This process helps project managers clearly understand what WMin/PP Program requirements apply to their project.

The DOE and NNSA sponsor annual pollution prevention awards competitions. The awards provide recognition to personnel who implement pollution prevention projects. LANS submits nominations for the DOE and NNSA awards each year. In FY13, LANS received four awards for pollution prevention projects, including two NNSA Best-in-Class awards and two NNSA Environmental Stewardship awards. The winning projects are described below. The first two projects received the Best in Class awards.

- Tracer Forensic Incident Response Exercise (FIRE) is a workshop for training and meetings on cyber security problems. The team converted the workshop, which was annually held in New Mexico, into an online meeting. Having a virtual exercise allowed more than seven times as many people to participate and avoided all travel costs and associated fuel use. An estimated 250 metric tons of carbon dioxide emissions were avoided by the reduced travel.
- Dr. Dennis Hjeresen won in the individual category of "Sustainability Champion" because he has demonstrated a deep understanding of sustainability and implemented innovative approaches to sustainability over his entire career at LANL. He is known nationally and internationally through the Green Chemistry Institute and his work on water issues and green technology development. Dr. Dennis L. Hjeresen currently serves as senior advisor for the Principle Associate Directorate for Business Services and Operations at LANL. He is responsible for integrating environmental responsibility and sustainability into all aspects of LANL operations. An important goal at the Laboratory is to not only increase the efficiency of building energy use but also to understand how to manage energy resources more intelligently.
- The National Security and Sciences Building (NSSB) provided a great opportunity for energy savings and Smart Grid Demand-Response experiments. Multiple energy conservation measures for the HVAC system resulted in almost a 13% reduction in energy use.
- Andrew Erickson won in the individual category of "Change Agent". As the Division leader for Utilities and Institutional Facilities at LANL, Andrew is responsible for meeting the DOE sustainability goals. He has been responsible over the past three years with for the establishment and implementation of a sustainability program at the

Laboratory. He is responsible for over four million square feet of facilities along with the site's utility and road infrastructure.

The Pollution Prevention Program holds a Pollution Prevention award ceremony every year in conjunction with other Earth Day activities. Employees submit descriptions of projects they completed during the past year that reduced waste generation. Each participant is recognized by senior management with an award certificate and a small cash award. During FY13, the Pollution Prevention Program gave awards to employees who worked on 47 projects to reduce waste generation, improve efficiency, and conserve resources. These projects have millions of dollars of value through cost savings, waste avoidance, and improved compliance.

Each year ENV-ES invites waste generators to submit proposals for pollution prevention project grants. ENV-ES coordinates the peer review of the project proposals and distributes the available funds to the projects. ENV-ES monitors progress on these projects and provides technical assistance as needed.

2.3 Utilization and Justification for the Use of Hazardous Materials

The Laboratory is a research and development (R&D) facility that executes thousands of projects requiring the use of chemicals or materials that may create hazardous waste. Pollution prevention and waste minimization requirements for waste generators include source reduction and material substitution techniques. Best management practices to reduce hazardous waste generation such as the use of micro-scale chemistry, use of nonhazardous cleaners, and other prevention techniques have been adopted. However, customer requirements, project specifications, or the basis of the research may demand the use of particular hazardous chemicals.

To encourage the use of nontoxic or less hazardous substitutes whenever possible, the Pollution Prevention Program has a link to a database of alternative chemical choices on its website. The database of alternative chemicals was developed by researchers at the Massachusetts Institute of Technology. The database contains possible alternatives to some hazardous chemicals for particular processes. All employees can access this database of nontoxic or less hazardous alternative chemicals.

The implementation of DOE Order 436.1 provides buyers with opportunities to choose less hazardous or nonhazardous janitorial products, office supplies, and other items that contain recycled content. The janitorial supply catalog that the Laboratory uses offers "green" cleaning supplies, as does the office supply vendor. In addition, the computer procurement contract includes the preference for computers that meet the Electronic Product Environmental Assessment Tool certification standard. Other procurement requirements address remanufactured printer cartridges and energy efficiency standards for all printers and copiers. In addition, sustainable acquisition requirements for water and energy-efficient equipment and recycled-content construction supplies are in place. In FY13, LANS received a Gold GreenBuy

Award for procuring products in FY12 with sustainable attributes. LANS met the DOE's leadership goals for nine product types in six product categories, including:

- Construction category: carpet and concrete;
- Cafeteria category: containers, cutlery, dishware, and food;
- Office category: furniture, computers/laptops, and monitors;
- Custodial category: toilet paper;
- Grounds category: vegetation; and Other category: elimination or reuse of a product.

2.4 Investigation of Additional Waste Minimization and Pollution Prevention Efforts

ENV-ES monitors waste trends and develops improvement projects. Waste reduction projects often come directly from researchers, waste management coordinators, and the EMS/Pollution Prevention team itself. EMS/Pollution Prevention staff provides engineering support to waste generators in the implementation of these projects.

During FY13, each directorate participated in the EMS process and examined its particular impacts on the environment. As a result of the EMS process, each directorate created an action plan with objectives and targets for reducing its environmental impact. These action plans detail projects that will reduce waste generation, increase recycling, save energy, or otherwise reduce environmental impacts.

2.4.1 Capital Funding for Past Projects

The following paragraphs describe Pollution Prevention projects and capital funding amounts for the past five years. Pollution Prevention projects address all types of waste and pollutants. However, the following only represent projects that were designed to reduce hazardous waste, MLLW, or MTRU.

In FY09, funds were allocated to the following projects:

- Nonhazardous Lead Equivalent Shielding Glovebox Gloves ($15,000)

  The purpose of this project was to replace lead-lined glovebox gloves with a new type of gloves that use bismuth and tungsten instead. For certain applications, other gloveboxes can be retrofitted over time, and less MLLW will be generated in the future since bismuth and tungsten are both nonhazardous materials.

- Acid Bath Glassware Cleaning Substitute ($30,000)

  A nonhazardous, biodegradable detergent was tested in place of a nitric acid bath to clean glassware for sensitive samples. By using this replacement, the team plans to avoid the generation of over 50 gallons of nitric acid waste annually.

- Light-Emitting Diode (LED) Lights at Technical Area (TA)-55 ($40,000)

  Based on the success of a previous project, gloveboxes are being retrofitted with LED lights instead of fluorescent panels. LED lights operate at cooler temperatures, are more energy efficient, last longer than fluorescent bulbs, and are low voltage, which reduces the chance of an injurious shock to a worker. The nonhazardous characteristics and longer life of the LEDs mean that less MLLW will be generated over time.

- Bioscience Organic Solvent Recycle ($48,000)

  Solvent distillation equipment was installed so that solvents used for separations could be reused in a closed-loop system onsite. This improvement resulted in a reduction of approximately 1300 kg of solvent waste and new solvent purchases each year.

- Ion Pump Hazardous Waste Elimination ($22,500)

  New ion pumps were purchased for the accelerator, so the old ion pumps no longer need to be reconditioned with an acid bath. The new parts reduce hazardous waste generation by about 180 kg annually.

In FY10, funds were allocated to the following projects:

- Direct Solid Analysis Using Direct Current (DC) Arc Spectrometry to Eliminate Waste Generation ($40,000)

  A new spectrometer with a solid-state detector was purchased for use in the plutonium-238 Heat Source Program. The old spectrometer that was replaced used about 3000 gallons of water and generated about 16 liters (L) of MLLW with silver annually. The new instrument is also expected to be used for another process, in which about 23 gallons of solid TRU waste can be avoided each year.

- Ion Exchange Column Reduction Project ($30,000)

  Wizard Bags are a super strong type of plastic bag that can completely cover a tall ion exchange column. When encased in a Wizard Bag, a 6-foot column can be safely broken apart without the risk of puncture from broken glass. This size reduction minimizes the number of waste containers containing TRU or MTRU that would be sent away as waste.

- Satellite Accumulation Area Elimination from PF-4 Analytical Method ($55,000)

This funding allowed Chemistry Division to obtain an unwanted alpha spectrometer from Plutonium Manufacturing and Technology Division instead of having the instrument sent away as waste. This spectrometer may eliminate the need for xylene in some experiments, which will reduce the volume of MTRU generated from this work by about 0.1 cubic meters per year.

- Purchase and Supply LED Lights for TA-50 ($50,000)

  This project replaced 4-foot fluorescent bulbs in radiological control areas (RCAs) at TA-50 with LED lights. Since fluorescent bulbs in RCAs can potentially become MLLW, the expected reduction in overall MLLW generation is 3 to 5 cubic meters each year.

- Fluorescent Light Substitution at TA-48 ($30,000)

  Fluorescent lights in hot cells at TA-48 were replaced with LED lights to avoid the potential generation of about 0.5 cubic meter of MLLW.

- Reduction of MLLW and Reuse of LLW at TA-53 ($125,000)

  Some older equipment at TA-53 was refurbished so that used targets can be remotely cut apart and disposed of as MLLW in normal, 55-gallon drums instead of in very large casks. The reduction in MLLW waste volume is expected to be about 3.8 cubic meters.

- Mercury Ignitron Replacement Prototype Project ($86,500)

  This project is to prototype, test, and install a solid-state ignitron to replace a mercury ignitron. If all 15 mercury ignitrons are ultimately replaced, about 11 kg of mercury-containing hazardous waste can be eliminated.

- 21st Century Solvent Purification for Actinide Chemistry ($20,000)

  A solvent-purification system was purchased for performing actinide chemistry operations. This system produces less hazardous waste than the old system did.

- Chemical Storage and Re-Use Centers, Virtual Chemical Exchange ($48,303)

  This project investigated the possibilities of having chemical pharmacies for sharing unused chemicals among divisions. Unused and unspent chemicals have long been a significant fraction of the hazardous waste stream at the Laboratory, so minimizing this waste stream is very desirable.

- Perchloric Acid Fume Hoods ($100,000)

A new fume hood dedicated to work with perchloric acid reduces the amount of piping that must be washed down by 75%. Concentrating all perchloric acid work into one hood means that about 70,000 L less of radioactive liquid waste will be generated each year.

- Chemical Inventory Reduction ($30,000)

  The Plutonium Manufacturing and Technology Division disposed of about 40 kg of unwanted chemicals as hazardous waste. The chemicals had been taking up valuable room in cold storage space.

- Van de Graaff Cleanout Project ($60,000)

  The old Ion Beam Facility was shut down, and this funding helped to remove the materials inside. Approximately 55 gallons of MLLW and 26 cubic meters of LLW were removed for disposal.

- Low-Energy Demonstration Accelerator Containment Trench Extension ($5,000)

  A secondary containment trench was extended to become capable of holding all of the oil in several transformers at TA-53 in case there were simultaneous catastrophic failures. If oil escaped in the event of such failures, then surrounding soil could get contaminated and ultimately become hazardous waste.

In FY11, funds were allocated to the following projects:

- Replacement of Lead-Loaded Glovebox Gloves with an Attenuation Medium of non-RCRA-Hazardous Metals ($7,500)

  The team ordered five pairs of Polyurethane – NonHaz Shielding – Hypalon gloves to test with gloveboxes. These do not contain lead, so they can ultimately be disposed of less expensively as LLW instead of as MLLW. In the future, many leaded gloves might be replaced with the Hypalon gloves.

- Two-Flange Gloveport Liner ($2,500)

  The team designed an improvement for gloveboxes that involves using an extra liner between the glove and the gloveport. This extra liner is expected to help reduce the chance of contamination getting onto the gloveport and glove inside the glovebox. This reduces the potential risk of contamination to employees and should result in the generation of less MLLW.

- Methanol Recirculation and Recovery Loop ($69,682)

  The multi-pass Methanol Recirculation and Recovery Loop (MRRL) replaced the single-pass methanol fuel system and provided methanol solution to four fuel cell test systems in parallel. The MRRL greatly reduces the volume and disposal cost of the hazardous methanol/water waste stream. Installation of the MRRL mitigates safety hazards associated with handling large volumes of methanol/water mixture.

- Target Fabrication Facility Centralized Chemical Stockroom ($75,000)

  This project established a centralized chemical stockroom for all operations at TA-35-213. By sharing chemicals among multiple projects, less hazardous waste in the form of unused or unspent chemicals is expected to be generated.

- 21st Century Solvent Purification for Actinide Chemistry ($20,000)

  This project is a continuation of work performed in FY10 to purify solvents for use in actinide chemistry. The system was made portable for use in multiple locations.

- Disposal of Hazardous Materials from TA-22-1 Cleanout ($4,000)

  Hazardous waste and oil were generated during the cleanout of a historical building at TA-22. The grant covered disposal costs of these wastes.

In FY12, funds were allocated to the following projects:

- Coolant Longevity Project ($30,000)

  This project implemented coolant filtering at several machines so that the coolant life is extended and less waste is produced. The allocated funds purchased equipment to filter the coolant.

- Waste Reduction Through Dry Cell Battery Recycling ($2,500)

  This project established more extensive recycling of various types of batteries from LANL-owned items such as cell phones and laptop computers.

- LANL Radiological and RCRA Constituents Background Study ($50,000)

  This project updated and expanded the current background report for soil and construction debris. This new report gives remediation and demolition projects one clear set of background values, both for RCRA and radiological constituents.

- Microshield® Non-Destructive Analysis Tool Pilot Project ($50,000)

  This project demonstrated the site wide application of the Microshield® Non-Destructive Analysis software for radiological waste characterization. Using the software is expected to cut analytical costs by 30%.

- ISR-4 Waste Reduction through the Incorporation of Automated Cleaning Systems ($64,000)

  A Trident LD Automatic De-Fluxing and Cleanliness Testing System and a bench top Ultrasonic Cleaning System were installed, which eliminated use of alcohol and other solvents to clean circuit boards and other electronic components.

- Trichloroethylene replacement study: cleaning effectiveness determination ($100,000)

  This project tested Novec fluids in place of trichloroethylene for ultrasonic cleaning. Novec fluids are more stable than trichloroethylene and are expected to save time for researchers as well as reduce the volume of hazardous or MLLW.

2.4.2 Capital Funding for FY13 Projects

The LANS FY13 Pollution Prevention projects addressed MLLW, hazardous, and New Mexico Special waste streams, as well as other environmental impacts. The project titles are listed below.

- Smoke Alarm Recycling ($18,200)

  The funds for this project will be used to recycle smoke detectors that contain americium and/or radium. These are smoke detectors that cannot be returned to their manufacturers and would otherwise be handled as MLLW.

- Oil-free and Cost Efficient Freeze Drying ($6,500)

  A new oil-free pump will be installed for synthesizing and preserving peptides. The new pump will not generate any hazardous waste oil and will require less maintenance.

- Replacement of Oil-Vacuum Pumps ($81,200)

  Many new oil-free pumps will be purchased with these funds for materials science research. Without oil, the new pumps will not generate hazardous waste oil, and there will be no chance of oil spills into the environment from these pumps.

- Sanitary Effluent Recycling (SERF) Sludge Makes Carbon Neutral Concrete ($158,000)
  Research will be performed on the best method to use for incorporating sludge from the SERF into concrete. Once the process is optimized, less sludge will need to be disposed of as New Mexico Special Waste because it can be incorporated into useful concrete.

3.0 Hazardous Waste

3.1 Introduction

The annual hazardous waste disposal amount that is reported as part of the Pollution Prevention Program DOE reporting requirements is based on the total waste disposed recorded in the Waste Compliance and Tracking System database (WCATS) system and does not include waste generation amounts prior to onsite treatment. Data quality assurance for this system is managed by the Operations Integration Office Group Leader. The WCATS waste data used in this report was collected for FY13 on October 23, 2013.

In brief, 40 CFR §261.3, as adopted by the NMED as 20.4.1.200 NMAC, defines hazardous waste as any solid waste that

- is not specifically excluded from the regulations as hazardous waste;
- is listed in the regulations as a hazardous waste;
- exhibits any of the defined characteristics of hazardous waste (i.e., ignitability, corrosiveness, reactivity, or toxicity);
- is a mixture of solid and hazardous wastes; or
- is a used oil having more than 1000 ppm of total halogens.

Hazardous waste commonly generated includes many types of research chemicals, solvents, acids, bases, carcinogens, compressed gases, metals, and other solid waste contaminated with hazardous waste. This waste may include equipment, containers, structures, and other items that are intended for disposal and that are contaminated with hazardous waste (e.g., compressed gas cylinders). Some contaminated wastewaters that cannot be sent to the sanitary wastewater system or the high explosives wastewater treatment plants also qualify as hazardous waste. Recycled wastes include aerosol cans, light bulbs, batteries, mercury, and ferric chloride solution. Figure 3-1 shows the process map for all waste generation at the Laboratory. This diagram comes from Procedure 409, which governs waste disposal at the Laboratory.

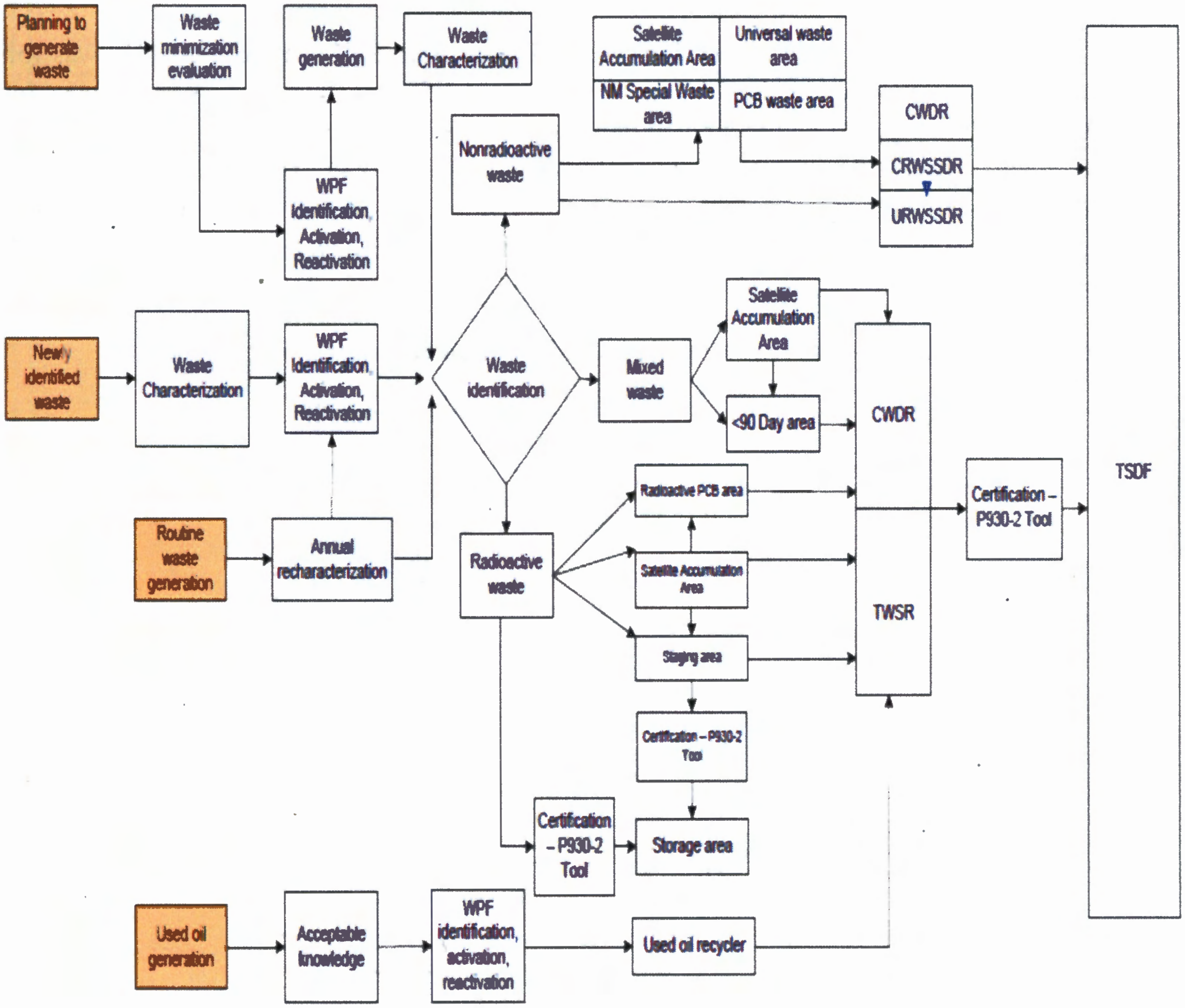

Figure 3-1. Waste Process Flow Map at the Laboratory.

3.2 Hazardous Waste Minimization Performance

The amount of non-remediation hazardous waste shipped from the Laboratory in FY13 was 15.9 m^3, excluding recycled materials. This amount is about half as much as the 32.9 m^3 of hazardous waste shipped during FY12. The amount of hazardous waste that was recycled during FY13 was 23 m^3, which was less than the 35 m^3 that was recycled during FY12. During FY13, no hazardous waste was generated from remediation activities, whereas about 0.8 m^3 of remediation hazardous waste was generated during FY12. All of the non-recycled hazardous waste shipped from the Laboratory in FY13 is shown in Table 3-1 sorted by the TA location.

Table 3-1. Generation of Hazardous Waste by Technical Area during FY13.

Technical Area	Hazardous Waste in m^3
3	1.67
9	0.44
15	0.03
16	0.29
22	0.39
35	2.79
36	0.06
39	0.36
40	0.38
46	2.69
48	0.98
50	0.12
54	2.20
55	3.18
59	0.33

The TAs where the most hazardous waste came from in FY13 are 55, 35, 46, 54, and 3. Figure 3.2 shows the relative volumes of hazardous waste generated by TA.

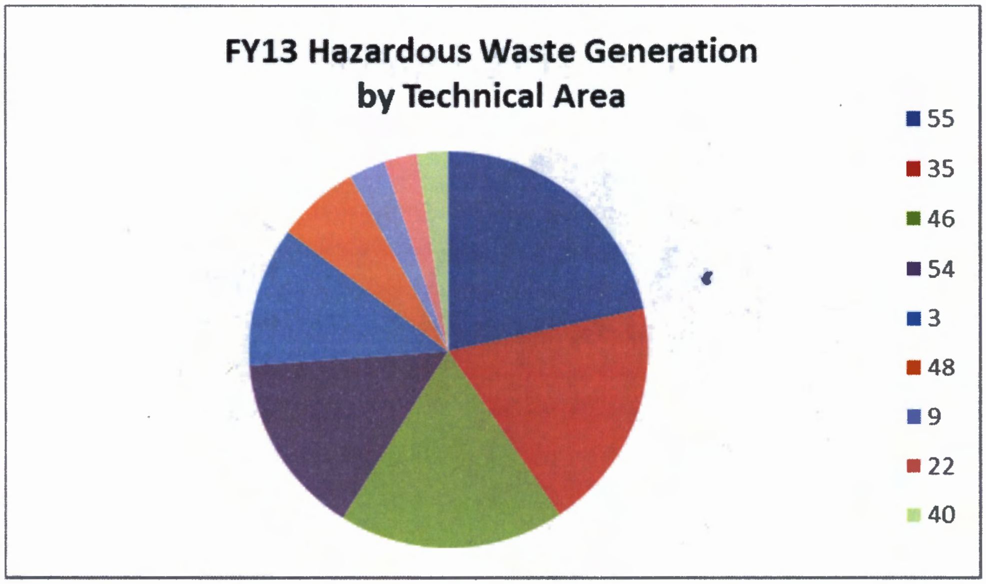

Figure 3-2. Hazardous Waste Generated at LANL in FY13 by Technical Area.

3.3 Waste Stream Analysis

Hazardous waste is derived from hazardous materials and chemicals; hazardous materials disposed of as part of equipment replacement or facility decommissioning; and water contaminated with hazardous materials. After material is declared waste, the hazardous waste is characterized, labeled, and collected in appropriate storage areas. The waste is ultimately shipped to offsite TSDFs for final treatment or disposal.

The largest non-recycled hazardous waste streams for FY13 are described in this section. High explosives waste and wastewaters are treated onsite, and these are excluded from the analysis. Spent R&D chemicals make up the largest number of individual hazardous waste items. The breakdown of components of hazardous waste for FY13 is shown in Figure 3-3.

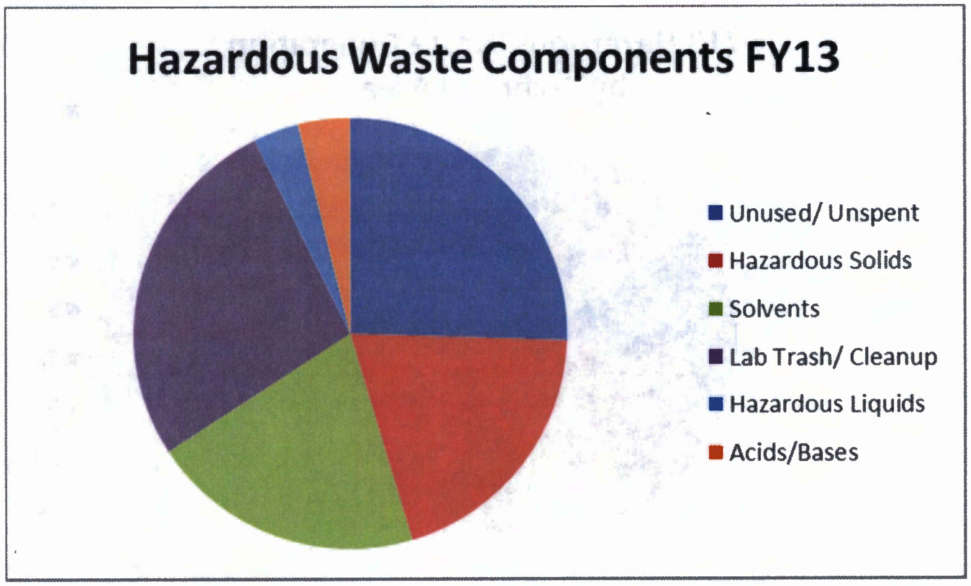

Figure 3-3. FY13 hazardous waste stream components, excluding recycled waste.

Unused/Unspent Chemicals. The volume of unused and unspent chemicals varies each year, but this waste stream comprised the largest fraction of the total non-remediation hazardous waste in FY13. The ChemLog system is set up to allow researchers to find and request unwanted, unexpired chemicals from others onsite. Researchers are encouraged not to buy more of any chemical than they are certain to need for several months to avoid having any unused amount. Efforts to "right-size" chemical procurements and share chemicals are being addressed. In FY13, the volume of unused and unspent in the hazardous waste stream was significantly lower than in FY12.

Solvents. EPA-listed and characteristic solvents and solvent-water mixtures are used widely in research, maintenance, and production operations, especially for cleaning and extraction. Nontoxic replacements for solvents are used whenever possible. New procedures are also adopted, where possible, that either require less solvent than before, or eliminate the need for solvent altogether. A project in FY12 studied a possible substitute for trichloroethylene. Recent acquisitions of solvent distillation equipment have reduced the total amount of solvent used, especially in Bioscience Division. As a result, the total volume of solvents generated has decreased over the past decade. However, solvents are still required for many procedures, and solvents persist as a large component of the hazardous waste stream. The volume of solvents shipped from the Laboratory in FY13 was quite a bit less than in FY12.

Acids and Bases. A variety of strong acids and bases are routinely used in research, testing, and production operations. Over the past decade, the overall volume of hazardous acid and base waste has been reduced mainly by using new procedures that require less acid or base, by recycling acids onsite for internal reuse, and by reusing spent acids and bases internally as part of established neutralization procedures. Acids made up over 70% of this waste stream during FY13. A slightly lower volume of these waste streams were generated during FY13 than FY12.

Hazardous Solids. This waste stream includes inert barium simulants used in high explosives research, electronics, contaminated equipment, broken leaded glass, firing site debris, ash, and various solid chemical residues from experiments. The volume of hazardous solids shipped from the Laboratory during FY13 was slightly higher than during FY12. There was an emphasis on cleanouts during FY13, which caused more electronics and equipment to be disposed. In FY13, there was also more solid waste generated from nanoparticle research.

Hazardous Liquids. This waste stream is primarily aqueous, neutral liquids that are generated from a variety of analytical chemistry procedures. This waste stream also includes aqueous waste from chemical synthesis, spent photochemicals, electroplating solutions, refrigerant oil, and ethylene glycol. In FY13, the volume of hazardous liquids was slightly more than was shipped during FY12.

Lab Trash and Spill Cleanup. Lab trash mostly consists of paper towels, pipettes, personal protective equipment, and disposable lab supplies. Rags are used for cleaning parts, equipment, and various spills. Equipment improvements have reduced the number of oil spills from heavy equipment, and new cleaning technologies have eliminated some processes where manual cleaning with rags was required. In FY13, the volume of lab trash and spill cleanup was slightly more than was shipped during FY12.

Figure 3-4 shows changes in the composition of the hazardous waste stream from FY12 to FY13.

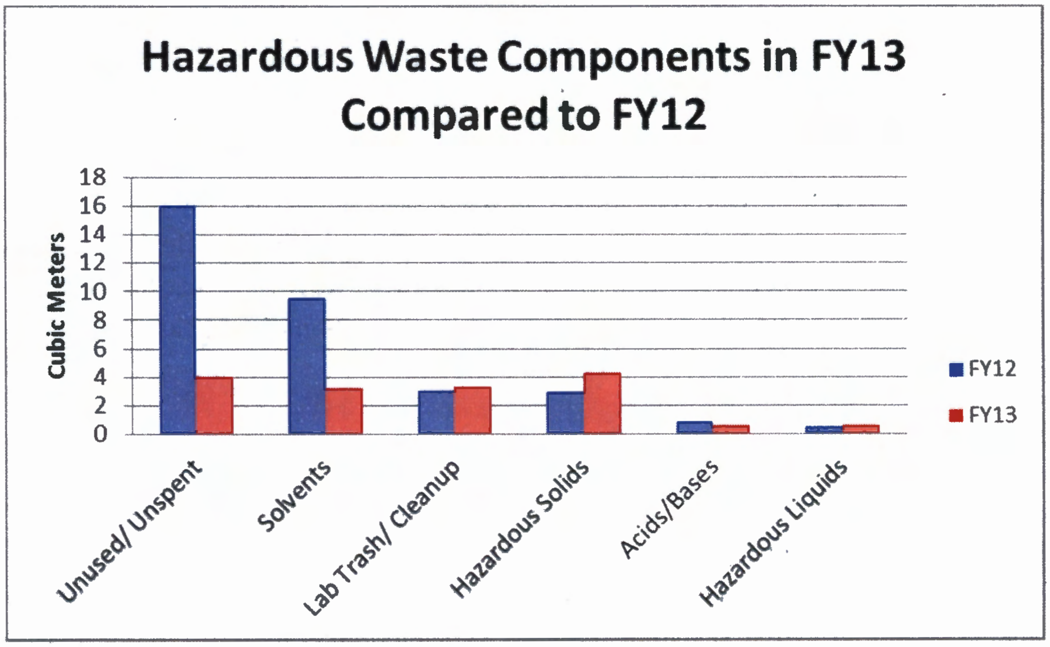

Figure 3-4. Changes in the Hazardous Waste Stream Composition from FY12 to FY13.

3.4 Hazardous Waste Minimization and Operational Funding

Fewer bulbs, batteries, and aerosol cans were recycled during FY13 than in past years. Starting in late FY11, special recycling operations were established in TA-60-86 at the Laboratory. Spent bulbs, aerosol cans, and batteries are collected from various sites and brought together for empty aerosol cans to be punctured, used bulbs to be crushed, and batteries to be packaged for recycling. Having all of these recycling operations together at one location is cost effective for packaging and encourages as much recycling as possible. FY12 was the first full year of recycling operations in this special building.

Table 3-2 below presents the operational costs to the Laboratory for recycling hazardous waste for the past five years.

Table 3-2. Hazardous Waste Recycled at the Laboratory.

Fiscal Year	Volume of Hazardous Waste Recycled (m^3)	Cost of Recycling Hazardous Waste
FY 2009	162	$677,802
FY 2010	158	$570,678
FY 2011	77	$716,738
FY 2012	35	$619,230
FY 2013	23	$480,997

Although the annual weight of recycled hazardous waste has decreased by about 25% during the past five years, the volume has decreased much more significantly due to efforts to package the recyclable materials more efficiently. The lower volume of waste means that fewer shipments need to be made, which saves fuel and reduces emissions of carbon dioxide associated with transportation.

Mercury Substitution

Researchers typically replace mercury-containing thermometers as they get broken with non-mercury thermometers. By doing so, the chances of accidentally spilling mercury and creating hazardous waste are reduced. It is especially valuable to have non-mercury thermometers in RCAs so that generation of MLLW can be avoided. The elemental mercury in old thermometers and in other obsolete mercury-containing equipment is recycled.

Acid Waste Reduction and Recycling

The metal plating shop in Material Physics and Applications Division uses an acid recycling system to recover nitric and hydrochloric acids for reuse in plating procedures within the shop. The system recovers about 90% of the acid used. Plutonium Manufacturing and Technology Division uses a nitric acid recycling system so that a significant fraction can be reused multiple times instead of becoming waste. Approximately 2.08 m^3 of ferric chloride solution were sent offsite to be recycled and resold during FY13, and this would otherwise have become hazardous waste.

Base Waste Reduction and Recycling

Weapons Experimentation Division uses sodium hydroxide solution to remove film resist from copper cables after etching. Over time, the sodium hydroxide solution gets diluted and is no longer useful for this purpose. Instead of disposing of the spent caustic solution, it is used in a process to neutralize waste acidic liquid. The neutralization procedure works very well with the spent caustic solution, and no new caustic chemicals need to be purchased for this purpose.

Solvent Waste Reduction and Recycling

There have been many projects implemented to reduce the use of solvents since solvents have consistently been one of the largest components of the hazardous waste stream. The volume of solvent generated during FY13 was quite a bit lower than was generated during FY12 as seen in Figure 3-4.

- Experiments in organic synthesis laboratories generate a large amount of glassware with organic residues. Solvents and oxidizing acids were formerly used to clean this glassware, thus generating hazardous waste. Besides the generation of waste, this process is time consuming and expensive. Two organic synthesis labs purchased Tempyrox Pyroclean ovens to clean the glassware with heat. The ovens eliminate the chemicals and other problems associated with manual cleaning. The organic vapors from this process are destroyed by a catalytic oxidizer system.

- The heavy equipment maintenance shop once cleaned metal parts by manually scrubbing them in solvent. The shop purchased a hot water parts washer, and the employees found that the hot water parts washer worked better for cleaning metal parts than solvent. The hot water parts washer saves time for employees, decreases their chemical exposure, and significantly reduces hazardous waste solvent generation.

- The Material Testing Lab uses a binder oven to test the amount of oil present in samples instead of performing solvent-based extractions. A sample can be weighed, baked in the oven, and then weighed again to determine how much oil was baked off from the sample.

- In Bioscience Division, the solvent formamide was eliminated from the preparation process to sequence strands of DNA. Formamide is a suspect teratogen, and employees proved that a water-based solution called TE worked just as well as formamide for suspending DNA prior to sequencing. Eliminating formamide reduces hazardous waste solvent and lab trash.

- The Chemistry Division organic synthesis team once performed experimental chemical synthesis activities in large glassware (25 mL to 2 L) reaction vessels. Now researchers use reaction vessels of 5 mL or less, which greatly reduces the volume of solvent used. Typical solvents include toluene, methylene chloride, tetrahydrofuran, and ethanol.

- Two laboratories in Bioscience Division installed solvent recovery systems for acetonitrile in high performance liquid chromatography waste. These systems prevent the generation of about 0.4 m^3 of hazardous waste solvents per week.

- The LANS protective forces subcontractor uses a non-hazardous cleaning solution, "Gunzilla", for their guns instead of the hazardous solution that was previously used.

Coolant Waste Reduction and Recycling

Material Physics and Applications and Weapons Components Manufacturing Divisions both implemented coolant recycling systems in their machine shops. Coolant is always used during machining procedures to ensure the quality of the machined pieces and maximize the lifetime of the machine tools. The coolant recycling system eliminated coolant waste from these facilities, and now only recyclable oil is generated.

Lead-Free Ammunition

Lead is a persistent, bio-accumulative toxin in the environment. Historically, the protective forces subcontractor, Special Operations Consulting, has used traditional lead-containing bullets during training exercises at the small-arms range. A lead-free ammunition project purchased 14,000 rounds of frangible lead-free ammunition in 2010, and an additional 100,000 rounds in 2011, for use in handguns during training exercises.

In addition, the protective forces staff uses high-accuracy scopes on their weapons, and this allows them to achieve certification while using many fewer bullets. The bullets used for certification are required to be the standard lead-containing variety.

3.5 Barriers to Hazardous Waste Minimization

The largest component of the hazardous waste stream during FY13 was unused and unspent chemicals. Full or partially used bottles of chemicals or other products are sent for disposal once they have expired. If a research project is discontinued, the scientists may no longer need some of the chemicals that were allocated to that project. In some cases of project discontinuation, usable chemicals are distributed to other researchers in the same building who can use them. Through the EMS, directorates are being asked to set specific objectives and targets for chemical waste reduction.

4.0 Mixed Transuranic Waste

4.1 Introduction

MTRU waste has the same definition as TRU waste, except that it also contains hazardous waste regulated under RCRA. TRU waste contains >100 nCi of alpha-emitting TRU isotopes per gram of waste, with half-lives greater than 20 years (atomic number greater than 92), except for (1) high-level waste; (2) waste that the DOE has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by 40 CFR 191; or (3) waste that the US Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61. MTRU waste is generated during research, development, nuclear weapons production, and spent nuclear fuel reprocessing.

MTRU waste has radioactive elements such as plutonium, neptunium, americium, curium, and californium. These radionuclides generally decay by emitting alpha particles. MTRU waste also contains radionuclides that emit gamma radiation, requiring it to be either contact handled or remote handled. MTRU waste is disposed of at the Waste Isolation Pilot Plant (WIPP), a geologic repository near Carlsbad, New Mexico.

MTRU waste can be liquids, cemented residues, combustible materials, noncombustible materials, and non-actinide metals. Typically, research production materials and supplies are brought into an RCA and introduced into a glovebox. Waste leaves the glovebox as either solid or liquid. Liquid MTRU is a small percentage of total MTRU, and these wastes are primarily organic liquids. Liquid wastes are sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) for treatment. The radionuclides and other contaminants are removed as a cemented solid waste at the RLWTF and shipped to TA-54 for storage, and the remaining water is discharged to a NPDES-permitted outfall.

MTRU solid wastes are accumulated, characterized, and assayed for accountability purposes at the generation site. MTRU solid waste is packaged for disposal in metal 55-gallon drums, standard waste boxes, and oversized containers, and then this waste is shipped to TA-54 for storage. Security and safeguards assay measurements are conducted on the containers for accountability before they are removed for transport, and then the waste is certified for transport and disposal at WIPP. The waste process generation map is shown in Figure 3-1.

During FY13, MTRU waste was generated by the groups at TA-55, operations at the RLWTF, operations at the Chemistry and Metallurgy Research facility (CMR), and by the Offsite Source Recovery Program. Much of the MTRU waste shipped during FY13 was older waste that was repackaged to meet current WIPP acceptance criteria.

4.2 MTRU Waste Minimization Performance

The Laboratory shipped offsite 1172.4 m^3 of MTRU waste during FY13, which is significantly more than the 231.5 m^3 of MTRU shipped during FY12. The majority of the MTRU waste generated during FY13 was from repackaging activities. There was much more repackaging waste in FY13 than in FY12. No remediation MTRU waste was generated during FY13 or FY12. The breakdown of MTRU generation at the Laboratory by location during FY13 is shown in Table 4-1.

Table 4-1. Generation of MTRU Waste by Technical Area during FY13.

Technical Area	MTRU Waste in m^3
3	4.8
21	3.8
50	217.0
54	895.5
55	51.3

4.3 Waste Stream Analysis

MTRU wastes are generated within RCAs. These areas also are material balance areas for security and safeguards purposes. The TA-55 Plutonium Facility processes ^{239}Pu from residues generated throughout the defense complex into pure plutonium feedstock. The manufacturing and research operations performed in the processing and purification of plutonium result in the production of plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as possible. These recovery operations, associated maintenance, and plutonium research are the sources of MTRU waste generated at TA-55.

MTRU wastes, process chemicals, equipment, supplies, and some RCRA materials are introduced into the RCAs in support of the programmatic mission. Because of the hazards inherent in the handling, processing, and manufacturing of plutonium materials, all process activities involving plutonium are conducted in gloveboxes. All materials removed from the gloveboxes must be multiple-packaged to prevent external contamination. Currently, all material removed from gloveboxes is considered to be TRU or MTRU waste. Large quantities of waste, primarily solid combustible materials such as plastic bags, cheesecloth, and protective clothing, are generated as a result of contamination avoidance measures taken to protect workers, the facility, and the environment. The percentage breakdown of MTRU shipped during FY13 is shown in Figure 4-1.

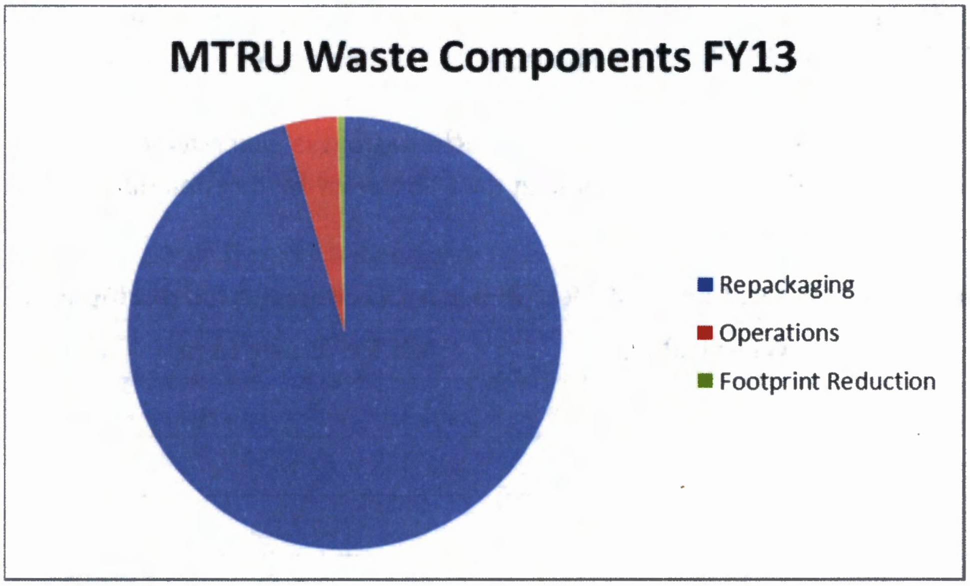

Figure 4-1. Composition of MTRU waste by volume for FY13.

Repackaging. Standards for waste acceptance at WIPP change periodically, so when this occurs, some drums of MTRU waste are repackaged to conform to new packaging standards. The waste inside the drums is old operational waste that is now packaged to meet the new standards. Over 95% of the MTRU waste shipped from the Laboratory during FY13 came from repackaging activities.

TA-55 Operations. Operational waste generated at TA-55 includes non–special nuclear material metal, plastic, cheesecloth, protective clothing, glass, filters, graphite, rubber, ceramics, ash, metals, lead-lined gloves, and a small volume of organic chemicals and oil. About 4% of the MTRU waste shipped from the Laboratory in FY13 was from TA-55 and CMR operations.

RLWTF. The RLWTF treats MTRU liquid in batches. At the end of the treatment process, the settled sludge is removed, dewatered, and then cemented in drums for disposal at WIPP. Less than 1% of the MTRU waste shipped from the Laboratory during FY13 was from cementation processes at the RLWTF.

Offsite Source Recovery. The Offsite Source Recovery Program collects radioactive sources from offsite and packages them for disposal to prevent these items from being used or disposed of improperly. These items were not originally produced at the Laboratory, but it is safer for everyone to have LANS collect and dispose of these items rather than leave them in their offsite locations. Less than 1% of the MTRU waste shipped from the Laboratory in FY13 was from the Offsite Source Recovery Program.

Footprint Reduction. In FY13, less than 1% of the MTRU waste shipped from the Laboratory came from activities related to removing old, unwanted buildings. This is known as "footprint reduction" since this work reduces the size of the Laboratory's physical footprint. The materials consist of contaminated metal, wood, and other building materials. This is a non-routine waste stream that is not always produced.

Table 4-2 below shows the changes in composition of MTRU generation at the Laboratory from FY12 to FY13.

Table 4-2. MTRU Generation in FY12 and FY13.

MTRU Component	FY12 (m^3)	FY13 (m^3)
Repackaging	189	1120.1
Operations	41.5	45.6
RLWTF	0.8	0.2
Offsite Source Recovery	0.2	0.2
Footprint Reduction	0	6.3

4.4 Mixed Transuranic Waste Minimization

Many process improvements have been identified for implementation within TA-55 and in the processing of MTRU waste after it is produced. Changes in TA-55 processes are made very slowly due to the caution involved with moving new equipment into RCAs and qualifying new processes or changes. Waste minimization projects focus on elimination of RCRA components from products and processes in operations that generate MTRU waste. MTRU waste minimization and avoidance projects are typically funded by the ENV-ES Pollution Prevention Program. The projects are described in Section 2.4.1 of this report.

The majority of MTRU waste generated in FY13 was from repackaging work. The volume of repackaging waste generated in FY13 was much higher than in FY12. The volume of repackaging waste fluctuates each year, but the volume is expected to decrease over time as less MTRU waste needs to be repackaged to meet WIPP acceptance criteria. Routine MTRU waste generated by operational activities has been reduced as a result of past Pollution Prevention activities. These activities include replacing lead with a non-hazardous substance whenever possible in items such as gloves and shielding; using non-hazardous solvents or redesigning processes to minimize chemical use whenever possible; using reusable equipment, such as Teflon-coated tubes, instead of disposable equipment; using carbon dioxide plasma for cleaning parts instead of trichloroethylene; and decontaminating equipment to prolong its useful life.

4.5 Barriers to MTRU Minimization

Packaging requirements at WIPP often make minimization efforts difficult. There are wattage and dose limits that must not be exceeded, and a very small volume of MTRU could potentially have a high wattage. All of the containers sent to WIPP are 55 gallons or larger, and often the containers have very small volumes of waste inside with the majority of the internal volume being empty space.

5.0 Mixed Low-Level Waste

5.1 Introduction

For waste to be considered MLLW, it must contain hazardous waste and meet the definition of radioactive LLW. LLW is defined as waste that is radioactive and is not classified as high-level waste, TRU waste, spent nuclear fuel, or by-product materials (e.g., uranium or thorium mill tailings). Test specimens of fissionable material irradiated only for R&D and not for the production of power or plutonium may be classified as LLW, provided that the activity of TRU waste elements is <100 nCi/g of waste.

Most of the routine MLLW results from stockpile stewardship and from R&D programs. Most of the non-routine waste is generated by off-normal events such as spills in legacy-contaminated areas. The DOE is interested in the volumes of routine and non-routine MLLW, so these materials are tracked separately. Typical MLLW items include contaminated lead-shielding bricks and debris, R&D chemicals, spent solution from analytic chemistry operations, mercury-cleanup waste, electronics, copper solder joints, and used oil. The waste process generation map is shown in Figure 3-1.

Table 5-1 shows MLLW generation by location during FY13.

Table 5-1. Generation of MLLW by Location during FY13.

Technical Area	MLLW in Cubic Meters
3	0.2
48	0.04
54	1964.2
55	1.4

Almost all of the MLLW shipped from the Laboratory during FY13 came from TA-54. Less than 1% came from TA-55 and other locations.

5.2 MLLW Waste Minimization Performance

The amount of MLLW shipped from the Laboratory during FY13 was 1965.8 m^3, which is much more than the 84 m^3 of MLLW that was generated during FY12. This total includes former MTRU waste that now qualifies as MLLW and was repackaged as such, and this was the vast majority of MLLW shipped from the Laboratory during FY13. There was no MLLW remediation waste generated during FY13, which is less than the 4.7 m^3 of MLLW remediation waste generated during FY12. Table 5-1 includes all MLLW shipped from the Laboratory during FY13.

MLLW is generated by routine programmatic work, cleanup activities, and repackaging efforts. The volume of non-routine MLLW from cleanup and repackaging efforts tends to vary significantly and often cannot be substantially minimized, so it is useful to examine the routine fraction of the MLLW waste stream separately to identify good waste minimization opportunities.

5.3 Waste Stream Analysis

Materials and equipment are introduced into an RCA as needed to accomplish specific work activities. In the course of operations, materials may become externally contaminated or become activated, thus becoming MLLW when the item is no longer needed.

MLLW is transferred to a satellite accumulation area after it is generated. Whenever possible, MLLW materials are surveyed to confirm the radiological contamination levels. If decontamination will eliminate the radiological or the hazardous component, materials are decontaminated to prevent them from becoming MLLW.

Waste classified as MLLW is managed in accordance with appropriate waste management and Department of Transportation requirements and shipped to TA-54. From TA-54, MLLW is sent to commercial and DOE-operated TSDFs.

The largest components of the MLLW stream by weight in FY13 are reclassified and repackaged MTRU, electronics, and boneyard cleanup, lead debris. Less MLLW generation is anticipated in the future as historical MTRU shipments are completed, as non-toxic materials are substituted for mercury and lead, and as oil-free vacuum pumps replace older pumps. The relative volumes of various waste streams are shown in Figure 5-1.

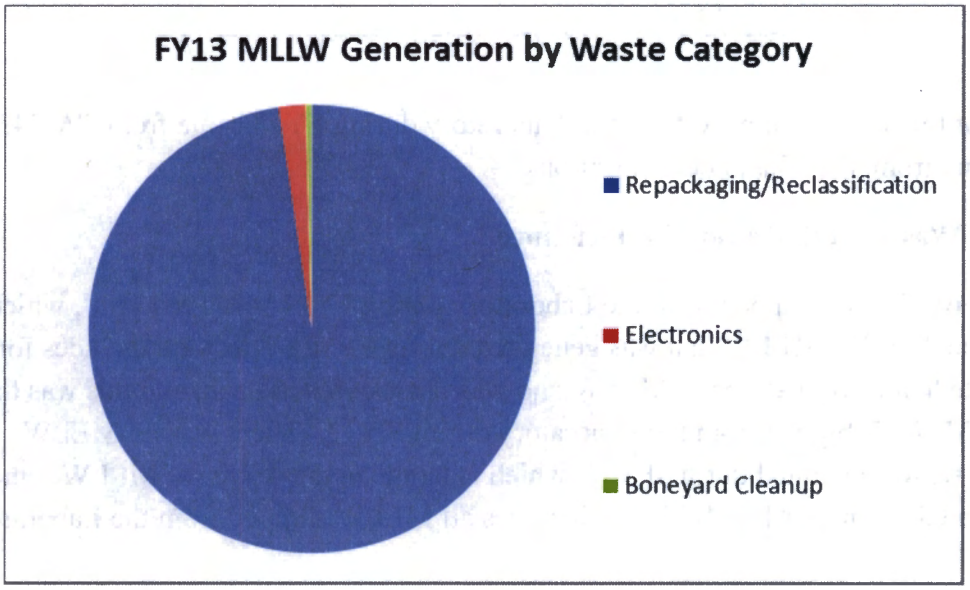

Figure 5-1. Constituents of MLLW in FY13.

Repackaging and Reclassification. This waste was formerly classified as MTRU, but as MTRU standards changed, these wastes could be reclassified and disposed of as MLLW instead. Since this waste is already generated, there are not many opportunities for minimization of this component of the MLLW stream. In FY13, the Laboratory removed from storage and processed a record amount of MTRU that was generated in past decades, and some of this waste was reclassified as MLLW. Over 97% of the MLLW shipped from LANL during FY13 was due to repackaging and reclassification.

Electronics. This waste stream includes various pieces of electronic equipment that were previously located within RCAs. In the future, RCAs will be engineered to not require electronics to be within them, and smaller electronic equipment will be used whenever possible. The Chemistry Division set up a demonstration laboratory using the smallest possible electronic equipment. More electronics were shipped from the Laboratory during FY13 than in FY12 due to the emphasis placed on cleanouts of unneeded materials during FY13.

Boneyard Cleanup. This is a one-time waste stream from the cleanup of a boneyard at TA-54. This waste stream includes old equipment and personal protective equipment that project personnel used during the cleanup.

Lead and Mercury Debris. The lead debris waste stream includes copper pipes with lead solder, lead-contaminated equipment, brass contaminated with lead, bricks, sheets, rags, electronics, and personal protective equipment contaminated with lead from maintenance activities. Mercury debris consists of bulbs, tape, rags, gloves, and glass contaminated with mercury. The volume of this waste stream is expected to decrease as lead and mercury are used for fewer applications. In FY13, all of the waste was contaminated with lead only, and no mercury debris contributed to the total.

Sludge from Radioactive Liquid Waste Treatment. Sludge is generated from the treatment of the Laboratory's radioactive liquid waste at the RLWTF, and this sludge is cemented prior to shipping for disposal.

Maintenance. This waste stream is composed of personal protective equipment, dry painting debris, spent light bulbs, and paper towels and rags.

Synthesis Waste and Chemicals. In FY13 this waste stream was composed of precipitated salts, spent solvents, aqueous solutions, unused/unspent chemicals that have become contaminated in RCAs, and analytical chemistry waste.

Oil. Used MLLW oil comes from vacuum pumps that are used within RCAs. Two pollution prevention projects in FY13 involved the purchase of oil-free pumps, which decreased the volume of MLLW oil. About 40% less MLLW oil was shipped during FY13 than in FY12.

Table 5-2 shows the changes in the composition of the MLLW stream from FY12 to FY13.

Table 5-2. MLLW Generation in FY12 and FY13.

MLLW Component	FY12 (m^3)	FY13 (m^3)
Repackaging/Reclassification	73.8	1916.7
Electronics	2.7	38.2
Boneyard Cleanup	0	8.9
Lab Trash / Maintenance	1.6	1.1
Synthesis Waste & Chemicals	0.7	0.4
RLW Sludge	0	0.2
Oil	0.25	0.15
Lead / Mercury Debris	0.7	0.1
Remediation	4.7	0

5.4 Mixed Low-Level Waste Minimization

Efforts to substitute hazardous materials with alternatives and to improve sorting and segregation of these waste streams will reduce MLLW volumes in the coming years. The Pollution Prevention Program has implemented a number of projects such as lead-free solder, bismuth shielding in RCAs instead of lead, oil-free vacuum pumps in RCAs, reduction of electronics in RCAs, and elimination of nitric acid bioassay wastes. During FY13, the Pollution Prevention Program funded projects designed to reduce the generation of MLLW waste. These projects are described in Section 2.5.1 of this report.

One especially promising project involves replacing traditional fluorescent fixtures with LED fixtures in gloveboxes. The LED lights do not contain any RCRA-regulated components, so after their useful life, they will not become MLLW as fluorescent lights do. The LEDs are much smaller and lighter than fluorescents, and the LEDs last longer, use less electricity, and generate less heat than fluorescents. From FY08 through FY13, groups at TA-55 purchased more LED lights for gloveboxes. During FY13, the Laboratory disposed of only 0.1 m^3 of fluorescent bulbs as MLLW.

5.5 Barriers to MLLW Reduction

One barrier to reducing the generation of MLLW is the DOE-imposed suspension of metals recycling from RCAs with particular postings. Previously, any scrap metal could be surveyed for radioactive contamination and released for recycling if no activity was detected. Since the suspension was imposed, scrap metal from RCAs with particular postings must be handled as waste. In particular, this suspension impacts MLLW in the area of electronics waste generation since electronic components often contain lead or other hazardous metals. Without the suspension, a larger percentage of electronics waste and lead debris could be sent for recycling.

6.0 Remediation Waste

6.1 Introduction

Section 6.0 of this report represents the WMin/PP Program awareness plan for the corrective actions component of the Associated Directorate for Environmental Programs (ADEP). This component includes the Corrective Action Program (EP-CAP) and its associated investigation, cleanup, and site closure projects.

The mission of the EP-CAP corrective actions activities is to investigate and remediate potential releases of contaminants as necessary to protect human health and the environment. These activities are implemented to comply with the requirements of a Compliance Order on Consent (hereafter, Consent Order) between the NMED, DOE, and LANS. In completing this mission, activities may generate large volumes of waste, some of which may require special handling, treatment, storage, and disposal. Because the activities involve investigating and, as necessary, conducting corrective actions at historically contaminated sites, source reduction and material substitution are difficult to implement. The corrective action process, therefore, includes the responsibility and the challenge of minimizing the risk posed by contaminated sites while minimizing the amounts of waste that will require subsequent management or disposal. Minimization is desired because of the high cost of waste management, the limited capacity for onsite or offsite waste treatment, storage, or disposal, and the desire to minimize the associated liability.

6.2 Remediation Waste Minimization Performance

No hazardous, MTRU, or MLLW remediation waste was generated at LANL during FY13. This is a reduction from the 0.6 m^3 of MLLW remediation waste and 0.8 m^3 of hazardous remediation waste generated during FY12. Project activities in FY13 involved investigations, including soil sampling and removal, storm water and groundwater monitoring, demolition of structures, aquifer pump testing, and well reconfiguration.

In January 2012, DOE and NMED entered into a framework agreement for realignment of environmental priorities at the Laboratory. In accordance with the framework agreement, resources for shipment of above ground TRU waste from TA-54 Area G to WIPP were increased in FY12 and FY13. This resulted in a commensurate decrease in resources for Consent Order investigation/remediation work by EP-CAP. As a result, there was a significant reduction in the volume of remediation waste generated in FY12, which continued into FY13.

6.3 Waste Stream Analysis

This report addresses all RCRA-regulated waste that may be generated by corrective actions during the course of planning and conducting the investigation and remediation of contaminant releases. Wastes generated include "primary" and "secondary" waste streams. Primary waste consists of generated contaminated material or environmental media that was present as a result of past DOE activities, before any containment and restoration activities. It includes contaminated building debris or soil from investigations and remedial activities. Secondary waste streams consist of materials that were used in the investigative or remedial process and may include investigative-derived waste (e.g., personal protective equipment, sampling waste, drill cuttings); treatment residues; wastes resulting from storage or handling operations; and additives used to stabilize waste. The corrective actions may potentially generate hazardous waste, MLLW, and MTRU.

The majority of FY13 waste generation was the result of investigations and monitoring and focused corrective actions. Investigations, corrective actions, and other activities associated with the Consent Order implemented during FY13 include the following:

- Investigations and corrective actions for Upper Los Alamos Canyon Aggregate Area;
- Subsurface vapor monitoring at Material Disposal Area (MDA) C;
- Plugging and abandonment of 11 obsolete monitoring wells and boreholes;
- Performance of periodic groundwater monitoring for the Chromium Investigation, General Surveillance, MDA AB, MDA C, TA-16-260, TA-21, and TA-54 monitoring groups;
- Performance of sediment monitoring in Water Canyon/Cañon de Valle and Pajarito Canyon;
- Performance of storm water monitoring throughout the Laboratory and Los Alamos townsite;
- Redevelopment of regional aquifer monitoring well R-61;
- Reconfiguration of intermediate and regional wells CdV-16-4ip, CdV-R-15-3, and CdV-R-37-2;
- Long-term pump tests of chromium plume regional wells R-28 and R-42;
- Construction of a grade control structure in Sandia Canyon; and
- Demolition of 5 structures used in the remediation of MDA B.

6.4 Remediation Waste Minimization

Waste minimization and pollution prevention were integral parts of the FY13 planning activities and field projects through recycling, reuse, contamination avoidance, risk-based cleanup strategies, and many other practices. Waste reduction benefits are typically difficult to track and quantify because the data to measure the amount of waste reduced (as a direct result of a pollution prevention activity) are often not available and are not easily extrapolated. In addition, many waste minimization practices employed during previous years are now incorporated into standard operating procedures.

The WMin/PP Program techniques used in FY13 to reduce investigation-related waste streams led to the following accomplishments:

- Dry decontamination techniques continued to be used almost exclusively during field investigations, thereby minimizing generation of liquid decontamination wastes.

- The formal procedure for land application of the groundwater extracted during well drilling, development, sampling, and rehabilitation/reconfiguration developed by the Laboratory's Water Quality team in FY08 continued to be implemented. Drilling, development, reconfiguration and purge waters constitute a major potential waste source for EP-CAP (i.e., upwards of 100,000 gal. may be produced per well). This procedure, which incorporates a decision tree negotiated with NMED, allows groundwater to be land applied if this will be protective of human health and the environment. Use of this procedure minimizes the amount of purge water that must be managed as wastewater. The volume of land-applied development water and drilling fluids from well drilling and rehabilitation is compiled and reported to NMED on a calendar-year basis. The report for calendar year 2013 will be submitted in March 2014.

- The formal procedure for land application of drill cuttings developed by the Laboratory's RCRA team in FY08 was not used in FY13 because there were no drilling activities. Drilling activities are expected to recommence in FY14 and this procedure will be re-implemented. Drill cuttings constitute a major potential source of solid wastes generated by EP-CAP. This procedure, which incorporates a decision tree negotiated with NMED, allows drill cuttings to be land applied if this will be protective of human health and the environment. These drill cuttings do not have to be managed and disposed of as waste. Additionally, land-applied drill cuttings can be beneficially reused as part of drill site restoration.

- ADEP stored and treated groundwater extracted during the long-term pump tests of chromium plume regional wells R-28 and R-42. The treated water was land applied in accordance with a temporary discharge permit granted by NMED. Treatment and the discharge permit eliminated the need for offsite treatment and disposal of the large volume of water generated in the extended pump test.

- ADEP continued to take actions during FY13 to improve integration of the EMS into remediation activities and to improve awareness of the EMS by ADEP subcontractors. These actions included flowing down EMS requirements into the environmental requirements in subcontracts and continuing environmental communications through Worker Safety and Security Teams. These activities continue to increase awareness of waste minimization requirements and opportunities by ADEP subcontractors.

Sort, Decontaminate, and Segregate

This task is currently being implemented by EP-CAP and is designed to segregate contaminated and non-contaminated soils so that non-contaminated soils can be reused as fill. These practices are implemented at sites where contaminated subsurface soils and structures are overlain by uncontaminated soils. During excavation to remove the contaminated soils and structures, the uncontaminated overburden is segregated and staged apart from contaminated materials. Following removal of the contaminated soils and structures, the overburden is tested to verify that it is nonhazardous and meets residential soil screening levels. If so, this material is used as backfill for the excavation. This practice minimizes the amount of contaminated soil that must be disposed of as waste and also minimizes the amount of backfill that must be imported from off site.

Segregation is also used to allow "contact" waste generated during investigations to be managed through the Green-is-Clean (GIC) Program, rather than disposed of as radioactive waste. During FY13, contact waste from site investigation and groundwater sampling activities continued to be managed through GIC.

Survey and Release

Past practices have conservatively classified non-indigenous investigation-derived waste (e.g., personal protective equipment, sampling materials) as contaminated, based on association with contaminated areas. New policy allows corrective actions managers and project leaders to develop procedures to survey and release these materials as non-radioactive if the survey finds no radioactivity. This reduces the volume of LLW from corrective actions activities.

Risk Assessment

Risk assessments are routinely conducted for corrective actions projects to evaluate the human health and ecological risk associated with a site. The results of the risk assessment may be used by NMED to determine whether corrective measures are needed at a site to protect human health and the environment. The risk assessment may demonstrate that it is adequately protective and appropriate or beneficial to leave waste or contaminated media in place, thus avoiding the generation of waste. Properly designed land-use agreements and risk-based cleanup strategies can provide flexibility to select remedial actions (or other technical activities) that may avoid or reduce the need to excavate or conduct other actions that typically generate high volumes of remediation waste.

As described in more detail in Section 6.5, a risk-based data evaluation procedure is now being used to determine whether extent of contamination is defined as sites being investigated by EP-CAP under the Consent Order. This approach will result in protection of human health and the environment while requiring fewer samples and generating less investigation-derived waste.

Equipment and Material Reuse

The reuse of equipment and materials (after proper decontamination to prevent cross contamination) such as plastic gloves, sampling scoops, plastic sheeting, and personal protective equipment produced waste reduction and cost savings. When reusable equipment is decontaminated, it is standard practice to use dry decontamination techniques to minimize the generation of liquid decontamination wastes.

In addition, an equipment-exchange program was initiated, which identifies surplus or inactive equipment available for use. This not only eliminates the cost of purchasing the equipment, but it also prolongs the useful life of the equipment.

During FY13, EP-CAP determined that over 70 gallons of unopened paint in storage was no longer needed for programmatic use. EP-CAP worked with other groups to identify possible users. The paint was eventually given to the New Mexico Forestry Department for their use. This prevented the Laboratory from having to dispose of this material as hazardous waste and allowed the materially to be beneficially used.

6.5 Pollution Prevention Planning

The potential to incorporate pollution prevention practices into future activities is evaluated annually as part of LANS' EMS planning efforts. As has been done in previous years, actions related to pollution prevention are being incorporated into the FY14 Environmental Action Plan for ADEP developed as part of the EMS. As appropriate, specific actions and approaches that will be incorporated into planned corrective action projects for FY14 are:

- Segregation and recycle or reuse of uncontaminated materials;
- Continued use of land application of drill cuttings and fluids;
- Waste avoidance;
- Reuse and recycling of equipment and materials;
- Increasing use of sustainable acquisition strategies;
- Replacement of paper records with electronic submittals; and
- Risk-based cleanup strategies.

Additionally, pursuant to the January 2012 Framework Agreement, DOE and NMED have agreed to increase the efficiency of cleanup activities, while maintaining protection of human health and the environment. These increased efficiencies should result in a reduction in sampling activities for future investigations, with a commensurate reduction in investigation-derived waste generation. In FY13, EP-CAP began re-evaluating sites being investigated under the Consent Order that had previously been recommended for additional Phase II sampling to define extent of contamination. Sites were re-evaluated using a risk-based approach agreed to by NMED under the Framework Agreement. The results of this effort showed that additional sampling was not required at most of these sites and that the remaining sites require fewer samples than originally recommended. As a result, future Phase II investigation activities will result in generation of substantially less waste.

To help improve the implementation of waste minimization activities, ADEP ensures communication of environmental issues to project participants. Environmental issues are and will continue to be integrated into routine project communications to increase awareness about waste minimization and promote sharing of lessons learned.

6.6 Barriers to Remediation Waste Minimization

In years when remediation waste is generated, levels of waste minimization achieved fell below potentially achievable levels based on site conditions. Examples follow:

- In order to allow for the possible future transfer of property from DOE ownership, some sites have been cleaned up to residential levels even though that is not the current land use (e.g., MDA B). The use of the more stringent residential cleanup levels has resulted in generation of a larger volume of waste than if the sites had been cleaned up based on current land use.

- The single largest potential source of waste generated by corrective actions is removal of buried waste or contaminated soil during implementation of corrective measures. Such actions have the potential to generate thousands of cubic meters of waste. In evaluating corrective measure alternatives, corrective action program and project leaders generally give preference to alternatives that would avoid generating large volumes of waste, provided they are protective of human health and the environment. The consideration of other factors by external stakeholders, however, may result in selection of an alternative that generates more waste than the alternative recommended by the Laboratory.