**Department of Energy**
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

MAR 3 1 1997

Hand Delivered By E. Horst 3/31/97

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Benito Garcia, Bureau Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street, Bldg. A
P. O. Box 26110
Santa Fe, NM 87505

Dear Mr. Garcia:

Subject: Transmittal of Los Alamos National Laboratory (LANL) Fiscal Year 1996 (FY 96) Site Treatment Plan (STP) Annual Update

The purpose of this letter is to provide the subject documents to the New Mexico Environment Department (NMED) in response to the requirements of the Federal Facility Compliance Order (FFCO), Section VII, *Annual Site Treatment Plan Updates*. The LANL FY 96 STP *Annual Update* is provided in two volumes. Enclosure A is LANL's *Background Volume (BV) Update* for FY 96. Enclosure B is LANL's *Compliance Plan Volume (CPV) Update* for FY 96.

These documents were drafted by the Department of Energy and the University of California in accordance with the requirements of Section VII, *Annual Site Treatment Plan Updates*, of the FFCO. A request to revise the FFCO to incorporate the changes in covered waste volumes discussed herein into the LANL CPV, in accordance with the requirements of Section X.C.2, *Revisions*, is presented as a separate transmittal.

A Certification Statement is enclosed. LANL's records and documents related to these submittals are available to NMED's staff upon request. We would be happy to discuss the information contained in this FY 96 STP *Annual Update* with you at your earliest possible opportunity, and we request that you inform us immediately should you have any concerns regarding our timely and full compliance with FFCO requirements. Please contact me at (505) 665-5042 or Ken Hargis at (505) 667-2347 if you have any questions.

Sincerely,

H. L. "Jody" Plum
Office of Environment and Projects

LAAMEP:3JP-037

Enclosures

cc:
See page 2

1838

MAR 3 1 1997

**CERTIFICATION**
**TRANSMITTAL OF SITE TREATMENT PLAN (STP) FY96 ANNUAL UPDATE, LOS ALAMOS NATIONAL LABORATORY (LANL), FEDERAL FACILITY COMPLIANCE ORDER (FFCO)**

I certify that I am the project manager responsible for overseeing the implementation of the Site Treatment Plan for the Los Alamos National Laboratory. To the best of my knowledge and belief, the information in this document is true, accurate, and complete.

Kenneth M. Hargis — 3/31/97

Kenneth M. Hargis
Manager of Operations
Waste Management Program
Environmental Management Programs
Los Alamos National Laboratory
Operator

Date Signed

3/31/97

H. L. Plum
Regulatory Permitting and Compliance Manager
Los Alamos Area Office
U.S. Department of Energy
Albuquerque Operations
Owner/Operator

Date Signed

MAR 3 1 1997

cc w/enclosures:
Ms. Janice Archuleta
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
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P. O. Box 26110
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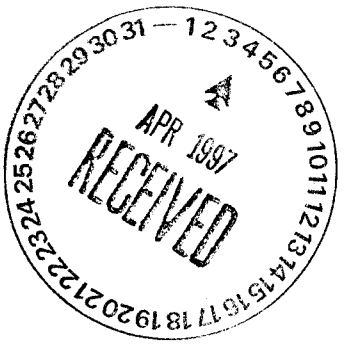

# ENCLOSURE A

# Los Alamos National Laboratory

# Federal Facility Compliance Order

# Annual Site Treatment Plan Update for Fiscal Year 1996 Background Volume

March 31, 1997

Los Alamos
NATIONAL LABORATORY

# TABLE OF CONTENTS

## TABLES

## ACRONYMS

| | |
|---|---|
| BIRD | Transuranic Waste Baseline Inventory Report (see also TWBIR) |
| BV | Background Volume |
| CY | Calendar Year |
| CHEAPER | Chemical Exchange Assistance Program and External Recycling |
| CCA | Compliance Certification Application |
| CPV | Compliance Plan Volume |
| CRD | Cylinder Recontainerization Device |
| DOE | Department of Energy |
| DOE/AL | DOE Albuquerque Operations Office |
| DSSI | Diversified Scientific Services, Inc. |
| EM | Environmental Management |
| EPA | Environmental Protection Agency |
| FFCAgreement | EPA Federal Facility Compliance Agreement |
| FFCAct | Federal Facility Compliance Act |
| FFCO | Federal Facility Compliance Order |
| FY | Fiscal Year |
| GJPO | Grand Junction Project Office |
| HEPA | high-efficiency particulate air |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| IDB | Integrated Data Base |
| IPAs | Isopropyl Alcohols |
| LANL | Los Alamos National Laboratory |
| LAPRE II | Los Alamos Power Reactor Experiment No. II |
| LDRs | Land Disposal Restrictions (RCRA) |
| LWAA | Land Withdrawal Act Amendments |
| LLW | Low-Level Waste |
| MEO | Mediated Electrochemical Oxidation |
| MTU | Mobile Treatment Unit |
| MLLW | Mixed Low-Level Waste |
| MTRU | Mixed Transuranic |
| MWIR | Mixed Waste Inventory Report |
| MWTP | Mixed Waste Treatment Plan |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emissions Standards for Hazardous Air Pollutants |
| NMED | New Mexico Environment Department |
| NMVP | No-Migration Variance Petition |
| NFS | Nuclear Fuel Services Inc |

| | |
|---|---|
| NSSI | Nuclear Support Services, Inc. |
| ORNL | Oak Ridge National Laboratory |
| OR | Oak Ridge Operations Office |
| PCB | Polychlorinated Biphenyl |
| QA/QC | Quality Assurance/Quality Control |
| RLWTP | Radioactive Liquid Waste Treatment Plant |
| RCRA | Resource Conservation and Recovery Act |
| RD&D | Research, Development, and Demonstration |
| RLWTF | Radioactive Liquid Waste Treatment Facility |
| S&A | Sampling and Analysis |
| SRS | Savannah River Site |
| SEG | Scientific Ecology Group, Inc. |
| SSD | Sort, Survey, and Decontamination |
| STP | Site Treatment Plan |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TRU | Transuranic |
| TSCA | Toxic Substances Control Act |
| TWBIR | Transuranic Waste Baseline Inventory Report |
| UC | University of California |
| WERF | Waste Experimental Reduction Facility |
| WIPP | Waste Isolation Pilot Plant |

## EXECUTIVE SUMMARY

The Los Alamos National Laboratory (LANL) Site Treatment Plan (STP) Fiscal Year 1996 (FY96) Update (Update) has been prepared in accordance with the requirements of Section VII, "*Annual Site Treatment Plan Updates*," of the October 4, 1995, Federal Facility Compliance Order (FFCO) (1). The FFCO issued by the New Mexico Environment Department (NMED) requires compliance by the Department of Energy (DOE) and its management and operating contractor, the University of California (UC) Regents (Respondents), with regulatory requirements for the treatment of covered mixed waste at LANL. By definition, the STP refers to both the Background Volume (BV) and the Compliance Plan Volume (CPV).

This FY96 Update consists of two volumes: the BV Update and the CPV Update. Unless otherwise specified, its focus is on FY96 (October 1, 1995, through September 30, 1996), as required by Section VII of the FFCO.

### Background Volume Update

Section 2.0 of the BV Update brings the STP BV current to the end of the previous federal fiscal year with respect to

- the inventory of covered waste in storage at the end of FY96 and projections of the inventory of covered waste expected to be placed into storage for the next five FYs;
- progress reports on treatment and treatment technology development;
- a report on the funding of STP-related activities;
- the status of the Waste Isolation Pilot Plant (WIPP) "No-Migration Variance Petition," which is the only treatment variance potentially applicable to LANL's covered waste for which a petition had been pending when the FFCO was issued; and
- a progress report for the treatment of mixed transuranic (MTRU) waste intended for disposal at the WIPP.

#### *Covered Waste*

It should be noted that the inventory presented in the Final STP (October 4, 1995) was for mixed low level waste (MLLW) in storage before October 1, 1994 and MTRU in storage before December 1992, regardless of its time of generation or its state of compliance with the Land Disposal Restrictions (LDRs) storage requirements. In addition, some wastes reported in the FY95 Update were in the LANL mixed waste inventory at that time, but inadvertently had been omitted from the final STP inventory. All such untreated waste now meets the definition of "covered waste" in the FFCO. This Update repeats the

information presented in the FY95 Update on changes from the Final STP inventory during FY95, and describes changes to the covered waste inventory that occurred in FY96. Mixed waste that was generated in FY96 is not included in this FY96 update, because it is not a covered waste under the FFCO until it no longer complies with the LDR 1-year storage limitation.

Because other documents published by the DOE require different reporting parameters and periods, the volumes of covered waste reported in this Update may not be the same as the volumes of LANL's mixed waste reported in other documents, such as the "*1995 Hazardous Waste Report for Los Alamos National Laboratory, Volumes I and II,*" (2) (LANL's Biennial Report) and the *DOE Transuranic Waste Baseline Inventory Report* (TWBIR or BIRD) (3). Table ES-1 summarizes the changes in the MLLW covered waste inventory occurring in FY96. Table ES-2 shows the volume of MTRU covered waste currently in storage as of the end of FY96 and CY96.

## Table ES-1. Volume Totals and Changes for MLLW

| Total Volumes | FY95 | FY96 |
|---|---|---|
| Total STP reported volume | 608.6 $m^3$ | --- |
| Total covered waste in storage at end of FY | 608.9 $m^3$ | 584.1 $m^3$ |
| **Volume Changes (+/-)** | | |
| Volume treated in treatability studies | -0.22 $m^3$ | -1.20 $m^3$ |
| Decontaminated and released | -37.92 $m^3$ | --- |
| Received from FY95 LD200 effort | +38.34 $m^3$ | --- |
| Waste volume omitted from original STP inventory | --- | +4.20 $m^3$ |
| Newly generated waste that became covered waste at end of FY | --- | +51.34 $m^3$ |
| Volume shipped off-site | -2.24 $m^3$ | -79.22 $m^3$ |
| Volume increase for waste that was inadvertently omitted from the original STP inventory | +2.36 $m^3$ | --- |

**Note:* *In the FY95 Annual Update, LANL inadvertently failed to report on a treatability study conducted in FY95 on electrochemical treatment (See Section 2.2.1 of FY96 BV Update).*

MAR 3 1 1997

## Table ES-2. MTRU Covered Waste Volumes

| Waste Treatability Group | EPA Code | Estimated Volume (m3) End of FY 96 | Estimated Volume(m3) End of CY 96 | Projections Volume(m3) CY97-CY01 |
|---|---|---|---|---|
| Solidified Inorganic and Organic Solids | D006,D007,D008, D019,D021,D039, F001,F002,F003 | 1,598.29 | 1,598.29 | 20.86 |
| Metallic Waste | D004,D006,D007, D008,D009,D019, D040 | 1,684.47 | 1,684.47 | 118.6 |
| Glass Waste | D008,D009,D019, D040 | 89.65 | 89.86 | 0.0 |
| Non-Combustible Waste | D008 | 947.09 | 947.09 | 0.0 |
| Combined Combustible and Non-Combustible Waste | D008,F001,F002 | 449.20 | 449.20 | 166.65 |
| Combustible Waste | D007,D008,D019, D040,F001,F002, U080 | 1,052.41 | 1,052.41 | 76.9 |
| Absorbed Organic | | 2.70 | 2.70 | 0.0 |
| Cemented Process Sludge | D007,D008,D009, D019,F001,F002, F005 | 156.57 | 156.57 | 83.0 |
| Leaded Glovebox Gloves | D008 | 1.46 | 1.46 | 2.1 |
| **Total** | | **5,981.84** | **5,982.05** | **447.25** |

***Treatment Progress and Treatment Technology Development***

Despite funding drawbacks, treatment technology development at LANL during FY96 continued to a limited extent, but the use of off-site treatment has continued to be the primary focus of the DOE at LANL. Technology development at other DOE Albuquerque Operations Office (DOE/AL) sites focused on the design or fabrication of mobile treatment units (MTUs). This work continued to a limited extent under the *AL Mixed Waste Treatment Plan* (MWTP) (4).

Since the FY95 Annual Update was issued, the availability of commercial off-site treatment and disposal capacity for MLLW has continued to increase, and other sites in the DOE complex have been aggressively pursuing the development and permitting of mixed waste treatment facilities that offer viable treatment options for many covered wastes in the LANL STP. Commercial and non-commercial off-site treatment facilities are being used to treat appropriate waste streams, well in advance of their compliance activity due dates. During FY96 off-site shipment provided cost and time savings as compared to fabricating, permitting, and operating mobile treatment units (MTUs) onsite

at LANL, as was originally planned. DOE and UC are continuing to evaluate commercial and DOE off-site treatment facilities, as they become available, for their appropriateness to treat LANL's covered waste.

Table ES-3 shows a summary of treatment progress in FY96 and the current status of treatment technology development.

## Table ES-3. Summary of Treatment Progress and Status*

| Treatment Technology | Status as of February 1997 |
|---|---|
| Evaporative Oxidation (MWIR Treatment ID GJ-S801C) | Replaced by off-site treatment capability |
| Thermal Desorption (MWIR Treatment ID GJ-S801B) | DOE funding to proceed with the fabrication of the unit has been cut in FY97 due to budget reductions and the availability of other likely treatment options. |
| Macroencapsulation (MWIR Treatment ID PX-S803) | Replaced by off-site treatment capability; SNL/NM is evaluating an on-site epoxy resin treatment process |
| Lead Decontamination Trailer (MWIR Treatment ID LA-S0001) | Operational |
| Chemical and Plating Waste Skid (MWIR Treatment ID LA-S004) | Bench-scale unit in place |
| Hydrothermal Processing | Replaced by off-site treatment capability |
| Detox Process | Currently looking at feasibility of off-site treatment |
| Gas Cylinder Recontainerization (MWIR Treatment ID LA-S801) | Currently looking at feasibility of off-site treatment |
| Gas Cylinder Scrubbing Skid (MWIR Treatment ID LA-S801) | Currently looking at feasibility of off-site treatment |
| Reactive Waste Treatment Skid (MWIR Treatment ID LA-S003) | Currently looking at feasibility of off-site treatment |
| Amalgamation of Mercury (MWIR Treatment ID PI-S801) | Replaced by off-site treatment capability; SNL/NM has developed a bench-scale amalgamation process |
| Sort, Survey, and Decontamination (MWIR Treatment ID GJ-S804) | Initiated in June 1995, the project was ongoing as of the end of FY96. |
| Distillation of Mercury (MWIR Treatment ID LA-S701) | Bench-scale tests were conducted in FY95 to demonstrate radionuclide removal efficiencies; analytical results are pending; no activity during FY96. |
| Packed Bed Reactor and Silent Plasma Discharge (MWIR Treatment ID LA-S801) and technology adaptation | Currently looking at feasibility of off-site treatment; DOE/AL has postponed further development of the PBS/SPD; LANL RD&D permitted unit was not used during FY96, currently undergoing closure. |
| Waste Work off | See Table ES-1 |

**Note: The table shows the status as of February 1997; during FY96 the DOE focused aggressively on off-site treatment (see Sections 2.2.2, 2.3, and 2.4 of the BV Update).*

### *Funding*

Funding to implement the LANL Site Treatment Plan for mixed waste during FY96 was sufficient to meet all compliance dates required by the STP as issued on October 4, 1995. Funding was reduced for development of mobile treatment units at LANL, but DOE's resources were directed at shipment of mixed waste off site for treatment and disposal. Funding during FY97 is also sufficient to meet all compliance dates established in the STP for FY97, and projected funding for FY98 should again allow all compliance dates in the STP to be met during FY98. Should funding reductions occur that would affect STP compliance dates, the Respondents will notify the NMED.

### *TRU Waste Characterization and Treatment*

As the result of the WIPP Land Withdrawal Act Amendments (LWAA) of 1996, a No Migration Variance Petition is no longer required at WIPP, and the EPA has terminated its review of DOE's No-Migration Variance Petition (5). To date, the DOE has met its schedule for submittal of regulatory documents related to opening WIPP. No treatment variances for WIPP were requested or granted in FY96.

At the WIPP facility, no capabilities for characterizing TRU waste for hazardous waste constituents or treatment of MTRU to meet the LDR standards were developed, or planned to be developed, as of the end of FY96. No treatment technologies for MTRU waste had been developed at LANL as of the end of FY96.

## *Compliance Plan Volume Update*

Section 2.0 of the CPV Update includes a description of revisions and amendments involving compliance date changes that were proposed or approved in FY96. Section 3.0 is provided for the purpose of describing deletions of STP waste, in accordance with the requirements in Section IX (*Deletion of Waste*) of the FFCO, that were proposed or approved in FY96. Section 4.0 discusses additions of new covered waste in accordance with the requirements in Section VIII (*Addition of New Covered Waste*), that were proposed or approved in FY96. Section 5.0 is provided for the purpose of describing any other changes to the overall schedule in the CPV of the STP that were proposed or approved in FY96. Section 6.0 is provided for the purpose of describing any planned changes to the STP that were proposed or approved since the end of FY96.

## 1.0 INTRODUCTION

On October 4, 1995, the New Mexico Environment Department (NMED) issued a Federal Facility Compliance Order (FFCO) to the Department of Energy (DOE) and its management and operating contractor, the University of California (UC) Regents, requiring Los Alamos National Laboratory (LANL) to implement the Site Treatment Plan (STP) for the treatment of mixed waste. The FFCO contains many provisions for implementation of the STP. Section VII of the FFCO requires LANL to submit an Annual Site Treatment Plan Update (Update) to the NMED each year on or before March 31.

This Background Volume Update is provided to bring the information in the STP Background Volume (BV) current to the end of the previous federal fiscal year as required by the FFCO. It provides information about changes to the LANL program for mixed waste treatment that occurred in FY96 (October 1, 1995, through September 30, 1996). This BV Update includes the following:

- updates to the inventory of covered waste in storage at the end of the previous fiscal year and projections of the inventory of covered waste expected to be placed into storage for the next five fiscal years;
- progress reports on treatment and treatment technology development;
- a report on the funding of STP-related activities;
- the status of any treatment variances being applied for; and
- a progress report for the treatment of mixed transuranic waste (MTRU) capabilities at the DOE Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico.

Section 2.1 of the BV Update focuses on changes to the inventory of covered waste in storage at LANL during FY96, and brings the inventory information current to the end of FY96. Section 2.1 also contains estimates of the volume of covered waste anticipated to be placed into storage in the next five FYs, i.e., covered waste to be placed in the STP inventory from FY97 through FY01. Mixed waste that is expected to be treated before it becomes a covered waste under the FFCO will not be reflected in this Update.

Section 2.2 of the BV Update presents a progress report on treatment progress and treatment technology development for each treatment technology specified in the original STP. Section 2.3 discusses any anticipated alternative technology that is being evaluated for use in place of the treatment technologies or capacities identified in the STP, in particular, potential alternative commercial treatment and off-site DOE treatment capacity or technology that has become available since the end of FY96. Section 2.4 describes LANL's funding expectations for STP-related activities and funding issues that may

affect the schedule. Section 2.5 discusses the status of the "No-Migration Variance Petition" that DOE had submitted for the WIPP. No other treatment variances are in progress. Section 2.6 provides a progress report on DOE's plans regarding characterization and/or treatment capabilities for treating MTRU at WIPP.

The FFCO also requires that the Update bring the STP Compliance Plan Volume (CPV) current to the end of the previous federal fiscal year. It describes revisions or amendments requested or granted in that FY that change the compliance dates, add or delete treatability groups, or in any other way change the schedules of the STP. The STP CPV update requirements are addressed in a separate volume, "*Annual Site Treatment Plan Update for Fiscal Year 1996, Compliance Plan Volume*" (CPV Update).

## 2.0 BACKGROUND VOLUME UPDATE

### 2.1 Inventory Report

The following Inventory Update Summary Tables (Tables 2-1 and 2-2) present a summary of LANL covered waste streams by treatability groups for mixed low-level waste (MLLW) and MTRU, respectively. The volumes given in Table 2-1 reflect changes to the individual treatability group volumes due to increases or decreases, as noted. As stated previously, mixed waste that was generated in FY96 is not reported in this Section, because it was not a covered waste subject to the FFCO as of September 30, 1996. See Section 6.0 of the CPV Update for a description of the associated revision request, which is being submitted to NMED concurrently with this Annual Update.

In general, **increases** may be attributed to:

- addition of waste that became covered waste since preparing the Mixed Waste Inventory Report ([MWIR], which served as the basis for the covered waste inventories reported in the original STP);

- reassignment of covered waste from one existing treatability group to another existing treatability group (not done during FY96), based on LANL's ongoing reevaluation of new or existing data;

- reassignment of covered MTRU waste to new treatability groups, based on LANL's ongoing reevaluation of new or existing data;

- correction of inaccurate volume information;

- addition of waste in inventory before October 1, 1995, that was inadvertently omitted from the STP inventory; or

- addition of waste that became covered waste during FY96.
-

**Decreases** may be attributed to:

- shipment of waste to an off-site facility for treatment;
- treatment of waste in a treatability study;
- other compliant management activity, such as recycling;
- reassignment of covered waste to another existing treatability group, based on reevaluation of new or existing data;
- reassignment of covered MTRU waste to new treatability groups, based on LANL's ongoing reevaluation of new or existing data;
- correction of inaccurate volume information;
- removal of waste from the inventory prior to the issuance of the FFCO, based on the reasons noted in the tables; or
- reclassification of waste as either hazardous waste or LLW based on new or improved data.

### 2.1.1 MLLW Inventory Summary

The increases in covered waste inventory as of the end of FY96 are attributable primarily to waste that was newly generated in FY95, which was not treated within 12 months of generation, thereby becoming covered waste during FY96. The decreases reflect the treatment and disposal of covered waste inventory at off-site commercial and off-site DOE facilities during FY96, and the treatment of covered wastes in on-site and off-site treatability studies during FY96. In addition, a small volume of waste treated in an on-site treatability study during FY95 is also reflected as a FY96 decrease, because it was inadvertently omitted from the March 1996 FY95 Annual Update (6).

Information on FY95 changes to LANL's covered MLLW Inventory, presented in the FY95 Annual Update, are repeated here for informational purposes only, so the reader can track all changes in the LANL covered waste inventory that have occurred between October 4, 1995 and the end of FY96. See Section 6.0 of the CPV Update for a description of the associated revision request, which is being submitted to NMED concurrently with this Annual Update.

# Table 2-1. FY96 MLLW Inventory Update Summary

| CPV Sec. | MWIR Waste ID and Treatability Group | CPV Vol. (m³)[a] | FY95 Changes (Covered Waste) (m³)[b] | Explanation for FY95 Change | Covered Vol. End of FY95 (m³) | FY96 Changes (Covered Waste) (m³)[b] | Comment | Covered Vol. End of FY96 (m³) | Projection FY97-FY01 (m³) |
|---|---|---|---|---|---|---|---|---|---|
| 3.1.1 | LA-W901<br>IPA Wastes | 15.89 | NC[c] | | 15.89<br>15.87+<br>4.11 = 19.98 | Increased 4.07[d]<br>Decreased 19.98 | Waste volume incorrectly reported in original STP inventory<br>Shipped off-site for treatment at commercial or DOE facilities during FY96 | 0.02 | 0.0 |
| 3.1.1 | LA-W902<br>Scintillation Fluids | 2.47 | Decreased 2.24 | Commercially treated in FY95 | 0.23 | Increased 0.13[d]<br>Decreased 0.36[d] | Waste volume incorrectly reported in original STP inventory<br>Shipped off-site for treatment at commercial or DOE facilities during FY96 | 0.0038[g] | 0.0 |
| 3.1.2 | LA-W903<br>Lead Blankets | 0.74 | NC | | 0.74 | Decreased 0.74 | Shipped off-site for treatment at commercial facility during FY96 | 0.00 | 0.0 |
| 3.1.2 | LA-W904<br>Soil with Heavy Metals | 10.53 | NC | | 10.53 | Increased 0.11 | Waste that was newly generated in FY95 that became covered waste in FY96 | 10.64 | 0.5 |
| 3.1.2 | LA-W905<br>ER Soils | 39.32 | NC | | 39.32 | Decreased 39.32 | Shipped off-site for treatment or disposal at commercial facility during FY96 | 0.00 | 0.0 |
| 3.1.3 | LA-W906<br>Aqueous Organic Liquids | 1.65 | Increased 0.43 | Inadvertently omitted from STP | 2.08 | Increased 3.62 | Waste that was newly generated in FY95 that became covered waste in FY96 | 5.70 | 18.1 |
| 3.1.4 | LA-W911<br>Organic-Contaminated Combustible Solids | 28.32 | Decreased 0.11<br>Increased 0.17 | Treated in treatability study in FY95<br>Inadvertently omitted from STP | 28.38 | Increased 5.24<br>Decreased 0.11 | Waste that was newly generated in FY95 that became covered waste in FY96<br>Shipped for treatment in on-site treatability study during FY96 | 33.51 | 26.2 |

| CPV Sec. | MWIR Waste ID and Treatability Group | CPV Vol (m³) | FY95 Changes Covered Waste (m³) | Explanation for FY95 Change | Covered Vol End of FY95 (m³) | FY96 Changes Covered Waste (m³) | Comments | Covered Vol End of FY96 (m³) | Projection FY97-FY01 (m³) |
|---|---|---|---|---|---|---|---|---|---|
| 3.1.4 | LA-W919<br>Organic-Contaminated Noncombustible Solids | 7.82 | Decreased 0.11<br><br>Increased 0.001 | Treated in treatability study in FY95<br><br>Inadvertently omitted from STP | 7.71 | Increased 9.58 | Waste that was newly generated in FY95 that became covered waste in FY96 | 17.29 | 47.9 |
| 3.1.5 | LA-W912<br>Combustible Debris | 13.82 | NC | | 13.82 | Increased 0.28 | Waste that was newly generated in FY95 that became covered waste in FY96 | 14.10 | 1.4 |
| 3.1.5 | LA-W921<br>Activated or Inseparable Lead | 15.60 | Decreased 7.42<br><br>Increased 10.11 | Decontaminated and released in FY95<br><br>Received from LD200 effort | 18.29 | Increased 2.29<br><br>Decreased 12.45 | Waste that was newly generated in FY95 that became covered waste in FY96<br><br>Shipped for off-site treatment at commercial facility during FY96 | 8.13 | 11.5 |
| 3.1.5 | LA-W922<br>Noncombustible Debris | 5.62 | Decreased 0.0002<br><br>Increased 1.25 | Treated in treatability study in FY95<br><br>Inadvertently omitted from STP<br>WRONG see REV 5 | 6.87 | Increased 21.04 | Waste that was newly generated in FY95 that became covered waste in FY96 | 27.91 | 105.2 |
| 3.1.6 | LA-W913<br>Aqueous Wastes with Heavy Metals | 1.85 | NC | | 1.85 | Increased 0.15<br><br>Decreased 0.030<br><br>Decreased 0.32 | Waste that was newly generated in FY95 that became covered waste in FY96<br><br>Shipped for treatment in on-site treatability study during FY95<br><br>Shipped for treatment in on-site | 1.65 | 0.8 |

| CPV Sec. | MWIR Waste ID and Treatability Group | CPV Vol. (m³) | FY95 Changes Covered Waste (m³) | Explanation for FY95 Change | Covered Vol. End of FY95 (m³) | FY96 Changes Covered Waste (m³) | Comments | Covered Vol. End of FY96 (m³) | Projection FY97-FY01 (m³) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | treatability study during FY96 | | |
| 3.1.6 | LA-W914<br>Corrosive Solutions | 1.36 | Increased 0.04 | Inadvertently omitted from STP | 1.40 | Increased 0.08<br><br>Decreased 0.67 | Waste that was newly generated in FY95 that became covered waste in FY96<br><br>Shipped for treatment in on-site treatability study during FY96 | 0.81 | 0.4 |
| 3.1.6 | LA-W915<br>Aqueous Cyanides, Nitrates, Chromates, and Arsenates | 0.13 | Decreased 0.0003<br><br>Increased 0.02 | Treated in treat-ability study in FY95<br><br>Inadvertently omitted from STP | 0.15 | Increased 0.02<br><br>Decreased 0.0002<br><br>Decreased 0.0031 | Waste that was newly generated in FY95 that became covered waste in FY96<br><br>Shipped for treatment in on-site treatability study during FY95<br><br>Shipped for treatment in on-site treatability study during FY96 | 0.17 | 0.1 |
| 3.1.7 | LA-W916<br>Water-Reactive Wastes | 6.03 | Increased 0.02 | Inadvertently omitted from STP | 6.05 | Increased 0.01 | Waste that was newly generated in FY95 that became covered waste in FY96 | 6.06 | 0.05 |
| 3.1.8 | LA-W917<br>Compressed Gases Requiring Scrubbing | 0.35 | NC | | 0.35 | NC | | 0.35 | 0.0 |
| 3.1.9 | LA-W918<br>Compressed Gases Requiring Oxidation | 0.08 | NC | | 0.08 | Increased 0.01 | Waste that was newly generated in FY95 that became covered waste in FY96 | 0.09 | 0.0 |
| 3.1.10 | LA-W920<br>Elemental Mercury | 0.50 | NC | | 0.50 | Increased 0.02 | Waste that was newly generated in FY95 that became covered waste in FY96 | 0.52 | 0.1 |

| CPV Sec. | MWIR Waste ID and Treatability Group | CPV Vol. ($m^3$) | FY95 Changes Covered Waste ($m^3$) | Explanation for FY95 Change | Covered Vol. End of FY95 ($m^3$) | FY96 Changes Covered Waste ($m^3$) | Comments | Covered Vol. End of FY96 ($m^3$) | Projection FY97-FY01 ($m^3$) |
|---|---|---|---|---|---|---|---|---|---|
| 3.2.1 | LA-W907<br>Halogenated Organic Liquids | 16.58 | Increased 0.04 | Inadvertently omitted from STP | 16.62 | Increased 0.45<br><br>Decreased 0.0025 | Waste that was newly generated in FY95 that became covered waste in FY96<br><br>Shipped for treatment in on-site treatability study during FY96 | 17.07 | 2.3 |
| 3.2.1 | LA-W908<br>Nonhalogenated Organic Liquids | 14.34 | Increased 0.08 | Inadvertently omitted from STP | 14.42 | Increased 2.83 | Waste that was newly generated in FY95 that became covered waste in FY96 | 17.25 | 14.2 |
| 3.2.1 | LA-W909<br>Bulk Oils | 3.75 | NC | | 3.75 | Increased 2.28 | Waste that was newly generated in FY95 that became covered waste in FY96 | 6.03 | 11.4 |
| 3.2.1 | LA-W910<br>PCB Wastes with RCRA Components | 0.74 | NC | | 0.74 | NC | | 0.74 | 0.0 |
| 3.2.1 | LA-W923<br>Inorganic Solid Oxidizers | 0.20 | Increased 0.32 | Inadvertently omitted from STP | 0.52 | Decreased 0.087 | Shipped for treatment in off-site treatability study during FY96 | 0.43 | 0.2 |
| 3.3 | LA-W924<br>Lead Wastes - TBD | 51.44 | Decreased 11.28 | Decontaminated and released in FY95 | 40.16 | NC | | 40.16 | 0.0 |
| 3.3 | LA-W925<br>Mercury Wastes - TBD | 18.30 | NC | | 18.30 | Increased 1.52 | Waste that was newly generated in FY95 that became covered waste in FY96 | 19.82 | 7.6 |
| 3.3 | LA-W926<br>Compressed Gases - TBD | 1.25 | NC | | 1.25 | NC | | 1.25 | 0.0 |
| 3.3 | LA-W927<br>Biochemical Laboratory Wastes | 1.34 | NC | | 1.34 | NC | | 1.34 | 0.0 |

| CPV Sec. | MWIR Waste ID and Treatability Group | CPV Vol. ($m^3$) | FY95 Changes Covered Waste ($m^3$)[a] | Explanation for FY95 Change | Covered Vol. End of FY95 ($m^3$) | FY96 Changes Covered Waste ($m^3$)[b] | Comments | Covered Vol. End of FY96 ($m^3$) | Projection FY97-FY01 ($m^3$) |
|---|---|---|---|---|---|---|---|---|---|
| 3.3 | LA-W928<br>Dewatered Treatment Sludge | 268.17 | NC | | 268.17 | NC | | 268.17<br>when Rev 2? | 0.0 |
| 3.4.1 | LA-W930<br>Lead for Surface Decontamination | 56.20 | Decreased 14.64<br><br>Increased 22.50 | Decontaminated and released in FY95<br><br>Received from LD200 effort | 64.06 | Increased 1.25 | Waste that was newly generated in FY95 that became covered waste in FY96 | 65.31 | 6.3 |
| 3.4.2 | LA-W929<br>Nonradioactive or Suspect Waste Items to be Surveyed | 14.24 | ~~Decreased 0.002~~ WRONG - see Rev 5<br><br>Increased 0.00002 | ~~Decontaminated and released in FY95~~<br><br>Inadvertently omitted from STP | ~~14.24~~ | Decreased 0.00094<br><br>Decreased 0.0029 | Shipped for treatment in on-site treatability study during FY95<br><br>Shipped for treatment in on-site treatability study during FY96 | 14.24 | 0.0 |
| None[d] | LA-W931<br>Lead Requiring Sorting | 9.97 | Decreased 4.58<br><br>Increased 5.73 | Decontaminated and released in FY95<br><br>Received from LD200 effort | 11.12 | Increased 0.44<br><br>Decreased 6.36 | Waste that was newly generated in FY95 that became covered waste in FY96<br><br>Shipped for off-site treatment at commercial facility during FY96 | 5.20 | 2.2 |
| None[e] | LA-W932<br>Explosives | 0.0 | NC | | ---------- | NC | | 0.0 | 0.0 |
| None[e] | LA-W933<br>Lab Packs | 0.0 | NC | | ---------- | Increased 0.13 | Waste that was newly generated in FY95 that became covered waste in FY96 | 0.13 | 0.8 |

## NOTES TO TABLE

[a]These changes in FY95 covered waste volume are based on waste work-off and corrections to data errors that occurred prior to the issuance of the FFCO/STP.

[b]These changes in FY96 covered waste volume are based on inclusion of FY95 newly generated waste and waste work-off during FY96.

[c]NC means No Change in the covered waste inventory.

[d]The volume changes for LA-W901 and LA-W902 in FY96 are based on current data in LANL's waste database. They are consistent with the original documentation submitted by the waste generator, and they are representative of the actual volumes of these waste shipped for treatment. The volumes used during the preparation of the original STP were erroneous, thereby resulting in more waste being shipped than reported in the original STP inventory. This volume inconsistency was discussed in NMED's letter dated March 5, 1997.

[e]This treatability group (LA-W931, *Lead Requiring Sorting*) is not listed in the *Compliance Plan Volume*; however, it is discussed in section 3.4.3 of the *Background Volume*.

[f]The treatability groups LA-W932, *Explosives*, and LA-W933, *Lab Packs*, were not part of the original STP. They have been proposed for addition in LANL's February 28, 1997 revision request. This revision is currently under review by NMED.

[g]The final FY96 volume for most treatability groups is reported to two decimal places for consistency with the original STP inventory. The final FY96 LA-W902 volume is given as $0.0038m^3$ (i.e., reported to four decimal places) in order to accurately report the presence of one small-volume waste item in this treatability group remaining in the LANL inventory at the end of FY96. This item was in fact shipped off-site on December 20, 1996.

### 2.1.2 MTRU Inventory Summary

The MTRU covered waste inventory at LANL is summarized in Table 2-2. The table shows the volumes of MTRU covered waste for each treatability group. After the enactment of the Federal Facility Compliance Act (FFCAct) in 1992, efforts were made to identify all mixed waste in storage at LANL. Because much of the TRU inventory was generated before the Resource Conservation and Recovery Act (RCRA) regulations were applicable to mixed waste, identification of MTRU as a subset of TRU necessarily relied largely on existing records. As stated in Section 1.5.1 of the original STP BV (7), until recently, the best available data for MTRU was published in the April 1993 Interim MWIR, and it was used to provide the MTRU waste inventory data in Section 4.1 of the original STP BV.

**Changes in MTRU Volumes**

While as much as possible of the MTRU and potential MTRU was identified early on to fulfill FFCAct reporting requirements, a more in-depth study of the inventory has taken place in the last two years, resulting in application of more conservative assumptions regarding the processes generating the waste. Thus, more of the existing TRU inventory now is identified as potentially being MTRU. Formerly, DOE and UC had assumed that approximately 70% of the legacy stored TRU was MTRU. As a result of this recent reinvestigation, DOE and UC now believe as much as 95% of LANL's stored TRU may be MTRU. Therefore, differences in total MTRU inventory volumes between Table 2-2 and the MTRU waste inventory data in Section 4.1 of the original STP BV are due largely to better knowledge of the legacy MTRU inventory since the Interim MWIR report was published.

The DOE relies primarily on two complex-wide data reports to provide information concerning MTRU generation and disposition: the MWIR and the Transuranic Waste Baseline Inventory Report (TWBIR; now termed BIRD).

- The MWIR is published by the DOE in response to the FFCAct requirement to submit to the EPA and to the State of New Mexico a report containing a national inventory of mixed waste and treatment capacities and technologies for mixed waste. Specific information regarding each waste stream was given for mixed waste generated from facility operations and the LANL Environmental Restoration Project.

- The BIRD summarizes the DOE TRU waste inventory, projections, and characteristics. The purpose of the BIRD is to document the total inventory of DOE TRU (not only the MTRU) as defined by the waste generator/storage sites, including waste that is not currently designated by DOE for disposal at WIPP.

As these data reports have matured, new information needs and new uses for the data have been identified, resulting in additions to or changes in parameters used to define MTRU waste streams across the DOE complex. As better process knowledge becomes available, it has been incorporated into the LANL TRU waste database. As part of these recent reevaluations for revisions to the BIRD

reports (see below), waste streams created prior to 1991 (when LANL generators officially began using the waste profile form (WPF) to characterize their newly generated TRU waste), were revisited and more conservative approaches were used to define the percentage that is managed as mixed waste (e.g., all combustibles were assumed to contain rags with solvents, which were conservatively classified as F001 and F002 wastes). As a result, the percentage of LANL's total TRU inventory managed as mixed waste appeared to increased although the same volume of TRU waste is in inventory at LANL. Thus, the LANL TRU waste database has evolved to address changes in DOE complex-wide requirements; the most notable change presented here is the re-casting of MTRU treatability groups. Because characterization of the TRU inventory through sampling and analysis is ongoing, DOE and UC anticipate some further changes to waste volumes may be reported in the future as newer and more accurate data become available.

**Changes in MTRU Waste Categories**

In an effort to support the WIPP Performance Assessment (PA), the BIRD report has been revised several times. The MTRU treatability groups reported in the FY95 STP Annual Update differed from those in the original STP BV, because in FY95 the waste categories defined in the BIRD II report were used. As a result of the new PA requirements, the LANL TRU waste categories were revised again during FY96 (for the BIRD III report) to better reflect refinements in DOE's TRU waste information. Therefore, the new BIRD III waste categories were used in this FY96 Update to identify the same volume of TRU waste reported previously.

DOE Headquarters has recently decided to merge the MWIR and the BIRD databases. The information provided in Table 2-2, FY96 TRU Inventory Update Summary, reflects the changes made to the waste treatability groups as a result of the combined MWIR/TWBIR data. Table 2-2 continues to report the volumes of MTRU waste generated at LANL for FY92–FY94, but this information is being presented in the new, combined MWIR/TWBIR-BIRD treatability groups.

Therefore, differences in total MTRU inventory between Table 2-2 and the MTRU waste inventory data originally given in Section 4.1 of the STP BV are due to two key changes: (1) the re-analyses and re-casting of the original MTRU volume data in the new, combined treatability groups (and reclassification of a greater percentage of the total volume as MTRU); and (2) the generation of a small volume of additional MTRU that has become covered waste since the Interim MWIR report was published.

**Calendar-Year versus Fiscal-Year Reporting**

It is important to recognize that some inconsistencies in waste volumes reported here and in future STP Updates will continue to exist because of the variations in update cycles (reporting periods) for the Update versus other documents reporting mixed waste inventories published by the DOE (i.e., the MWIR and BIRD). Because the STP Update requires reporting of covered waste only, the volumes listed herein are of covered MTRU in storage as of the previous fiscal year. However, covered MTRU volumes are also reported here on a calendar-year (CY) basis. In most of the reports that LANL regularly provides to DOE and the public, the waste volumes are reported on a CY basis.

For example, the Integrated Data Base (IDB), the BIRD for WIPP, and the Mixed Waste Inventory Report all report waste volumes as of 12/31/96 as their latest information. Making the STP reporting consistent with these reports will help to resolve some of the issues related to apparent inconsistency of numbers. DOE and UC will request revisions (submitted concurrently with this Update and shortly thereafter; see Section 6.0 of CPV Update) to incorporate the new MTRU treatability group designations, and the use of the CY reporting period rather than the FY reporting period for MTRU, in the STP.

## Table 2-2. FY96 TRU Inventory Update Summary

| Waste Treatability Group | EPA Code | Estimated Volume (m3) End of FY 96 | Estimated Volume(m3) End of CY 96 | Projections Volume(m3) CY97-CY01 |
|---|---|---|---|---|
| Solidified Inorganic and Organic Solids | D006,D007,D008, D019,D021,D039, F001,F002,F003 | 1,598.29 | 1,598.29 | 20.86 |
| Metallic Waste | D004,D006,D007, D008,D009,D019, D040 | 1,684.47 | 1,684.47 | 118.6 |
| Glass Waste | D008,D009,D019, D040 | 89.65 | 89.86 | 0.0 |
| Non-Combustible Waste | D008 | 947.09 | 947.09 | 0.0 |
| Combined Combustible and Non-Combustible Waste | D008,F001,F002 | 449.20 | 449.20 | 166.65 |
| Combustible Waste | D007,D008,D019, D040,F001,F002, U080 | 1,052.41 | 1,052.41 | 76.9 |
| Absorbed Organic | | 2.70 | 2.70 | 0.0 |
| Cemented Process Sludge | D007,D008,D009, D019,F001,F002, F005 | 156.57 | 156.57 | 83.0 |
| Leaded Glovebox Gloves | D008 | 1.46 | 1.46 | 2.1 |
| **Total** | | **5,981.84** | **5,982.05** | **447.25** |

### 2.2 Progress Report on Treatment and Treatment Technology Development

This section of the BV Update reports on LANL's progress during FY96 in on- and off-site treatment of covered waste (BV Update Section 2.2.1), and in development of treatment technologies specified in the FFCO (BV Update Section 2.2.2). Also addressed briefly in this section is a description of the progress or status of other activities scheduled in the STP.

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### 2.2.1 Treatment During FY96

**Off-Site Treatment**

During FY96, covered mixed waste streams were shipped to off-site treatment facilities such as Diversified Scientific Services, Inc. (DSSI) in Tennessee, Envirocare in Utah, and the Waste Experimental Reduction Facility (WERF) in Idaho for treatment and disposal. Table 2-3 is a summary of LANL covered mixed waste shipped off-site for treatment in FY96.

## Table 2-3. FY96 LANL STP Mixed Low-Level waste Offsite Shipments

| Date Shipped | Shipment Received Date | Letter Date (to NMED) | Destination | Waste | CPV Volume treated ($m^3$) | Items | CPV Sec. |
|---|---|---|---|---|---|---|---|
| 3/19/96 | 3/21/96 | 5/2/96 | Envirocare, UT | LA-W905 ER Soils | 39.32 | 36 | 3.1.2 |
| 4/19/96 | 4/24/96 | 2/01/97 | DSSI, TN. | LA-W901 IPA Waste | 9.99 | 48 | 3.1.1 |
| 6/21/96 | 6/24/96 | 7/16/96 | WERF/INEL | LA-W901 IPA Waste<br>LAW902 Scintillation Fluids | 9.99<br>0.36 | 48<br>2 | 3.1.1 |
| 8/6/96 | 8/8/96 | 9/20/96 | Envirocare, UT . | LA-W921 Activ/Insep. Lead<br>LA-W931 Lead Requiring Sorting<br>LA-W903 Lead Blankets | 9.07<br>5.53<br>0.74 | 49<br>27<br>4 | 3.1.2 & 3.1.5 |
| 9/24/96 | 9/26/96 | 10/24/96 | Envirocare, UT | LA-W921 Activ/Insep. Lead<br>LA-W931 Lead Requiring Sorting | 3.39<br>0.83 | 19<br>4 | 3.1.5 |
| **Total Volume of Waste Shipped Offsite** | | | | | **79.22 $m^3$** | | |

## Treatability Studies

During FY96, LANL actively pursued treatability studies, which resulted in the treatment of some STP covered wastes in several treatability groups. Treatability studies on LANL covered wastes involving electrochemical treatment and heterogeneous waste processing were conducted at LANL, while vitrification treatability studies were performed at the Catholic University of America's Vitreous State Laboratory (VSL).

- Electrochemical treatment is a process which involves a system of electrochemical cells that separate and recover heavy metals from wastes. Further discussion of electrochemical treatment is provided in Section 2.3.3.

- The Heterogeneous Waste Processing Unit uses an environmentally benign, modular treatment train for the destruction of hazardous and mixed heterogeneous wastes. The heterogeneous waste processing treatment train destroys RCRA-regulated organics through biodegradation in a biorector; the liquification of bulk components and the mobilization of toxic metals in a digestion chamber by using fungal enzymes; and the coupling of metals with water-soluble polymer chelators.

- One shipment of LA-W923 wastes was sent to VSL. Vitrification treatability studies were performed at VSL to evaluate the effectiveness of this treatment for toxic and highly reactive solid materials.

Table 2-4 below shows LANL treatability groups and associated volumes involved in on- and off-site treatability studies during FY96.

**Table 2-4. FY96 LANL STP On-site and Off-site Treatability Studies**

| CPV Section | Treatability Group | Treatment Study Process | Volume of Waste Treated ($m^3$) | Treatment Study Location |
|---|---|---|---|---|
| 3.2.1 | LA-W907 Halogenated organic liquids | Electrochemical treatment | 0.0025 | LANL |
| 3.1.4 | LA-W911 Organic-Contaminated Combustible Solids | Heterogeneous Waste Processing | 0.11 | LANL |
| 3.1.6 | LA-W913 Aqueous wastes with Heavy Metals | Electrochemical treatment | 0.32 | LANL |
| 3.1.6 | LA-W914 Corrosive Solutions | Electrochemical treatment | 0.67 | LANL |
| 3.1.6 | LA-W915 Aqueous Cyanides, Nitrates, Chromates, and | Electrochemical treatment | 0.0031 | LANL |

| | | | | |
|---|---|---|---|---|
| | Arsenates | | | |
| 3.2.1 | LA-W923<br>inorganic solid oxidizers | Vitrification | 0.087 | VSL |
| 3.4.2 | LA-W929<br>nonradioactive or suspect waste items to be surveyed | Electrochemical treatment | 0.0029 | LANL |
| **Total Volume of Waste Treated** | | | **1.20 $m^3$** | |

In addition, in the FY95 Annual Update, LANL inadvertently failed to report on a treatability study conducted in FY95 on electrochemical treatment. Waste samples from LA-W913 (CPV Section 3.1.6) in the amount of 0.030 $m^3$, LA-W915 (CPV Section 3.1.6) in the amount of 0.0002 $m^3$, and LA-W929 (CPV Section 3.4.2) in the amount of 0.00094 $m^3$ were shipped to this treatability study in August, 1995.

It is LANL's intent to minimize generation of mixed waste from treatability studies as much as possible. If mixed waste is generated from a treatability study, LANL will manage such waste as a newly generated mixed waste as defined by the FFCO. LANL will try to avoid creating a STP covered waste by working off waste in a timely fashion whenever practicable. If the waste becomes subject to LANL's STP, LANL will manage the waste as such and add the waste as a new covered waste to the CPV under Section VIII of the FFCO titled *Addition of New Covered Waste.*

**Other Types of Mixed Waste Activities**

During FY96, the efforts under CPV Section 3.4.2, *Nonradioactive or Suspect Waste Items to be Surveyed* (Sort, Survey, Decontamination [SSD]) continued. Personnel from the Grand Junction Projects Office continued to work onsite, reviewing data packages on waste items, opening drums to inspect and remove items, surveying and sampling items, shipping samples to their radiological laboratory in Grand Junction, CO, and returning samples to their containers after completion of analytical work. To ensure that defensible radiological results are obtained, all of this work effort is conducted in accordance with strict radiological controls.

Also during FY96, efforts continued to characterize additional MLLW, some of which was covered waste under the FFCO/STP and some was newly generated waste. This characterization included full RCRA and radiological characterization at an offsite analytical laboratory.

### 2.2.2 Ongoing Treatment Technology Development

Work progressed in FY96 on some technologies identified in the STP for treatment of mixed waste, but at a slower rate due to funding reductions during the year. However, during FY96, the availability of commercial off-site treatment and disposal capacity for MLLW continued to increase. In addition, many sites in the DOE complex have continued to pursue development and permitting of mixed waste treatment facilities. These off-site facilities would be used for timely treatment of newly generated waste as well as its covered waste.

Technology development at LANL and other sites for the mixed waste streams at LANL was originally coordinated under a comprehensive plan called the DOE/AL Mixed Waste Treatment Plan (MWTP). The plan includes recommendations for treating most treatability groups at LANL as well as other DOE/AL sites. Work which occurred during FY96 under this plan, as identified in the STP and the FFCO, is described in this section.

The following subsections report on development progress during FY96 of each treatment technology discussed in the original STP. DOE and UC plans to submit a revision to modify or eliminate compliance dates associated with further on-site development, construction, or permitting of treatment skids whose development is being discontinued, as discussed in section 6.0 of the CPV Update.

**Evaporative Oxidation (MWIR Treatment ID GJ-S801C)**

The GJPO is developing the evaporative oxidation process in accordance with the MWTP. This process combines evaporation and vapor catalytic oxidation to destroy volatile organic compounds and concentrate nonvolatile contaminants into a thick liquor or slurry. The aqueous waste is concentrated in an evaporator by boiling off most of the water and the volatile compounds. Air or oxygen is added to the vaporized fraction and forced through a catalyst bed, where organic and inorganic compounds are oxidized. The Evaporative Oxidation unit was intended for treatment of the MWIR LA-W906 stream.

According to the DOE/AL Mixed Waste Treatment Plan *Evaluation and Identification of Treatment Options for MTUs* (8), further development of the evaporative oxidation is on indefinite hold. In December, 1995, LANL sent a proposal to the Oak Ridge operations Office (OR) for treating numerous waste streams at the TSCA incinerator (9). Treatment at the TSCA incinerator may become the preferred option for most waste streams associated with the Evaporative Oxidation MTU. LANL's planned future use of the TSCA incinerator is discussed in Section 2.2.1 of the BV Update.

**Thermal Desorption (MWIR Treatment ID GJ-S801B)**

The GJPO is developing the thermal desorption process in accordance with the MWTP. This process is a batch-drying process that separates organic and other volatile contaminants from solids, soils, and sludges. In the process, the organic contaminants are vaporized under a vacuum in an indirectly heated vessel and passed through an off-gas treatment system. Volatile organics are condensed and collected for subsequent treatment by a process that treats organic liquids. Solid "debris" may be disposed of as low-level waste. Nondebris solids remaining after treatment must meet land disposal restriction (LDR) standards and must be disposed in a RCRA-permitted facility. The Thermal Desorption unit was intended for treatment of MWIR LA-W911 and LA-W919 streams.

Treatability testing is complete and the treatability test report was issued in January 1996. The detailed design, and initial hazard operations analysis is complete as of March 1996. Although GJPO was reviewing bids for fabrication, DOE funding to proceed was cut for FY97 due to budget reductions and the likely availability of other treatment options.

**Macroencapsulation (MWIR Treatment ID PX-S803)**

The DOE Pantex Plant is developing the macroencapsulation process in accordance with the MWTP. This technology encloses solid wastes in an inert envelope to reduce their exposure to potential leaching media in a landfill. This minimizes the risk of contaminants transferring to the environment and is the LDR treatment standard for debris and radioactive lead solids. The macroencapsulation process can be used to treat MWIR LA-W912, LA-W921, and LA-W922 streams.

The Waste Management Division (WMD) of DOE/AL discontinued further development work for macroencapsulation. The proposed alternative for macroencapsulation waste stream activities is to use existing commercial treatment capacity at Envirocare of Utah. SNL/NM is also evaluating use of an on-site epoxy resin treatment process, or of another non-mobile unit at Pantex.

**Lead Decontamination Trailer (MWIR Treatment ID LA-S0001)D**

The Lead Decontamination Trailer uses a wet-abrasive blasting system to clean radioactive contamination from the exterior of lead bricks and shapes. The liquid and abrasive are collected and reused until radioactive contamination of the slurry becomes excessive. The slurry is then recovered and encapsulated in concrete with a polymer additive. The clean lead is surveyed and reused.

The Lead Decontamination Trailer completed processing of all applicable lead as identified in the EPA FFCAgreement, Milestone LD200 during FY95, prior to issuance of the FFCO, as discussed in LANL's FY95 STP Update. This unit was not used during FY96, but it remains operational, and may be used at other DOE/AL sites in the future.

**Chemical Plating Waste Treatment Skid (MWIR Treatment ID LA-S004)**

The Chemical Plating Waste Treatment Skid was intended to treat waste including cyanide, ammonia, heavy metals, and sulfide-containing metals. A kynar-lined tank is used to hold the solutions where pH adjustments and chemical additives can be mixed with the wastes. Cyanide and ammonia can be removed through pH control and the addition of oxidizers. Heavy metals are precipitated by controlling the pH and sulfide addition. The precipitated metals are then filtered, encapsulated, and disposed of in a landfill. Off gas from the operation is fed to a scrubber and all gas discharge is vented through high-efficiency particulate air (HEPA) filters.

The RCRA part B permit application for the planned Chemical Plating Waste Treatment Skid was originally submitted to NMED in September, 1993 with the application for the planned TA-63 Hazardous Waste Treatment Facility. Wastes intended for treatment included the STP treatability groups LA-W913, LA-W914, and LA-W915. New off-site treatment capability became available after the date of submission, and a decision was made not to construct these units. Consequently, this permit application was formally withdrawn by letter dated August 7, 1996 (10).

NMED was notified by letter dated November 12, 1996, of additional STP treatability groups that have been treated in treatability studies using the processes originally intended for use in this skid, but on a smaller scale (11). These additional treatability groups include LA-W907 and LA-W929. A revision will be requested to eliminate future compliance dates for on-site skid development.

**Hydrothermal Processing**
***(Technology adaptation for streams where technology does not exist)***

The process uses high-temperature (400–600°C) water with low concentrations of waste (<20%) to break down compounds. Under these conditions, water is a fluid with fluid-like densities and gas-like transport properties. This benefits throughput and a rapid chemical reaction. Reactor volumes are small because the reactions occur in seconds to minutes.

On May 23, 1996, LANL submitted a letter to NMED requesting a cancellation and withdrawal of the RD&D permit for the LANL Hydrothermal Processing Unit (12). The LANL Hydrothermal Processing Unit was never used to treat wastes, or to perform a treatability study. DOE/AL eliminated funding for further development of a mobile unit, and instead proposed further development of the Packed Bed Reactor/Silent Discharge Plasma process for the affected waste streams. Potential MWIR streams targeted for the Hydrothermal Processing Unit had included LA-W907, LA-W908, LA-W909, LA-W910, and LA-W923. LANL may use off-site treatment capabilities at WERF/INEEL, and/or the TSCA incinerator at Oak Ridge National Laboratory (ORNL) to treat these waste streams. A compliance schedule related to this process will be submitted by November 30, 1998, and/or a revision will be requested to eliminate future compliance dates for on-site skid development.

**Detox Process**
***(Technology adaptation for streams where technology does not exist)***

The Detox Process uses an iron chloride solution to catalyze reactions in a liquid phase. The technology is not a primary treatment for any MWIR stream, but had been considered an alternate option for various streams. The process uses iron (III) in an acid solution as the primary oxidant. Iron(II) formed during the reactions with the waste is turned back into iron(III) by a second catalyzed reaction with oxygen. The main benefit of the process is the ability to oxidize organic materials at relatively low temperatures (250°C).

LANL was developing this process to treat waste included in the mixed waste inventory. Potential MWIR streams for which this technology had been targeted included LA-W907, LA-W908, LA-W909, LA-W910, and LA-W923. DOE/AL determined it will eliminate this unit in its Albuquerque Operations Office Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs, which was completed in September 1995. LANL is currently looking at off-site treatment capabilities at WERF at INEL and TSCA incinerator at Oak Ridge National Laboratory (ORNL) for waste streams potentially treatable under the Detox process.

**Gas Cylinder Recontainerization (MWIR Treatment ID LA-S801)**

A gas recontainerization and analysis system has been designed and is being constructed off-site to safely open damaged gas cylinders, analyze the contents, and recontainerize the gas into a new cylinder. The system encloses the cylinder in a larger high-pressure vessel and then pierces the cylinder, allowing the gas to vent into the larger surrounding vessel. The gas is then sampled and

analyzed. Construction of the unit is 90% complete. ORNL is presently funding the final fabrication steps needed to complete the final MTU design. The gas cylinder recontainerization skid was originally designed to be used with the gas cylinder scrubbing skid. After safely containing the waste gases, the gas cylinder scrubbing skid would be used to treat the waste gases. Existing commercial options do not integrate sampling and analysis (S&A), handling of radioactive gases, and final disposal of some cylinder contents, although some of these processes could potentially be explored further in treatability studies.

DOE/AL eliminated the Gas Scrubbing unit but requires the use of the gas cylinder recontainerization skid in its Albuquerque Operations Office *Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs*, which was completed in September 1995. LANL is continuing to seek off-site treatment capabilities to treat wastes originally destined for the Gas Cylinder Recontainerization MTU. A detailed cost analyses will be done in order to determine the feasibility of off-site shipment versus reassignment of the candidate MWIR streams to the Packed Bed Reactor.

**Gas Cylinder Scrubbing Skid (MWIR Treatment ID LA-S801)**

This skid was intended to treat the LA-W917 MWIR stream. The gas-scrubbing skid would treat many but not all gases. Flammable hydrocarbon gases, for example, would need to be oxidized using another process (such as the gas oxidation technology originally planned for treatment of the LA-W918 MWIR stream).

This transportable waste gas treatment unit was to treat toxic and hazardous gases not appropriate for recontainerization and off-site treatment. The unit was intended to complement the gas cylinder analysis/recontainerization system currently being constructed. Gases were to be treated by scrubbing with acid or caustic, liquid-phase oxidation and other treatments proven to destroy the hazardous components of the compressed gas.

Title I and Title II design packages have been completed. However, DOE/AL determined it will eliminate the Gas Scrubbing unit in its Albuquerque Operations Office *Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs*, which was completed in September 1995. An alternate technology, Packed Bed Reactor and Silent Discharge Plasma, was identified as being appropriate for treatment of the candidate MWIR streams, but has been postponed because of the availability of off-site shipment capabilities. LANL is also evaluating off-site treatment capabilities for the candidate MWIR streams currently destined for the Gas Cylinder Scrubbing Skid.

**Packed Bed Reactor and Silent Discharge Plasma**

Sandia National Laboratory had progressed in development of a combined Packed Bed Reactor and Silent Discharge Plasma treatment unit. Liquid waste can be injected into the Packed Bed Reactor and volatilized, and hazardous off-gases are destroyed in the Silent Discharge Plasma unit. The technology is also applicable to some combustible solids. The Packed Bed Reactor is a thermal

treatment unit and is not classified as an incinerator. The Silent Discharge Plasma unit is a nonthermal plasma system. Although the gas remains at ambient temperatures, effective electron temperatures greater than 50,000 K are generated in the discharge plasma, efficiently producing free radical species that oxidize the target organics.

The detailed design of the Silent Discharge Plasma unit is complete and potential subcontractors are being contacted regarding fabrication. The conceptual design of the gas and oil subsystems for the Silent Discharge Plasma unit have been completed. Preliminary design work on the secondary containment tank and electrical control systems continues. Procurement of the variable frequency/variable voltage series inverter power supply is behind schedule because of the high cost of this unit.

In December, 1995, DOE sent a proposal to the Oak Ridge Operations Office (OR) for treating numerous LANL covered waste streams at the TSCA incinerator, including those intended for the Packed Bed Reactor MTU. Because DOE may redirect these wastes to the TSCA incinerator, the Albuquerque Area Office has postponed further development of the Packed Bed Reactor.

The LANL Packed Bed Reactor (an RD&D-permitted unit), which had been intended for treatment development work involving nonradioactive hazardous, was not operated during FY96. This unit is currently undergoing closure.

**Reactive Waste Treatment Skid (MWIR Treatment ID LA-S003)**

The Water Reactive Metals Skid is intended to treat metal-containing wastes which are very reactive with water. These wastes are reacted with water in a controlled system. The metal or metal hydride reacts to form the metal hydroxide and hydrogen. The metal hydroxide is then neutralized to make a simple salt solution that could be discharged to the Radioactive Liquid Waste Treatment Facility (RLWTF). Hydrogen produced as part of the reaction is diluted with nitrogen below flammability limits and vented through HEPA filters.

Both the conceptual design (Title I) and the detailed engineering design (Title II) are complete. Further work on this skid has been delayed by funding reductions during FY96. A value engineering (VE) study was conducted at Grand Junction Projects Office (GJPO) in 1995. GJPO concluded that there are no feasible alternatives for treatment of water-reactive waste other than the designed skid, therefore DOE/AL determined it will retain this unit in its Albuquerque Operations Office *Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs*. LANL is currently evaluating existing off-site treatment facilities at M4 Environmental Management Inc. in Oak Ridge, Tennessee, the University of Chicago, and the Catholic University of America-VSL.

**Amalgamation of Mercury (MWIR Treatment ID PI-S801)**

A mercury amalgamation unit was being developed at the DOE Pinellas Plant located in Florida. The technology is a treatment required under the LDR for liquid elemental mercury contaminated

with radioactive materials. Amalgamation is achieved by mixing the liquid metal with powdered reagents such as copper, zinc, tin, nickel, gold, and sulfur to yield a metal alloy with no free mercury.

DOE/AL has discontinued further treatment process development work for amalgamation of mercury (DOE/AL memo, March 20, 1996). DOE may treat waste in this treatability group by using existing commercial capacity at Nuclear Fuel Services (NFS), in Erwin, Tennessee, or at other commercial treatment facilities. SNL/NM has developed a process at bench scale.

**Sort, Survey, and Decontamination (MWIR Treatment ID GJ-S804)**

Sort, survey, and decontamination (SSD) was identified as a preferred option for lab-packed reagent chemicals, bulk chemicals, and other selected chemicals that are currently being managed as MLLW due to the suspected presence of radioactive contamination. Over 1250 items included in MWIR waste stream LA-W929 are potential candidates for review by this process.

The SSD field survey effort was started in 1995 and continued after the end of FY96 (See discussion in CPV Update, Section 6.3). Items in this treatability group will be reassigned to other treatability groups through the revision process. Additional compliance dates for treatment will be proposed, if necessary.

**Distillation of Mercury (MWIR Treatment ID LA-S701)**

Triple distillation, an alternative treatment for amalgamation in treating mercury wastes, is being evaluated as a means of decontaminating mercury from the radioactive contaminants and for reuse. Bench-scale tests were conducted during FY95 to determine the efficiency of radionuclide removal. Because of the shielding properties of mercury, attempts were made to demonstrate the process design using cerium, but they failed. It was then decided to test the unit directly with depleted uranium, which was done in September 1995. Analytical results are pending. No further work on mercury distillation or radioactivity detection occurred in FY96.

DOE/AL did not evaluate this unit in its Albuquerque Operations Office Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs, which was completed in September 1995.

### 2.2.3 Current Alternative Treatment Technologies Being Evaluated

This section of the report is provided for discussion of LANL's activities during FY96 to evaluate technologies that were not discussed in the original October 4, 1995 STP.

## 2.3 Anticipated Alternative Treatment Technologies Being Evaluated

LANL is obtaining information on other potential treatment technologies that may become available in the future (see Appendix A). Some of these technologies are being developed at LANL and at other DOE sites in the nuclear complex. Numerous other commercially developed treatment processes exist which have not been demonstrated on mixed wastes. Some processes for which information is being collected are listed in Appendix A.

### 2.3.1 Off-Site Commercial Treatment Facilities

DOE and UC plan to continue shipping STP covered waste streams to DSSI, Catholic University of America, and Envirocare in the future. The following off-site commercial facilities are also being considered for near-term use:

- M4 Environmental Management Inc. (TN) can treat MLLW streams such as noncombustible debris, halogenated organic liquids, non-halogenated organic liquids, bulk oils, Polychlorinated Biphenyl (PCB) wastes with RCRA components, combustible debris, water-reactive wastes, inorganic solid oxidizers, compressed gases, and biochemical laboratory wastes.

- Several firms have have expressed interest in treating compressed gases on-site at LANL.

- Nuclear Fuel Services Inc. (NFS) can treat MLLW streams such as sludges contaminated with uranium, thorium, cadmium and other small concentrations of radionuclides, as well as mercury contaminated waste streams. NFS can perform amalgamation of mercury and mercury contaminated waste, and perform surface decontamination.

- Nuclear Support Services, Inc. (NSSI) is a fully RCRA Part B permitted facility which may accept MLLW such as compressed gases. Since compressed gases are not a routine type waste stream NSSI normally treats, the facility is expected to evaluate treatment methods capable of treating LANL mixed waste streams containing compressed gases.

- Scientific Ecology Group, Inc. (SEG) accepts MLLW such as contaminated aqueous liquids and slurries, organic liquids and sludges, inorganic sludges, metal debris, and lead contaminated debris.

- The University of Chicago offers some capability for treating water-reactive MLLW streams present at LANL.

DOE and UC continue to evaluate commercial off-site treatment facilities for their appropriateness to treat LANL's covered waste as new information about these facilities becomes available.

### 2.3.2 Off-Site DOE Treatment Facilities

During FY96, one shipment was made to an off-site DOE treatment facility for incineration. LANL shipped 9.99 m3 of isopropyl alcohol (IPA) (MWIR waste ID LA-W901) and 0.36 m3 of scintillation fluids (MWIR waste ID LA-W902) to the WERF at INEEL on June 21, 1996 (13).

Recently, INEEL, Oak Ridge National Laboratory (ORNL), and Savannah River Site (SRS) indicated potential near-term availability of their available treatment options. INEEL, ORNL, and SRS facilities operate thermal destruction processes that could provide treatment for many LANL mixed low level waste streams.

DOE and UC are also currently planning future shipments to the TSCA Incinerator at ORNL in Tennessee, and the Battelle Columbus Laboratories' Treatment and Disposal Facility in Richland, Washington to treat various waste streams. As mentioned earlier in Section 2.2.2, utilization of the TSCA Incinerator may affect waste streams currently listed for treatment under the following MTUs.

- Packed-Bed Reactor and Silent Discharge Plasma
- Thermal Desorption
- Evaporative Oxidation
- Hydrothermal Processing
- Detox Process

DOE and UC are also reviewing the capability and availability of the Consolidated Incineration Facility (CIF) facility at the Savannah River Site to treat waste streams in treatability groups LA-W906, LA-W907, LA-W908, LA-W909, LA-910, and LA-W923. Other DOE off-site treatment facilities will be considered in the future as they become available.

### 2.3.3 Recycling or Other Options

Recycling has been identified by the Environmental Protection Agency as a preferred alternative to treatment and disposal. The Chemical Exchange Assistance Program and External Recycling (CHEAPER) was developed in 1995, and currently recycles chemicals from various LANL organizations, including areas where radioactive materials operations are conducted. In the past, chemicals from radioactive areas were disposed as MLLW because they were suspected to be radioactively contaminated. The current STP inventory includes a large number of these chemicals in several treatability groups, particularly LA-W929.

Pollution prevention practices in many of the areas that generate mixed waste are reducing the amount of suspect MLLW that is currently being generated. These changes are making it possible to recycle chemicals through the CHEAPER program that were previously disposed of as MLLW because no other alternative existed. Recycling chemicals, such as acids, caustics, solvents, and other materials that are in the current STP inventory, can offer an acceptable alternative to treatment

and disposal, however the FFCO currently does not recognize recycling as an alternative to treatment of MLLW. DOE and UC will submit a revision to the STP to facilitate recycling of STP covered wastes where appropriate, as discussed in Section 6.0 of the CPV Update.

**Electrochemical Treatment Process**

In FY96, an electrochemical treatment process was tested in treatability studies on existing low-level mixed waste streams listed in LANL's STP (see BV Update, Section 2.2.1, "*Treatability Studies*)". This treatment process uses a system of electrochemical cells that separate and recover heavy metals from mixed wastes for the purpose of recycling the metals. During the electrochemical treatment process, cyanides are destroyed, nitrates are reduced, and organic compounds are oxidized in aqueous solutions. The electrochemical treatment process is currently a lab-scale treatment unit with a pilot scale assembly in progress.

Based on treatability studies, recycling of heavy metals could take place in waste streams containing salts, inorganic oxides, aqueous organic solutions, nitrate wastes, acids, basis, and solutions and solids. A RCRA Research, Development, and Demonstration (RD&D) permit application for the electrical treatment process was submitted to NMED on September 6. 1996 (14). The research objective of the work to be conducted under the RD&D permit is to experimentally define waste streams that are amenable for electrochemical treatment, to determine conditions for electrolysis of these waste streams, and to assess the feasibility of processing larger batch waste quantities than allowed under RCRA treatability studies.

Recovered metals from the electrochemical treatment process are expected to be free from radioactive contamination. These metals could be reused by converting them to sulfates, chlorides, nitrates, sulfides, etc. for laboratory uses at LANL. The recovered metals could also be returned to the LANL plating shop for reuse in on-site plating processes. Further information and analyses of recovered metals from the electrical chemical treatment process may be found in the previously submitted RCRA Research, Development, and Demonstration Permit Application.

**Proposed Treatability Studies for FY97**

Several new treatability studies were proposed during FY96; however, due to changes in funding and programmatic priorities, they were not conducted in FY96 but are proposed for FY97.

- Hydrothermal Processing are planned to be tested for the destruction of the organic component of several LANL covered waste streams in the near future as funding permits (See Section 2.2.2 for process description).

- Mediated Electrochemical Oxidation (MEO) is an aqueous-based waste treatment process which destroys organic compounds by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source of oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell, where it is regenerated for use in further oxidation processes.

The MEO process was not included in LANL's STP, however, these processes are planned to be evaluated in the near future as possible future on-site treatment technologies to treat mixed low level waste at LANL, as funding permits.

In addition, treatability studies were conducted in FY96 or are proposed at LANL for the future:

- LANL performed a treatability study during FY96 on cyanide-containing wastes from SNL/NM, using an oxidation process.

- LANL proposed to conduct treatability studies on waste streams generated at the DOE's Portsmouth Gaseous Diffusion Plant (PORTS) in Piketon, Ohio, which are covered in PORTS' Site Treatment Plan. The studies, intended to determine the effectiveness of various treatment technologies associated with LANL's new Uranium Line for Special Separation Science (ULISSES), were proposed in a letter to NMED dated September 27, 1996. These technologies (as specified below) will treat mixed waste by separating the radionuclides for recovery and reuse, thereby making the secondary residue from these treatment processes more amenable for subsequent treatment, storage, and disposal. The seven treatability studies will consist of several multi-step treatment processes such as: fluorination, calcination, filtration, precipitation, pyrohydrolysis, leaching, degreasing, ion exchange, and extraction chromatography.

Although these treatability studies are not listed in LANL's current STP, they will be evaluated for possible future applicability to similar waste streams present at LANL.

## 2.4 Funding

Funding to implement the LANL Site Treatment Plan for mixed waste during FY96 was sufficient to meet all compliance dates as required by the STP issued on October 4, 1995 (at the beginning of FY96). Funding for development of mobile treatment units at LANL was reduced during FY96, but funding was provided for shipment of mixed waste offsite for treatment and disposal at DOE and commercial facilities. Funding during FY97 is also sufficient to meet all compliance dates established in the STP for FY97, and projected funding for FY98 should again allow all compliance dates in the STP to be met during FY98. Should funding reductions occur that would affect STP compliance dates, the Respondents will notify the NMED to amend compliance schedules and activities accordingly.

During FY96, the DOE Assistant Secretary for Environmental Management initiated a Ten Year Plan for its cleanup and waste management activities, with a goal of accelerating cleanup progress as much as possible during the ten years (FY97 through FY06) (14). The draft Ten Year Plan for the LANL site addresses both MLLW and TRU wastes that are currently in storage and are projected to be generated during the 10-year period. Current funding targets in the draft LANL Ten Year Plan should allow LANL to continue to meet all compliance dates in the STP and to dispose of all covered waste during the ten-year period. Beginning in FY00, all newly generated MLLW is

planned to be treated and disposed within one year. All MLLW placed into storage before FY00 is planned to be treated and disposed before the end of FY03. Beginning in FY99, all newly generated TRU waste is planned to be shipped for disposal at the WIPP site within one year of generation (assuming that the WIPP site opens as scheduled). All TRU waste placed into storage before FY99 is planned to be characterized, certified to meet WIPP Waste Acceptance Criteria, and shipped to the WIPP before the end of FY04. Current funding levels in the draft LANL Ten Year Plan assume that TRU waste is not required to be treated to meet LDR before shipment to WIPP for disposal.

## 2.5 Treatment Variances

The RCRA allows certain case-by-case variances of LDR standards. Variances that may be sought under the RCRA relate to requests for substitution of an alternative treatment technology in place of the LDR-required treatment technology. This section discusses planned or requested treatment variances related to LANL's covered waste, as described below.

### 2.5.1 WIPP No-Migration Variance Petition

The WIPP is a DOE facility being developed near Carlsbad, New Mexico, as a planned repository for the TRU waste that was generated by the nation's defense-related activities. Some of the TRU waste contains hazardous waste constituents regulated under the RCRA.

The WIPP repository is considered to be a deep geologic repository rather than a shallow landfill. It is wholly sited 2,100 ft below the land surface in a salt bed . Because salt has the advantageous characteristic of slow plastic deformation, it is predicted that the salt will entomb the waste and seal it from the human environment, making potential release of hazardous constituents a low-probability event.

As a result of the LWAA of 1996, EPA has terminated its review of the No-Migration Variance Petition (NMVP), and the NMVP requirement has been removed. On October 29, 1996, DOE submitted its Compliance Certification Application (CCA) to EPA. The CCA is intended to demonstrate to EPA that WIPP meets the requirements of 40 CFR 191 and 40 CFR 194.

### 2.5.2 Other Treatment Variance(s)

No treatment variances were requested or granted in FY96. It is possible that in the future there may be requests submitted to the NMED to consider substituting alternative treatment technologies for waste streams that are not amenable to treatment technology because of their radioactive nature or other waste characteristics (for example, recycling/reuse of radioactive lead-acid batteries would be inappropriate, and approval to use an immobilization technology such as macroencapsulation may be requested). See Section 2.0 (Proposed Revisions and Amendments) of the Compliance Plan Volume Update additional discussion.

## 2.6 WIPP Facility Capabilities

The DOE is planning to dispose of its defense TRU waste, both mixed and nonhazardous, in its deep geologic repository at the WIPP near Carlsbad, New Mexico. This facility is planned to be a receiving and disposal facility, without capability of routine opening and repackaging of waste. TRU waste will be containerized when received at the WIPP facility. This facility is not a generator of TRU waste, and therefore will receive all of the waste in shipments from off-site. Described below is the status of the characterization and treatment capabilities at the WIPP facility.

### 2.6.1 Characterization Capabilities at WIPP

No capabilities for characterization of TRU waste for hazardous waste constituents regulated by the RCRA were developed or are planned to be developed at the WIPP facility.

### 2.6.2 MTRU Treatment Capabilities and Plans

No capabilities for treatment of MTRU to meet the LDR standards were developed or are planned to be developed at the WIPP facility. The LWAA exempted wastes designated by the Secretary of Energy of disposal at the WIPP from this requirement.

## BIBLIOGRAPHY

### References Sited in BV Update

1. "*Federal Facility Compliance Order (Los Alamos National Laboratory*" New Mexico Environment Department (October 4, 1995)

2. "*Hazardous Waste Report for Los Alamos National Laboratory*" Volumes I and II, ESH-19, Los Alamos National Laboratory (February 1996)

3. "*Transuranic Waste Baseline Inventory Report Revision 3*", US Department of Energy, Carlsbad Area Office (December 1995)

4. "*AL Mixed Waste Treatment Plan*", Los Alamos National Laboratory (March 1994)

5. Congress, 1996. Text of Public Law 104-201, Congressional Record dated September 23, 1996, Amendment to Public Law 102-579, 1992 *Waste Isolation Pilot Plant Land Withdrawal Act (106 Stat. 4777)*

6. "*Los Alamos National Laboratory Federal Facility Compliance Order Annual Site Treatment Plan Update for Fiscal Year 1995*" (March 31, 1996)

7. *"Mixed Waste Inventory Report*", US Department of Energy, Office of Environmental Management (1995)

8. "*Albuquerque Operations Office Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs,"*, US Department of Energy Albuquerque Operations Office (September 1995).

9. "*Proposed Changes to the AL-Mixed Waste Treatment Plan*", US Department of Energy Albuquerque Operations Office (March 1996)

10. "*Request for cancellation and withdrawal of the Los Alamos National Laboratory Technical Area (TA) 63 Hazardous Waste Treatment Facility (HWTF) and Chemical Plating Waste Skid*", T. Todd, LAAO to B. Garcia, NMED (August 7, 1996)

11. "*Los Alamos National Laboratory, Site Treatment Plan, Notice of Completion of Permit application Resubmittal, Activity 3.1.6A*", J. Plum, LAAO to J. Archuleta, NMED (November 12, 1996)

12. "*Request for cancellation and withdrawal of the Los Alamos National Laboratory Hydrothemal Processing Unit*", T. Todd, LAAO to B. Garcia, NMED (May 23, 1996)

13. *"Notification of Completion of Off-Site Waste Shipment to the Waste Experimental Research Facility (WERF), Idaho National Engineering Laboratory (INEL), Activity 3.1.1C in the Site Treatment Plan Federal Facility Compliance Order (FFCO), Rev. 1.0, June 12, 1996"*, J. Plum, LAAO to J. Archuleta, NMED (July 16, 1996)

14. "*Los Alamos National Laboratory Draft Ten Year Plan*", Los Alamos National Laboratory (1997)

15. "*Mixed Waste Characterization, Treatment, and Disposal Focus Area. Technology Summary*", Office of Environmental Management, Technology Development, Report Number DOE/EM-0252 (June 1995)

**References Sited in CPV Update**

16. "*Notice of Completion of Schedule for Further Lead Processing, Activity in Section 3.4.1 in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", P. Schumann, LANL, to J. Plum, LAAO (June 24, 1996)

17. "*Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", J. Archuleta, NMED, to J. Plum, LAAO (June 3, 1996)

18. "*Re-characterization of Wastewaster Treatment Sludge in Storage at Technical Area (TA) 54 - Request for Removal from Federal Facility Compliance Order (FFCO)*", J. Plum, LAAO, to B. Garcia, NMED (January 12, 1996)

19. "*Site Treatment Plan (STP), Los Alamos National Laboratory (LANL) - Wastewater Treatment Sludge*", J. Plum, LAAO to J. Archuleta, NMED (August 14, 1996)

20. "*Los Alamos National Laboratory (LANL), Site Treatment Plan (STP), Wastewater Treatment Sludge*", J. Plum, LAAO, to J. Archuleta, NMED (November 7, 1996)

21. "*Los Alamos National Laboratory (LANL) TA-50-1 Wastewater Treatment Sludge Reclassification*", J. Archuleta, NMED, to J. Plum, LAAO (October 7, 1996)

22. "*Hazardous and Radioactive Materials Bureau Approval of Reclassification of TA-50-1 Waste Water Treatment Sludge*", J. Archuleta, NMED, to J. Plum, LAAO (December 4, 1996)

23. "*Request for Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", J. Plum, LAAO, to B. Garcia, NMED (March 1, 1996)

24. "*Omission and Errata on Revision to the LANL Site Treatment Plan, October 4, 1995 Federal Facility Compliance Order, Revision 1.0 (June 1996)*", J. Archuleta, NMED, to J. Plum, LAAO (June 10, 1996)

25. "*NMED Response to Request for Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", B. Garcia, NMED, to J. Plum, LAAO (March 12, 1996)

26. "*Approval of Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, Revision 1.0 (June 1996)*", J. Archuleta, NMED, to J. Plum, LAAO (June 12, 1996)

27. "*Recharacterization of "Soil With Heavy Metals" in Storage at Technical Area (TA) 54 - Request for Removal from the Site Treatment Plan (STP)*", J. Archuleta, NMED, to J. Plum, LAAO (October 18, 1996)

28. "*Los Alamos National laboratory (LANL) Request to Reclassify "soil with heavy metals" in Section 3.1.2 of the Site Treatment Plan Compliance Plan Volume (STP/CPV) of the Federal Facility Compliance Order (FFCO) October 4, 1995*", J. Plum, LAAO, to J. Archuleta, NMED (November 22, 1996)

29. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFCO) October 4, 1995, Site Treatment Plan (STP) Sort, Survey, and Decontamination (SSD) Request for Revision No. 3 and Amendment No. 1*", J. Plum, LAAO, to J. Archuleta, NMED (October 21, 1996)

30. "*Los Alamos National Laboratory's Federal Facility Compliance Order (October 4, 1995), Request for Amendment*", J. Plum, LAAO, to J. Archuleta, NMED (October 29, 1996)

31. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFC)), Exhibit A, Mixed Waste Site Treatment Plan (STP) Compliance Plan volume (CPV), Request for Revision No. 2 and Amendment 1*", J. Archuleta, NMED, to J. Plum, LAAO (October 30, 1996)

32. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFCO) October 4, 1995, Site Treatment Plan (STP) Sort, Survey, and Decontamination (SSD) Request for Revision No. 3*", J. Archuleta, NMED, to J. Plum, LAAO (October 30, 1996)

# Appendix A

# Potential Treatment Technologies for LANL Waste

Treatment technologies summarized in this Appendix have been divided into two sections: thermal treatments and non-thermal treatments (15).

Tables A-1 and A-2 list potential treatment technologies. Also included in these tables are a number of technologies that may be effective in pre-processing hazardous or mixed wastes prior to use of an LDR treatment method, for example to reduce waste volumes, separate radioactive from hazardous components, or allow reclassification of TRU as LLW. Also listed for each technology is the state of readiness of the technology, (i.e. is the technology fully developed, partially developed (pilot-scale) or in need of extensive development (lab-scale)); the place of development; and the types of waste which could be processed by the technology.

## Table A-1. Potential Thermal Treatment Technologies for Treatment of LANL Waste

| Treatments Available | Degree of Develop-ment | Place of Development | Type of Waste Processed by this Method | Technology Code EPA |
|---|---|---|---|---|
| **A1. Microwave Solidification**<br>The process dries the waste, mixes it with a matrix modifier and subjects the mixture to microwave energy with temperatures of 1,000°C to melt the materials. The processed waste form then cools and solidifies. The resulting waste form is a vitreous material containing no free liquids and is highly leach resistant. | Pilot Scale | Rocky Flats Environmental Technology Site | Homogeneous inorganic solids | |
| **A2. Molten Salt Oxidation (MSO)**<br>The hazardous and/or radioactive wastes are injected into molten sodium carbonate ($Na_2CO_3$) at 900°C using a carrier gas such as air. The waste feed to the MSO unit can be a solid, slurry, solution, or liquid. Oxygen from air provides an oxidizing environment in the melt. The wastes are then catalytically destroyed (in some cases, up to 10 wt% $Na_2SO_4$ is added to the melt as a catalyst). Acidic gases from waste destruction are converted to sodium chloride (NaCl) by reaction with $Na_2CO_3$. Furthermore, $Na_2CO_3$ does not decompose into its oxide and carbon dioxide until well above 1200°C. | Full-Scale | Rockwell - Energy Technology and Engineering Center (ETEC), LLNL, ORNL | Heterogeneous and homogeneous inorganic solids, combustibles, organic compounds | |
| **A3. Plasma Hearth Process**<br>The plasma hearth process uses a "plasma torch", which is a direct current arc-generated plasma generated in a gas flowing between two electrodes. One electrode is inside the torch while the other is the molten pool of waste (maintained at ground potential). The heat generated causes chemical and physical changes: organic compounds form simple gases while the inorganic materials melt and separate into two phases: slag and metal. Actinides and heavy metals migrate to the slag phase which cools and solidifies into a vitreous material. | Pilot Scale | Lockheed Idaho/ANL-W SAIC | Heterogeneous waste including actinides, heavy metals, organic compounds | INCIN |
| **A4. Slagging**<br>After waste has been heat treated (as in plasma hearth process) and cooled, two phases result: slag and metal. Heat may be applied through the plasma hearth process or other processes. The slag is a physically and chemically stable compact waste form. | Proof of Principle | Lockheed Idaho/ANL-W SAIC | Heterogeneous waste including actinides, heavy metals, organic compounds | INCIN |

| Treatments Available | Degree of Development | Place of Development | Type of Waste Processed by this Method | Technology Code EPA |
|---|---|---|---|---|
| **A5. Steam Reforming**<br>This treatment destroys organic materials and inorganic salts that decompose thermally. It is a two stage system. First, exposure of the waste stream to superheated steam volatilizes any organic compounds. Secondly, the organic gases are destroyed by passage through a resistively heated high temperature reaction chamber to temperatures up to 1200°C. This is mainly developed for organic compound destruction, such as for chlorinated hydrocarbons. | Full-Scale | Synthetica Technologies/SNL, SEG | Organic compounds and inorganic salts that decompose. e.g. nitrate | |
| **A6. Vitrification**<br>Vitrification involves converting wastes which are primarily inorganic in nature into glass. Additives are added which react chemically with waste through heat treatment. On cooling glasses are formed which are leach resistant and compact. The vitrification system will be used to immobilize radioactive contaminants (mainly Pu) so they can be safely transported to the WIPP facility. The central piece of equipment in this system is the furnace used for melting glass. Commercially available systems can accommodate the applicable waste streams at LANL. | Full-Scale | Complex wide | Inorganic wastes | HLVIT |

## Table A-2. Non-Thermal Treatment Technologies for Treatment of LANL Waste

| Treatments Available | Degree of Develop-ment | Place of Development | Type of Waste Processed by this Method | Technology Code EPA |
|---|---|---|---|---|
| **B1. Bacterial decomposition**<br>This method works on nitrate-containing aqueous solutions at near neutral conditions. Toxicity studies with the actinides have demonstrated that bacteria exhibit considerable resistance to radiation damage. Lab-scale bioreactor systems are under development. | Lab-Scale | Complex Wide, Including LANL, ORNL & BNL | Aqueous Nitrate Wastes | BIODG |
| **B2. Catalytic Chemical Oxidation**<br>Chemical oxidation systems use the reaction of oxygen, or an alternate oxidizing agent, to destroy the organic constituents of the waste in an aqueous solution. In a catalytic chemical oxidation, one or more chemical species are added, to increase the rate of oxidation reactions. Moderate temperatures and pressures are used (150$^{o}$C and 70 psig). | Lab-Scale, Pilot-Scale in progress at SRS | Rocky Flats/Delphi Research | Organics | CHOXD |
| **B3. Cementation**<br>Waste is mixed with cement before cement has hardened and dried, successfully preventing waste from migrating. There are concerns with embrittlement for long term storage. | Full-Scale | Complex Wide | Salts, inorganic oxides, organic liquids/solids | STABL |
| **B4.- Electrochemical Treatment Process**<br>A system of electrochemical cells separates and recovers heavy metals from wastes, destroys cyanides, reduces nitrates, and oxidizes organic compounds in aqueous solutions. The system was used at LANL to process 96 drums of MLLW. | Lab scale, Pilot Scale in progress | LANL, CRADA with Faraday Technology Inc. | salts, inorganic oxides, aqueous organic solutions, nitrate wastes, acids, bases, solutions and solids | |

| | | | | |
|---|---|---|---|---|
| **B5. Electrokinetics**<br>Electrokinetic decontamination is a method of in-situ soil remediation from toxic and/or radioactive metals. Electrodes are installed horizontally or vertically in contaminated soil. Direct electric field is applied between the electrodes causing mobility of ions. The soil either contains enough moisture to provide electric conductivity and solubility of ions, or it has to be preconditioned with an appropriate electrolyte. In the latter case the electrolyte is introduced into the soil by pumping it into drilled holes, or simply poured over the surface. This solvent may be simply water, a salt solution (for example carbonate in case of uranium), or a solution of a chelating agent in case of metals recalcitrant to solubilization. The optimum electrode spacing depends on conditions such as metal concentration, moisture content, conductivity, and typically is between 0.5-5 m. The metal ions move toward the electrodes and concentrate in their vicinity. The metals are removed from around the electrodes by either pumping the electrolyte in and out from the electrode vicinity (there may be a membrane separator near the electrode surface through which the metals diffuse) or by deposition on electrode surface or adsorption followed by electrode or sorbent removal. | Pilot-Scale | LANL, Isotron, SNL | Metallic contaminants in soil | |
| **B6. Electrolytic Decontamination**<br>The implementation of a "washing" process which will be used to treat large surface-contaminated objects, mostly gloveboxes, for TRU, RCRA and mixed wastes. Surface etching of contaminated surface using an appropriately designed electrolytic cell allows up to 6 orders of magnitude decontamination of plutonium- contaminated conducting surfaces. The process involves the removal of micron layers of surface with the electrolytic decontamination products falling into the wash solution. Plutonium and other by-products are reclaimed from the solution and the electrolyte is recycled. This method has been in use at LANL at TA-55 to decontaminate weapons components, stainless steel gloveboxes, and stainless steel containers used for storing plutonium. The process is similar to industrial practice of electro-polishing, except that the object to be cleaned is not immersed in an electrolyte. A low dc voltage is applied through a suitable electrolyte (sodium nitrate has been used at TA-55) to induce metal dissolution and lifting of contaminants separated from the electrolyte as solid precipitates. | Full-Scale | Complex Wide | Metallic | |

| | | | | |
|---|---|---|---|---|
| **B7. Freeze drying**<br>Cryogenic grinding technology is proposed to reduce the volume of non-compactible plastic materials from TA-55. The variety of materials that can be subject to this process include glove box gloves, plastics of all kinds and shapes, and HYTREX filters from liquid waste lines. The procedure involves the freezing of plastic materials in liquid nitrogen followed by crushing (or chipping for HYTREX filters) followed by granulation using conventional mechanical devices. The experience at TA-55 shows that this approach allows a reduction in volume of plastics by 76-90%. About one hundred 55 gallon drums of TRU plastics are generated at TA-55 annually and if this technology were fully implemented, it would reduce waste streams from TA-55 significantly. This technology could also be used to reduce plastic waste streams from facilities throughout LANL. The proposed activity provides for the implementation of a treatment process at TA-35 for TRU and Mixed Waste using a liquid nitrogen system to cryogenically freeze plastics and a crusher to reduce the waste volume. | Lab-Scale | LANL, CRADA with BOC, Edwards and Calumatic | Evaporator Bottoms | RORGS |
| **B8. Leaching**<br>Leaching consists of passing a solution containing reagents which dissolve the contaminant from the contaminated medium. The solubilized contaminants can then be separated using different methodologies including ion exchange or polymer filtration. The proper choice of reagents will cause minimum degradation of the solids substrate and also will not generate secondary waste streams which are difficult to treat. These reagents are chelating agents such as carbonates, ascorbic acid and siderophores (microbial iron chelators) and can be tailored for specific contaminants. In addition polymeric chelators can be used. | Full-Scale | Complex Wide | All | LLEXT<br>RMETL |
| **B9. Magnetic separation**<br>High Gradient Magnetic Separation (HGMS) can be applied to effect the selective extraction of actinide contaminants from soils, clays and silts. In most instances the TRU elements are widely dispersed within the host material. This requires the processing of large amounts of material to remove low levels of contaminant. Magnetic separation is a physical separation process that exploits differences in magnetic susceptibility. The technology is capable of extracting and concentrating the radioactive components from solid, liquid or gas waste streams with minimal pretreatment and at significant rates. | Pilot-Scale | LANL, CRADA, Lockheed-Martin | Sand, Slag & Crucible | |

| | | | | |
|---|---|---|---|---|
| **B10. Plasma Decontamination**<br>Plasma decontamination uses a radiofrequency (RF) discharge in a low-pressure atmosphere of a fluorine bearing gas, such as $CF_4/O_2$ or $NF_3$. Plasma-induced dissociation of the gas produces chemical species that react with plutonium to form the gaseous compound $PuF_6$. A processing mode, reactive ion etching, uses plasma generated species to aggressively remove matter from surfaces, physically etching contaminants from on or near the surface. A conceptual system would pump gaseous $PuF_6$ from the plasma decontamination reaction vessel and trap it on metallic fluorides such as NaF in the recovery system. | Lab-Scale | LANL/ERSC (Environmental Research Systems Corp.) | Metallic objects | |
| **B11. Polymer encapsulation**<br>Polymer encapsulation of mixed waste products encloses waste in thermoplastic or thermosetting materials using commercially-available processing technologies. Two polymer processes are being tested: micro-encapsulation and macro encapsulation. In micro-encapsulation thermoplastic polymers (such as polyethylene) are combined with dry waste in a heated extruder. This melts the polyethylene and mixes it with the waste which is extruded into drums where the mixture solidifies on cooling. The second variation, macro-encapsulation, molten plastic is added to waste already in a drum. The polymer solidifies in situ and immobilizes hazardous contaminants. | Lab-Scale | Rocky Flats/BNL | Salts, inorganic oxides | MACRO |
| **B12. Physical separation**<br>Different forms of waste are divided into different categories such as size, before being classified into waste streams. | Full-Scale | Complex Wide | All | RMETL |
| **B13. Radioactive Sorting**<br>The Segmented Gate Sorter (SGS) method assays and separates uranium and other radioactive contamination from soil or other matrices using NaI gamma ray scintillation detectors, count geometry, shielding and count times. It has radiation detectors and a conveyor system. An electronic signal is generated upon detection of radiation and the signal activates a gate, causing the contaminated components to be separated from the non contaminated. The procedure is capable of separating contamination from large volumes (as much as 100,000 cubic yards) of soil. Thermo-Nuclean has shown that reduction in the volume of contaminated soil is as great as 98%. Contaminated soil is diverted to segmented gates to a conveyer belt which separates it from the rest of the clean soil. | Full-Scale | Complex Wide, Thermo-Nuclean | All | RMETL |

| | | | | |
|---|---|---|---|---|
| **B14. Super-critical Carbon Dioxide or Supercritical Water Oxidation**<br>Supercritical extraction is a process that uses either water or carbon dioxide as a solvent since both these fluids are non-combustible, non-toxic and environmentally safe fluids. The process takes advantage of the enhanced ability of carbon dioxide or water to dissolve organic contaminants once they have been heated and compressed. In waste clean-up operations, the process is used to dissolve hazardous components, separating them from the substrate material. By lowering the temperature and pressure of the expansion vessel, contaminants can be precipitated out of solution and the solvent recycled. | Lab-Scale | Rocky Flats/ Univ. of Colorado, LANL | Organics, Nitrates? | RORGS |
| **B15. Thermal Desorption**<br>Hazardous contaminants are separated from mixed waste by heating the materials to temperatures no greater than 120°C. The waste is loaded into an indirectly heated vacuum dryer equipped with agitator vanes. Heated nitrogen gas is injected and brought to operating temperature. At the operating temperature it is subjected to a vacuum. The organic contaminants are driven off and condensed. | Full-Scale | Industrially based | Organics, Mercury | RMERC |
| **B16. Evaporation**<br>Volatile contaminants can be removed by subjecting them to vacuum distillation | Full-Scale | Complex Wide | Organics | RORGS |
| **B17. Water Soluble Polymers**<br>The water soluble polymers are added to aqueous waste streams to chelate the metals present thus forming a metal/polymer complex. The metal/polymer complex can then be separated from the solution using ultrafiltration. | Full-Scale | LANL | Metals | |
| **B18. Extraction Chromatography**<br>A reagent with specific extraction capability is physically sorbed onto an inert resin, such as Amberlite XAD-4 or XAD-7. This allows for specific metal extraction without using solvent extraction techniques and also will given the benefits of ion exchange techniques, such as small footprint and batch | Full-Scale | LANL, France | Metals and in particular the actinides | |

# ENCLOSURE B

# *Los Alamos National Laboratory*

# *Federal Facility Compliance Order*

# *Annual Site Treatment Plan Update for Fiscal Year 1996 Compliance Plan Volume*

## *March 31, 1997*

**Los Alamos**
NATIONAL LABORATORY

# TABLE OF CONTENTS

## TABLES

## ACRONYMS

| | |
|---|---|
| BV | Background Volume |
| CY | Calendar Year |
| CHEAPER | Chemical Exchange Assistance Program and External Recycling |
| CCA | Compliance Certification Application |
| CPV | Compliance Plan Volume |
| CRD | Cylinder Recontainerization Device |
| DOE | Department of Energy |
| DOE/AL | DOE Albuquerque Operations Office |
| DSSI | Diversified Scientific Services, Inc. |
| EM | Environmental Restoration and Waste Management |
| EPA | Environmental Protection Agency |
| FFCAgreement | EPA Federal Facility Compliance Agreement |
| FFCAct | Federal Facility Compliance Act |
| FFCO | Federal Facility Compliance Order |
| FY | Fiscal Year |
| GJPO | Grand Junction Project Office |
| HEPA | high-efficiency particulate air |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| IDB | Inegrated Data Base |
| IPAs | Isopropyl Alcohols |
| LANL | Los Alamos National Laboratory |
| LAPRE II | Los Alamos Power Reactor Experiment No. II |
| LDRs | Land Disposal Restrictions (RCRA) |
| LWAA | Land Withdrawal Act Amendments |
| LLW | Low-Level Waste |
| MEO | Mediated Electrochemical Oxidation |
| MTU | Mobile Treatment Unit |
| MLLW | Mixed Low-Level Waste |
| MTRU | Mixed Transuranic |
| MWIR | Mixed Waste Inventory Report |
| MWTP | Mixed Waste Treatment Plan |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emissions Standards for Hazardous Air Pollutants |
| NMED | New Mexico Environment Department |
| NMVP | No-Migration Variance Petition |
| NFS | Nuclear Fuel Services Inc |
| NSSI | Nuclear Support Services, Inc. |

| | |
|---|---|
| ORNL | Oak Ridge National Laboratory |
| OR | Oak Ridge Operations Office |
| PCB | Polychlorinated Biphenyl |
| QA/QC | Quality Assurance/Quality Control |
| RLWTP | Radioactive Liquid Waste Treatment Plant |
| RCRA | Resource Conservation and Recovery Act |
| RD&D | Research, Development, and Demonstration |
| RLWTF | Radioactive Liquid Waste Treatment Facility |
| S&A | Sampling and Analysis |
| SRS | Savannah River Site |
| SEG | Scientific Ecology Group, Inc. |
| STP | Site Treatment Plan |
| SSD | Sort, Survey, Decontamination |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TRU | Transuranic |
| TSCA | Toxic Substances Control Act |
| TWBIR | Transuranic Waste Baseline Inventory Report |
| UC | University of California |
| WERF | Waste Experimental Reduction Facility |
| WIPP | Waste Isolation Pilot Plant |

## EXECUTIVE SUMMARY

The Los Alamos National Laboratory (LANL) Site Treatment Plan (STP) Fiscal Year 1996 (FY96) Update (Update) has been prepared in accordance with the requirements of Section VII, "*Annual Site Treatment Plan Updates*," of the October 4, 1995, Federal Facility Compliance Order (FFCO) (1). The FFCO issued by the New Mexico Environment Department (NMED) requires compliance by the Department of Energy (DOE) and its management and operating contractor, the University of California (UC) Regents (Respondents), with regulatory requirements for the treatment of covered mixed waste at LANL. By definition, the STP refers to both the Background Volume (BV) and the Compliance Plan Volume (CPV).

This FY96 Update consists of two volumes: the BV Update and the CPV Update. Unless otherwise specified, its focus is on FY96 (October 1, 1995, through September 30, 1996), as required by Section VII of the FFCO.

### Background Volume Update

Section 2.0 of the BV Update brings the STP BV current to the end of the previous federal fiscal year with respect to

- the inventory of covered waste in storage at the end of FY96 and projections of the inventory of covered waste expected to be placed into storage for the next five FYs;
- progress reports on treatment and treatment technology development;
- a report on the funding of STP-related activities;
- the status of the Waste Isolation Pilot Plant (WIPP) "No-Migration Variance Petition," which is the only treatment variance potentially applicable to LANL's covered waste for which a petition had been pending when the FFCO was issued; and
- a progress report for the treatment of mixed transuranic (MTRU) waste intended for disposal at the WIPP.

#### *Covered Waste*

It should be noted that the inventory presented in the Final STP (October 4, 1995) was for mixed low level waste (MLLW) in storage before October 1, 1994 and MTRU in storage before December 1992, regardless of its time of generation or its state of compliance with the Land Disposal Restrictions (LDRs) storage requirements. In addition, some wastes reported in the FY95 Update were in the LANL mixed waste inventory at that time, but inadvertently had been omitted from the final STP inventory. All such untreated waste now meets the definition of "covered waste" in the FFCO. This Update repeats the

information presented in the FY95 Update on changes from the Final STP inventory during FY95, and describes changes to the covered waste inventory that occurred in FY96. Mixed waste that was generated in FY96 is not included in this FY96 update, because it is not a covered waste under the FFCO until it no longer complies with the LDR 1-year storage limitation.

Because other documents published by the DOE require different reporting parameters and periods, the volumes of covered waste reported in this Update may not be the same as the volumes of LANL's mixed waste reported in other documents, such as the "*1995 Hazardous Waste Report for Los Alamos National Laboratory, Volumes I and II,*" (2) (LANL's Biennial Report) and the *DOE Transuranic Waste Baseline Inventory Report* (TWBIR or BIRD) (3). Table ES-1 summarizes the changes in the MLLW covered waste inventory occurring in FY96. Table ES-2 shows the volume of MTRU covered waste currently in storage as of the end of FY96 and CY96.

## Table ES-1. Volume Totals and Changes for MLLW

| Total Volumes | FY95* | FY96 |
|---|---|---|
| Total STP reported volume | 608.6 $m^3$ | --- |
| Total covered waste in storage at end of FY | 608.9 $m^3$ | 584.1 $m^3$ |
| **Volume Changes (+/-)** | | |
| Volume treated in treatability studies | -0.22 $m^3$ | -1.20 $m^3$ |
| Decontaminated and released | -37.92 $m^3$ | --- |
| Received from FY95 LD200 effort | +38.34 $m^3$ | --- |
| Waste volume omitted from original STP inventory | --- | +4.20 $m^3$ |
| Newly generated waste that became covered waste at end of FY | --- | +51.34 $m^3$ |
| Volume shipped off-site | -2.24 $m^3$ | -79.22 $m^3$ |
| Volume increase for waste that was inadvertently omitted from the original STP inventory | +2.36 $m^3$ | --- |

**Note:* *In the FY95 Annual Update, LANL inadvertently failed to report on a treatability study conducted in FY95 on electrochemical treatment (See Section 2.2.1 of FY96 BV Update).*

## Table ES-2. MTRU Covered Waste Volumes

| Waste Treatability Group | EPA Code | Estimated Volume (m3) End of FY 96 | Estimated Volume(m3) End of CY 96 | Projections Volume(m3) CY97-CY01 |
|---|---|---|---|---|
| Solidified Inorganic and Organic Solids | D006,D007,D008, D019,D021,D039, F001,F002,F003 | 1,598.29 | 1,598.29 | 20.86 |
| Metallic Waste | D004,D006,D007, D008,D009,D019, D040 | 1,684.47 | 1,684.47 | 118.6 |
| Glass Waste | D008,D009,D019, D040 | 89.65 | 89.86 | 0.0 |
| Non-Combustible Waste | D008 | 947.09 | 947.09 | 0.0 |
| Combined Combustible and Non-Combustible Waste | D008,F001,F002 | 449.20 | 449.20 | 166.65 |
| Combustible Waste | D007,D008,D019, D040,F001,F002, U080 | 1,052.41 | 1,052.41 | 76.9 |
| Absorbed Organic | | 2.70 | 2.70 | 0.0 |
| Cemented Process Sludge | D007,D008,D009, D019,F001,F002, F005 | 156.57 | 156.57 | 83.0 |
| Leaded Glovebox Gloves | D008 | 1.46 | 1.46 | 2.1 |
| **Total** | | **5,981.84** | **5,982.05** | **447.25** |

***Treatment Progress and Treatment Technology Development***

Despite funding drawbacks, treatment technology development at LANL during FY96 continued to a limited extent, the use of off-site treatment has continued to be the primary focus of the DOE at LANL. Technology development at other DOE Albuquerque Operations Office (DOE/AL) sites focused on the design or fabrication of mobile treatment units (MTUs). This work continued to a limited extent under the *AL Mixed Waste Treatment Plan* (MWTP) (4).

Since the FY95 Annual Update was issued, the availability of commercial off-site treatment and disposal capacity for MLLW has continued to increase, and other sites in the DOE complex have been aggressively pursuing the development and permitting of mixed waste treatment facilities that offer viable treatment options for many covered wastes in the LANL STP. Commercial and non-commercial off-site treatment facilities are being used to treat appropriate waste streams, well in advance of their compliance activity due dates. During FY96 off-site shipment provided cost and time savings as compared to fabricating, permitting, and operating mobile treatment units (MTUs) onsite

at LANL, as was originally planned. DOE and UC are continuing to evaluate commercial and DOE off-site treatment facilities, as they become available, for their appropriateness to treat LANL's covered waste.

Table ES-3 shows a summary of treatment progress in FY96 and the current status of treatment technology development.

## Table ES-3. Summary of Treatment Progress and Status*

| Treatment Technology | Status as of February 1997 |
|---|---|
| Evaporative Oxidation (MWIR Treatment ID GJ-S801C) | Replaced by off-site treatment capability |
| Thermal Desorption (MWIR Treatment ID GJ-S801B) | DOE funding to proceed with the fabrication of the unit has been cut in FY97 due to budget reductions and the availability of other likely treatment options. |
| Macroencapsulation (MWIR Treatment ID PX-S803) | Replaced by off-site treatment capability; SNL/NM is evaluating an on-site epoxy resin treatment process |
| Lead Decontamination Trailer (MWIR Treatment ID LA-S0001) | Operational |
| Chemical and Plating Waste Skid (MWIR Treatment ID LA-S004) | Bench-scale unit in place |
| Hydrothermal Processing | Replaced by off-site treatment capability |
| Detox Process | Currently looking at feasibility of off-site treatment |
| Gas Cylinder Recontainerization (MWIR Treatment ID LA-S801) | Currently looking at feasibility of off-site treatment |
| Gas Cylinder Scrubbing Skid (MWIR Treatment ID LA-S801) | Currently looking at feasibility of off-site treatment |
| Reactive Waste Treatment Skid (MWIR Treatment ID LA-S003) | Currently looking at feasibility of off-site treatment |
| Amalgamation of Mercury (MWIR Treatment ID PI-S801) | Replaced by off-site treatment capability; SNL/NM has developed a bench-scale amalgamation process |
| Sort, Survey, and Decontamination (MWIR Treatment ID GJ-S804) | Initiated in June 1995, the project was ongoing as of the end of FY96. |
| Distillation of Mercury (MWIR Treatment ID LA-S701) | Bench-scale tests were conducted in FY95 to demonstrate radionuclide removal efficiencies; analytical results are pending; no activity during FY96. |
| Packed Bed Reactor and Silent Plasma Discharge (MWIR Treatment ID LA-S801) and technology adaptation | Currently looking at feasibility of off-site treatment; DOE/AL has postponed further development of the PBS/SPD; LANL RD&D permitted unit was not used during FY96, currently undergoing closure. |
| Waste Work off | See Table ES-1 |

**Note: The table shows the status as of February 1997; during FY96 the DOE focused aggressively on off-site treatment (see Sections 2.2.2, 2.3, and 2.4 of the BV Update).*

### *Funding*

Funding to implement the LANL Site Treatment Plan for mixed waste during FY96 was sufficient to meet all compliance dates required by the STP as issued on October 4, 1995. Funding was reduced for development of mobile treatment units at LANL, but DOE's resources were directed at shipment of mixed waste off site for treatment and disposal. Funding during FY97 is also sufficient to meet all compliance dates established in the STP for FY97, and projected funding for FY98 should again allow all compliance dates in the STP to be met during FY98. Should funding reductions occur that would affect STP compliance dates, the Respondents will notify the NMED.

### *TRU Waste Characterization and Treatment*

As the result of the WIPP Land Withdrawal Act Amendments (LWAA) of 1996, a No Migration Variance Petition is no longer required at WIPP, and the EPA has terminated its review of DOE's No-Migration Variance Petition (5). To date, the DOE has met its schedule for submittal of regulatory documents related to opening WIPP. No treatment variances for WIPP were requested or granted in FY96.

At the WIPP facility, no capabilities for characterizing TRU waste for hazardous waste constituents or treatment of MTRU to meet the LDR standards were developed, or planned to be developed, as of the end of FY96. No treatment technologies for MTRU waste had been developed at LANL as of the end of FY96.

## *Compliance Plan Volume Update*

Section 2.0 of the CPV Update includes a description of revisions and amendments involving compliance date changes that were proposed or approved in FY96. Section 3.0 is provided for the purpose of describing deletions of STP waste, in accordance with the requirements in Section IX (*Deletion of Waste*) of the FFCO, that were proposed or approved in FY96. Section 4.0 discusses additions of new covered waste in accordance with the requirements in Section VIII (*Addition of New Covered Waste*), that were proposed or approved in FY96. Section 5.0 is provided for the purpose of describing any other changes to the overall schedule in the CPV of the STP that were proposed or approved in FY96. Section 6.0 is provided for the purpose of describing any planned changes to the STP that were proposed or approved since the end of FY96.

## 1.0 INTRODUCTION

On October 4, 1995, the New Mexico Environment Department (NMED) issued a Federal Facility Compliance Order (FFCO) to the Department of Energy (DOE) and its management and operating contractor, the University of California (UC) Regents, requiring Los Alamos National Laboratory (LANL) to implement the Site Treatment Plan (STP) for the treatment of mixed waste. The FFCO contains many provisions for implementation of the STP. Section VII of the FFCO requires LANL to submit an Annual Site Treatment Plan Update (Update) to the NMED each year on or before March 31.

The FFCO requires that the Update bring the information in the STP Compliance Plan Volume (CPV) current to the end of the previous federal fiscal year by describing any revisions or amendments requested or granted in that FY that change the compliance dates, add or delete treatability groups, or in any other way change the schedules of the STP.

Section 2.0 of the CPV Update includes a description of revisions and amendments involving compliance date changes that were proposed or approved in FY96. Section 3.0 is provided for the purpose of describing deletions of STP waste in accordance with the requirements in Section IX (Deletion of Waste) of the FFCO, that were proposed or approved during the previous FY. None occurred in FY96. Section 4.0 is provided for the purpose of describing any additions of new covered waste in accordance with the requirements in Section VIII (Addition of New Covered Waste). Section 5.0 is provided for the purpose of describing any other changes to the overall schedule in the CPV of the STP that were proposed or approved in FY96. Section 6.0 is provided for the purpose of describing any changes to the STP that have been planned or proposed to NMED since the end of FY96.

## 2.0 PROPOSED REVISIONS AND AMENDMENTS



The purpose of this section is to provide information about the changes to the CPV of the LANL STP requested or approved as revisions, amendments, or other changes under the FFCO in FY96 that affect compliance dates. One such revision was approved during FY96, as described in Section 2.1.

### 2.1 Further Lead Processing Activity Schedule

Section 3.4.1 of the CPV required DOE and UC to provide a schedule for development of lead processing techniques and options by June 30, 1996. This schedule was submitted to address those lead shapes and forms found to be "*not amenable to processing using the lead decontamination trailer*". This lead is MLLW contained in the treatability group "lead for surface decontamination (MWIR waste ID LA-W930).

DOE and UC proposed that lead not subject to treatment using the decontamination trailer would be processed using commercially available lead decontamination services or macroencapsulation. The process for using commercial lead decontamination services is a multi-step process to ensure that as much of the lead as possible is recycled instead of treated and disposed. The schedule provided by letter to NMED on June 26, 1996 described each of the multi-step processes as well as a compliance date LANL proposed to meet for each process (16). NMED concurred with LANL's submitted schedule and incorporated it in Revision 1.0 in June 1996 (see Section 5.1 of this Update for further discussion of Rev. 1.0) (17).

## 3.0 DESCRIPTION OF WASTE DELETED IN ACCORDANCE WITH SECTION IX

One request was submitted during FY96 and approved after the end of FY96, as discussed in Section 3.1.

### 3.1 TA-50-1 Waste Water Treatment Sludge Re-Classification (FFCO Rev. 2.0)

In a letter dated January 12, 1996, LANL requested reclassification (as nonhazardous low-level waste) of 1,228 out of a total of 1,288 drums of wastewater treatment sludge stored at LANL(18), in accordance with the FFCO, Section V.B, and the deletion provisions in Section IX. These sludges are generated by treatment of wastewaters at LANL's TA-50, Building 1 Radioactive Liquid Waste Treatment Plant (RLWTP). The 1,288 drums of sludges included in the FFCO are in the treatability group "*dewatered*

*treatment sludge*", MWIR waste ID LA-W928, and are addressed in Section 3.3 of the CPV.

The RLWTP was constructed to treat radioactively-contaminated wastewater from nuclear research activities and other operations conducted at LANL. During the 1980s, DOE and UC began managing the sludge as MLLW, based on a conservative application of regulatory requirements. These sludges later became subject to management as "covered wastes" in the STP. DOE and UC conducted a recent reevaluation of the available data, together with a review of the numerous earlier studies at LANL reviewing various aspects of RLWTP operations and/or sludges in particular. Based on the reevaluation of the sludges, it was determined that the drums of sludge should not be regulated under RCRA and should be re-classified as LLW. NMED was provided with information such as analytical results, relevant LANL Administrative Requirements (ARs), analytical methods, Quality Assurance/Quality Control (QA/QC) procedures for sampling, and excerpts from LANL's Chemical and Mixed Waste Database (19, 20).

NMED agreed with DOE and UC's determination that the sludges should be reclassified by way of letter dated October 7, 1996 (21) . Due to the significance of the amount of waste proposed to be reclassified, NMED stipulated that the reclassification be approved through the revision process. DOE and UC modified their original request ot address 1,227 of the 1,288 drums, and provided NMED with additional information to assure only reclassified waste are removed from the treatability group (MWIR waste ID LA-W928) for disposal on-site. On December 9, 1996, NMED approved DOE and UC's request to reclassify the sludges as LLW as Revision 2.0. Thus, 1,227 of the sludge drums are no longer covered by the FFCO (22).

## 4.0 DOCUMENTATION OF NEW COVERED WASTE IN ACCORDANCE WITH THE REQUIREMENTS IN SECTION VIII

No requests were submitted in FY96 for a revision or amendment due to additions of treatability groups. Refer to Section 6.0, "*Anticipated revisions and Amendments,*" for discussion of a request made since the end of FY96 in accordance with the requirements of Section VIII (Addition of New Covered Waste) of the FFCO.

## 5.0 ANY OTHER CHANGES TO THE OVERALL SCHEDULE IN THE COMPLANCE PLAN VOLUME

### 5.1 Revision of Off-Site Shipment Approval Process (FFCO Rev. 1.0)

Since the FY95 Annual Update was issued, the availability of commercial off-site treatment and disposal capacity for MLLW has continued to increase because other sites

in the DOE complex have been aggressively pursuing the development and permitting of mixed waste treatment facilities that offer viable treatment options for many covered wastes in the LANL STP. These facilities provide LANL with viable, cost-effective options for treatment and disposal of many STP/CPV covered wastes.

In order to expeditiously utilize off-site treatment facility capabilities, LANL requested a revision by letter (March 1, 1996) to NMED concerning the off-site shipment approval process in the FFCO of October 4, 1995 (23). Two key changes were requested by LANL in order to change the language in the STP/CPV of the FFCO: (1) to add off-site treatment as a parallel preferred option to most STP/CPV MLLW treatability groups; and (2) to eliminate the requirement for pre-approval by NMED of shipments to commercial off-site facilities for all covered waste not listed in Sections 3.1.1 and 3.1.2 of the STP/CPV.

STP compliance dates were not modified. In accordance with Section X of the FFCO, LANL proposed to utilize off-site DOE facilities at Idaho National Engineering and Environmental Laboratory (INEEL) and Oak Ridge National Laboratory (ORNL), as well as commercial treatment facilities. NMED made some modifications to LANL's draft revision (24, 25). One important modification made by NMED involved language specifying that DOE must obtain NMED approval prior to shipment to any newly identified non-commercial facilities. Other modifications addressed minor changes, such as typographical errors in the proposed draft revision. On June 12, 1996, following a public comment period, NMED approved LANL's request as "Revision 1.0" of the STP/CPV, which replaced the original STP/CPV dated October 4, 1995 (26).

## 6.0 ANTICIPATED REVISIONS AND AMENDMENTS

### 6.1 Re-Characterization of "Soils With Heavy Metals" in Storage at TA-54

In October, 1996, by letter to NMED, DOE and UC proposed to reclassify (as nonhazardous low-level waste ) forty-seven (47) 55-gallon containers of soil waste being stored at LANL (27). These soil and debris wastes were generated from the decommissioning and decontamination of the TA-2 Water Boiler Reactor and TA-35 Los Alamos Power Reactor Experiment No. II (LAPRE II). The Water Boiler Reactor and LAPRE II were used to provide researchers with an intense source of neutrons to conduct experiments. Originally, the waste was classified as MLLW due to the suspected presence of lead and chromium. The suspected lead component in the waste was believed to have come from soil that was taken from under and over lead plates and vent piping. Chromium, a product of corrosion, would have resulted from the fuel solution that could strip the chromium from the inside of the stainless steel tank.

These soils are listed in the STP under Section 3.1.2 in the Compliance Plan Volume (CPV, Rev. 1.0, June 12, 1996), and the Background Volume, in the treatability group "soil with heavy metals," MWIR waste ID LA-W904. NMED has requested additional information regarding this request, which was modified by DOE and UC to address 46, rather then 47, containers of soil (28). As of March 31, 1997, NMED has not yet approved this request.

## 6.2 Federal Facility Compliance Order Amendment

On October 30, 1996, DOE and UC requested an amendment to the LANL FFCO issued October 4, 1995 (29). This amendment request was made in order to resolve practical problems that had been encountered while implementing certain FFCO requirements at LANL. While LANL was trying to work off STP waste in storage, numerous instances arose that would eventually lead to a delay meeting compliance dates listed in LANL's STP, for example, regarding the transfer of waste to another treatability group or addition of newly identified wastes to a treatability group. DOE and UC proposed amendments to the FFCO to address these problems.

In addition to the requested amendments to Section X.B.4 of the FFCO described above, DOE and UC also requested changes to Section IX, "Deletion of Waste". These amendments are currently pending final review and approval by NMED (3).

## 6.3 Sort, Survey, and Decontamination (FFCO Rev. 3.0)

On October 21, 1996, DOE and UC requested a revision to revise the CPV language in Section 3.4.2, titled Sorting, Surveying, and Decontamination, in the STP (31). The following were included in the revision requests by DOE and UC to NMED:

- to subdivide the SSD wastes into three subgroups;
- to modify the existing CPV language to allow additional sampling and analysis to proceed for some (approximately 101) of the remaining 201 unsurveyed SSD items (subgroup 2);
- to allow for visual inspections of the other remaining unsurveyed SSD items that cannot or should not be sampled (subgroup 3); and
- to establish compliance dates for subsequent disposition of all 1,250 SSD waste items.

NMED responded by letter to UC and DOE on October 30, 1996 with additional language it felt was necessary to approve such a revision (30). NMED approved UC and DOE's revision and Revision No. 3.0 to the STP on January 27, 1997 (32).

## 6.4 Documentation of New Covered Waste

A request for a revision to include the new covered waste discussed in the FY95 and FY96 Background Volume Updates is being submitted concurrently with this Update.

## 6.5 Multi-part Revision

LANL is currently considering proposing a revision consisting of multiple parts. This revision will incorporate changes to the Compliance Plan Volume not related to the STP inventory. The proposed revision will represent LANL's concerns regarding language in the Compliance Plan Volume up to and beyond FY96. When LANL has fully examined which proposed revisions should be incorporated in the Compliance Plan Volume, NMED will be notified by letter as required under Section X of the FFCO.

As discussed in the BVU under section 2..3.3, LANL is currently reviewing on and off site recycling options for all waste streams present in LANL's STP. Pollution prevention initiatives such as the use of LANL's Chemical Exchange Program to recycle chemicals characterized as STP mixed waste, and recycling of metals such as lead, are two examples of recycling options that are being evaluated for the purpose of reducing LANL's STP waste inventory, as well as reducing the generation of additional mixed waste in the future. Recycling options will be included as part of the multi-part revision process discussed above. Also included will be a section regarding the use of on and off-site treatability studies to explore recycling options for all of LANL's STP mixed waste streams. LANL will also include revision language to FFCO Revision 1.0, Revision of Off-Site Shipment Approval Process to include off-site treatment capabilities applicable to all waste streams present in LANL's CPV.

## BIBLIOGRAPHY



### References Sited in BV Update

1. "*Federal Facility Compliance Order (Los Alamos National Laboratory*" New Mexico Environment Department (October 4, 1995)

2. "*Hazardous Waste Report for Los Alamos National Laboratory*" Volumes I and II, ESH-19, Los Alamos National Laboratory (February 1996)

3. "*Transuranic Waste Baseline Inventory Report Revision 3*", US Department of Energy, Carlsbad Area Office (December 1995)

4. "*AL Mixed Waste Treatment Plan*", Los Alamos National Laboratory (March 1994)

5. Congress, 1996. Text of Public Law 104-201, Congressional Record dated September 23, 1996, Amendment to Public Law 102-579, 1992 *Waste Isolation Pilot Plant Land Withdrawal Act (106 Stat. 4777)*

6. "*Los Alamos National Laboratory Federal Facility Compliance Order Annual Site Treatment Plan Update for Fiscal Year 1995*" (March 31, 1996)

7. *"Mixed Waste Inventory Report*", US Department of Energy, Office of Environmental Management (1995)

8. "*Albuquerque Operations Office Mixed Waste Treatment Plan Evaluation and Identification of Treatment Options for MTUs,"*, US Department of Energy Albuquerque Operations Office (September 1995).

9. "*Proposed Changes to the AL-Mixed Waste Treatment Plan*", US Department of Energy Albuquerque Operations Office (March 1996)

10. "*Request for cancellation and withdrawal of the Los Alamos National Laboratory Technical Area (TA) 63 Hazardous Waste Treatment Facility (HWTF) and Chemical Plating Waste Skid*", T. Todd, LAAO to B. Garcia, NMED (August 7, 1996)

11. "*Los Alamos National Laboratory, Site Treatment Plan, Notice of Completion of Permit application Resubmittal, Activity 3.1.6A*", J. Plum, LAAO to J. Archuleta, NMED (November 12, 1996)

12. "*Request for cancellation and withdrawal of the Los Alamos National Laboratory Hydrothemal Processing Unit*", T. Todd, LAAO to B. Garcia, NMED (May 23, 1996)

13. *"Notification of Completion of Off-Site Waste Shipment to the Waste Experimental Research Facility (WERF), Idaho National Engineering Laboratory (INEL), Activity 3.1.1C in the Site Treatment Plan Federal Facility Compliance Order (FFCO), Rev. 1.0, June 12, 1996"*, J. Plum, LAAO to J. Archuleta, NMED (July 16, 1996)

14. "*Los Alamos National Laboratory Draft Ten Year Plan*", Los Alamos National Laboratory (1997)

15. "*Mixed Waste Characterization, Treatment, and Disposal Focus Area. Technology Summary*", Office of Environmental Management, Technology Development, Report Number DOE/EM-0252 (June 1995)

**References Sited in CPV Update**

16. "*Notice of Completion of Schedule for Further Lead Processing, Activity in Section 3.4.1 in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", P. Schumann, LANL, to J. Plum, LAAO (June 24, 1996)

17. "*Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", J. Archuleta, NMED, to J. Plum, LAAO (June 3, 1996)

18. "*Re-characterization of Wastewaster Treatment Sludge in Storage at Technical Area (TA) 54 - Request for Removal from Federal Facility Compliance Order (FFCO)*", J. Plum, LAAO, to B. Garcia, NMED (January 12, 1996)

19. "*Site Treatment Plan (STP), Los Alamos National Laboratory (LANL) - Wastewater Treatment Sludge*", J. Plum, LAAO to J. Archuleta, NMED (August 14, 1996)

20. "*Los Alamos National Laboratory (LANL), Site Treatment Plan (STP), Wastewater Treatment Sludge*", J. Plum, LAAO, to J. Archuleta, NMED (November 7, 1996)

21. "*Los Alamos National Laboratory (LANL) TA-50-1 Wastewater Treatment Sludge Reclassification*", J. Archuleta, NMED, to J. Plum, LAAO (October 7, 1996)

22. "*Hazardous and Radioactive Materials Bureau Approval of Reclassification of TA-50-1 Waste Water Treatment Sludge*", J. Archuleta, NMED, to J. Plum, LAAO (December 4, 1996)

23. "*Request for Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", J. Plum, LAAO, to B. Garcia, NMED (March 1, 1996)

24. "*Omission and Errata on Revision to the LANL Site Treatment Plan, October 4, 1995 Federal Facility Compliance Order, Revision 1.0 (June 1996)*", J. Archuleta, NMED, to J. Plum, LAAO (June 10, 1996)

25. "*NMED Response to Request for Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", B. Garcia, NMED, to J. Plum, LAAO (March 12, 1996)

26. "*Approval of Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, Revision 1.0 (June 1996)*", J. Archuleta, NMED, to J. Plum, LAAO (June 12, 1996)

27. "*Recharacterization of "Soil With Heavy Metals" in Storage at Technical Area (TA) 54 - Request for Removal from the Site Treatment Plan (STP)*", J. Archuleta, NMED, to J. Plum, LAAO (October 18, 1996)

28. "*Los Alamos National laboratory (LANL) Request to Reclassify "soil with heavy metals" in Section 3.1.2 of the Site Treatment Plan Compliance Plan Volume (STP/CPV) of the Federal Facility Compliance Order (FFCO) October 4, 1995*", J. Plum, LAAO, to J. Archuleta, NMED (November 22, 1996)

29. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFCO) October 4, 1995, Site Treatment Plan (STP) Sort, Survey, and Decontamination (SSD) Request for Revision No. 3 and Amendment No. 1*", J. Plum, LAAO, to J. Archuleta, NMED (October 21, 1996)

30. "*Los Alamos National Laboratory's Federal Facility Compliance Order (October 4, 1995), Request for Amendment*", J. Plum, LAAO, to J. Archuleta, NMED (October 29, 1996)

31. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFC)), Exhibit A, Mixed Waste Site Treatment Plan (STP) Compliance Plan volume (CPV), Request for Revision No. 2 and Amendment 1*", J. Archuleta, NMED, to J. Plum, LAAO (October 30, 1996)

32. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFCO) October 4, 1995, Site Treatment Plan (STP) Sort, Survey, and Decontamination (SSD) Request for Revision No. 3*", J. Archuleta, NMED, to J. Plum, LAAO (October 30, 1996)

24. "*Omission and Errata on Revision to the LANL Site Treatment Plan, October 4, 1995 Federal Facility Compliance Order, Revision 1.0 (June 1996)*", J. Archuleta, NMED, to J. Plum, LAAO (June 10, 1996)

25. "*NMED Response to Request for Revision to Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, October 4, 1995*", B. Garcia, NMED, to J. Plum, LAAO (March 12, 1996)

26. "*Approval of Off-Site Shipment Approval Process in the Site Treatment Plan, Federal Facility Compliance Order, Revision 1.0 (June 1996)*", J. Archuleta, NMED, to J. Plum, LAAO (June 12, 1996)

27. "*Recharacterization of "Soil With Heavy Metals" in Storage at Technical Area (TA) 54 - Request for Removal from the Site Treatment Plan (STP)*", J. Archuleta, NMED, to J. Plum, LAAO (October 18, 1996)

28. "*Los Alamos National laboratory (LANL) Request to Reclassify "soil with heavy metals" in Section 3.1.2 of the Site Treatment Plan Compliance Plan Volume (STP/CPV) of the Federal Facility Compliance Order (FFCO) October 4, 1995*", J. Plum, LAAO, to J. Archuleta, NMED (November 22, 1996)

29. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFCO) October 4, 1995, Site Treatment Plan (STP) Sort, Survey, and Decontamination (SSD) Request for Revision No. 3 and Amendment No. 1*", J. Plum, LAAO, to J. Archuleta, NMED (October 21, 1996)

30. "*Los Alamos National Laboratory's Federal Facility Compliance Order (October 4, 1995), Request for Amendment*", J. Plum, LAAO, to J. Archuleta, NMED (October 29, 1996)

31. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFC)), Exhibit A, Mixed Waste Site Treatment Plan (STP) Compliance Plan volume (CPV), Request for Revision No. 2 and Amendment 1*", J. Archuleta, NMED, to J. Plum, LAAO (October 30, 1996)

32. "*Los Alamos National Laboratory (LANL) Federal Facility Compliance Order (FFCO) October 4, 1995, Site Treatment Plan (STP) Sort, Survey, and Decontamination (SSD) Request for Revision No. 3*", J. Archuleta, NMED, to J. Plum, LAAO (October 30, 1996)