MACROENCAPSULATED AND ELEMENTAL LEAD MIXED WASTE SITES REPORT

prepared by
Asha Kalia
Roger Jacobson

submitted to
Nevada Operations Office
U.S. Department of Energy
Las Vegas, Nevada

September 1996

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MACROENCAPSULATED AND ELEMENTAL LEAD MIXED WASTE SITES REPORT

prepared by

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Desert Research Institute
University and Community College System of Nevada

Publication No. 45145

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U.S. Department of Energy
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Las Vegas, Nevada

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EXECUTIVE SUMMARY

The Desert Research Institute (DRI), University and Community College System of Nevada, was directed by the Department of Energy, Nevada Operation Office (DOE/NV) Waste Management Division (WMD) to review five DOE sites under the Federal Facility Compliance Act of 1992 (FFCAct), Proposed Site Treatment Plans (PSTPs) and Final Site Treatment Plans (FSTPs). The purpose of this study was to compile a list of the Macroencapsulated (MACRO) and Elemental Lead (EL) Mixed Wastes sites that will be treated and require disposal at the Nevada Test Site within the next five to ten years. The five sites selected by the DOE/NV/WMD, Project Manager were: Hanford Site, Richland, Washington; Idaho National Engineering Laboratory (INEL), Idaho Falls, Idaho; Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee; Rocky Flats Environmental Technology (RF), Golden, Colorado; and Savannah River (SRS), Charleston, South Carolina. DRI was able to review and compile information on the four available PSTPs and FSTPs. The Hanford site information was gathered from the DOE/ERWM report, “Contaminated Concrete: Occurrence and Emerging Technologies for the DOE Decontamination.” Hanford has been exempted from preparing a PSTP and FSTP as described in the Introduction of this report.

A summary of total lead mixed waste forms at the five selected DOE sites is described in Table E-1. This table provides a summary of total waste and grand total of the current inventory and five-year projected generation of lead mixed waste for each site. It appears from the data obtained from the PSTPs and FSTPs that a large quantity of radioactively contaminated lead and other waste forms contaminated with lead are stored for macroencapsulation treatment and disposal at the four DOE facilities, INEL, ORNL, RF and SRS.

This report provides conclusions and recommendations for further investigations. The major conclusions are: (1) the quantity of lead mixed currenty inventory waste is 500.1 m$^3$ located at the INEL, and (2) the five sites contain several other waste types contaminated with mercury, organics, heavy metal solids, and mixed sludges.

It is recommended that the DOE/NV/WMD continue to compile data on the rest of the DOE facilities on the MACRO/EL mixed waste and other contaminated wastes destined for disposal at the Nevada Test Site. The DRI recommends that the DOE/NV conduct onsite visits to collect additional information on the MACRO/EL waste mixed with other wastes at the major DOE facilities.
<table>
<thead>
<tr>
<th>Site Name</th>
<th>Type of Waste (Total Amount)</th>
<th>Technology Group</th>
<th>Current Inventory 1995 (m$^3$)</th>
<th>Five-Year Projected Generation 1995–1999 (m$^3$)</th>
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<td>HANF</td>
<td>1 Approximate Contaminated Concrete</td>
<td>No Information Available</td>
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<td>MACRO</td>
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<td>Total Lead Contaminated</td>
<td>MACRO</td>
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<td>10.446</td>
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<td>ORNL</td>
<td>Elemental (Lead) Hazardous Metal</td>
<td>Elemental Lead</td>
<td>2 INV 1993 (m$^3$) 94.884</td>
<td>GEN 1993 (m$^3$) 1.874</td>
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<td>ORNL</td>
<td>MLLW Contact–handled Batteries</td>
<td>MACRO</td>
<td>18.675</td>
<td>7.380</td>
</tr>
<tr>
<td>RF</td>
<td>Total Lead Contaminated</td>
<td>MACRO</td>
<td>38.89</td>
<td>38.98</td>
</tr>
<tr>
<td>SRS</td>
<td>Total Lead Contaminated</td>
<td>MACRO</td>
<td>156.3</td>
<td>90.2</td>
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<tr>
<td></td>
<td>Grand Total of four sites (m$^3$)</td>
<td></td>
<td>840.656</td>
<td>375.52</td>
</tr>
</tbody>
</table>

1 Hanford site data were compiled from the DOE/ERWM report, “Contaminated Concrete: Occurrence and Emerging Technologies for DOE Decontamination.” The concrete lead contamination data are not included in the grand total.

2 ORNL reported data other than that for 1995 under Inventory (INV) and Generated (GEN) wastes.

Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
ACKNOWLEDGMENTS

This report was prepared with the combined efforts of Dr. Asha Kalia and Dr. Roger Jacobson, Desert Research Institute, University and Community College System of Nevada. The funding for the Macroencapsulation and Elemental Lead Mixed Waste project was provided by the Department of Energy (DOE), Nevada Operations Office (NV), Office of Technology Development (TD). The authors gratefully acknowledge the support provided by Frank Di Sanza and Ralph F. Smieckinski of DOE/NV/TD. The project investigations were coordinated by Ms. Colleen O’Laughlin, Project Manager, DOE/NV Waste Management Division.
LIST OF ACRONYMS AND ABBREVIATIONS

APP      Appendix
DRI      Desert Research Institute
DOE      Department of Energy
DEQ      Division of Environmental Quality
EL       Elemental Lead
EPA      Environmental Protection Agency
ERWM     Environmental Restoration and Waste Management
ETF      Effluent Treatment Facility
FFCA     Federal Facility Compliance Act
FT       Feet
FSTP     Final Site Treatment Plan
HANF     Hanford
INEL     Idaho National Engineering Laboratory
LDR      Land Disposal Restriction
LLW      Low-Level Waste
MACRO    Macroencapsulated
MWIR     Mixed Waste Inventory Report
NV       Nevada Operations Office
NTS      Nevada Test Site
ORNL     Oak Ridge National Laboratory
OAT      Option Analysis Team
PSTP     Proposed Site Treatment Plan
RF       Rocky Flats
RCRA     Resource Conservation and Recovery Act
SRS      Savannah River Site
STP      Site Treatment Plan
TC       Toxic Characterization
TTP      Technical Task Plan
WEDS     Waste Engineering Development Facility
WMD      Waste Management Division
WROC     Waste Reduction Operation Complex
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</tr>
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</tbody>
</table>
INTRODUCTION

In May 1996, the Desert Research Institute (DRI) of the University and Community College System of Nevada was directed by the Department of Energy, Nevada Operations Office (DOE/NV), Waste Management Division (WMD) to review Final Site Treatment Plans (FSTPs) for the five DOE sites. DRI was requested to compile data only on the macroencapsulated (MACRO) and elemental lead (EL) waste forms that will be treated and may require disposal at the Nevada Test Site (NTS) within the next five to ten years. The five DOE sites investigated were:

- Hanford Site (HANF), Richland, Washington
- Idaho National Engineering Laboratory (INEL), Idaho Falls, Idaho
- Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee
- Rocky Flats Environmental Technology Site (RF), Golden, Colorado
- Savannah River Site (SRS), Charleston, South Carolina

The MACRO/EL waste data were compiled only for four sites (INEL, ORNL, RF and SRS). The PSTPs were available at the DOE/NV Reading Facility for the study. The PSTP for the Hanford site in Richland, Washington, was not available. As described in the DOE National Summary Report, “Draft Site Treatment Plans, 1994,” the Hanford site was exempted from preparing an STP as required by the Federal Facility Compliance Act (FCCAct) of 1992. This site had an existing agreement with the state of Washington and the Environmental Protection Agency (EPA), Region 10, that addresses mixed waste treatment requirements. The Hanford site data on lead mixed waste were available in the DOE Environmental Restoration and Waste Management (ERWM), Office of Technology Development report “Contaminated Concrete: Occurrence and Emerging Technologies for the DOE Decontamination” (DOE/ORO-2034). Various terms used in this report are described in Definitions, Appendix A.

REQUIREMENTS

The requirements for this investigation are found in the FCCAct of 1992. It requires that the DOE prepare STPs for each individual DOE site that generates or stores mixed waste. Mixed wastes contain both hazardous and radioactive components. This is also required by the Resource Conservation and Recovery Act (RCRA), as amended by the FCCAct of 1992. The mixed waste streams are subject to the Land Disposal Restriction (LDR) regulations.

As required by the FCCAct of 1992, each DOE STP must provide a list or inventory of mixed waste treatment technology required and the approach or treatment facility that will be used to treat the waste. The law also requires that the STP includes treatment capacity and schedules for bringing new facilities into operation. Each STP is a result of a three-part planning process consisting of a (1) Conceptual Site Treatment Plan, (2) Draft Treatment Plan, and (3) Proposed Site Treatment Plan. The PSTP, upon concurrence with the appropriate state regulatory agency, becomes the final STP.
OBJECTIVES

The basic objectives of this study were to determine the type and amount of lead mixed waste to be disposed of at the NTS in the next five to ten years. Information on the composition of lead mixed waste would then be provided to the University of Nevada, Reno (UNR) to help in the design of laboratory experiments. Another objective of this study was to determine whether macroencapsulation (MACRO) is the preferred treatment option of lead-contaminated mixed waste to be disposed of at the NTS as well as throughout the DOE complex. MACRO is accomplished by totally encasing the waste in a thermoset or thermoplastic resin or epoxy. The product of this unit is a final waste form suitable for land disposal.

PURPOSE AND SCOPE

The purpose of this study was to conduct research only on the final MACRO/EL waste forms and verify their suitability for disposal or recommend alternative modifications required prior to safe disposal at the NTS within five to ten years. Appendix C contains the Technical Task Plan (TTP) for this study. The TTP was provided to DRI by DOE and contains specific guidance for conducting these investigations. DRI was requested by the DOE/NV directives to obtain the following information in conjunction with the review of the PSTPs for the five DOE sites described earlier:

- DOE site responsible for the waste.
- Final waste form (e.g., MACRO lead, grouted material).
- Anticipated volume of final waste form (ballpark estimate, as needed).
- Waste treatment “recipe” (i.e., identify MACRO specifics such as coating thickness and constitution).
- Treatment schedule by fiscal years (described in the Tables wherever available).
- Proposed and alternative disposal locations, if determined.

The above information is presented in Tables 3 through 9 for the HANF, INEL, ORNL, RF and SRS sites. The waste treatment “recipe” is described in “Review of Encapsulation Technologies,” report.

STUDY METHODOLOGY

DRI reviewed PSTPs and other documents available in the DOE public reading facility and from other sources. The bibliography at the end of this report provides a list of documents used in developing the data reported here. Data were also obtained by interviewing the site managers by telephone. Two interview forms were developed (Appendix B) to obtain consistent data on MACRO/EL waste forms from each site either by calling or by visiting the sites. However, during the investigation, no interviews were conducted and none of the five sites were visited.
DATA COMPILATION ON THE MIXED LEAD WASTE (MACRO/EL WASTE)

It was noted during the investigation that the density of the lead mixed waste is highly varied because of the variety of mixed waste forms. As discussed in the Introduction, the PSTPs were developed by each DOE site under similar format and guidelines to establish consistency among all the sites. These guidelines were developed and coordinated with the individual sites by the DOE task forces and working groups to provide guidance on the format and content of the proposed plans.

DRI was directed by the DOE/NV/WMD Project Manager to compile MACRO/EL waste forms-related information for each of the five sites investigated. The type of data to be gathered includes:

- localities within a given site;
- name of site
- name of waste stream;
- description of waste stream;
- treatability group;
- treatment technology;
- schedule for shipment to the facility;
- treatment on site;
- current inventory; and
- five-year projected generation of waste at the facility

During the investigation, it was noted that all of the PSTPs for the sites did not contain all of the information requested by DOE/NV/WMD.

DESCRIPTION OF TABLES FOR EACH SITE

Summary of Information Requested by the DOE/NV and the Type of Data Obtained from the PSTPs (Table 1)

Table 1 presents the information that was available, as directed by DOE/NV, and relevant information by each site. Cross checks are placed under similar information; inconsistent information is described in each individual column as it is described in each of the PSTPs. Data collected for each site are presented in Tables 1 through 9.

Hanford Site – Summary of Lead Mixed Waste Sites (Table 2)

As indicated earlier, the Hanford site was exempted from preparing a PSTP, as required by the FFCAct of 1992 and RCRA. Therefore, the data reported in this table were compiled from the DOE/ERWM report “Contaminated Concrete: Occurrence and Emerging Technologies for the DOE
Decontamination” (DOE/ORO-2034). These data are inconsistent with the DOE directives because information reported in the ERWM document is in a different format. The approximate volume of contaminated concrete at the site in 1995 was 18,540,100 ft$^3$ or 525,364 m$^3$ for the four buildings. Contaminated concrete appears to be a major waste volume at this site.

**Idaho National Engineering Laboratory Site – Summary of Onsite Lead Mixed Waste Sites (Table 3)**

This table identifies only MACRO/EL waste streams intended to be treated at INEL. These waste streams were generated onsite for treatment at INEL. The data compiled in this table are described in various sections of the INEL PSTP with other waste forms. MACRO/EL waste forms were separated from the other waste forms for this study. The total volume of current inventory of lead mixed waste in 1995 was 500.1 m$^3$. However, the generation of lead mixed waste from 1995–1999 was projected to be 226.1 m$^3$. All the lead waste is required for MACRO treatment at the INEL. The study shows about 70% of scrap metal contaminated with lead exist at the facility as it is described in Table 3 (ID–INL–143, current inventory 345.1 m$^3$). Mixed wastes at INEL are predominantly expected to meet LDR treatment standards onsite through a number of facilities, such as the Waste Experimental Reduction Facility, Waste Reduction Operation Complex, Idaho Chemical Processing Plant, Argonne National Laboratory West and Test Area North.

The Waste Reduction Operation Complex (WROC), as described in Table 3, has been identified as a potential location for development, testing and implementation of various mixed low-level waste treatment technologies. The WROC is used to demonstrate, test and operate sizing, segregation, mercury retorting and MACRO/stabilization technologies.

The following are the treatment facility schedules (P1, P2, P3, P4, P5, P6) as described in Table 3, and the schedule for approval by the state (S1). A detailed description for MACRO/EL waste forms can be obtained in the INEL PSTP, Section 5, Table 5-1 “Milestones/Planning Dates for Mixed Wastes with Existing Treatment Technologies” for each individual facility.

- **P1** – Submit Part B: The date on which INEL presents the RCRA Part B submittal to the DEQ for approval is June 30, 1996.
- **P2** – Procure Contracts: The date on which contracts are in place for the design of facilities and/or process equipment is September 30, 1995.
- **P3** – Initiate Construction: The date on which a contractor(s) mobilizes and begins construction of a process or facility containing a process is June 30, 1997.
- **P4** – Commence System Testing: The date on which testing begins on the treatment process equipment on “cold” feedstock is December 31, 1998.
- **P5** – Commence Operations: The date on which treatment of waste using the treatment process begins is June 30, 1998.
- **P6** – Schedule for System Backlog: The date on which the INEL submits a schedule after commencing operation identifying the time required for processing waste currently in
storage (this includes waste in storage at INEL and offsite waste intended to be treated at INEL) is December 31, 1999.

- S1 – State Action: The estimated date of approval of Part B. This date is not a milestone or planning date.

Idaho National Environmental Laboratory – Summary of Offsite Lead Mixed Waste Sites (Table 4)

This table presents MACRO/EL waste streams information for wastes generated at offsite sources for which (a) the generator selected the option of treatment at INEL and/or (b) the Options Analysis Team (OAT) recommended INEL as the treatment center of choice. It shows the offsite MACRO/EL waste streams that have been identified by the offsite generator and/or by the OAT as potential matches for treatment at the INEL. The total volume of current inventory of lead mixed waste in 1995 was 31.8 m³. However, the generation of lead mixed waste from 1995–1999 was projected to be 10.4 m³. All the lead mixed waste is planned for MACRO containment at the facility. It is considered to be the preferred option for treating waste. It is important to note that INEL was not identified as the recommended treatment facility by the OAT for some of the waste streams listed in this table. However, after contacting the generators of these waste streams, it was confirmed that they intended INEL to be their primary treatment option for the listed waste streams.

Waste streams from the Charleston Naval Shipyard and the Mare Island Naval Shipyard were shipped to the INEL in FY 1996 for treatment. Since these shipyards were scheduled for closure in early 1996, they had requested that their waste be transported by January 1996 to the DOE facilities that have been identified as the primary treatment options for storage prior to treatment.

Oak Ridge National Laboratory Site – Summary of Elemental (Lead) Hazardous Metals Waste Sites (Table 5)

Table 5 presents the most recent data available in the 1993 PSTP on the EL waste form. It appears that ORNL reported site data from the MWIR, as shown in the first column of this table. The last four columns present the 1993 inventory and EL hazardous waste generated in 1993 in kilograms (kg) and cubic meters (m³). The total elemental (lead) hazardous metal inventory in 1993 was projected to be 142,330 kg or 95 m³. However, the expected waste generated in 1993 was 2,811 kg or 1.9 m³. The total volume of current inventory of lead mixed waste in 1993 at ORNL was anticipated to be very modest and the projected generation of waste was expected to be very small. All the EL waste will require MACRO treatment. The waste density is variable because of the form and the packaging.

Oak Ridge National Laboratory Site – Summary of Mixed Wastes/Contact-handled Batteries Sites (Table 6)

Information presented in Table 6 was compiled from the ORNL PSTP. It is clear from the first column of this table that data were reported from the MWIR. The last four columns present the 1993 inventory and elemental (lead) hazardous waste generated in 1993 in kg and m³. The total mixed low-level waste/contact-handled batteries 1993 inventory was 27,815.5 kg or 19 m³. However, the
expected 1993 generated waste was projected to be 10,996 kg or 7.4 m$^3$. Other detailed information is also provided in the table. The total volume of current inventory of lead mixed waste in 1993 at ORNL was anticipated to be very modest and the projected generation of waste was expected to be very small. The treatment method for most batteries will likely be MACRO.

**Rocky Flats Environmental Technology Site – Summary of Lead Mixed Waste Sites (Table 7)**

This table presents lead mixed waste stored at the Rocky Flats site. The total volume of waste in 1995 was 39 m$^3$. The five-year (1995-1999) projected generation of waste from this site is 39 m$^3$. It is anticipated that Polymer, either coating or extrusion, will be utilized for macroencapsulation.

**Rocky Flats Environmental Technology Site – Summary of Lead Mixed Waste Characterization Report Schedules (Table 8)**

This table describes schedules for completing the initial lead and leaded gloves waste characterization. The review of existing data was completed in September 1995 and the informal sampling and analysis will be completed in June 1997.

**Savannah River Site – Summary of Lead Mixed Waste Sites (Table 9)**

Information presented in this table contains categories requested by the DOE/NV, described in Table 1. Current inventory as reported in the 1995 PSTP for the 1994 total mixed lead waste stored at the SRS was 156 m$^3$. The five-year (1995-1999) projected generation of waste is 90 m$^3$. This DOE facility is projecting a decrease in the lead mixed waste to be generated during the next five years.

**Summary of Lead Mixed Waste Data from MWIR and PSTP on the RF and SRS Sites (Tables 10 and 11)**

The RF and SRS current inventory and five-year projected generation of waste (in cubic meters) from 1995-1999 were compared with the Mixed Waste Inventory Report (MWIR) data. The same data were also described in the DOE waste stream report of September 1996. It was also noted that the MWIR contains information on both current inventory and the five-year projected generation in kilograms. The PSTPs did not report the amount of waste in kilograms. This information is provided in Tables 10 and 11. The comparative study between the two documents show that a large quantity of lead mixed waste exists at both the sites as described in Tables 10 and 11. No description was provided in the MWIR on the RF five-year projected waste generation. The comparative study for the INEL and ORNL was not performed due to the unavailability of the MWIR data.

**CONCLUSIONS**

The total volume from the four major sites (INEL, ORNL, RF and SRS) is very modest at ~840 m$^3$ (29,400 ft$^3$). If this volume were to be shipped to Nevada, it would generate approximately $500,000 utilizing the projected disposal rates upto $17.00 per ft$^3$. The largest potential volume of mixed waste that could come to Nevada is the contaminated concrete from the DOE complex. Some portion of this concrete is contaminated with lead mixed waste. Based on the investigations performed by DRI as directed by DOE/NV, the following conclusions can be drawn:
- HANF was exempted from preparing a PSTP. Therefore, data for this site were obtained from the DOE/ERWM report, “Contaminated Concrete: Occurrence and Emerging Technologies for the DOE Decontamination” (DOE/ORO-2034).
- The data for the other four sites, INEL, ORNL, RF and STS, reported in the PSTPs, were found to be inconsistent, as described in Table 1.
- The total volume of current inventory of lead mixed waste form for each site is as follows:
  - **HANF**
    - Approximate lead contaminated concrete
    - Total: 525,364 m³
  - **INEL**
    - Onsite lead mixed waste:
    - Total: 500.1 m³
    - Offsite lead mixed waste:
    - Total: 31.8 m³
  - **ORNL**
    - Elemental lead waste:
    - Total: 95 m³, 142,330.5 kg
    - Mixed low-level waste/contact-handled batteries:
    - Total: 19 m³, 27,815.5 kg
  - **RF**
    - Mixed lead waste:
    - Total: 39 m³
  - **SRS**
    - Mixed lead waste:
    - Total: 156 m³
- The five-year projected generation of total waste for each site is as follows:
  - **HANF** (no data exist for this site)
  - **INEL**
    - Onsite lead mixed waste:
    - Total: 226.1 m³
    - Offsite lead mixed waste:
    - Total: 10.4 m³
  - **ORNL**
    - Elemental (lead) hazardous metals waste:
    - Total: 1.9 m³, 2,811 kg
    - Mixed low-level waste/contact-handled batteries:
    - Total: 7.4 m³, 10,996 kg
  - **RF**
    - Mixed lead waste:
    - Total: 39 m³
  - **SRS**
    - Mixed lead waste:
    - Total: 90 m³
  - **Current inventory GRAND TOTAL:**
    - 840 m³
  - **Five-year projected generation GRAND TOTAL:**
    - 376 m³
- The five DOE sites investigated contain several other types of contaminated wastes, such as mercury, organics, heavy metal solids, and various mixed sludges.
- MACRO appears to be the preferred treatment option for the contaminated lead waste.
RECOMMENDATIONS

It is recommended that DOE/NV:

- Continue to compile these types of data on all of the other DOE facilities to gain a better understanding of quantity and type of mixed low-level waste that might be disposed of at the NTS within five to ten years.

- Expand the data base to include other types of wastes that might be stored at the NTS over a five- to ten-year period.

- Conduct onsite visits to collect additional information for major DOE facilities. Appendix B contains interview forms, which can facilitate obtaining the needed data for the various sites.

- Investigate contaminated concrete from the DOE complex. (In the conclusion section of DOE/ORO-2034 is a description of contaminated concrete which could require macroencapsulation).
<table>
<thead>
<tr>
<th>DOE Sites</th>
<th>Site Name</th>
<th>Waste Stream Name</th>
<th>Waste Stream Description</th>
<th>Treatability Group</th>
<th>Treatment Technology</th>
<th>Schedule for Shipment to Facility</th>
<th>Treatment Onsite</th>
<th>Current Inventory (m³)</th>
<th>Five-Year Projected Generation (m³)</th>
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</thead>
<tbody>
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<td>HANF</td>
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<td>Bldg Number</td>
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<td>Media Type (if more than one)</td>
<td>Volume %</td>
<td>Treatment Facility</td>
<td>Treatment Facility Schedules</td>
<td>Inventory (kg)</td>
<td>Inventory (m³)</td>
<td>Generated (kg)</td>
</tr>
<tr>
<td>ORNL</td>
<td>4MWIR</td>
<td>5APP B</td>
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<td>Technology Group</td>
<td>Preferred Options</td>
<td>Treatment Facility</td>
<td>Treatment Facility Schedules</td>
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<td>RF</td>
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<td>No Information Found</td>
<td>No Information Found</td>
<td>No Information Found</td>
</tr>
<tr>
<td>SRS</td>
<td>WS ID</td>
<td>Preferred Options</td>
<td>Waste Stream Composition</td>
<td>Technology Needs</td>
<td>Treatment Facility</td>
<td>Treatment Facility Schedules</td>
<td>No Information Found</td>
<td>No Information Found</td>
<td>No Information Found</td>
</tr>
</tbody>
</table>

1. Table headings are categories of information recommended by the DOE/NV; the other columns are defined differently by each of the DOE sites in the Proposed Site Treatment Plans.

2. Hanford Site information was obtained from the DOE/ERWM report, “Contaminated Concrete: Occurrence and Emerging Technologies for the DOE Decontamination” (DOE/ORO/2034).

3. WS - Waste Stream

4. MWIR - Mixed Waste Inventory Report

5. APP - Appendix B

Note: The current 1995 inventory and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
<table>
<thead>
<tr>
<th>Site Name</th>
<th>Bldg. Number</th>
<th>Site Type</th>
<th>Operating Status</th>
<th><strong>Contaminant Type</strong></th>
<th>Approximate Contaminated Concrete (ft³)</th>
<th>Approximate Contaminated Concrete (m³)</th>
<th>Contaminant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanford</td>
<td>232Z</td>
<td>3</td>
<td>Surplus</td>
<td>R</td>
<td>259,000</td>
<td>7,339</td>
<td>Plutonium, Lead, Gamma</td>
</tr>
<tr>
<td>Hanford</td>
<td>105B</td>
<td>1</td>
<td>Surplus</td>
<td>R</td>
<td>5,357,100</td>
<td>151,802</td>
<td>Cadmium, Lead</td>
</tr>
<tr>
<td>Hanford</td>
<td>105H</td>
<td>1</td>
<td>Surplus</td>
<td>R</td>
<td>7,464,000</td>
<td>211,505</td>
<td>Cadmium, Lead</td>
</tr>
<tr>
<td>Hanford</td>
<td>105F</td>
<td>1</td>
<td>Surplus</td>
<td>R</td>
<td>5,460,000</td>
<td>154,718</td>
<td>Cadmium, Lead</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18,540,100</td>
<td>525,364</td>
<td></td>
</tr>
</tbody>
</table>

1Site Type: 1 = production reactor; 3 = other radiologically contaminated building
2R = radiological

Note 1: Information for this table was obtained from the DOE/ERWM report "Contaminated Concrete: Occurrence and Emerging Technologies for DOE Decontamination."

Note 2: The current 1995 inventory and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
<table>
<thead>
<tr>
<th>Waste Stream ID</th>
<th>Waste Stream Name</th>
<th>Technology Group</th>
<th>Media Type (if more than one)</th>
<th>Volume %</th>
<th>Treatment Facility</th>
<th>Current Inventory 1995 (m³)</th>
<th>Five-Year Projected Generation 1995-1999 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH-ANL-111</td>
<td>Uranium/ Cadmium from 4IFR Experiments</td>
<td>¹MACRO</td>
<td>Other, Cd-ignot</td>
<td>99.00</td>
<td>²WROC, ³P1, P2, P3, P4, P5, P6</td>
<td>0.4164</td>
<td>0.4000</td>
</tr>
<tr>
<td>ID-CH-ANL-142</td>
<td>Lead-contam. Solids ANL-W Operations</td>
<td>MACRO</td>
<td>Pb-metal, Gloves Paper</td>
<td>95.00</td>
<td>WROC, Same as above</td>
<td>0.5469</td>
<td>0.0800</td>
</tr>
<tr>
<td>ID-CFA-280</td>
<td>Borax D&amp;D Noncompactable Lead Shielding</td>
<td>MACRO</td>
<td>Pb-scrap, Pb-recycle</td>
<td>50.00</td>
<td>WROC, Same as above</td>
<td>0.0000</td>
<td>0.5000</td>
</tr>
<tr>
<td>ID-INL-143</td>
<td>Radioactive Contaminated Lead</td>
<td>MACRO</td>
<td>Pb-scrap, Casks-outer metal, Casks-Pb-scarred, Casks-Pb-scrap, Pb-scarred/smooth, Pb-scrap</td>
<td>10.50, 4.00, 16.50, 12.50, 50.00, 6.50</td>
<td>WROC, Same as above</td>
<td>345.1160</td>
<td>12.0000</td>
</tr>
<tr>
<td>ID-PBF-272</td>
<td>Uranium Spikes and Lead</td>
<td>MACRO</td>
<td>No Description</td>
<td>No Description</td>
<td>WROC, Same as above</td>
<td>0.0303</td>
<td>0.0000</td>
</tr>
<tr>
<td>ID-TAN-531</td>
<td>Lead Shielding Loft Mobile Test Assembly</td>
<td>MACRO</td>
<td>Pb-shot/wool, Pb-plate</td>
<td>95.00, 5.00</td>
<td>WROC, Same as above</td>
<td>0.0000</td>
<td>9.7000</td>
</tr>
<tr>
<td>ID-TAN-547</td>
<td>Radioactive Cadmium Sources</td>
<td>MACRO</td>
<td>No Description</td>
<td>No Description</td>
<td>WROC, Same as above</td>
<td>0.0303</td>
<td>0.0000</td>
</tr>
<tr>
<td>ID-CFA-533</td>
<td>ARA-1 D&amp;D Noncompactable Lead</td>
<td>MACRO</td>
<td>Uncleanable, Cleanable</td>
<td>50.00, 50.00</td>
<td>WROC, Same as above</td>
<td>0.0000</td>
<td>0.5500</td>
</tr>
<tr>
<td>ID-CFA-667</td>
<td>Mixed Lead</td>
<td>MACRO</td>
<td>Pb-cleanable, Pb-not cleanable</td>
<td>90.00, 10.00</td>
<td>WROC, Same as above</td>
<td>0.0303</td>
<td>0.1200</td>
</tr>
<tr>
<td>ID-CPP-154</td>
<td>Radioactive Contaminated Lead</td>
<td>MACRO</td>
<td>⁵CH-blankets (Pb), CH-blankets (vinyl), CH-Pb-scarred Brick Sheet, CH-Pb-scrap, RH</td>
<td>16.50, 5.50, 44.00, 6.00, 28.00</td>
<td>WROC, Same as above</td>
<td>56.0960</td>
<td>197.1800</td>
</tr>
</tbody>
</table>
## TABLE 3. SUMMARY OF IDAHO NATIONAL ENGINEERING LABORATORY ONSITE LEAD MIXED WASTE SITES (Cont.).

<table>
<thead>
<tr>
<th>Waste Stream ID</th>
<th>Waste Stream Name</th>
<th>Technology Group</th>
<th>Media Type (if more than one)</th>
<th>Volume %</th>
<th>Treatment Facility</th>
<th>Treatment Facility Schedule</th>
<th>Current Inventory 1995 (m³)</th>
<th>Five-Year Projected Generation 1995-1999 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID-CPP-552</td>
<td>Radioactive Lead with Listed Codes</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>WROC</td>
<td>Same as above</td>
<td>0.3964</td>
<td>0.0000</td>
</tr>
<tr>
<td>ID-INL-142</td>
<td>Lead Contaminated Debris</td>
<td>MACRO</td>
<td>HEPA-media</td>
<td>15.00</td>
<td>WROC</td>
<td>Same as above</td>
<td>7.6209</td>
<td>3.8400</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HEPA-frames &amp; other</td>
<td>44.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pb &amp; Dross</td>
<td>40.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Soil</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID-SMC-400</td>
<td>Radioactive Contaminated Lead</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>WROC</td>
<td>Same as above</td>
<td>0.0189</td>
<td>0.0000</td>
</tr>
<tr>
<td>ID-TAN-534</td>
<td>TAN 616 Lead Shielding (Plating)</td>
<td>MACRO</td>
<td>Cleanable</td>
<td>90.00</td>
<td>WROC</td>
<td>Same as above</td>
<td>0.0000</td>
<td>0.0500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Uncleanable</td>
<td>10.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID-TRA-253</td>
<td>Cadmium Fuel Grid</td>
<td>MACRO</td>
<td>Al-grid</td>
<td>95.00</td>
<td>WROC</td>
<td>Same as above</td>
<td>43.3479</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cd-strips</td>
<td>5.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID-TRA-281</td>
<td>ETR</td>
<td>MACRO</td>
<td>Pb-scrap</td>
<td>50.00</td>
<td>WROC &amp; WROC Lead Recycle</td>
<td>Same as above</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>Noncompactable Lead</td>
<td></td>
<td>Pb-recycle</td>
<td>50.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID-TRA-282</td>
<td>MTR D&amp;D</td>
<td>MACRO</td>
<td>Pb-scrap</td>
<td>50.00</td>
<td>WROC</td>
<td>Same as above</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>Noncompactable Lead</td>
<td></td>
<td>Pb-recycle</td>
<td>50.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NR-NRF-143</td>
<td>Radioactive Contaminated Lead (NRF)</td>
<td>MACRO</td>
<td>Pb-scrap</td>
<td>50.00</td>
<td>WROC &amp; WROC Lead Recycle</td>
<td>Same as above</td>
<td>46.2133</td>
<td>2.2200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pb-cleanable</td>
<td>50.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NR-NRF-117</td>
<td>Cadmium Sheets</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>WROC</td>
<td>Same as above</td>
<td>0.2082</td>
<td>0.0002</td>
</tr>
<tr>
<td>NR-NRF-190</td>
<td>Lead Fillings</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>WROC</td>
<td>Same as above</td>
<td>0.0379</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>500.1097</strong></td>
<td><strong>226.6402</strong></td>
</tr>
</tbody>
</table>

1MACRO - Macroencapsulation
2WROC - Waste Reduction Operation Complex
3P1 - Submit Part B/S1 - Approval of Part B; P2 - Procure Contracts; P3 - Initiate Construction; P4 - Commence System Testing; P5 - Commence Operation; P6 - Schedule for System Backlog
4IFR - Integral Fast Reactor
5CH - Contract handled
6RH - Remote handled

Note: The current inventory 1995 and the five-year projected generation of waste (1995-1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
### TABLE 4. SUMMARY OF IDAHO NATIONAL ENGINEERING LABORATORY OFFSITE LEAD MIXED WASTE SITES.

<table>
<thead>
<tr>
<th>Waste Stream ID</th>
<th>Waste Stream Name</th>
<th>Technology Group</th>
<th>Media Type (if more than one)</th>
<th>Volume %</th>
<th>Treatment Facility</th>
<th>Current Inventory 1995 (m³)</th>
<th>Five-Year Projected Generation 1995-1999 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT-W019</td>
<td>Elemental Lead</td>
<td>¹MACRO</td>
<td>Pb-scrap, Pb-bricks</td>
<td>30.00</td>
<td>²WROC</td>
<td>1.1600</td>
<td>0.5300</td>
</tr>
<tr>
<td>GA-W013</td>
<td>Hot Cell D&amp;D: Pb-brick</td>
<td>MACRO</td>
<td>No Description</td>
<td>70.00</td>
<td>Same as above</td>
<td>1.0400</td>
<td>0.8320</td>
</tr>
<tr>
<td>LA-W921</td>
<td>Activated or Inseparable Lead</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>Same as above</td>
<td>15.600</td>
<td>0.8000</td>
</tr>
<tr>
<td>MI-W931</td>
<td>Lead Requiring Sorting</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>Same as above</td>
<td>9.9700</td>
<td>0.0000</td>
</tr>
<tr>
<td>MI-W007</td>
<td>Lead Brick, Sheets, Wool Scrapings</td>
<td>MACRO</td>
<td>Pb-scrap</td>
<td>100.00</td>
<td>Same as above</td>
<td>2.7600</td>
<td>0.4640</td>
</tr>
<tr>
<td>CN-W002</td>
<td>Lead and Lead-Bearing Materials</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>Same as above</td>
<td>0.3200</td>
<td>3.5000</td>
</tr>
<tr>
<td>GA-W007</td>
<td>Hot Cell D&amp;D: Pb-shot</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>Same as above</td>
<td>0.2080</td>
<td>4.1600</td>
</tr>
<tr>
<td>LA-W903</td>
<td>Lead Blankets</td>
<td>MACRO</td>
<td>No Description</td>
<td></td>
<td>Same as above</td>
<td>0.7400</td>
<td>0.1600</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31.798</td>
<td>10.446</td>
</tr>
</tbody>
</table>

¹MACRO - Macroencapsulation  
²WROC - Waste Reduction Operation Complex  
³P1 - Submit Part B/S1 - Approval of Part B; P2 - Procure Contracts; P3 - Initiate Construction; P4 - Commence System Testing; P5 - Commence Operation; P6 - Schedule for System Backlog  

Note 1: Onsite and offsite waste streams are currently being proposed for treatment at each INEL facility. (See INEL, STP, Sec.6, Waste Stream Treatment Plans).  
Note: The current inventory 1995 and the five-year projected generation of waste (1995-1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
<table>
<thead>
<tr>
<th>MWIR# X7200</th>
<th>1APP</th>
<th>Waste Stream Name</th>
<th>Technology Group</th>
<th>Preferred Option</th>
<th>Treatment Facility</th>
<th>Treatment Facility Schedules</th>
<th>INV 1993 (kg)</th>
<th>INV 1993 (m³)</th>
<th>GEN 1993 (kg)</th>
<th>GEN 1993 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2721</td>
<td>B</td>
<td>Elemental Hazardous Metals</td>
<td>Elemental Lead</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
<td>295.31</td>
<td>0.196</td>
<td>25</td>
<td>0.017</td>
</tr>
<tr>
<td>3721</td>
<td>B</td>
<td>Elemental Hazardous Metals</td>
<td>Elemental Lead</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
<td>6,992.93</td>
<td>4.661</td>
<td>1,784</td>
<td>1.189</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>142,329.54</td>
<td>94.884</td>
<td>2,811</td>
<td>1.874</td>
</tr>
</tbody>
</table>

1APP – Appendix
2WEDF – Waste Engineering Development Facility
Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
### TABLE 6. SUMMARY OF OAK RIDGE NATIONAL LABORATORY MIXED LOW-LEVEL WASTES/CONTACT-HANDLED-BATTERIES SITES.

<table>
<thead>
<tr>
<th>Waste Stream ID</th>
<th>Technology Group</th>
<th>Preferred Option</th>
<th>Treatment Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWIR# X7200</td>
<td>APP</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stream ID</th>
<th>Waste Stream Name</th>
<th>Preferred Facility Schedules</th>
</tr>
</thead>
<tbody>
<tr>
<td>2741</td>
<td>B Batteries</td>
<td>Same as above</td>
</tr>
<tr>
<td>3741</td>
<td>B Batteries</td>
<td>Same as above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th>Inv 1993</th>
<th>Inv 1993</th>
<th>Gen 1993</th>
<th>Gen 1993</th>
</tr>
</thead>
<tbody>
<tr>
<td>27,815.49</td>
<td>21,439.34</td>
<td>14.296</td>
<td>8,695</td>
<td>5.797</td>
</tr>
</tbody>
</table>

**Note:** The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
### TABLE 7. SUMMARY OF ROCKY FLATS ENVIRONMENTAL TECHNOLOGY LEAD MIXED WASTE SITES.

<table>
<thead>
<tr>
<th>Waste Stream ID</th>
<th>Waste Stream Name</th>
<th>Technology Group</th>
<th>Treatment Facility Schedules</th>
<th>Current Inventory 1995 (m³)</th>
<th>Five-Year Projected Generation 1995–1999 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF-W035</td>
<td>Glovebox Parts w/Lead</td>
<td>Polymer</td>
<td>See Table 8</td>
<td>0.42</td>
<td>0.00</td>
</tr>
<tr>
<td>RF-W023</td>
<td>Lead</td>
<td>Same as above</td>
<td>Same as above</td>
<td>34.69</td>
<td></td>
</tr>
<tr>
<td>RF-W030</td>
<td>Leaded Gloves</td>
<td>Same as above</td>
<td>Same as above</td>
<td>3.57</td>
<td>27.85</td>
</tr>
<tr>
<td>RF-W031</td>
<td>Leaded Gloves Acid Contaminated</td>
<td>Same as above</td>
<td>Same as above</td>
<td>0.21</td>
<td>11.13</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>38.89</strong></td>
<td><strong>38.98</strong></td>
</tr>
</tbody>
</table>

1MACRO – Macroencapsulation

Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.

### TABLE 8. SUMMARY OF ROCKY FLATS ENVIRONMENTAL TECHNOLOGY LEAD MIXED WASTE CHARACTERIZATION REPORT SCHEDULES.

<table>
<thead>
<tr>
<th>Waste Form</th>
<th>Waste Identification Characterization</th>
<th>Review Contracts</th>
<th>Review Real-time Data</th>
<th>Review Radiography Tapes</th>
<th>Drum Walkdowns</th>
<th>Screening</th>
<th>Informal Sampling and Analysis</th>
<th>Formal Sampling and Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>2/95</td>
<td>Complete</td>
<td>Complete</td>
<td>1/96</td>
<td>1/96</td>
<td>3/96</td>
<td>3/96</td>
<td>Not Planned</td>
</tr>
<tr>
<td>Ledead Gloves</td>
<td>5/95</td>
<td>Complete</td>
<td>9/95</td>
<td>9/95</td>
<td>Not Planned</td>
<td>6/97</td>
<td>Not Planned</td>
<td>Not Planned</td>
</tr>
</tbody>
</table>

Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
<table>
<thead>
<tr>
<th>Waste Stream ID</th>
<th>Waste Stream Name</th>
<th>Preferred Options</th>
<th>Waste Stream Composition</th>
<th>Technology Needs</th>
<th>Treatment Facility</th>
<th>Treatment Facility Schedules</th>
<th>Current Inventory 1994 (m³)</th>
<th>Five-Year Projected Generation 1995–1999 (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-W013</td>
<td>¹LLW Lead to be Decontam.</td>
<td>²MACRO</td>
<td>Elemental Lead</td>
<td>Lead Decontam. Acid Bath</td>
<td>Offsite Vendor</td>
<td>No Description</td>
<td>82.2</td>
<td>30</td>
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<tr>
<td>SR-W023</td>
<td>Cadmium Safety Control Rods</td>
<td>MACRO in a cask as a 90-day generator</td>
<td>Inorganic Debris and Cadmium Containing Metals</td>
<td>MACRO</td>
<td>No Description</td>
<td>No Description</td>
<td>0.3</td>
<td>3.2</td>
</tr>
<tr>
<td>SR-W041</td>
<td>Aqueous Mercury and Lead</td>
<td>F&amp;H Area ³ETF</td>
<td>Aqueous &amp; Lead Waste</td>
<td>Ion Exchange</td>
<td>F&amp;H Area ETF, and Z Area</td>
<td>No Description</td>
<td>0.3</td>
<td>No future generation is expected</td>
</tr>
<tr>
<td>SR-W063</td>
<td>MACRO</td>
<td>Meets Treatment Standards</td>
<td>Metal Debris</td>
<td>MACRO</td>
<td>No Treatment Required, Waste Stream Already Meets Treatment Standard</td>
<td>No schedule required</td>
<td>0</td>
<td>42</td>
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<tr>
<td>SR-W069</td>
<td>LLW Lead to be MACRO Waste Stream</td>
<td>MACRO with Polymer by a vendor–onsite</td>
<td>EL, Non EL and Lead acid Batteries from Radiological Areas</td>
<td>MACRO</td>
<td>Onsite by Vendor</td>
<td>No Description</td>
<td>73.5</td>
<td>15</td>
</tr>
</tbody>
</table>

¹LLW – Low-Level Waste  
²MACRO – Macroencapsulation  
³ETF – Effluent Treatment Facility  
⁴TC – Toxic Characterization  

Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
<table>
<thead>
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<th></th>
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<tr>
<td>RF-W035</td>
<td>Glovebox Parts w/Lead</td>
<td>Polymer</td>
<td>See Table 8 of this report</td>
<td>.42</td>
<td>389.2</td>
<td>0.00</td>
<td>No Description</td>
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<tr>
<td>RF-W023</td>
<td>Lead</td>
<td>Same as above</td>
<td>Same as above</td>
<td>34.69</td>
<td>27,838.2</td>
<td>0.00</td>
<td>No Description</td>
</tr>
<tr>
<td>RF-W030</td>
<td>Leaded Gloves</td>
<td>Same as above</td>
<td>same as above</td>
<td>3.57</td>
<td>1,683.0</td>
<td>27.69</td>
<td>No Description</td>
</tr>
<tr>
<td>RF-W031</td>
<td>Leaded Gloves Acid</td>
<td>Same as above</td>
<td>Same as above</td>
<td>0.21</td>
<td>46.9</td>
<td>11.13</td>
<td>No Description</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>Total 38.89</td>
<td>Total 29,967.3</td>
<td>Total 38.98</td>
<td>No Description</td>
</tr>
</tbody>
</table>

¹MACRO – Macroencapsulation

Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
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</tr>
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<tbody>
<tr>
<td>SR-W013</td>
<td>LLW Lead to be Decontaminated</td>
<td>MACRO</td>
<td>Elemental Lead</td>
<td>Lead Decontaminated Acid Bath</td>
<td>Offsite Vendor</td>
<td>82.2</td>
<td>129,386.0</td>
<td>30.00</td>
<td>60,000.0</td>
</tr>
<tr>
<td>SR-023</td>
<td>Cadmium Safety Control Rods</td>
<td>MACRO in a Cask as a 90-Day Generator</td>
<td>Inorganic Debris &amp; Cadmium Containing Metals</td>
<td>MACRO</td>
<td>No Description</td>
<td>0.3</td>
<td>2,270.0</td>
<td>3.2</td>
<td>20,874.0</td>
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<tr>
<td>SR-W041</td>
<td>Aqueous Mercury &amp; Lead</td>
<td>F&amp;H Area &amp; Ion Exchange</td>
<td>Aqueous &amp; Lead Waste</td>
<td>F&amp;H Area &amp; Ion Exchange</td>
<td>No Schedule Required</td>
<td>0.3</td>
<td>104.2</td>
<td>No Future Generation is Expected</td>
<td>No Description</td>
</tr>
<tr>
<td>SR-W063</td>
<td>MACRO @ TC Waste</td>
<td>MACRO with Polymer by a Vendor Onsite</td>
<td>% EL, Non-EL &amp; Lead Acid Batteries from Radiological Areas</td>
<td>MACRO</td>
<td>No Treatment Required Waste Stream Meets Treatment Standard</td>
<td>0.0</td>
<td>0.00</td>
<td>42</td>
<td>0.00</td>
</tr>
<tr>
<td>SR-W069</td>
<td>LLW Lead to be MACRO Waste Stream</td>
<td>MACRO with Polymer by a Vendor Onsite</td>
<td>EL, Non-EL &amp; Lead acid Batteries from Radiological Areas</td>
<td>MACRO</td>
<td>Onsite by Vendor Treatment</td>
<td>73.5</td>
<td>98,852.0</td>
<td>15</td>
<td>30,000.0</td>
</tr>
</tbody>
</table>

1LLW—Low-level Waste  
2MACRO—Macroencapsulation  
3ETF—Effluent Treatment Facility  
4TC—Toxic Characterization  

Note: The current inventory 1995 and the five-year projected generation of waste (1995–1999) figures in cubic meters are the same as described in the PSTPs and the FSTPs for the four sites except HANF. The HANF site data were obtained from the DOE/ERWM report.
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APPENDIX A
Definitions

Disposal – the permanent isolation of waste with no intent of recovery.

Disposal Facility – (1) The land, structures, and equipment used for the disposal of waste. (2) A facility or part of a facility at which waste is intentionally placed into or on the land or water, and at which waste will remain after closure.

Elemental Lead (EL) (Activated and Non-Activated) (as a waste matrix) – both surface-contaminated and activated elemental lead. Activated lead includes lead from accelerators or other neutron sources that may result in irradiation. Surface–contaminated lead materials include bricks, counterweights, shipping casks, and other shielding materials.

Facilities – buildings and other structures; their functional systems and equipment, including site development features such as landscaping, roads, walks, and parking areas; outside lighting and communications systems; central utility plants; utilities supply and distribution systems; and other physical plant features.

Macroencapsulation (MACRO) – application of surface coating materials such as polymeric organics (e.g., resins and plastics) or a jacket of inert organic materials to substantially reduce surface exposure to potential leaching media. Macroencapsulation specifically does not include any material that would be classified as a tank or container according to 40 CFR 260.10.

Mixed Waste – (1) Radioactive waste (as defined by the Atomic Energy Act) that contains material listed as hazardous waste in Subpart D of 40 CFR 261 or that exhibits any of the hazardous waste characteristics identified in Subpart C of 40 CFR 261. (2) Waste that contains both radioactive and hazardous components, as defined by the Atomic Energy Act and RCRA. The term "radioactive component" refers only to the actual radionuclides dispersed or suspended in the waste substance.

Offsite – Any facility or installation other than generating or storing facility.

Onsite – (1) Within a single research or production site of the DOE weapons complex (e.g., Los Alamos National Laboratory is a site, as are Idaho National Engineering Laboratory and Sandia National Laboratories. (2) The contaminated area and all potential areas in very close proximity to the contamination that must be taken into account for effective implementation of the response action.

Onsite Facility – a hazardous waste treatment, storage, or disposal area that is located on the generating site.

Resource Conservation and Recovery Act (RCRA) Permit, Part A – the first part of a RCRA permit application that identifies treatment, storage, and disposal units within a to-be–permitted facility.

Resource Conservation and Recovery Act (RCRA) Permit, Part B – the detailed second part of a RCRA permit application that describes waste to be managed, waste quantities, and facilities.

Site – (1) A geographic entity comprising land, buildings, and other facilities required to perform program objectives. Generally a site has, organizationally, all of the required facilities for the
management functions. That is, it is not a satellite of some other site. (2) For the purposes of the Environmental Restoration and Waste Management (ERWM) Five-Year Plan, sites are lands, installations, and/or facilities for which DOE has or shares responsibility for ERWM activities. (3) An area or a location at which hazardous substances have been stored, treated, disposed of, placed, or otherwise come to be located. This includes all contiguous land, structures, other appurtenances, and improvements on the land used for treatment, storage, or disposal of hazardous substances. A site may consist of several treatment, storage, or disposal facilities (e.g., impoundments, containers, buildings, or equipment).

**Technology-Based Standards** – a restricted waste for which a technology–based standard is specified may be land disposed after it is treated using that specified technology or an equivalent treatment approved by the administrator of EPA.

**Treatability Group** – The DOE has grouped its wastes to reflect salient treatment considerations for each waste form based on the radioactive characteristics, hazardous components and physical/chemical matrices. These "treatability groups" are used to relate waste forms and waste quantities to treatment facilities and technology development needs.

**Treatment** – (1) Any method, technique, or process designed to change the physical or chemical character of waste to render it less hazardous; safer to transport, store or dispose of; or reduce in volume. (2) Any activity that alters the chemical or physical nature of hazardous waste to reduce its toxicity, volume, or mobility, or render it amenable for transport, storage, or disposal.

**Treatment Facility** – the specific area of land, structures, and equipment dedicated to waste treatment and related activities.

**Treatment Method** – a group of treatment technologies that utilize the same chemical or physical principle to destroy or mitigate the waste characteristics or constituents.

**Treatment, Storage, and Disposal (TSD) Facility** – any building, structure, or installation where a radioactive or hazardous substance has been treated, stored, or disposed of.

**Treatment System** – the equipment and processes used for similar waste types at treatment facilities. A treatment system is unit treatment operation or sequence of unit treatment operations carried out on all wastes that enter the system (e.g., a treatment system may consist of chemical reduction followed by precipitation, or an incinerator and vitrification unit for the ash).

**Treatment Unit** – the portion of a single treatment system that will treat mixed low level waste to meet both LDR requirements and the disposal site waste acceptance criteria.

**Waste Form** – a grouping of one or more item description codes based on presumed similarity of waste treatment requirements.

**Waste Management** – the planning, coordination and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance and maintenance activities.

**Waste Stream** – a flow of waste materials with specific definable characteristic that remain the same throughout the life of the process generating the waste.
APPENDIX B
(PART A)

INTERVIEW FORM
DESERt RESEARCH INSTITUTE
UNIVERSITY AND COMMUNITY COLLEGE SYSTEM OF NEVADA

MIXED WASTE EXPERIMENTS QUESTIONNAIRES

Site:_________________________Address:__________________________________________

Contact:______________________________________________________________

Phone No:________________________Date:______________________________________

1. Mixed waste quantities (m³/kg).


3. What specific elements or compounds exist in the mixed waste (for example, heavy metals (HM), radionuclide (RN), organic, or inorganic).

4. What form or valence exists in the mixed waste (leadoxide-dissolved chromium or any other specifics).

5. Mixed waste concentration range for each element.

6. Mixed waste matrix groups (for example, soil or any other matrix group, including grain size primary, etc.).
APPENDIX B

(PART B)

INTERVIEW FORM

DESERT RESEARCH INSTITUTE
UNIVERSITY AND COMMUNITY COLLEGE SYSTEM OF NEVADA

MIXED WASTE INFORMATION FOR PLANNING

Site: ______________________  Address: ______________________

Contact: ______________________

Phone No: ______________________  Date: ______________________

1. Mixed waste quantities (m³/kg).


3. Mixed waste treatability groups.

4. Mixed waste disposal period (month and year).

5. Mixed waste combination/concentration groups for treatability (for example, silt+clay+sand) or any other combination of waste applied.

6. Mixed waste treatability group and also % of each mixed waste (MW) group, if possible.

7. Mixed waste treatment cost estimate, if possible.
APPENDIX C

Desert Research Institute
Technical Task Plan
Resource estimates for the DRI Federal Facility Compliance Act (FFCAct) Task Agreement Plan will provide labor and materials needed to determine what treated mixed waste from DOE sites might be disposed at the Nevada Test Site. This information will be used to research the final waste forms and verify their suitability for disposal at the Nevada Test Site or recommend modifications required prior to safe disposal.

DRI is directed to review five FFCAct Site Treatment Plans available at the DOE/NV Public Reading Facility and compile a list of the mixed waste that will be treated and require disposal within the next five to ten years. Following are the five selected DOE Sites to compile data on the Lead Mixed Waste Sites:
- Idaho National Engineering Laboratory Site
- Rocky Flats Environmental Technology Site
- Savannah River Site - Mixed Waste Site
- Oak Ridge National Laboratory Site
- Hanford Site

DRI is also directed to compile the following information in conjunction with the review of Site Treatment Plans for the five Lead Mixed Waste Sites described above:
- Name of DOE site responsible for waste
- Final waste form (e.g. macroencapsulated lead, grouted material)
- Anticipated volume of final waste form (ball-park estimate as needed)
- Waste treatment "recipe" (i.e., identify macroencapsulated specifics such as coating thickness and constitution)
- Treatment schedule
- Proposed and alternative disposal location, if determined

This information shall be presented in a draft and final report. The final report will include additional information on the Lead Mixed Waste sites selected by the Project Manager, Waste Management Division- DOE/NV, if time and resources permit.
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