



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

APR 16 2001

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. James P. Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87505



Dear Mr. Bearzi:

Subject: 60-Day Response to Request for Information (RI) Pursuant to the New Mexico Hazardous Waste Act and the Resource Conservation and Recovery Act, Los Alamos National Laboratory, EPA ID NM 0890010515

The purpose of this letter is to provide the Department of Energy (DOE) and University of California (UC) response to the New Mexico Environment Department's (NMED), Request for Information (Mr. James Bearzi, Hazardous Waste Bureau, to Dr. John Browne, LANL, and Mr. David Gurulé, U.S. Department of Energy [DOE] February 12, 2001). This response includes answers for the information requests numbered 1 through 17, 20, and 21, as required within sixty days by Instruction 7, page 3 of the letter. The complete response and supporting documentation are included as enclosures to this letter.

This document consists of responses to the 19 information requests and appendices with supplemental information, as referenced in the numbered information requests. The responses contain waste stream information from the DOE/UC waste management and corrective action organizations. The information presented has been obtained from waste management and Environmental Restoration (ER) project records and various previously submitted or published reports. The enclosed information consists of database retrievals, tables, and reports. Information available from previously published or submitted documents is also referenced in the individual responses as appropriate.

In accordance with Instruction 4, page 3 of the letter, DOE/UC is responding as fully as possible to this request within the allotted sixty-day period. Most of the information contained in this response has been developed and kept by DOE/UC in response to procedures developed since the 1970s in compliance with advancing regulations and policies. These sources represent the majority of the information available for the generation and management of operational radioactive and mixed waste streams and for



15922

APR 16 2001

waste generated by ER activities since that point. However, the time period allotted in the request has not been sufficient to answer the request completely. DOE/UC is continuing to collect historical information for wastes managed and disposed of before the regulatory dates, in addition to current data, supplementing that presented in this response. We propose a similar submittal schedule as that suggested (and subsequently approved by the NMED in a letter dated March 13, 2001) for ongoing submittals in the first 15-day response to this RI for Request No. 18. The proposed dates for the submittal of data supplementing that collected for this sixty-day response are May 15, June 15, and July 15, 2001. DOE/UC will provide the data collected and prepared for submittal for those dates (if available) in order to maintain a consistent data submittal for NMED review. Please consider this correspondence as a request for an extension for that time to fully answer this question as explained above.

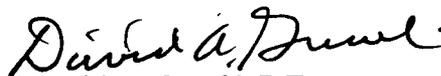
DOE/UC has concerns about the request for this data in light of the fact that much of the requested information cannot be used in setting conditions to be included in the new hazardous waste facility permit as indicated by the request letter. As stated in the discussion portion of the enclosed response, certain types of data are presented for informational purposes, although the materials discussed are not subject to regulation either under the Resource Conservation and Recovery Act (RCRA) or the New Mexico Hazardous Waste Act.

This response lists the persons who compiled the data used to answer each question, and identifies the documents that contain responsive information as required by Information requests 20 and 21 in the February 12, 2001 letter. A certification for the submitted data is also enclosed as required by 20.4.1 NMAC, Subpart IX, §270.11(d)(1).

We are hopeful that this extensive information submittal will expedite the current schedule for the renewal of the DOE/UC hazardous waste facility permit.

If you have questions concerning this submittal, please contact Gene Turner of my staff at (505) 667-5794, or Jack Ellvinger, UC/LANL, at (505) 667-0633.

Sincerely,


David A. Gurulé, P.E.
Area Manager

LAAME:3GT-008

Enclosures

cc:

See page 3

APR 19 2001

cc w/o enclosures:
David Neleigh, Chief (6PD-N)
New Mexico/Federal Facilities Section
Environmental Protection Agency--
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Greg Lewis, Director
Water and Waste Management Division
New Mexico Environment Department
Harold S. Runnels Building
1190 St. Francis Drive
P. O. Box 26110
Santa Fe, NM 87502

Carl Will
LANL Permits Project Leader
Hazardous Waste Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

John E. Kieling, Manager
Hazardous Waste Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

Robert S. (Stu) Dinwiddie,
RCRA Advisor
Hazardous Waste Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

John Young
Hazardous Waste Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

P. Allen
Hazardous Waste Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

John Parker, Chief
DOE Oversight Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

Steve Yanicak
DOE Oversight Bureau
New Mexico Environment Department
2044-A Galisteo Street
P. O. Box 26110
Santa Fe, New Mexico 87502

James Davis, Chief
Surface Water Quality Bureau
New Mexico Environment Department
Harold S. Runnels Building
1190 St. Francis Drive
P. O. Box 26110
Santa Fe, NM 87502

Marcy Leavitt, Chief
Groundwater Quality Bureau
New Mexico Environment Department
Harold S. Runnels Building
1190 St. Francis Drive
P. O. Box 26110
Santa Fe, NM 87502

C. de Saillan
Office of General Counsel
New Mexico Environment Department
Harold S. Runnels Building
1190 St. Francis Drive
P. O. Box 26110
Santa Fe, NM 87502

APR 16 2001

J. Vozella, LAAME, LAAO
G. Turner, LAAME, LAAO
T. Gunderson, DLDOPS, LANL, MS-A100
D. Erickson, ESH-DO, LANL, MS-K491
J. Canepa, EM/ER, LANL, MS-M992
M. Kirsch, EM/ER, LANL, MS-M992
D. McInroy, EM/ER, LANL, MS-M992
E. Louderbough, LC-GL, LANL, MS-A187
J. Ellvinger, ESH-19, LANL, MS-K490
G. Bacigalupa, ESH-19, LANL, MS-K490
D. Griswold, ERD, AL

**Response to Request for Information
Pursuant to the New Mexico Hazardous Waste Act
and the Resource Conservation and Recovery Act,
Los Alamos National Laboratory
EPA ID No. 0890010515**

April 2001

**Prepared by:
Los Alamos National Laboratory
Hazardous and Solid Waste Group (ESH-19)
Los Alamos, New Mexico 87545**

**Response to Request for Information
Pursuant to the New Mexico Hazardous Waste Act
and the Resource Conservation and Recovery Act
Los Alamos National Laboratory
EPA ID No. 0890010515**

Introduction

The following information is the submittal for the 60-day portion of the response by Los Alamos National Laboratory (LANL) to a Request for Information (RI) sent by the New Mexico Environment Department (NMED) on February 12, 2001. The full title of the RI is "Request for Information Pursuant to the New Mexico Hazardous Waste Act and the Resource Conservation and Recovery Act, Los Alamos National Laboratory, EPA ID No. 0890010515," officially received by LANL on February 16, 2001. The RI asked for additional information to prepare corrective action requirements in conjunction with the renewal of the LANL Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Permit, originally issued on November 8, 1989.

This document consists of responses to 19 information requests contained in the RI. As stated in Instruction No. 7 on page 3 of the RI letter, the response to these 19 requests was required within sixty (60) days of the receipt of the RI. This response includes appendices with supplemental information, as referenced in the individual responses to the numbered information requests. NMED's original information requests are included in this document as italicized text for ease of review. A copy of the original RI is also included as Appendix A.

A general point regarding LANL's responses to the RI is that continuing efforts are being made to obtain the information requested. The effort involved in identifying and retrieving information responsive to the comprehensive nature of the RI will, of necessity, involve a longer timeframe than the 60 days stipulated. The information presented to date was obtained from existing waste management and Environmental Restoration (ER) Project databases, and various previously submitted or published reports. The information has been collected using waste management documentation and site characterization procedures developed since the 1970s in compliance with developing regulations and policies. These sources represent the majority of the relevant information available for recent radioactive and mixed waste streams at LANL and for the hazardous and solid waste generated by ER activities discussed in the responses to Request Nos. 12-17.

LANL has initiated efforts to collect historical and other process-generation documentation from internal waste-generating organizations to supplement the information presented in this response, and will submit this supplemental information as soon as it is received, reviewed, and prepared for transmittal. LANL proposes a similar submittal schedule as that suggested (and subsequently approved by the NMED in a

letter dated March 13, 2001) for ongoing corrective action information submittals in the first 15-day response to this RI for Request No. 18, submitted to the NMED on March 1, 2001. Proposed dates for submittal of supplemental data collected for this 60-day response are May 15, June 15, and July 15, 2001. These proposed submittal dates may need to be modified, subject to NMED approval, if unforeseen circumstances (e.g., amount of information required to be collected, additional information request clarifications, and security review and classification requirements) further affect the information retrieval schedule. Specific details regarding supplemental submittals of data are included in the individual responses below, as appropriate for the discussion.

Discussion

The information contained in this response has been developed from existing data and databases, consultation with appropriate internal LANL organizations, and from previously published documents and reports, in accordance with Instruction Nos. 3 and 6 of the RI. The following discussion is provided for clarification of specific issues raised in LANL's presentation of this information.

In answer to Request Nos. 4, 14, and 15, the regulatory waste characterization classifications (i.e., characteristic hazardous waste, listed hazardous waste) discussed have not been determined for wastes or waste streams managed prior to the regulatory development of the classification system. The only exception may be 'retroactive' listing if the waste or waste stream has been subsequently managed.

It should be noted that certain material is not subject to RCRA regulation as a hazardous waste or a hazardous constituent but may nonetheless be included in this response. This includes material that is not "hazardous waste" because:

- it is either not the prerequisite solid waste, or
- it is solid waste but does not exhibit a characteristic, is not listed, or does not pose a substantial threat to human health or the environment.

It may also include material that would not be considered a "hazardous constituent" subject to corrective action because:

- it did not emanate from a solid waste management unit (SWMU) as prescribed by the statute, or
- it was released from a SWMU but was otherwise subject to a different Act.

For example, although source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (as amended, 42 U.S.C. 2001 *et seq.*) (AEA) is exempt from the definition of solid waste and hence not a hazardous waste, LANL has provided this information in response to Request No. 2. Another example is material discharged from an outfall subject to the National Pollutant Discharge Elimination System. Pursuant to statute, regulation, and supporting interpretive *Federal Register* preamble,

this material is neither solid waste nor does it contain hazardous constituents subject to RCRA corrective action. Information regarding this material is also provided to the extent it is available (LANL's Water Quality and Hydrology Group has additional outfall data collected under Clean Water Act requirements).

In addition to data provided regarding material not regulated by RCRA, information about several Potential Release Sites (PRS) that are not subject to the Hazardous and Solid Waste Amendments (e.g., active firing sites that do not manage waste or are not yet closed) is also included in this submittal. However, because the requested information pertains to materials and areas regulated by other authorities, LANL reserves its objections to this request and subsequent use of the data for any resulting draft permit conditions.

Information Requests and Responses

1. *Please identify each radionuclide waste or waste stream, including mixed and non-mixed wastes, that is currently or has been at any time generated, treated, stored, disposed of, otherwise managed at, or transported to the LANL Facility, and that meets the statutory definition of "hazardous waste" in section 1004(5) of RCRA, 42 U.S.C. § 6903(5). (Please note that the statutory definition is broader than the regulatory definition.)*

LANL began generating radioactive waste in the 1940s and continues to manage radioactive and mixed waste as a result of research and development activities supporting its national role in nuclear weapons development and maintenance, energy research, and medical studies. Radioactive waste generated at LANL includes operational or routine waste, non-routine waste, and waste from ER and decontamination and decommissioning (D&D) activities. Operational waste consists of a wide range of laboratory materials, including compactible trash (e.g., paper, cardboard, and plastic), rubber, glass, disposable protective clothing, solidified powders and ash, biological waste, and suspect radioactive waste (material that may have been contaminated due to its presence in a radioactive materials management area). Non-routine waste includes classified waste and large contaminated equipment. ER and D&D waste generally consists of equipment and scrap metal, building debris, and soil.

The management and description of these types of waste at LANL has changed as different regulatory mechanisms have come into being. These have included improved radioactive waste stream management procedures implemented through the U.S. Department of Energy (DOE) and the regulation of mixed waste (hazardous waste with a radioactive component) through RCRA.

Prior to the late 1950s, radioactive waste generated or stored at LANL was handled without significant distinctions and was disposed of in various formal and informal areas, now referred to as Material Disposal Areas (MDA) and PRSs. The best source

of records obtained for these wastes at this time is ER Project data associated with site characterization efforts for these sites. Appendix B is a list of all LANL PRSs that are suspected or confirmed to contain radionuclide concentrations, as defined by the DOE.

LANL also retrieved the available information pertaining to the radionuclide wastes or waste streams that may be present in PRSs whose corrective action is being managed by the ER Project. LANL searched the ER Project PRS Database for all PRSs identified as having radionuclides associated with them. As part of DOE's Integrated Planning, Accountability, and Budgeting System—Information System, the "radioactive site" code in the PRS Database initially was assigned by the DOE to any PRS for which radionuclides were known or suspected to be present at the site. The PRS Database does not specify the source of the radionuclides, nor does it provide any information regarding exemptions pertaining to the AEA; therefore, LANL's search was all-inclusive and unbiased. This search identified a subset of 299 PRSs, listed in Appendix B, with the potential to have had radionuclide wastes or waste streams initially disposed of in them. Any PRSs that were previously recommended for No Further Action and that were subsequently and formally removed from LANL's Hazardous Waste Facility Permit were not included in this list. Data from these 299 PRSs were reviewed to respond to Request Nos. 1-11 of this RI. Because some of the 108 PRSs described in the response to Request No. 12 have radioactive wastes or waste streams associated with them, data regarding these PRSs are discussed in Request No. 12 and will not be discussed further in the responses to Request Nos. 1-11.

The available information about radionuclide wastes and waste streams disposed at LANL PRSs, including determinations as to whether or not a waste met the statutory definition of hazardous waste at the time of initial disposal, falls into two categories:

- information contained in published documents previously provided to the U.S. Environmental Protection Agency (EPA) and the NMED, including the RCRA Facility Assessment (RFA), the SWMU Report, and the Operable Unit (OU) RCRA Facility Investigation (RFI) workplans; and
- data about wastes removed from PRSs, which are included in Appendix C of this response.

These two categories of information are discussed further below.

Unless the PRS has been excavated, the information contained in published documents about wastes and waste streams disposed of at a PRS, although limited, is all that has been identified as relevant to this request. Most or, in some cases, all the wastes were disposed of at the PRS before the enactment of RCRA, or before the effective date of regulation (and the applicability of the regulatory definition of hazardous waste). Exhaustive investigations were conducted by EPA contractors, and subsequently by LANL personnel and subcontractors in the 1980s and early 1990s to locate all existing information about the LANL PRSs, including waste information, as

documented in the RFA, the SWMU Report, and the OU RFI workplans and their associated correspondence.

The historical information available regarding these wastes was generally obtained from interviews of personnel responsible for the waste or the site in which it is now located. Occasionally, the information could be supplemented by file memoranda, reports, historical photographs, or other documents that may have provided information regarding physical or chemical properties of the waste at the time of disposal. The information has not always been sufficient to allow LANL to determine whether or not the waste would meet a statutory or regulatory definition of hazardous waste. Upon excavation, determinations were made to confirm appropriate management requirements; meanwhile, the waste was and/or is being managed subject to an approved corrective action program.

Understanding and managing the wastes disposed of in PRSs has been the basis of the ER Project's corrective action program. This approach follows the corrective action requirements of the proposed RCRA Subpart S regulations, and has received the concurrence of the EPA and the NMED via their approval of the LANL Installation Work Plan and subsequent RFI reports, voluntary corrective action reports, and reports of other activities at LANL PRSs.

The second category of available information about radionuclide wastes and waste streams at LANL PRSs consists of data about wastes that have been removed from PRSs and were subsequently sent on- or off-site for disposal. This category of information is included in Appendix C of this response, or in documents previously submitted to the NMED or those listed herein in Appendix D. At the time of removal, the excavated materials became subject to current waste management definitions and regulations. Therefore, the data available regarding those wastes are obtained and analyzed using the same system as for other LANL wastes, and maintained within the same database. The ER Project currently is reviewing its records to identify sites among the 299 PRSs from which wastes have been removed. This analysis was not complete at the time of this submittal; therefore, it will be provided to the NMED in a separate submittal, in accordance with Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

The ER Project PRS database does not distinguish between low-level waste (LLW), mixed low-level waste (MLLW), transuranic (TRU) waste, and mixed TRU (MTRU) waste. A list of documents not previously submitted to the NMED and that contain radiological waste information (e.g., wastes generated or disposed of) for these ER-characterized sites is provided in Appendix D.

The Technical Area (TA) 54, Area G, disposal area began receiving radioactive waste for disposal in pits in 1957. Waste disposal activities were recorded in paper logbooks that are currently being reviewed for security issues. Examples of these logbooks are included with this response as Appendix E. The logbooks contain a large amount of

handwritten information that appears to be irrelevant for the disposal and waste management purposes of this RI. LANL proposed (during a meeting on April 2, 2001, between Carl Will [NMED Hazardous Waste Bureau], Gene Turner [DOE Los Alamos Area Office], and Jack Ellvinger [LANL]) that complete copies of these logbooks not be produced until the NMED reviews the examples in Appendix E.

In accordance with 1970 DOE policy (Atomic Energy Commission Immediate Directive 0511-21), waste at Area G was categorized by its radionuclide content and managed separately as LLW or TRU waste. At that time, the types and quantities of LLW and TRU waste stored or disposed of at TA-54 were recorded on manifests as separate shipments. Information about each waste shipment managed since 1970 at TA-54, Areas G and L, is presented in the database included herein as Appendix C. The database captures all available information from TRU Waste Storage Records (TWSR) and from Radioactive Solid Waste Disposal (RSWD) and Chemical Waste Disposal Request (CWDR) forms used for waste shipping and management at LANL. Tables explaining the waste description codes used in the database are also provided with Appendix C. A review of the wastes buried at Area G, including waste descriptions, radionuclide content, and operational history, was conducted during preparation of the "Radioactive Waste Inventory for the TA-54, Area G Performance Assessment and Composite Analysis," which is available electronically at <http://swo.lanl.gov/PA/PDF>. In addition, pit and shaft inventories for Areas G and L are included in the "Operable Unit 1148 Data Report," submitted in 1992.

Prior to 1986, no distinction was made between storing and/or treating mixed waste and management of non-mixed radioactive waste. Almost all radioactive waste (including mixed) generated at LANL prior to 1986 was stored and/or treated on site. After July 1986 when the EPA clarified authority over the regulation of the hazardous component of mixed waste, LANL managed mixed waste separately from non-mixed radioactive waste through on-site storage and/or treatment. In 1991, LANL established interim status storage and treatment areas for mixed waste, pending the RCRA permitting of these units. Identification of these units and, for the purposes of this response, descriptions of these wastes were provided in the January 25, 1991, "Hazardous Waste Permit Application: Part A Permit Application for Mixed Waste," and in waste analysis plans of Part B permit applications subsequently submitted to the NMED. The most recent mixed waste stream descriptions are contained in Appendix B of the "Los Alamos National Laboratory General Part B Permit Application," Revision 1.0, submitted to the NMED in October 1998.

Additional supporting documents with detailed records describing and documenting radioactive and mixed waste streams previously submitted to the NMED include:

- The "Compliance Order Site Treatment Plan FFC Act" (STP), which was originally submitted in 1995. The most recent approved revision of the STP was submitted to the NMED in January 2000. In 1995, LANL prepared and implemented the STP in accordance with the Federal Facility Compliance Act. The Background Volume of

the STP discusses the preferred options for treating MLLW stored or generated at LANL and includes waste stream descriptions and existing inventories. Appendix F presents a crosswalk of the DOE Treatability Groups used in the STP for tracking mixed waste with the waste categories described in Appendix B, the Waste Analysis Plan, of the "Los Alamos National Laboratory General Part B Permit Application," Revision 1.0, submitted to the NMED in October 1998.

- The 1990-92 Waste Stream Characterization Survey (WCS) was conducted to meet the reporting requirements contained in Attachment I of the 1989 LANL Hazardous Waste Facility Permit. For the WCS, LANL prepared and submitted summary reports with room-by-room records of the wastes generated at the Laboratory, including descriptions and generation processes for radioactive and mixed wastes. Although the information is no longer current, the survey is still indicative of the types of wastes generated and the waste-generating processes at LANL.
- The LANL Biennial Report, submitted to the EPA and the NMED as required by the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20.4.1 NMAC), Subpart III, §262.41, provides information on the hazardous waste component and volumes for mixed waste streams generated and subsequently managed at LANL. The most recent report was submitted in March 2000.

Treatment is discussed further in the response to Request No. 8, and a discussion of wastes transported to TA-54 is provided in the response to Request No. 7.

Ray Hahn (Facility and Waste Operations Division (FWO) Solid Waste Operations (SWO) Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Ray Hahn provided information used to prepare the TA-54 portion of this response, and Gian Bacigalupa (Hazardous and Solid Waste Group [ESH-19] Technical Staff Member [TSM]) collected information used to prepare the remaining waste management portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 1 are identified in the text above.

Any additional waste management information that can be identified regarding generation, treatment, storage, disposal, recycling, and transportation of radioactive and mixed waste will be produced in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

2. *Please identify each radionuclide waste or waste stream, including mixed and non-mixed wastes, that is currently or has been at any time generated, treated, stored, disposed of, otherwise managed at, or transported to the LANL Facility, and that meets the following criteria: a) LANL claims the waste to be exempt from regulation as a solid waste under section 1004(27) of RCRA, 42 U.S.C. § 6903(27), because such waste meets the definition of source, special nuclear, or*

by-product material as defined by the Atomic Energy Act, 42 U.S.C. §§ 2011 et seq.; and b) the waste would meet the statutory definition of "hazardous waste" in section 1004(5) of RCRA, 42 U.S.C. § 6903(5), but for such exemption.

Each radioactive waste that is currently or has been managed since 1970 at TA-54, Areas G and L, at LANL and that is exempt from regulation as solid waste because the waste meets the definition of source, special nuclear, or by-product material as defined by the AEA is presented in the database included herein as Appendix C. In this database, identified AEA waste is indicated by a checkmark in the column titled "AEA." A discussion of wastes managed prior to 1970 is presented in the response to Request No. 1.

Mixed waste is not addressed in this response because the criteria set forth in Request No. 2a and 2b could not be met. If a waste was by definition mixed, LANL would not have claimed it to be exempt from regulation as solid waste (2a). By its very nature, it is a combination of a radioactive waste component exempt from RCRA and a hazardous waste component subject to RCRA. Such a mixture could never simultaneously be exempt from the definition of solid waste in its entirety, as suggested in the criterion set forth in Request No. 2a, while meeting the definition of solid waste necessary to be a mixed waste.

All information about the radionuclide wastes and waste streams *in situ* in unexcavated LANL PRSs, including their AEA status, to the extent it is available, was provided to the EPA and the NMED in the RFA, the SWMU Report, and the OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All information about the radionuclide wastes and waste streams removed from LANL PRSs, including their AEA status, to the extent it is available, is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

LANL is submitting information on material that is AEA exempt and also, but for the exemption, may meet the statutory definition of "hazardous waste." These materials possess certain qualities that may be similar to EPA's definition of ignitable, corrosive, reactive, or toxic materials. Because neither EPA nor DOE have prescribed constituent-specific criteria for concentrations of radioactive material that would pose a substantial threat to human health and the environment if improperly managed, LANL believes the information presented adequately describes, to the extent possible, exempt AEA material that would meet the conditions of this request.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. Ray Hahn and Paul Schumann (ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Alice Barr (ESH-19 TSM) also provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Any additional waste management information that can be identified regarding the generation, treatment, storage, disposal, recycling, and transportation of AEA exempt radioactive waste at LANL will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

3. *For each waste and waste stream identified in response to Request #1 and #2, please provide a detailed description of the radioactive, chemical, and physical properties of the waste. Include in your response a description of all radionuclides, all radioactive decay chains, and the half-lives of both the radionuclides and their daughter products.*

For wastes managed at TA-54, Areas G and L, a description of the radioactive, chemical, and physical properties of the waste, to the extent known, is provided in the database included herein as Appendix C. In this database, the radioactive properties are described in the column titled "Radioisotope Content." The chemical properties are described in the columns titled "Code" and "RCRA Codes Assigned." EPA Hazardous Waste Numbers (RCRA Codes) have been assigned only for those mixed wastes managed after the effective date of regulation (July 25, 1990). The physical properties are described in the column titled "State," and are denoted as solid (S), liquid (L), or gas (G).

The radionuclides and levels of radioactivity determined at the time the waste was received at TA-54 are described in the database. A description of radionuclides, radioactive decay chains, and the half-lives of radionuclides and their daughter products can be found in the publication titled *Table of Radioactive Isotopes*, written by Edgardo Browne and Richard B. Firestone, edited by Virginia S. Shirley, and published by John Wiley & Son, 1986. A comprehensive commercial database on radioactive wastes is available at <http://radwaste.org>.

As discussed under Request No. 1, LANL retrieved the information pertaining to radionuclide wastes or waste streams that may be present in PRSs whose corrective action is being managed by the ER Project. Data from the 299 PRSs identified in the PRS database search were reviewed to respond to this request. All available information about radioactive, physical, and chemical properties of the radionuclide wastes and waste streams *in situ* in unexcavated LANL PRSs was provided to the EPA and the NMED in the RFA, the SWMU Report, and the OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All available information about radioactive, physical, and chemical properties of the radionuclide wastes and waste streams removed from LANL PRSs is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. Ray Hahn and Paul Schumann (ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 3 are identified in the text above. The TA-54 database, provided herein as Appendix C, captures information from TWSRs and from RSWD and CWDR forms, as discussed in the response to Request No. 1.

Any additional waste management information that can be identified regarding the descriptions of radioactive, chemical, and physical properties of radioactive and mixed waste generated at LANL will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

4. *For each waste and waste stream identified in response to Request #1 and #2, please state whether or not the waste exhibits any of the characteristics of a hazardous waste under 40 C.F.R. pt. 261, subpt. C:*
 - a. *Ignitability under 40 C.F.R. § 261.21;*
 - b. *Corrosivity under 40 C.F.R. § 261.22;*
 - c. *Reactivity under 40 C.F.R. § 261.23;*
 - d. *Toxicity under 40 C.F.R. § 261.24.*

For wastes managed at TA-54, Areas G and L, the hazardous waste characteristics for each waste and waste stream identified in response to Request Nos. 1 and 2, to the extent known, are presented in the database included herein as Appendix C. The hazardous waste characteristics are identified in the column titled "RCRA Codes Assigned." EPA Hazardous Waste Numbers (RCRA Codes) have been assigned only for those mixed wastes managed after the effective date of regulation (July 25, 1990).

As discussed under Request No. 1, LANL retrieved the information pertaining to radionuclide wastes or waste streams that may be present in PRSs whose corrective action is being managed by the ER Project. Data from the 299 PRSs identified in the PRS database search were reviewed to respond to this request. All available information about whether the radionuclide wastes and waste streams *in situ* in unexcavated LANL PRSs meet any of the characteristics of a hazardous waste was provided to the EPA and the NMED in the RFA, the SWMU Report, and the OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All available information about whether the radionuclide wastes and waste streams removed from LANL PRSs meet

any of the characteristics of a hazardous waste is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. Ray Hahn and Paul Schumann (ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

5. *For each waste and waste stream identified in response to Request #1 and #2, please state whether or not the waste contains any hazardous constituents listed under 40 C.F.R. pt. 261, Appendix VIII and name the specific constituent or constituents.*

LANL waste management organizations do not have a process in place that specifically tracks or identifies only those hazardous constituents that are listed under 20.4.1 NMAC, Subpart II, Part 261, Appendix VIII. Beginning in the early 1990s, individual waste generators at LANL were required to complete a Waste Profile Form (WPF) that documents the characterization of each generated waste stream. The WPF requires the generator to identify the hazardous and inert components in the waste stream. Some, but not all, of the chemicals and waste components listed are contained in Appendix VIII. Paper copies of all WPFs are maintained within the document control organization at TA-54. In addition, an electronic Waste Profile Management Database (WPMD) has been developed. This electronic database contains specific information on all WPFs related to hazardous waste determinations. It includes a data field that identifies constituents and contaminants. The WPMD does not, however, contain any radiological information. Therefore, it cannot be searched to provide a list of the constituents and contaminants within radiological waste streams. For hazardous and mixed waste shipments that are sent off site, LANL completes a Land Disposal Restriction (LDR) certification. As part of this certification, LANL identifies all Underlying Hazardous Constituents that are contained in the waste. The LDR certifications are maintained with the Hazardous Waste Manifests for each shipment and are stored in the document control organization at TA-54. These records are reviewed by NMED during their periodic inspections. LDR certifications are generated only at the time of shipment and are not generated for waste that has solely a radioactive component. LANL has not yet fully developed an electronic database from the LDR records.

The TA-54 database (Appendix C) does not contain complete details regarding hazardous constituents identified in Appendix VIII. The information contained in this database for the ER-characterized sites is at the same level of detail.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. His address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 5 are included herein as Appendix C. The TA-54 database captures information from TWSRs and from RSWD and CWDR forms, as discussed in the response to Request No. 1.

6. *For each waste and waste stream identified in response to Request #1 and #2, please provide a detailed description of the generation of the waste, including the location of its generation, the date of its generation, the process or processes by which it was generated, and the volume of waste that was generated.*

Mixed waste-generating processes are described in Appendix B, the Waste Analysis Plan, of the "Los Alamos National Laboratory General Part B Permit Application," Revision 1.0, submitted to the NMED in October 1998. Radioactive and mixed waste-generating processes were also identified and described in the "Los Alamos National Laboratory Site-Wide Environmental Impact Statement" (SWEIS), submitted to the NMED in 1999. The most recent revision of this information is contained in the "SWEIS Yearbook-1999," included as Appendix G of this response. Detailed process and waste descriptions for MTRU waste generated and managed at the TA-55 facility have been developed recently and are provided in Appendix H of this response. This information consists of electronic copies of acceptable knowledge reports developed for the LANL Transuranic Waste Certification Program that are used for waste disposal documentation at the Waste Isolation Pilot Plant. The reports provide information on waste-generating processes and locations and types of waste generated.

As discussed under Request No. 1, LANL retrieved the information pertaining to radionuclide wastes or waste streams that may be present in PRSs whose corrective action is being managed by the ER Project. Data from the 299 PRSs identified in the PRS database search were reviewed to respond to this request. All available information about the generation of the radionuclide wastes and waste streams *in situ* in unexcavated LANL PRSs (including location, dates, process, and volumes) was provided to the EPA and the NMED in the RFA, the SWMU Report, and the OU RFI workplans unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All the available information for radionuclide wastes and waste streams removed from LANL PRSs is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) and Gian Bacigalupa (ESH-19 TSM) provided information used to prepare the operational waste management portion of this response. Ray Hahn and Paul Schumann (ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 6 are identified in the text above.

Any additional waste stream descriptions that can be identified for radioactive and mixed waste at LANL will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

7. *For each waste and waste stream identified in response to Request #1 and #2 that was transported to the LANL Facility from elsewhere, please state the origin of the waste, the volume of the waste transported to the LANL Facility, broken down by shipment if possible, and the date or dates the waste was received at the LANL Facility.*

For wastes transported to TA-54, the requested information is presented in a report titled "Disposal of Offsite Generated Radioactive Waste," which is provided herein as Appendix I. The report summarizes the wastes received for storage or disposal at Area G from off-site generators. An additional shipment of waste received from the New Mexico Health Department was disposed of on March 30, 1970. This was radium waste (estimated at 100 Curies) in a stainless steel cask. In the database included herein as Appendix C, wastes from off-site sources are indicated with an "XX" in the column titled "TA."

LANL periodically receives small amounts of Nuclear Regulatory Commission-licensed material from off site in the form of radioactive sealed sources that are stored at TA-54, Area G. Additional information regarding this material will be made available upon request.

As discussed under Request No. 1, LANL retrieved the information pertaining to radionuclide wastes or waste streams that may be present in PRSs whose corrective action is being managed by the ER Project. Data from the 299 PRSs identified in the PRS database search were reviewed to respond to this request. In no known cases have wastes from non-LANL sources been transported to and/or disposed of in these PRSs. Some of the 299 PRSs listed in Appendix B, particularly those identified in TA-0, TA-1, TA-73, and a few other sites, are in locations that were within the facility boundary at the time of initial disposal of wastes at the PRS. Although property ownership may have been transferred outside DOE, the PRSs remain under the control of LANL, and continue to remain listed in (and subject to the requirements of) Module VIII of LANL's Hazardous Waste Facility Permit. Where wastes have been excavated and subsequently removed from these PRSs, all available information about the radionuclide wastes and waste streams from the PRSs, including origin, volumes transported, and dates the wastes and waste streams were received, is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

In most such instances, the excavated wastes were transported to TA-54 for further management and/or disposal. Therefore, they are reported in this response as wastes

"transported to the facility from elsewhere," although they are from LANL PRSs located within former facility boundaries. In 1994-1995, waste was received from off-site PRSs using temporary EPA Identification Numbers. Reports on these shipments were submitted to the NMED. Subsequently, Table 2-1 of Module II of the 1989 LANL Hazardous Waste Facility Permit was modified to include other off-site PRSs that could require transport of wastes to the facility. As stated in the response to Request No. 1, the ER Project currently is reviewing its records to identify off-site PRSs among the 299 PRSs from which wastes have been excavated, if any.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. Ray Hahn, Terry Rust (ER Project Team Leader), and Paul Schumann (ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 7 are identified in the text above.

Any additional waste management information regarding the transportation of radioactive and mixed waste to LANL that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

8. *For each waste and waste stream identified in response to Request #1 and #2 that was treated at the LANL Facility, please provide a detailed description of the treatment, including the method or process of treatment, the effectiveness of the treatment in reducing the hazardous properties of the waste, and the volume of waste treated.*

For the purposes of this response and resulting submittals, past and current radioactive and mixed waste treatment methods or processes at LANL are described as:

- Non-RCRA radioactive waste treatment
- Treatment that is not subject to RCRA interim status or permitting requirements (e.g., reclamation, elementary neutralization, wastewater treatment units)
- Mixed waste treatment
- Maintenance activities that allow the continued use of radioactively-contaminated material.

The basis for these categories includes the need to distinguish between treatment processes for radioactive and mixed waste streams, the RCRA definition of "treatment," and processes managed under separate regulatory mechanisms. LANL is continuing to identify and collect information about treatment processes.

Radioactive waste treatment methods or processes used at LANL have included non-traditional *in-situ* vitrification (NTISV) of low-level radioactively-contaminated soils, the Thermo-Nuclear™ Segmented Gate System (SGS) for radioactively-contaminated soils, and incineration. A description of the NTISV treatment process is available electronically at <http://www-emptd.lanl.gov/SubCon/NTISV.html>. A description of the SGS was presented in the Voluntary Corrective Action Report for SWMU No. 33-007(c), dated September 30, 1996, and submitted to the NMED. A description of the treatment process, effectiveness, and waste volumes for incineration at the Controlled Air Incinerator at TA-50, for which RCRA-closure was approved in July 1998, is presented in "Los Alamos National Laboratory Controlled Air Incinerator Resource Conservation and Recovery Act Closure Report and Certification," submitted to the NMED in April 1998.

Sort, survey, and decontamination (SSD) and lead decontamination treatment processes have been used for reclamation and maintenance. Descriptions of SSD and lead decontamination treatment processes, effectiveness, and waste volumes are discussed in the Background Volume of the "Compliance Order Site Treatment Plan, FFC Act," submitted to the NMED in 1995.

Mixed waste treatment processes at LANL include cementation of MTRU waste and MLLW. A description of the treatment process, effectiveness, and waste volumes for cementation at TA-55 is provided in the "Technical Area 55 Part B Permit Application; Building 4, Container Storage Areas 1-11, Storage Tank Systems, Cementation Treatment Unit; Container Storage Pad; Building 185, Container Storage Area," Revision 0.0, submitted to the NMED in June 1996. A description of the treatment process, effectiveness, and waste volumes for cementation at TA-50 is provided in the "Los Alamos National Laboratory Technical Area 50 Part B Permit Renewal Application," Revision 1.0, submitted in January 1999.

Gian Bacigalupa (ESH-19 TSM) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Further details regarding the volumes of mixed waste treated at LANL, including generator treatment, can be found in the STP and in the LANL Biennial Report, as discussed in the response to Request No. 1. Other documents providing information used to prepare the response to Request No. 8 are identified in the text above.

Any additional waste management information that can be identified regarding treatment of radioactive and mixed waste will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

9. *For each waste and waste stream identified in response to Request #1 and #2 that was stored at the LANL Facility, please state the location of such storage at*

the LANL Facility, the method of storage, the volume of waste stored, and the dates during which each volume of such waste was stored at each such location.

For wastes managed at TA-54, Areas G and L, the location of storage, volume of waste stored, and dates of storage at each location are presented in the database provided herein as Appendix C. The information is shown in the columns titled "Storage History," "Volume," and "RCV Date." Supporting storage information is presented in "Disposal and Storage Facility Information at Area G." As indicated in Appendix J, two copies of this document are provided as a separate package with this submittal.

Wastes are normally shipped to Area G for storage in U.S. Department of Transportation (DOT)-approved containers. A detailed container inspection is performed at the staging area(s) adjacent to the storage location to ensure that the containers are within acceptable parameters. The parameters for acceptance are identified in the LANL Waste Acceptance Criteria (WAC). Waste containers that meet the LANL WAC are accepted for storage and are removed from the transport vehicle by forklift or other waste-handling equipment. Waste containers are surveyed for external contamination and dose rates prior to placement into storage. Drums are placed on metal pallets and then placed into a storage array. Containers are stored in rows separated by aisles that are consistent with applicable permits and codes. Drums banded with metal straps may be stacked three layers high. The container/waste types are grouped/segregated in designated locations. Remote-handled (RH) TRU wastes are stored in shafts. Waste management in shafts is discussed further in the response to Request No. 10.

Trenches have also been used to manage waste. These trenches are approximately 13 feet (ft) long and 4 to 6 ft deep. Waste was placed in two rows of augered holes cut into the floor of the cell. Into each hole was placed a concrete cask. The cask was filled with two 30-gallon metal drums. Each array was backfilled with crushed tuff up to the rims of the casks. After placement of the waste into the casks, the lids were sealed and the area mounded with crushed tuff.

At Area L, mixed wastes are stored inside a dome with secondary containment. The wastes are in DOT-approved containers that meet packaging standards in the Code of Federal Regulations, Title 49, Parts 173-177. The largest container used for storage is the 83-gallon drum. All liquid containers are stored on containment structures. Stored wastes are segregated by chemical compatibility groups and include physical separation and engineered structures. Shaft Nos. 36 and 37 are used at Area L for retrievable storage of high-activity mixed waste lead stringers. Each shaft is constructed of corrugated metal pipe, has a welded metal plate and 1-ft-thick concrete plug at the base, and has a steel cover at the surface. Additional information on storage at Area L is presented in the "Los Alamos National Laboratory Technical Area 54 Part B Permit Renewal Application," submitted to the NMED in January 1999. Storage information for ER-characterization waste that has not yet been shipped off site, if any, is included in the TA-54 database.

The locations for storage of mixed waste at LANL are generator storage areas, and permitted and interim status tanks or container storage areas. A listing of over 2,000 active or closed out generator storage areas (i.e., satellite accumulation areas or <90-day storage areas, as defined by 20.4.1 NMAC, Subpart III, §262.34) that have been or are currently used for storage of mixed waste at LANL is provided as Appendix K of this response. Identification of permitted or interim status mixed waste storage units was originally provided in the January 25, 1991, "Hazardous Waste Permit Application: Part A Permit Application for Mixed Waste." This Part A was subsequently revised due to the addition of new storage areas or closure of existing areas. The most recent listing of approved locations and storage capacities is included in the "Los Alamos National Laboratory General Part A Permit Application," Revision 0.0, submitted to the NMED in April 1998. The methods of storage for these mixed wastes are discussed in TA-specific Part B permit applications, which include:

- "Los Alamos National Laboratory Technical Area 3, Building 29, Chemistry and Metallurgy Research Building Part B Permit Application, Container Storage Unit," Revision 0.0, submitted to the NMED in September 1999
- "Los Alamos National Laboratory Technical Area 50 Part B Permit Renewal Application," Revision 1.0, submitted to the NMED in January 1999
- "Los Alamos National Laboratory Technical Area 54 Part B Permit Renewal Application," Revisions 0.0 and 0.1, submitted to the NMED in January and September 1999, respectively
- "Technical Area 55 Part B Permit Application; Building 4, Container Storage Areas 1-11, Storage Tank Systems, Cementation Treatment Unit; Container Storage Pad; Building 185, Container Storage Area," Revision 0.0, submitted to the NMED in June 1996.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. Gian Bacigalupa (ESH-19 TSM) collected, from various sources, the information that was used to prepare the generator storage areas and tanks/container storage areas portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 9 are identified in the text above.

Any additional waste management information regarding storage of radioactive waste at LANL that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

10. *For each waste and waste stream identified in response to Request #1 and #2 that was disposed of at the LANL Facility, please provide a detailed description of the disposal, including the method of disposal, the location of disposal, the dates of disposal, and the volume of waste disposed of at each such location.*

For wastes managed at TA-54, Areas G and L, the location of disposal, the dates of disposal, and the volume of waste disposed at each location are presented in the database provided herein as Appendix C. The information is shown in the columns titled "Disposal Information" and "Volume." The database captures waste management information from 1970 to present; prior to 1970, this information, if available, is contained in logbooks. A list of the logbooks containing information not included in the database is presented in Appendix E, along with an example page from each logbook, as discussed in the response to Request No. 1. Entries in these logbooks were used as a source of information in Appendix 2e of the *Performance Assessment and Composite Analysis for Los Alamos National Laboratory Material Disposal Area G* (Area G PA, Report-54G-013). (The Area G PA was provided to the NMED; it is available electronically at <http://swo.lanl.gov/PA/PDF>. Appendix 2e of the Area G PA is available electronically at <http://swo.lanl.gov/PA/PDF/Appendix%202.pdf.pdf>.) Supporting disposal information is presented in "Disposal and Storage Facility Information at Area G." As indicated in Appendix J, two copies of this document are provided with this submittal. Additional supporting disposal information (i.e., pit and shaft inventories at Areas G and L) is included in the "Operable Unit 1148 Data Report," submitted in 1992. Information on early disposal at Area G can be found in *History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)* (LA-6848-MS, 1977). Volume I of this report is available electronically at <http://lib-www.lanl.gov/la-pubs/00371730.pdf> and <http://lib-www.lanl.gov/la-pubs/00209943.pdf>. Volume II is available at <http://lib-www.lanl.gov/la-pubs/00309178.pdf>.

At Area G, disposal pits are used for the shallow land burial of LLW. The pits are unlined and managed according to DOE requirements. Ramps are provided on one end of each pit to provide access for waste transporters and heavy equipment. Pits are constructed on an as-needed basis within Area G in accordance with the location requirements identified in the Area G PA. Pit walls must be no closer than 50 ft to the mesa rim and cannot be deeper than 15 ft above the adjacent canyon floors. Pits are filled with waste to within 6.5 ft below the pit surface; the top 6.5 ft of each pit is completed with compacted backfill and restored with indigenous shallow rooting grasses. Backfill is primarily reclaimed crushed tuff that was removed from the pit during excavation. Backfill is transported and placed by a large front-end loader or bulldozer and compacted in place. Fall protection is installed around excavations deeper than 6 ft. Where vehicle traffic is possible, moveable concrete barriers are installed at pit perimeters to prevent vehicles from accidentally falling into open pits. Where vehicle traffic is not possible at pit edges, fall protection consists of barrier chains placed approximately 6 ft from the pit edge with conspicuously posted hazard and warning signs.

Shafts at Area G are used for both disposal and retrievable storage. Shafts may contain radioactive biological waste, polychlorinated biphenyls- and beryllium-contaminated waste, solid LLW, or RH TRU waste. There are approximately 260 shafts in Area G. Individual shafts or shaft groups are conspicuously posted with

hazard and warning signs. Location requirements for the shafts are identified in the Area G PA, and require that the shafts are set back from the edge of the mesa rim by a minimum distance of 50 ft. LLW shaft depths must be at least 10 ft above the canyon floor and waste must be kept 6.5 ft from the surface. Shafts vary in diameter from 1 to 16 ft and are up to 65 ft in depth. Most of the shafts are unlined, but some have metal liners to facilitate retrieval or to reduce the potential for environmental contamination. Active shafts typically have a steel plate or concrete cover and chain guardrails for fall protection. A concrete collar prevents run-on into active shafts and helps protect the integrity of the top of the shaft. Once filled, the shafts are sealed (capped) with concrete mounds that are placed over a minimum backfill of 6.5 ft of crushed tuff over the waste. At that time, the shafts are marked with a brass cap indicating "Buried Radioactive Wastes," and include the shaft number, radionuclides disposed of or retrievably stored, and dates of use. Active shafts and shafts with high radionuclide content are conspicuously posted with warning signs. Additional information on storage at Area G is presented in the "Los Alamos National Laboratory Technical Area 54 Part B Permit Renewal Application," submitted to the NMED in January 1999, and in the "RCRA Part B Permit Application: Technical Area 54, Area G, Pads 1, 2, and 4, Storage Domes A-D; Chemical Plating Waste Treatment Skid and Treated Liquid Storage Tanks, Technical Area 63, Hazardous Waste Treatment Facility," submitted to the NMED in September 1993.

Additional information on disposal at TA-54, Areas G and L, is presented in the "Closure and Post-Closure Plans for TA-54 Area G Landfill at Los Alamos National Laboratory," submitted to the NMED in September 1985; in the "Closure and Post-Closure Plans for TA-54 Area H and Area L Landfill at Los Alamos National Laboratory," submitted in November 1986; and in the "Closure Plan for Technical Area 54, Material Disposal Area L," submitted in March 1998.

As discussed under Request No. 1, LANL retrieved the information pertaining to radionuclide wastes or waste streams that may be present in PRSs whose corrective action is being managed by the ER Project. Data from the 299 PRSs identified in the PRS database search were reviewed to respond to this request. All available information about the disposal of radionuclide wastes and waste streams remaining *in situ* in unexcavated LANL PRSs, including methods, locations, dates, and volumes, was provided to the EPA and the NMED in the RFA, the SWMU Report, and the OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All collected information about disposal of the radionuclide wastes and waste streams excavated from LANL PRSs is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) provided information used to prepare the TA-54 portion of this response. Ray Hahn and Paul Schumann (ER Project Team Leader)

provided information used to prepare the ER Project portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 10 are identified in the text above.

Any additional waste management information regarding disposal of radioactive waste and mixed waste at LANL that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

11. *For each waste and waste stream identified in response to Request #2, please state the basis for LANL's claim that the waste is exempt from regulation as a solid waste under RCRA because such waste is source, special nuclear, or by-product material as defined by the Atomic Energy Act.*

The following table lists the types of radioactive waste that have been managed as non-RCRA waste identified in the response to Request No. 2. It also indicates the basis for LANL's claim that they are exempt from regulation as solid waste under RCRA because they are source, special nuclear, and by-product material as defined by the Atomic Energy Act, 42 USC §§2011 *et seq.*:

Waste Description	Reason for AEA Exemption
Uranyl Nitrate	Source Material
Thorium Nitrate	Source Material
Pyrophoric Uranium (chips & turnings)	Source Material
Pyrophoric Thorium (chips & turnings)	Source Material
Uranium Hexafluoride	Source Material

Definitions for source, special nuclear, and by-product material are provided at Title II, Section 11 of the AEA.

All information about the radionuclide wastes and waste streams *in situ* in unexcavated LANL PRSs, including their AEA status, to the extent it is available, was provided to the EPA and the NMED in the RFA, the SWMU Report, and the OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All information about the radionuclide wastes and waste streams removed from LANL PRSs, including the basis for their AEA status, to the extent it is available, is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader), Alice Barr (ESH-19 TSM), and Gian Bacigalupa (ESH-19 TSM) collected information used to prepare this response. Paul Schumann

(ER Project Team Leader) provided information used to prepare the ER Project portion of this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used in preparing the response to Request No. 11 are identified in the text above. The TA-54 database captures information from TWSRs and from RSWD and CWDR forms, as discussed in the response to Request No. 1.

Any additional waste management information regarding generation, treatment, storage, disposal, recycling, and transportation of AEA exempt radioactive waste at LANL that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter. Further discussion of the basis for the AEA exemption as source, special nuclear, or by-product material will be included, as such information is applicable.

12. *For each Site listed in Part 1 of Attachment A, please identify each waste or waste stream that is currently or has been at any time disposed of at the Site.*

The available information identifying wastes and waste streams initially disposed at the 108 LANL PRSs listed in Part 1 of Attachment A of NMED's February 12, 2001, letter, including specific determinations as to whether or not a waste met the statutory or regulatory definitions of hazardous waste at the time of initial disposal, falls into two categories:

- information contained in published documents previously provided to the EPA and the NMED, including the RFA, the SWMU Report, and the OU RFI workplans (unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs); and
- data about wastes removed from PRSs, which are included in Appendix C of this response.

These two categories of information are discussed further below.

Regarding wastes remaining *in situ* in the unexcavated PRSs among the 108 listed PRSs, all published documents containing information responsive to this request have been submitted to the NMED previously, either prior to LANL's March 1, 2001, response, or attached (as documents containing Category 1 data) to LANL's previous (March 1 and April 2, 2001) responses. Unpublished Category 2 and 3 data pertaining to these PRSs were submitted to NMED in response to Request No. 18 on March 1, March 16, and April 2, 2001, or will be submitted in the near future.

The available information identifying wastes and waste streams removed from LANL PRSs is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D. At the time of removal, the excavated materials became subject to current waste management definitions and regulations, just

as with any other waste generated at LANL; meanwhile, they are managed subject to the approved corrective action program.

Ray Hahn (FWO-SWO Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 12 are identified in the text above.

Any additional wastes and waste streams that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

13. *For each waste and waste stream identified in response to Request #12, please provide a detailed description of the radioactive, chemical, and physical properties of the waste. Include in your response a description of all radionuclides, all radioactive decay chains, and the half-lives of both the radionuclides and their daughter products.*

The information available about radioactive, physical, and chemical properties of the wastes and waste streams in the unexcavated PRSs included in the 108 LANL PRSs discussed in response to Request No. 12 was provided to the EPA and the NMED in the RFA, the SWMU Report, the OU RFI workplans, and previous submittals to this RI responding to Request No. 18. The available information about radioactive, physical, and chemical properties for the radionuclide wastes and waste streams removed from the 108 PRSs is included in Appendix C of this response.

A description of radionuclides, radioactive decay chains, and the half-lives of radionuclides and their daughter products can be found in the publication titled *Table of Radioactive Isotopes*, written by Edgardo Browne and Richard B. Firestone, edited by Virginia S. Shirley, and published by John Wiley & Son, 1986. A comprehensive commercial database on radioactive wastes is available at <http://radwaste.org>.

Ray Hahn (FWO-SWO Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 13 are identified in the text above.

14. *For each waste and waste stream identified in response to Request #12, please state whether or not the waste is a listed hazardous waste under 40 C.F.R. pt. 261, subpt. D and indicate the specific listing or listings.*

Regarding the 108 LANL PRSs discussed in Request No. 12, the available information about whether the wastes and waste streams *in situ* in unexcavated LANL PRSs met the regulatory definitions of listed hazardous waste at the time of initial disposal was provided to the EPA and the NMED in the RFA, the SWMU Report, and OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All available information about whether the wastes and waste streams removed from LANL PRSs with radionuclides met the regulatory definitions of listed hazardous wastes is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 14 are identified in the text above.

Any additional information regarding listed hazardous wastes and waste streams that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

15. *For each waste and waste stream identified in response to Request #12, please state whether or not the waste meets any of the characteristics of a hazardous waste under 40 C.F.R. pt. 261, subpt. C:*
 - a. *Ignitability under 40 C.F.R. § 261.21;*
 - b. *Corrosivity under 40 C.F.R. § 261.22;*
 - c. *Reactivity under 40 C.F.R. § 261.23;*
 - d. *Toxicity under 40 C.F.R. § 261.24.*

Regarding the 108 LANL PRSs discussed in Request No. 12, the available information about whether the wastes and waste streams *in situ* in unexcavated LANL PRSs met the regulatory definitions of characteristic hazardous waste at the time of initial disposal was provided to the EPA and the NMED in the RFA, the SWMU Report, and OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All available information about whether the wastes and waste streams excavated from LANL PRSs with radionuclides met the regulatory definitions of characteristic hazardous waste is included in Appendix

C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 15 are identified in the text above.

Any additional information regarding characteristic hazardous wastes and waste streams that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

16. *For each waste and waste stream identified in response to Request #12, please state whether or not the waste contains any hazardous constituents listed under 40 C.F.R. pt. 261, Appendix VIII and name the specific constituent or constituents.*

Regarding the 108 LANL PRSs discussed in Request No.12, the available information about whether the wastes and waste streams *in situ* in unexcavated LANL PRSs contained Appendix VIII hazardous constituents at the time of initial disposal was provided to the EPA and the NMED in the RFA, the SWMU Report, and OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. For waste removed from the PRSs with radionuclides, the data available in the TA-54 database (Appendix C) do not contain complete information regarding hazardous constituents identified in 20.4.1 NMAC, Subpart II, Part 261, Appendix VIII, as stated in the response to Request No. 5 above.

Ray Hahn (FWO-SWO Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 16 are identified in the text above.

Any additional information regarding whether or not the wastes or waste streams contain any hazardous constituents listed in 20.4.1 NMAC, Subpart II, Part 261, Appendix VIII, that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

17. *For each waste and waste steam identified in response to Request #12, please provide a detailed description of the disposal, including the method of disposal,*

the location of disposal, the dates of disposal, and the volume of waste disposed of at each such location.

Regarding the 108 LANL PRSs discussed in Request No. 12, the available information about the initial disposal of the wastes and waste streams *in situ* in unexcavated LANL PRSs, including methods, locations, dates, and volumes, was provided to the EPA and the NMED in the RFA, the SWMU Report, and OU RFI workplans, unless those data have since been supplemented by additional investigations and reported in subsequent RFI reports, voluntary corrective action reports, and/or reports of other activities at LANL PRSs. All available information about on-site or off-site disposal of the wastes and waste streams excavated from LANL PRSs with radionuclides is included in Appendix C of this response, or in documents previously submitted to the NMED or listed herein in Appendix D.

Ray Hahn (FWO-SWO Group Leader) and Paul Schumann (ER Project Team Leader) provided information used to prepare this response. Their address is P.O. Box 1663, Los Alamos, NM 87545.

Documents providing information used to prepare the response to Request No. 17 are identified in the text above.

Any additional information regarding a detailed description, method, location, date and volume of waste disposal that can be identified will be provided in a supplement to this response, as provided by Instruction No. 5 on page 3 of NMED's February 12, 2001, letter.

20. *For each Request #1 through #19, inclusive, identify each and every person who provided information that was used to prepare the response. Identify each such person by name, title or job description, employer, and current or last known address.*

Numerous sources of information (including database retrievals, logbooks, waste characterization documentation, and site characterization reports) were used to prepare this response. This retrieval effort involved a large number of personnel who provided information within their work responsibilities and were otherwise not involved in the direct preparation of this response. Some of the data presented and reports referenced were prepared or authored by personnel no longer employed at LANL. In the interest of brevity, a responsible individual (or individuals) who collected data and prepared the response has been identified for the appropriate portion of the response for each numbered request. If necessary, these individuals can provide further details regarding the preparation of this response. Title or job description, employer, and current or last known addresses for these individuals are also provided in each numbered request, in accordance with Instruction No. 7 of the RI.

21. *For each Request #1 through #19, inclusive, identify each and every document that provided information that was used to prepare your response. Identify each such document by type of document, title or description, author, and date.*

Each and every document that provided information used to prepare responses are identified in the corresponding responses to each numbered request, in accordance with Instruction No. 7 of the RI. The document type, title or description, author, and document date are also provided in each numbered request, per Instruction No. 7.

ATTACHMENT A**PART 1**

PRS Name	TA	SWMU Number
MDA-A	21	21-014
MDA-B	21	21-015
MDA-C	50	50-009
MDA-D	33	33-003(a)-99
MDA-E	33	33-001(a)-99
MDA-F	6	6-007(a)-99
MDA-K	33	33-002(a)-99
MDA-M	9	9-013
MDA-N	15	15-007(a)
MDA-P	16	16-018
MDA-Q	8	8-006(a)
MDA-R	16	16-019
MDA-S	11	11-009
MDA-T	21	21-016(a)-99
MDA-U	21	21-017(a)-99
MDA-V	21	21-018(a)-99
MDA-W	35	35-001
MDA-X	35	35-002
MDA-Y	39	39-001(b)
MDA-Z	15	15-007(b)
MDA-AA	36	36-001
MDA-AB	49	49-001(a-g)
90's Line	16	16-008(a)
Firing Sites	39	39-004(a-e), 39-008
Firing Sites	15	15-004(f); 15-006(a, c, d); 15-008(a)
Townsite PRS's	0, 1	0-010(b), 1-001(a-w), 1-002, 1-003(a-e)
Outfall	21	21-011(k)
Surface Impoundments	35	35-003(d, r), 35-010(a-e)
Outfalls	46	46-004(g, h, m, q, s, u, v, x, y, z, a2, b2, c2)
Bayo Canyon Sites	10	10-003(a-o), 10-007
Fish Ladder	16	16-003(o)

VALID RSWD WASTE CODES

The RSWD (Form 1354) contains three spaces for the Waste Code. Use the code number below which best describes your waste. If you are using a two digit code, enter it in the first two spaces and leave the third space blank. If you are using a three digit code, use all three spaces. Do not use the A, S, or M prefix as in the past; instead, check the correct box:

ACTUAL RAD - measurable radioactivity or contamination; MUST indicate amount of radionuclide on RSWD.

SUSPECT RAD - no radioactivity or contamination detectable

MIXED WASTE - contains both radioactive and RCRA hazardous components

NON-RAD - waste is certified to be non-radioactive

Be as specific as possible; a more accurate description is preferable to a "catch-all" code. If no code is applicable to the waste, call EM-7 at 5-WAST (5-9278) for further guidance.

CODE WASTE MATERIAL DESCRIPTION

10	Graphite Solids
11	Graphite Powder
14	Combustible Decon Waste
15	Cellulosics (paper, wood, etc.)
16	Plastics
17	Rubber Materials
18	Combustible Lab Trash (paper, plastic, rubber, etc.)
181	Non-Combustible Lab Trash (glass, metal, etc.)
19	Combined Combustible/Non-Combustible Lab Trash
20	Hydrocarbon Oil - Liquid
201	Hydrocarbon Oil - Absorbed - NO Free Liquid
21	Silicon-Based Oil - Liquid
211	Silicon-Based Oil - Absorbed - NO Free Liquid
22	Petroleum Contaminated Soil
23	Aqueous Solution - Absorbed - NO Free Liquid
24	Cemented/Immobilized Residues/Powders
25	Leached Process Residues
26	Evaporator Bottoms/Salts
27	Nitrate Salts
28	Chloride Salts
29	Hydroxide Cake
30	PN Equipment
31	Non-PN Equipment
35	Combustible Building Debris
36	Non-Combustible Building Debris
40	Combustible Hot-Cell Waste
41	Non-Combustible Hot-Cell Waste
45	Uranium Chips and Turnings in Diesel Fuel
46	Skull and Oxide
47	Slag and Porcelain
49	Sanitary Sludge
60	Metal Crucibles, Scrap, Dies
61	Precious Metals

CODE WASTE MATERIAL DESCRIPTION

52	Scrap Metal
53	Lead
54	Aerosol Cans/Gas Cylinders - Cut, Punctured, or Wire through Valve
55	Filter Media
56	Filter Media Residue
60	Other Combustibles
61	Other Non-Combustibles
62	Molecular Sieves
65	Animal Tissue
68	Asbestos
69	Asbestos Contaminated Debris
70	Chemical Waste
71	Beryllium
711	Beryllium Powder
72	Beryllium Contaminated Debris
73	Scintillation Vials
74	Ion Exchange Resin
75	Chemical Treatment Sludge
76	Cement Paste
77	PCB Contaminated Materials
78	PCB Contaminated Equipment
79	PCB Contaminated Soil
791	PCB Contaminated Concrete
80	Irradiation Sources
801	Irradiation Sources in Lead Shielding
85	Firing Point Residues
90	Radioactively-Contaminated Soil
95	Glass
99	Items Needing Special Tracking (EM-7 use only)

APPENDIX B

WASTE CONTENT CODES

<u>Code</u>	<u>Description</u>
001	Mixed metal scrap and combustibles primarily from operations at the TRU Waste Size Reduction Facility. Contains primarily metals or metal equipment, either whole or sectioned, along with its combustible components and the combustibles generated during decommissioning, sectioning, and packaging.
002	Cemented sludges Caustic sludge solidified with Portland cement to form a noncorrosive solid monolith in a 55-gal. drum.
003	Dewatered sludges Caustic sludge from a liquid waste treatment facility. Contains 30-45% solids. Packaged in drums with 90 mil and 5 mil plastic liners and dry Portland cement added to stabilize any liquids that may separate.
004	Combustible Solids - Paper, rags, plastic, rubber, etc., which may contain some small fraction of noncombustible solids as scrap metals, etc.
005	Noncombustible Scrap - Small tools, cans, small equipment items, broken glass, etc., which may contain some small fraction of combustible solids.
006	Cemented Process Residues - Process leached solids, filter cakes, evaporator bottoms, etc., stabilized in Portland or Gypsum cement.
007	Contact and remote-handled solids from hot-cell operations.
008	Cemented Incinerator Ash - Incinerator ash as stabilized with Portland cement.

APPENDIX A

**COPY OF "REQUEST FOR INFORMATION PURSUANT TO THE
NEW MEXICO HAZARDOUS WASTE ACT AND THE RESOURCE
CONSERVATION AND RECOVERY ACT,
LOS ALAMOS NATIONAL LABORATORY
EPA ID NO. 0890010515"**



GARY E. JOHNSON
GOVERNOR

State of New Mexico
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau
2044 A Galisteo Street
Santa Fe, New Mexico 87505
Telephone (505) 827-1557
Fax (505) 827-1544



PETER MAGGIORE
SECRETARY

PAUL R. RITZMA
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

February 12, 2001

Dr. John Browne, Director
Los Alamos National Laboratory
c/o University of California
Post Office Box 1663, MS A100
Los Alamos, New Mexico 87545

Mr. David A. Gurule, Area Manager
Los Alamos Area Office
Department of Energy
528 35th Street, MS A316
Los Alamos, New Mexico 87544

**RE: REQUEST FOR INFORMATION PURSUANT TO THE NEW MEXICO
HAZARDOUS WASTE ACT AND THE RESOURCE CONSERVATION AND
RECOVERY ACT
LOS ALAMOS NATIONAL LABORATORY
EPA ID NO. 0890010515**

Dear Dr. Browne and Mr. Gurule:

The New Mexico Environment Department ("NMED") Hazardous Waste Bureau ("HWB") is preparing corrective action requirements for the Los Alamos National Laboratory facility ("LANL Facility") in Los Alamos, New Mexico pursuant to the New Mexico Hazardous Waste Act ("HWA"), NMSA 1978, §§ 74-4-1 through 74-4-14, and the federal Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6901 through 6992k, in conjunction with reissuance of the RCRA hazardous waste management Permit ("Permit") for the LANL Facility. The corrective action will address releases of hazardous wastes and hazardous constituents into the environment from the LANL Facility. Preparation of these requirements necessitates inquiry into the identification, nature, and quantity of waste materials that are or have been generated, treated, stored, disposed of, or otherwise managed at, or transported to, the LANL Facility. Inquiry into the nature, size, and location of waste disposal areas at the LANL Facility, and the release or potential for release of hazardous waste or hazardous constituents from such disposal areas, is also necessary.

Letter to John Browne and David A. Gurule
February 12, 2001
Page 2

Los Alamos National Laboratory ("LANL") is a national laboratory owned and operated by the United States Department of Energy ("DOE"), and DOE is an agency of the United States. LANL is also operated by the University of California ("UC"). Each of these entities, DOE and UC, is a person who generates, stores, treats, transports, disposes of, or otherwise handles or has handled hazardous wastes within the meaning of the HWA and RCRA. NMSA 1978, § 74-4-3.K; 42 U.S.C. § 6903(15).

Section 74-4-3.A(1) of the HWA provides that "For the purposes of taking any corrective action or enforcing the provisions of the [HWA], . . . upon request of [NMED] any person who generates, stores, treats, transports, disposes of or otherwise handles or has handled hazardous wastes shall furnish information relating to such hazardous wastes." Likewise, section 3007(a) of RCRA provides that "For purposes of enforcing the provisions of [RCRA], any person who generates, stores, treats, transports, disposes of, or otherwise handles or has handled hazardous wastes shall, upon request of . . . any duly designated officer, employee, or representative of a State having an authorized hazardous waste program, furnish information relating to such wastes." 42 U.S.C. § 6927(a).

In accordance with these provisions, compliance with this information request by you is mandatory. Failure to respond fully and truthfully to this information request within the time specified herein, or adequately justify such failure to respond, may result in an enforcement action by NMED pursuant to section 74-4-10 of the HWA, or section 7002(a)(1)(A) of RCRA, 42 U.S.C. § 6972(a)(1)(A), or both. Both the HWA and RCRA provide for the imposition of civil penalties for noncompliance. Section 74-4-12 of the HWA provides that any person who violates any provision of the HWA "may be assessed a civil penalty not to exceed ten thousand dollars (\$10,000) for each day during any portion of which a violation occurs." See also NMSA 1978, § 74-4-10.A and B. Section 3008(g) of RCRA provides that any person who violates any requirement of RCRA shall be liable for a civil penalty not to exceed \$27,500¹ for each such violation. 42 U.S.C. § 6928(g). Both the HWA and RCRA also provide for criminal fines and imprisonment for knowingly omitting material information or making a false statement or representation in any document used for compliance with the HWA or RCRA. NMSA 1978, § 74-4-11.A(3); 42 U.S.C. § 6928(d)(3).

INSTRUCTIONS

The following instructions shall apply to your response to these information requests:

¹ Although this provision of RCRA on its face provides for a civil penalty not to exceed \$25,000, the maximum penalty has been increased to \$27,500 to account for inflation pursuant to the Debt Collection Improvement Act of 1996, 31 U.S.C. § 3107 note. 40 C.F.R. § 19.4, Table 1.

Letter to John Browne and David A. Gurule

February 12, 2001

Page 3

1. Provide a separate narrative response to each information request, and to each subpart.
2. Precede each response with the number of the information request to which it responds.
3. In responding to these information requests, every source of information to which DOE or UC has access shall be consulted, regardless of whether the source is in the immediate possession or control of DOE or UC. All documents or other information in the possession of experts, consultants, attorneys, or agents shall be consulted.
4. If any information request cannot be fully responded to, as full a response as is possible shall be provided. The response shall state the reason for the inability to respond fully, and provide any available information, knowledge, or belief regarding the portion not responded to.
5. If information that is not known or not available as of the date of the submission of a response to these information requests subsequently becomes known or available, the response must be supplemented to include such newly found or available information. Moreover, if any information in a response is subsequently found to be false or inaccurate, the response must be supplemented to correct the falsity or inaccuracy.
6. If information requested herein has already been supplied to NMED, for example, in response to the November 20, 2000 "Request for Additional Information" attached to the administrative completeness determination, your response may reference that submission in lieu of a duplicative submission, provided that the referenced submission satisfies these instructions.
7. The information requested in Requests #1 through #17, inclusive, shall be submitted to NMED within sixty (60) days of your receipt of this letter. The information requested in #18, #19, #22, and #23 shall be submitted within fifteen (15) days of your receipt of this letter. The identification of persons and documents requested in Requests #20 and #21 shall be submitted with the corresponding responses to the other requests.

Letter to John Browne and David A. Gurule
February 12, 2001
Page 4

8. Responses shall be submitted to:

Carl Will
LANL Permits Project Leader
New Mexico Environment Department
Hazardous Waste Bureau
2044-A Galisteo Street
Santa Fe, New Mexico 87505

DEFINITIONS

Terms used in these information requests shall have the following definitions:

1. Except as otherwise specifically provided herein, any terms defined in section 74-4-3 of the HWA, section 1004 of RCRA, 42 U.S.C. § 6903, or the hazardous waste regulations at 40 C.F.R. § 260.10, have the meanings provided therein.
2. The term "document" means any object that records, stores, or presents information, and includes writings, memoranda, records, charts, tables, computer printouts, data, or information of any kind, formal or informal, whether wholly or partially handwritten or typed, whether in computer format, memory, or storage device, or in hard copy, including any form or format of these.
3. The term "hazardous waste" has the meaning provided in section 1004(5) of RCRA, 42 U.S.C. § 6903(5).
4. The term "Site" means any solid waste management unit, area of concern, "potential release site," or other place or area where hazardous wastes or hazardous constituents have come to be located as specifically listed in Attachment 1 hereto.
5. The terms "and" and "or" shall be construed either disjunctively or conjunctively as necessary to make the request inclusive rather than exclusive.
6. Words in the singular shall be construed in the plural, and vice versa as necessary to make the request inclusive rather than exclusive.

INFORMATION REQUESTS

NMED hereby requests that DOE and UC jointly furnish to NMED the following information relating to the LANL Facility:

Letter to John Browne and David A. Gurule
February 12, 2001
Page 5

1. Please identify each radionuclide waste or waste stream, including mixed and non-mixed wastes, that is currently or has been at any time generated, treated, stored, disposed of, otherwise managed at, or transported to the LANL Facility, and that meets the statutory definition of "hazardous waste" in section 1004(5) of RCRA, 42 U.S.C. § 6903(5). (Please note that the statutory definition is broader than the regulatory definition.)
2. Please identify each radionuclide waste or waste stream, including mixed and non-mixed wastes, that is currently or has been at any time generated, treated, stored, disposed of, otherwise managed at, or transported to the LANL Facility, and that meets the following criteria: a) LANL claims the waste to be exempt from regulation as a solid waste under section 1004(27) of RCRA, 42 U.S.C. § 6903(27), because such waste meets the definition of source, special nuclear, or by-product material as defined by the Atomic Energy Act, 42 U.S.C. §§ 2011 *et seq.*; and b) the waste would meet the statutory definition of "hazardous waste" in section 1004(5) of RCRA, 42 U.S.C. § 6903(5), but for such exemption.
3. For each waste and waste stream identified in response to Request #1 and #2, please provide a detailed description of the radioactive, chemical, and physical properties of the waste. Include in your response a description of all radionuclides, all radioactive decay chains, and the half-lives of both the radionuclides and their daughter products.
4. For each waste and waste stream identified in response to Request #1 and #2, please state whether or not the waste exhibits any of the characteristics of a hazardous waste under 40 C.F.R. pt. 261, subpt. C:
 - a. Ignitability under 40 C.F.R. § 261.21;
 - b. Corrosivity under 40 C.F.R. § 261.22;
 - c. Reactivity under 40 C.F.R. § 261.23;
 - d. Toxicity under 40 C.F.R. § 261.24.
5. For each waste and waste stream identified in response to Request #1 and #2, please state whether or not the waste contains any hazardous constituents listed under 40 C.F.R. pt. 261, Appendix VIII and name the specific constituent or constituents.

Letter to John Browne and David A. Gurule
February 12, 2001
Page 6

6. For each waste and waste stream identified in response to Request #1 and #2, please provide a detailed description of the generation of the waste, including the location of its generation, the date of its generation, the process or processes by which it was generated, and the volume of waste that was generated.
7. For each waste and waste stream identified in response to Request #1 and #2 that was transported to the LANL Facility from elsewhere, please state the origin of the waste, the volume of the waste transported to the LANL Facility, broken down by shipment if possible, and the date or dates the waste was received at the LANL Facility.
8. For each waste and waste stream identified in response to Request #1 and #2 that was treated at the LANL Facility, please provide a detailed description of the treatment, including the method or process of treatment, the effectiveness of the treatment in reducing the hazardous properties of the waste, and the volume of waste treated.
9. For each waste and waste stream identified in response to Request #1 and #2 that was stored at the LANL Facility, please state the location of such storage at the LANL Facility, the method of storage, the volume of waste stored, and the dates during which each volume of such waste was stored at each such location.
10. For each waste and waste stream identified in response to Request #1 and #2 that was disposed of at the LANL Facility, please provide a detailed description of the disposal, including the method of disposal, the location of disposal, the dates of disposal, and the volume of waste disposed of at each such location.
11. For each waste and waste stream identified in response to Request #2, please state the basis for LANL's claim that the waste is exempt from regulation as a solid waste under RCRA because such waste is source, special nuclear, or by-product material as defined by the Atomic Energy Act.
12. For each Site listed in Part 1 of Attachment A, please identify each waste or waste stream that is currently or has been at any time disposed of at the Site.
13. For each waste and waste stream identified in response to Request #12, please provide a detailed description of the radioactive, chemical, and physical properties of the waste. Include in your response a description of all radionuclides, all radioactive decay chains, and the half-lives of both the radionuclides and their daughter products.

Letter to John Browne and David A. Gurule

February 12, 2001

Page 7

14. For each waste and waste stream identified in response to Request #12, please state whether or not the waste is a listed hazardous waste under 40 C.F.R. pt. 261, subpt. D and indicate the specific listing or listings.
15. For each waste and waste stream identified in response to Request #12, please state whether or not the waste meets any of the characteristics of a hazardous waste under 40 C.F.R. pt. 261, subpt. C:
 - a. Ignitability under 40 C.F.R. § 261.21;
 - b. Corrosivity under 40 C.F.R. § 261.22;
 - c. Reactivity under 40 C.F.R. § 261.23;
 - d. Toxicity under 40 C.F.R. § 261.24.
16. For each waste and waste stream identified in response to Request #12, please state whether or not the waste contains any hazardous constituents listed under 40 C.F.R. pt. 261, Appendix VIII and name the specific constituent or constituents.
17. For each waste and waste stream identified in response to Request #12, please provide a detailed description of the disposal, including the method of disposal, the location of disposal, the dates of disposal, and the volume of waste disposed of at each such location.
18. For each Site listed in Part 1 of Attachment A, please submit all analytical data in LANL's possession that has not been previously submitted to NMED. Include data that was obtained under a RCRA Facility Investigation for the Site and for which an RFI Report has not been submitted to NMED. Submit the data in compliance with the format and content requirements set forth in Part 2 of Attachment A.
19. Please submit a detailed description of Material Disposal Area "S" (MDA-S), a Site listed in Part 1 of Attachment A. Include in the Site description the following information:
 - a. The purpose for which the Site was created;
 - b. A description of Site operations;
 - c. The dates of operation of the Site;

Letter to John Browne and David A. Gurule
February 12, 2001
Page 8

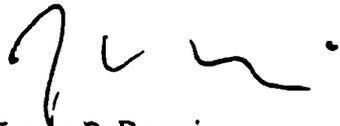
- d. A list of all materials, including solid waste, disposed of or otherwise placed at the Site, both above and below the ground surface, and their quantities and locations;
 - e. A list of all high explosives ("HE") disposed of or otherwise placed at the Site, both above and below the ground surface, stating the type of HE, the original quantity of HE, the number of tubes containing HE, the volume of each tube, and the quantity of HE originally in each tube;
 - f. The frequency of inspection of the Site, including the inspection of HE tubes;
 - g. The results of each inspection, including reports on the integrity of HE tubes;
 - h. A statement or conclusion as to whether water can infiltrate the hardware cloth tops of the HE tubes, and the basis of such statement or conclusion;
 - i. An identification of each and every person responsible for operation of the Site, by name, title or job description, employer, and current or last known address;
 - j. A description of any known or suspected release of hazardous waste or hazardous constituents from the Site, including releases from mesh screen bottoms;
 - k. Any other present or future threats to human health or the environment posed by the Site;
 - l. Any and all data collected since the beginning of the Site study.
20. For each Request #1 through #19, inclusive, identify each and every person who provided information that was used to prepare the response. Identify each such person by name, title or job description, employer, and current or last known address.
21. For each Request #1 through #19, inclusive, identify each and every document that provided information that was used to prepare your response. Identify each such document by type of document, title or description, author, and date.

Letter to John Browne and David A. Gurule
February 12, 2001
Page 9

22. Please submit the document in which the MDA-S experiment is described, entitled "Effect of Soil and Weather on the Decomposition of Explosives," LASL Report, LA-4943.
23. Please submit the schedule of Environmental Restoration activities contained in the "FY2000 Environmental Restoration (ER) Project Lifecycle Baseline Requirements Document."

Thank you for your cooperation in this matter. If you have any questions please contact Carl Will of my staff at 505-827-1557, extension 1031.

Sincerely,



James P. Bearzi
Chief
Hazardous Waste Bureau

cc: G. Lewis, NMED W&WMD
J. Kieling, NMED HWB
J. Young, NMED HWB
C. Will, NMED HWB
P. Allen, NMED HWB
J. Parker, NMED DOE OB
S. Yanicak, NMED DOE OB
J. Davis, NMED SWQB
M. Leavitt, NMED GWQB
C. de Saillan, NMED OGC
D. Neleigh, EPA 6PD-N

J. Vozella, DOE LAAO, MS A316
G. Turner, DOE LAAO, MS A316
J. Canepa, LANL EM/ER, MS M992
M. Kirsch, LANL EM/ER, MS M992
D. McInroy, LANL EM/ER, MS M992
D. Erickson, LANL ESH-DO, MS K491
J. Ellvinger, LANL ESH-19, MS K490
G. Bacigalupa, LANL, ESH-19, MS K490

ATTACHMENT A

PART 1

PRS NAME	TA	SWMU NUMBER
MDA-A	21	21-014
MDA-B	21	21-015
MDA-C	50	50-009
MDA-D	33	33-003(a)-99
MDA-E	33	33-001(a)-99
MDA-F	6	6-007(a)-99
MDA-K	33	33-002(a)-99
MDA-M	9	9-013
MDA-N	15	15-007(a)
MDA-P	16	16-018
MDA-Q	8	8-006(a)
MDA-R	16	16-019
MDA-S	11	11-009
MDA-T	21	21-016(a)-99
MDA-U	21	21-017(a)-99
MDA-V	21	21-018(a)-99
MDA-W	35	35-001
MDA-X	35	35-002
MDA-Y	39	39-001(b)
MDA-Z	15	15-007(b)
MDA-AA	36	36-001
MDA-AB	49	49-001(a-g)
90's Line	16	16-008(a)
Firing Sites	39	39-004(a-e), 39-008
Firing Sites	15	15-004(f); 15-006(a, c, d); 15-008(a)
Townsite PRS's	0, 1	0-010(b), 1-001(a-w), 1-002, 1-003(a-e)
Outfall	21	21-011(k)
Surface Impoundments	35	35-003(d, r), 35-010(a-e)
Outfalls	46	46-004(g, h, m, q, s, u, v, x, y, z, a2, b2, c2)
Bayo Canyon Sites	10	10-003(a-o), 10-007
Fish Ladder	16	16-003(o)

PART 2

Present separate tables for each Site. All analytical data must be provided in both electronic and hard-copy formats.

Include the following items in the hard-copy submittal:

- Present field and fixed-laboratory analytical data in separate tables. Different sample matrixes and analytical suites may also be presented in separate tables.
- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank). If a data qualifier field is blank because no qualifier flag is required, write "None" in the cell.
- Include all chemical results (even nondetected values) for both field and fixed-laboratory measurements.
- Include all data that are not available in electronic form (e.g., non-FIMAD data).
- Include all results for measured physical or physiochemical parameters (e.g., grain size, turbidity, suspended solids, etc.).
- Include all groundwater analytical data collected during the RFI for the Site in areas down-gradient from the Site.
- Include a map of the Site with sample locations and sample ID's.
- Include the following fields in the hard copy data:
 1. Name of unit;
 2. SWMU number;
 3. Location ID;
 4. Sample ID;
 5. Depth and units;
 6. Sample medium (as defined in FIMAD);
 7. Analyte name;
 8. Sample results and units (use consistent units for all results); and
 9. Data validation qualifiers (i.e., the qualifier flag that appears on the data in the tables based on the analytical laboratory data qualifier, the LANL data qualifier, and/or the results of focused data validation).

Include the following items in the electronic data submittal:

- Present field and fixed-laboratory analytical data in separate electronic files. Different sample matrixes and analytical suites may also be presented in separate files.

- Indicate when data are not available or not applicable (i.e., do not leave any table cells blank). If a data qualifier field is blank because no qualifier flag is required, write "None" in the cell.
- Include all chemical results (even nondetected values) for both field and fixed-laboratory measurements.
- Include all quality control (QC) data (e.g., results from matrix spike samples, surrogate compounds, etc.).
- Include all results for measured physical or physiochemical parameters (e.g., grain size, turbidity, suspended solids, etc.).
- Include all groundwater analytical data collected for the Site investigation down-gradient from the Site.
- Include the following fields in the electronic data:
 1. Name of unit;
 2. SWMU number;
 3. Location ID;
 4. Sample ID;
 5. Collection date for each sample;
 6. Depth and units;
 7. Sample matrix (as defined in FIMAD);
 8. Sample medium (as defined in FIMAD);
 9. Request number;
 10. Date of submittal to the analytical laboratory for each sample (if available in FIMAD);
 11. Date of analysis (if available in FIMAD);
 12. Analytical suite;
 13. Analytical laboratory name;
 14. Analyte name;
 15. Sample results and units (use consistent units for all results);
 16. Analytical laboratory data qualifiers;
 17. LANL data validation qualifiers; and
 18. Data validation qualifiers (i.e., the qualifier flag that appears on the data in the tables based on the analytical laboratory data qualifier, the LANL data qualifier, and/or the results of focused data validation).

Other applicable data results to be provided include core logs, flow rates, geophysical reconstructions, foot-by-foot geophysical logging results, fracture density calculations, daily flow rates, raw geophysical data, etc.

APPENDIX B

**POTENTIAL RELEASE SITES (PRS) IDENTIFIED AS
POTENTIALLY CONTAINING RADIOACTIVE OR MIXED WASTE**

Appendix B
Potential Release Sites (PRS) Identified as Potentially Containing Radioactive or Mixed Waste¹

1	00-001	40	06-003(f)	79	13-001	118	16-006(g)
2	00-017	41	06-007(g)	80	13-002	119	16-007(a)
3	00-018(a)	42	06-008	81	13-003(b)	120	16-013
4	00-030(b)	43	08-001(a)	82	13-004	121	16-016(a)
5	00-030(h)	44	08-001(b)	83	14-001(f)	122	16-024(h)
6	01-007(l)	45	08-002	84	14-002(a)	123	16-025(b)
7	03-001(d)	46	08-004(a)	85	14-005	124	16-025(d2)
8	03-001(e)	47	08-004(b)	86	14-009	125	16-025(m)
9	03-001(k)	48	08-004(c)	87	14-010	126	16-025(n)
10	03-004(c)	49	09-001(c)	88	15-001	127	16-025(o)
11	03-004(d)	50	09-002	89	15-004(b)	128	16-025(s)
12	03-012(b)	51	09-003(a)	90	15-004(g)	129	16-025(t)
13	03-014(c2)	52	09-003(b)	91	15-004(h)	130	16-025(z)
14	03-025(c)	53	09-006	92	15-005(b)	131	16-026(k2)
15	03-034(a)	54	09-012	93	15-005(c)	132	16-026(q)
16	03-038(a)	55	09-014	94	15-008(b)	133	16-029(c2)
17	03-038(b)	56	10-002(a)	95	15-008(c)	134	16-029(j)
18	03-049(b)	57	10-002(b)	96	15-008(g)	135	16-029(y)
19	03-053	58	10-004(b)	97	15-010(b)	136	16-032(a)
20	03-056(k)	59	10-005	98	15-012(b)	137	16-034(b)
21	04-001	60	11-001(a)	99	16-003(a)	138	16-034(f)
22	04-002	61	11-001(b)	100	16-003(b)	139	16-036
23	04-003(a)	62	11-001(c)	101	16-003(h)	140	20-001(c)
24	04-004	63	11-002	102	16-003(j)	141	20-002(d)
25	05-001(a)	64	11-004(a)	103	16-003(k)	142	21-004(a)
26	05-001(b)	65	11-004(b)	104	16-004(a)	143	21-004(b)
27	05-001(c)	66	11-004(c)	105	16-004(b)	144	21-004(c)
28	05-002	67	11-004(d)	106	16-004(c)	145	21-006(a)
29	05-003	68	11-004(e)	107	16-004(d)	146	21-006(b)
30	05-004	69	11-004(f)	108	16-004(e)	147	21-006(c)
31	05-005(a)	70	11-005(a)	109	16-004(f)	148	21-006(d)
32	05-005(b)	71	11-005(b)	110	16-005(d)	149	21-006(e)
33	05-006(b)	72	11-005(c)	111	16-005(e)	150	21-006(f)
34	05-006(e)	73	11-006(a)	112	16-005(j)	151	21-011(b)
35	05-006(h)	74	11-006(b)	113	16-005(m)	152	21-013(a)
36	06-001(a)	75	11-006(c)	114	16-006(a)	153	21-013(f)
37	06-001(b)	76	11-006(d)	115	16-006(c)	154	21-022(a)
38	06-003(a)	77	12-001(a)	116	16-006(d)	155	21-022(b)
39	06-003(c)	78	12-001(b)	117	16-006(e)	156	21-022(c)

Appendix B
Potential Release Sites (PRS) Identified as Potentially Containing Radioactive or Mixed Waste¹

157	21-022(d)	194	35-003(h)	231	46-004(c)	268	54-012(a)
158	21-022(e)	195	35-003(j)	232	46-004(d)	269	54-016(b)
159	21-022(g)	196	35-003(k)	233	46-004(e)	270	55-011(a)
160	21-022(h)	197	35-003(l)	234	46-004(e2)	271	55-011(b)
161	21-022(i)	198	35-003(m)	235	48-001	272	55-011(c)
162	21-023(a)	199	35-003(misc)	236	48-003	273	55-011(d)
163	21-023(b)	200	35-003(n)	237	48-005	274	55-011(e)
164	21-023(d)	201	35-003(o)	238	48-010	275	73-001(a)
165	21-024(a)	202	35-003(q)	239	49-002	276	73-005
166	21-024(b)	203	35-004(h)	240	49-003	277	73-007
167	21-024(c)	204	35-009(c)	241	49-008(a)	278	C-00-007
168	21-024(i)	205	35-009(d)	242	49-008(b)	279	C-00-008
169	21-024(j)	206	35-014(a)	243	49-008(c)	280	C-00-010
170	21-024(k)	207	35-014(b)	244	49-008(d)	281	C-00-011
171	21-024(n)	208	35-014(d)	245	50-001(b)	282	C-00-012
172	21-026(a)	209	35-016(g)	246	50-002(a)	283	C-03-006
173	21-026(b)	210	35-016(h)	247	50-002(b)	284	C-03-014
174	21-026(c)	211	35-016(l)	248	50-002(c)	285	C-11-001
175	22-010(a)	212	35-016(o)	249	50-003(a)	286	C-11-002
176	22-010(b)	213	35-016(q)	250	50-003(c)	287	C-15-001
177	22-016	214	36-004(a)	251	50-003(d)	288	C-15-005
178	26-002(a)	215	36-004(b)	252	50-004(b)	289	C-16-060
179	26-002(b)	216	36-004(d)	253	50-006(a)	290	C-16-068
180	26-003	217	36-004(e)	254	50-006(d)	291	C-16-074
181	32-004	218	36-005	255	50-010	292	C-36-006(e)
182	33-004(d)	219	39-001(a)	256	52-001(a)	293	C-43-001
183	33-004(g)	220	39-007(d)	257	52-002(a)	294	C-73-005(a)
184	33-004(h)	221	40-006(a)	258	53-002(a)	295	C-73-005(b)
185	33-007(c)	222	40-006(b)	259	53-006(a)	296	C-73-005(c)
186	33-011(c)	223	40-006(c)	260	53-006(b)	297	C-73-005(d)
187	33-011(d)	224	40-009	261	53-006(c)	298	C-73-005(e)
188	35-003(a)	225	40-010	262	53-006(d)	299	C-73-005(f)
189	35-003(b)	226	43-001(a1)	263	53-006(e)		
190	35-003(c)	227	43-001(a2)	264	53-006(f)		
191	35-003(e)	228	43-001(b2)	265	54-004		
192	35-003(f)	229	46-002	266	54-005		
193	35-003(g)	230	46-003(d)	267	54-007(a)		

NOTE: Radiological component as defined by the U.S. Department of Energy (DOE), Environmental Restoration (EM Associate Directorate) (EM-40) data

APPENDIX C

TECHNICAL AREA 54 SOLID WASTE OPERATIONS DATABASE

Electronic copies of this database were provided to the New Mexico Environment Department. Windows Access 2000 is required for this electronic database.

**Table C-1
Chemical and Low-Level Waste Groups and Descriptions**

WASTE GROUP CODE	WASTE DESCRIPTION	DELETION DATE
0	CHEMICAL WASTES	
1	MIXED WASTE	
2	AQUEOUS LIQUIDS	
5	PCB WASTES-LIQUID (W/PCB ID #)	
6	BIOMEDICAL WASTE	
7	PCB WASTES-SOLID (W/PCB ID #)	
8	COMPRESSED GAS CYLINDERS	
9	HE (K044)	
10	GRAPHITE SOLIDS	
11	GRAPHITE POWDER	
12	AREA J - LANDFILL	
13	AREA J - CLASSIFIED LANDFILL	
14	COMBUSTIBLE DECON WASTE	
15	CELLULOSICS (PAPER, WOOD, ETC.)	
16	PLASTICS	
17	RUBBER MATERIALS	
18	COMBUSTIBLE LAB TRASH (PAPER, PLASTIC, RUBBER,ETC)	
19	COMBINED COMBUSTIBLE/NON-COMBUSTIBLE LAB TRASH	
20	HYDROCARBON OIL - LIQUID	
21	SILICON-BASED OIL - LIQUID	
22	PETROLEUM CONTAMINATED SOIL	
23	AQUEOUS SOLUTION - ABSORBED- NO FREE LIQUID	
24	CEMENTED/IMMOBILIZED RESIDUES/POWDERS	
25	LEACHED PROCESS RESIDUES	
26	EVAPORATOR BOTTOMS/SALTS	
27	NITRATE SALTS	13-Mar-01
28	CHLORIDE SALTS	13-Mar-01
29	HYDROXIDE CAKE	13-Mar-01
30	PN EQUIPMENT	
31	NON-PN EQUIPMENT	
32	PN SIZE REDUCED EQUIPMENT (SRF ONLY)	13-Mar-01
33	NON-PN SIZE REDUCED EQUIPMENT (SRF ONLY)	13-Mar-01
35	COMBUSTIBLE BUILDING DEBRIS	
36	NON-COMBUSTIBLE BUILDING DEBRIS	
40	COMBUSTIBLE HOT-CELL WASTE	
41	NON-COMBUSTIBLE HOT-CELL WASTE	
45	URANIUM CHIPS AND TURNINGS IN DIESEL FUEL/VAC OIL	13-Mar-01
46	SKULL AND OXIDE	
47	SLAG AND PORCELAIN	
49	SANITARY SLUDGE	
50	METAL CRUCIBLES, SCRAP, DIES	
51	PRECIOUS METALS	
52	SCRAP METAL	
53	LEAD	
54	AEROSOL CANS/GAS CYLINDERS-CUT,PUNCTURED,WIRE IN E	
55	FILTER MEDIA	
56	FILTER MEDIA RESIDUE	
60	OTHER COMBUSTIBLES	
61	OTHER NON-COMBUSTIBLES	

**Table C-1
Chemical and Low-Level Waste Groups and Descriptions**

WASTE GROUP CODE	WASTE DESCRIPTION	DELETION DATE
62	MOLECULAR SIEVES	
65	ANIMAL TISSUE	
68	ASBESTOS	
69	ASBESTOS CONTAMINATED DEBRIS	
70	CHEMICAL WASTE	
71	BERYLLIUM	
72	BERYLLIUM CONTAMINATED DEBRIS	
73	SCINTILLATION VIALS	
74	ION EXCHANGE RESIN	
75	CHEMICAL TREATMENT SLUDGE	
76	CEMENT PASTE	
77	PCB CONTAMINATED MATERIALS	
78	PCB CONTAMINATED EQUIPMENT	
79	PCB CONTAMINATED SOIL	
80	IRRADIATION SOURCES	
85	FIRING POINT RESIDUES	
90	RADIOACTIVELY CONTAMINATED SOIL	
95	GLASS	
99	ITEMS NEEDING SPECIAL TRACKING (EM-7 USE ONLY)	
181	NON-COMBUSTIBLE LAB TRASH (GLASS, METAL, ETC.)	
201	HYDROCARBON OIL - ABSORBED - NO FREE LIQUID	
211	SILICON-BASED OIL - ABSORBED - NO FREE LIQUID	
711	BERYLLIUM POWDER	
791	PCB CONTAMINATED CONCRETE	
801	IRRADIATION SOURCES IN LEAD SHIELDING	

Table C-2

**Cross Reference of Matrix Parameter Codes with
TRUCON^a, IDC^b, and RSWD^c Codes**

Matrix Parameter Code^d	TRUCON Code(s)	IDC Code(s)	RSWD Code(s)	Waste Description
S3000 (Homogeneous Solids)	LA 111/211	002 003	A75 A76 A25 A26 A29	Stabilized Inorganic Process Solids and Aqueous Waste
	LA 114/214	006	A24 A25 A26	Solidified Inorganic Process Solids
	LA 124/224	005P2S	A27 A28 A29	Uncemented Inorganics
	LA 126	006	A24 A25 A26 A29 A46	Solidified Organic Process Solids
	LA 112/212	none	A20 A21 A70	Absorbed Organics on Vermiculite
S4000 (Soils/Gravel)	none	none	A90	Contaminated Soils
S5000 (Debris Waste)	LA 115/215	005P2G	A10 A46	Graphite Waste
	LA 116/216	004	A14 A15 A16 A17 A18 A19 A35 A40 A60	Combustible Waste
	LA 117/217	005LM	A30 A31 A41 A50 A51 A52 A61 A80 A85	Metal Waste
	LA 118/218	005LG	A47 A95	Glass Waste/Noncombustible Waste
S5000 (Debris Waste) (Cont'd)	LA 119/219	005	A55 A56	High-Efficiency Particulate Air Filters
	LA 120/220	none	A80	Isotopic Source Waste

Table C-2

**Cross Reference of Matrix Parameter Codes with
TRUCON^a, IDC^b, and RSWD^c Codes**

Matrix Parameter Code^d	TRUCON Code(s)	IDC Code(s)	RSWD Code(s)	Waste Description
	LA 122/222	none	A36	Inorganic Solid Waste
	LA 123	005P1	A61	Lead-Lined Gloves and Metal Waste
	LA 125/225	001	A14 A19 A30 A31 A36 A40 A41 A47 A52 A55 A56 A61 A72 A74 A77	Combustible/Noncombustible Waste

^a TRUCON = Transuranic Package Transporter-II (TRUPACT-II) Content

^b IDC = Item Description Code

^c RSWD = Radioactive Solid Waste Disposal

^d Information in this column was extracted from the "TRU Waste Characterization Quality Assurance Program Plan," U.S. Department of Energy, 1994 and all approved updates, CAO-94-1010, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico.

APPENDIX D

**DOCUMENTS CONTAINING INFORMATION REGARDING
RADIOACTIVE OR MIXED WASTE STREAMS AT POTENTIAL
RELEASE SITES**

Hard copies of the documents listed were provided to
the New Mexico Environment Department.

APPENDIX D
Documents Containing Information Regarding Radioactive or Mixed Waste Streams at
Potential Release Sites

PRS	Title/Subject	Date of Document	LA-UR # or Reference #	ER ID #	Page Count	Question Number	Due Date to NMED	Special Notes/Comments	Contact Person
21-023(a)	Sampling and Analysis Plan for Phase I Investigation at PRSs 21-023(a,b,d) and Other Structures at Buildings TA-21-2, -3, -4, -5, and -150	Apr-97	LA-UR-95-3624	69687	18	1 through 11	4/16/01	Submittal: 4/16/01	Dan Holmquist
32-004	Phase II and Voluntary Corrective Action Report for Potential Release Sites at TA-32 32-001, Former Incinerator, 32-002(a,b), Former Septic Systems, 32-003, Former Transformer, 32-004, Former Radioactive Source Vault, Drain Line, and Outfall	Sep-96	LA-UR-96-3128	69589	64	1 through 11	4/16/01	Submittal: 4/16/01	Terry Rust
11-001(c)	Voluntary Corrective Action Report for Solid Waste Management Unit 11-001(c)	Sep-96	LA-UR-96-3349	69686	11	1 through 11	4/16/01	Submittal: 4/16/01	Don Hickmott
33-007(c)	Voluntary Corrective Action Report for a Solid Waste Management Unit at TA-33	Sep-96	LA-UR-96-3198	69688	20	1 through 11	4/16/01	Submittal: 4/16/01	Nancy Riebe
50-003(a)	RFI Report for Potential Release Site 50-003(a) (Container Storage Area)	Sep-99	LA-UR-99-4834	69692	11	1 through 11	4/16/01	Submittal: 4/16/01	John Hopkins
73-007, C-73-005(a, b, c, d, e, f)	Voluntary Corrective Action for Completion Report for Potential Release Sites 73-004(a,b), 73-007, C-73-005(a-f)	Sep-96	LA-UR-96-3350	69693	48	1 through 11	4/16/01	Submittal: 4/16/01	Terry Rust
00-030(h)	Voluntary Corrective Action Completion Report for Potential Release Sites 0-030(h,i,n,o,p), Group 0-3, Septic Tanks	Sep-96	LA-UR-96-3351	69694	67	1 through 11	4/16/01	Submittal: 4/16/01	Terry Rust
00-030(b)	Voluntary Corrective Action Completion Report for Potential Release Sites 0-033(b) and 0-30(b)	Sep-96	LA-UR-96-2278	69695	27	1 through 11	4/16/01	Submittal: 4/16/01	Terry Rust
14-003	Voluntary Corrective Action Completion Report for Potential Release Site 14-003 Burn Area	Sep-96	LA-UR-97-3870	69696	49	1 through 11	4/16/01	Submittal: 4/16/01	Nancy Riebe

APPENDIX E

**LIST OF AND EXAMPLES FROM LOGBOOKS WITH
INFORMATION NOT CONTAINED IN TECHNICAL AREA 54 SOLID
WASTE OPERATIONS DATABASE**

Logbooks with Information not Contained in Technical Area 54 Solid Waste Operations

Logbook No.	Date Range	Area	Total Pages	Contents
1743	01/06/47 - 11/23/48	Contaminated Dump	142	Summary of contaminated truck operations
2587	11/24/48 - 04/28/50	Contaminated Dump	151	Summary of contaminated truck operations
3478	04/29/50 - 09/28/51	Contaminated Dump	151	Summary of contaminated truck operations
4644	10/01/51 - 04/27/53	Contaminated Dump	151	Summary of contaminated truck operations
6030	04/28/53 - 10/17/54	Contaminated Dump	151	Summary of contaminated truck operations
7951	02/25/56 - 04/29/80	A, G	79	Locations on property disposed
12442	01/10/63 - 02/24/76	C, G, H	105	Notes on disposal locations/waste disposed
15953	04/09/69 - 04/14/72	G	152	Notes on disposal locations/waste disposed
18048	07/01/72 - 12/01/75	Area A, Pit A	5	Disposal Information
3174	04/29/80 - 11/04/88		75	Data without RSWD # not in database

- 12/31/47 MADE RUN OF CONT. TRASH AT D, D-2, H, M, & TU BLDGS - DP-EAST, DP-WEST, AND DP-LAUNDRY - PICKED UP PROPERTY AT ~~TECH SAVINGS~~. AT DP-EAST
- 1/1/48 - HOLIDAY
- 1/2/48 - MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, & DP-EAST, WEST, AND DP-LAUNDRY - PICKED UP PROPERTY AT DP-LAUNDRY - MADE BAYO CANYON RUN.
- 1/5/48 - MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, & BLDGS, DP-EAST, DP-WEST AND DP LAUNDRY -
- 1/6/48 MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, Q, & BLDGS, DP-EAST, DP-WEST, AND DP-LAUNDRY
- 1/7/48 MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, Q, & BLDGS, DP-EAST, DP-WEST, AND DP-LAUNDRY
- 1/8/48 MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, Q, & BLDGS, DP-EAST, DP-WEST, AND DP-LAUNDRY
- 1/9/48 MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, Q, & BLDG, DP-EAST, DP-WEST, AND PICKED UP PROPERTY AT DP-LAUNDRY.
- 1/12/48 MADE DAILY RUN OF CONT. TRASH AT D, D-2, H, M, Q, & BLDGS, DP-EAST, DP-WEST, DP-LAUNDRY

Names	Protective Clothing Worn	Hand Count	Nose Count	Urinanalysis & other tests
_____	Respirators, 2 Pcs. of Rubber gloves,	0/0	0	
_____	underwear, shoes & socks, & coveralls	50/50	7	
_____	Respirators, Rubber gloves, shoes & socks, underwear,	20/30	0	
_____	& 2 Pcs. of Coveralls.	75/50	2	
_____	Respirators, Rubber gloves, 2 Pcs. of Coveralls, underwear,	0/0	1	
_____	shoes & socks.	0/0	1	
_____	Respirators, 2 Pcs. of coveralls, shoes	30/30	3	
_____	& socks, underwear, & Rubber gloves	50/75	4	

Summary of Contaminated Truck Operations

8/4/47 Made daily run of contaminated trash pick up & hauled to the contaminated dump. The daily stops consist of D. H. & M. Bldg., Sigma, D. P. East & West & D. P. Laundry. Picked up some contaminated material from D. P. West & hauled to the contaminated dump.

8/5/47 Hauled contaminated material (logs) from D. Bldg. (3 loads) to the contaminated dump. Hauled contaminated material (lumber) from D. Bldg. to the contaminated dump. Made daily run of contaminated trash pick up from D. H. & M. Bldg., Sigma, D. P. East & West, & D. P. Laundry & hauled to the contaminated dump.

8/6/47 Picked up contaminated material (dry ice) from U-12 & hauled to the contaminated dump. Made daily run of contaminated trash pick up from D. H. & M. Bldg., Sigma, D. P. East & West, & D. P. Laundry & hauled to the contaminated dump.

8/7/47 Picked up contaminated property from D. P. Laundry & hauled to the contaminated dump. Made daily run of contaminated trash pick up from D. H. & M. Bldg., Sigma, D. P. East & West, & D. P. Laundry & hauled to the contaminated dump.

Summary of Contaminated Truck Operations

11-28-49

Hauled Contaminated material from D. bldg, D-2 bldg, H. bldg, M. bldg, J-2 bldg, Sigma bldg, D.P. West, D.P. East and D.P. Laundry. Hauled Contaminated steel Fan from J-2 bldg. No Property involved. Hauled Contaminated Property from D.P. Laundry. All Contaminated Trash and Property from above areas was hauled to the dump.

11-29-49

Hauled Contaminated trash from D. bldg, D-2 bldg, H. bldg, M. bldg, J-2 bldg, Sigma bldg, D.P. West, D.P. East and D.P. Laundry. Hauled class C. Property from 24-36. All Contaminated trash and Property from above areas was hauled to the contaminated dump.

11-30-49

Hauled Contaminated trash from D. bldg, D-2 bldg, H. bldg, M. bldg, Sigma bldg, J-2 bldg, D.P. West, D.P. East, and D.P. Laundry. All Contaminated trash from above areas was hauled to the Contaminated dump.

12-1-49

Hauled Contaminated trash from D. bldg, D-2 bldg, H. bldg, M. bldg, J-2 bldg, Sigma bldg, D.P. West, D.P. East and D.P. Laundry. Hauled Contaminated Tri-chloroethylene from T-4 bldg. All Contaminated trash & solution from above areas was hauled to the Contaminated dump.

12-2-49

Made special trip to Bayo Canyon to pick Contaminated trash. Hauled Contaminated trash from D. bldg, D-2 bldg, H. bldg, M. bldg, J-2 bldg, T-4 bldg, Sigma bldg, D.P. West, D.P. East and D.P. Laundry. Hauled Contaminated Property from D.P. Laundry. All Contaminated trash and Property from above areas was hauled to the Contaminated dump.

Name	Hand Count	Dose Count	Protection Clothing WORN	Other tests
XXXXXXXXXX	0	0	Respirator, Rubber gloves, two pairs of coveralls, underwear, shoes and socks.	
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	1		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		
XXXXXXXXXX	0	0		

8-6-51

HAULED CONTAMINATED TRASH FROM O-BLDG, D-2 BLDG, H-BLDG, M-BLDG, T-2 BLDG, SIGNA BLDG, D.P. WEST, D.P. EAST + D.P. LAUNDRY. HAULED CONTAMINATED HOO + TABLE FROM O-BLDG, HAULED PROPERLY FROM SIGNA. ALL CONTAMINATED MATERIAL FROM ABOVE AREAS WAS HAULED TO THE DUMP.

8-7-51

HAULED CONTAMINATED TRASH FROM O-BLDG, D-2 BLDG, H-BLDG, M-BLDG, T-2 BLDG, SIGNA BLDG, WHITE DUBS PLANT, TEN SITE, D.P. WEST, D.P. EAST + D.P. LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE DUMP.

ABOVE MATERIAL WAS SET BETWEEN #52 + #53.

8-8-51

HAULED CONTAMINATED TRASH FROM O-BLDG, D-2 BLDG, H-BLDG, M-BLDG, T-2 BLDG, D.P. WEST, SIGNA BLDG, GAMMA BLDG, D.P. EAST + D.P. LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE DUMP.

ABOVE MATERIAL WAS SET BETWEEN #52 + #53.

8-9-51

HAULED CONTAMINATED TRASH FROM O-BLDG, D-2 BLDG, H-BLDG, M-BLDG, T-2 BLDG, WHITE DISPOSEL LAB. TEN SITE, D.P. WEST, D.P. EAST + D.P. LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP.

ABOVE MATERIAL WAS SET BETWEEN #53 + #54.

8-10-51 - DUMP WAS COVERED ON THIS DATE FROM #51 TO #54

DRIVERS NAME

TANK
COUNT

HOSE
COUNT

PROTECTIVE CLOTHING WORN

137

[REDACTED]

0

0

COMPLETE PROTECTIVE
CLOTHING WORN.

[REDACTED]

0

0

[REDACTED]

0

0

[REDACTED]

0

[REDACTED]

0

0

[REDACTED]

0

1

[REDACTED]

0

1

[REDACTED]

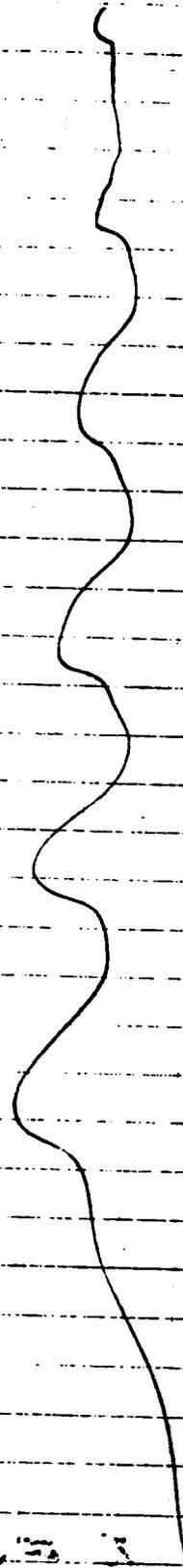
0

0

[REDACTED]

0

0



SUMMARY OF CONTAMINATED TRUCK OPERATIONS

11-23-57

HAULED CONTAMINATED TRASH FROM D-BLDG, M-BLDG, J-2 BLDG, SIGMA BLDG, H-BLDG, WASTE TREATMENT LAB, TEN SITE, D.P. WEST, D.P. EAST AND D.P. LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #25 AND #27.

11-26-57

HAULED CONTAMINATED TRASH FROM D-BLDG, M-BLDG, J-2 BLDG, D-1 BLDG, SIGMA BLDG, WASTE TREATMENT LAB, TEN SITE, D.P. WEST AND D.P. EAST. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #26 AND #27.

11-27-57

HAULED CONTAMINATED TRASH FROM D-BLDG, M-BLDG, H-BLDG, J-2 BLDG, SIGMA BLDG, H-BLDG, D.P. WEST, D.P. EAST AND D.P. LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #26 AND #27.

11-28-57

HAULED CONTAMINATED TRASH FROM D-BLDG, M-BLDG, J-2 BLDG, SIGMA BLDG, WASTE TREATMENT LAB, GAMMA BLDG, TEN SITE, D.P. WEST, D.P. EAST, AND D.P. H-BLDG LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #27 AND #28.

11-24-57

HAULED CONTAMINATED TRASH FROM D-BLDG, M-BLDG, D-2 BLDG, ^{J-2 BLDG} SIGMA BLDG, H-BLDG, D.P. WEST, D.P. EAST AND D.P. LAUNDRY. HAULED ONE BOX OF PIE CONTAMINATED GLASS WARE FROM U-BLDG Rm 36. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #27 AND #28.

11-30-57

HAULED CONTAMINATED TRASH FROM D-BLDG, M-BLDG, H-BLDG, J-2 BLDG, SIGMA BLDG, WASTE TREATMENT LAB, TEN SITE, D.P. WEST, D.P. EAST AND D.P. LAUNDRY. HAULED PROPERTY FROM D.P. LAUNDRY. ALL CONTAMINATED TRASH FROM ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #28 AND #29.

DRIVER AND LABORERS
NAMES

HAND
COUNT

NOSE
COUNT

PROTECTIVE CLOTHING
WORN

[REDACTED]

0

1

Full Protective
Clothing Worn

[REDACTED]

0

0

By
[REDACTED]

[REDACTED]

0

0

[REDACTED]

0

1

[REDACTED]

0

0

[REDACTED]

0

0

- 11/10/54 HAULED PROPERTY FROM ANCHOE ARANCH 147
Bldg WA-1 J-13 GROUP
- 1-23/54 HAULED PROPERTY FROM D.P. LAUNDRY (CLOTHING)
- 1-3-54 HAULED PROPERTY FROM SM 30 SALVAGE J13 GROUP
OLIVER MERCURY, MULTIPLIER P.No. 133793. POWER SUPPLY P.No. 126779,
CHASSIS P.No. 134482. INDICATOR P.No. 126914 & —
ELECTRICAL WIRE. ALL MATERIAL WAS HAULED TO THE
CONTAMINATED DUMP
- 2-7-54 HAULED PROPERTY FROM D.P. LAUNDRY (CLOTHING)
WAS HAULED TO THE CONTAMINATED DUMP
- 2-20-54 HAULED PROPERTY FROM D.P. LAUNDRY (CLOTHING)
TO THE CONTAMINATED DUMP
- 2-21-54 HAULED PROPERTY FROM SIGN. Bldg CMR-6 1 Pump P.No. 15107
BLOWER AMERICAN CORP MODEL H, 1 BLOWER ME NY. SIZE 75B.
ALL PROPERTY WAS HAULED TO THE CONTAMINATED DUMP
- 2/30/54 HAULED PROPERTY FROM D.P. WEST (VAC PUMP)
- 1/4/55 HAULED PROPERTY FROM D.P. LAUNDRY (CLOTHING)
- 1/12/55 HAULED ONE RING METAL, SCRAP, METAL PLATE SCRAP
AND 12 GALS OF MINERAL OIL FROM SM 30 SALVAGE
ALL MATERIAL WAS HAULED TO THE CONTAMINATED DUMP
- 1/14/55 ONE FORK LIFT WAS HAULED TO THE DUMP
BY SOME BODY ELSE.
- 1/17/55 HAULED ELECT SCRUBBER FROM D.P. WEST
ELECTRICIANS SHOP — IT WAS HAULED TO THE
CONTAMINATED DUMP.
- 1/17/55 HAULED PROPERTY FROM D.P. LAUNDRY
(CLOTHING) IT WAS HAULED TO THE CONTAMINATED DUMP
- 1/18/55 HAULED PROPERTY FROM D.P. WEST
ANALYZER GAS THERMAL P.No. 137293; PUMP GASTO P.No. 45969
AND BALANCE TORSION P.No. 71687 ALL PROPERTY WAS
HAULED TO THE CONTAMINATED DUMP
- 1/20/55 HAULED PROPERTY FROM D.P. WEST
BALANCE-ANALY. CAL P.No. 71629. ALL PROPERTY
WAS HAULED TO THE CONTAMINATED DUMP
- 1/26/55 HAULED PROPERTY FROM D.P. WEST LAUNDRY
(CLOTHING) ALL PROPERTY WAS HAULED TO THE CON DUMP

22 Summary of Contaminated Truck Operations

7-24-53

HAULED CONTAMINATED TRASH M-Bldg, Sigma-Bldg, J-2-Bldg, D-Bldg, CMR-TEN-SITE, RAT-LAB, D.P. WEST, D.P. EAST, WASTE DISPOSAL PLANT, D.P. LAUNDRY ALL CONTAMINATED TRASH FROM THE ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #14

7-27-53

No DUMP RUN TRUCK driver & Labor wet out ON UNION

7-28-53

No DUMP RUN TRUCK driver & Labor wet out ON UNION

7-29-53

HAULED CONTAMINATED TRASH FROM M-Bldg, D-Bldg U-Bldg, J-2-Bldg, SIGMA WASTE-DISPOSAL PLANT, D.P. WEST, D.P. EAST, Omega-site & D.P. LAUNDRY ALL CONTAMINATED PROPERTY FROM D.P. LAUNDRY ALL CONTAMINATED TRASH FROM THE ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #15 & #18

7-30-53

HAULED CONTAMINATED TRASH FROM M-Bldg, D-Bldg, U-Bldg, J-2-Bldg, RAT SIGMA-Bldg WASTE-DISPOSAL PLANT, D.P. WEST, D.P. EAST, & D.P. LAUNDRY ALL CONTAMINATED MATERIAL FROM THE ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #15 & #18

7-31-53

HAULED CONTAMINATED TRASH FROM M-Bldg, D-Bldg, Omega W-1 SIGMA WASTE DISPOSAL PLANT, J-2 TEN SITE, D.P. WEST, D.P. EAST, D.P. LAUNDRY ALL CONTAMINATED TRASH FROM THE ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #19 & #20

Dump Covered up to #19

8-3-53

HAULED CONTAMINATED TRASH FROM M-Bldg, D-Bldg, J-2-Bldg, SIGMA-Bldg WASTE DISPOSAL PLANT, D.P. WEST, D.P. EAST & D.P. LAUNDRY. HAULED PROPERTY FROM D.P. LAUNDRY ALL CONTAMINATED MATERIAL FROM THE ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #20 & #21

8-4-53

HAULED CONTAMINATED TRASH FROM M-Bldg, D-Bldg, J-2-Bldg, CMR-Bldg, SIGMA-Bldg, WASTE DISPOSAL PLANT, D.P. WEST, D.P. EAST & D.P. LAUNDRY ALL CONTAMINATED MATERIAL FROM THE ABOVE AREAS WAS HAULED TO THE CONTAMINATED DUMP BETWEEN #21 & #22

June 21, 1956

5

Cleaning of water-closets, and replacement of
Spray-heads in Wing 2 Floor-2, main floor
and Attic, Towers.

The usual health-safety precautions were
observed - paper laid on floor, Filter Queen
H-1 Test in operation, all personnel in full-
protective clothing, Respirators Issued & fitted,
and a preliminary monitoring of area in which
work was performed.

The preliminary monitoring showed no significant
high areas of contamination so MSA-Compo respirators
were issued, (no dust), except where chipping
operations constituted an eye-hazard - then Assult
masks were worn in both cases.

All waste was boxed and sent to the Hot Dump.
Contaminated Tools and spray heads were sent to
decontamination. nose-swipes were taken at end
of job, Personnel showered & checked for activity.
And again, after-operation area check showed
no significantly high areas of contamination.

~~_____~~, a Gia Plumber on
two occasions punctured the skin of his fingers.
The wounds were very slight, but they were
monitored immediately, and since there were
very slight signs of contamination on his hand,
he was instructed to scrub & soak the injured
hand. Subsequent monitoring showed no signs
of any type of activity on the hand or emanating
from either wound.

The following are personnel injured.

~~_____~~
~~_____~~
~~_____~~

~~_____~~
~~_____~~
James A. Delmest H-1

7/14/78	9			
7/14/78	9			
7/14/78	9			
7/18/78	18	3	19	W
7/18/78	18	3	20	E
7-21-78	18	3	13	C
7/21/78	18	3	13-14	C
7-25-78	18	3	15-16	C
7-25-78	18	3	15-16	C
8-2-78	18	3	26	C
8-2-78	18	3	26	C
8/2/78	18	3	27	C
8/2/78	18	3	27	C
8/2/78	18	3	27	C
8/2/78	18	3	27	C
8/2/78	18	3	27	C
8-4-78	18	3	22	C
8-4-78	18	3	22	C
8-4-78	18	3	22	C
8-4-78	18	3	22	C
8-4-78	18	3	22	C
8/7/78	18	3	23	C
8/8/78	18	3	25	C
8/9/78	18	3	150	C
8/11/78	18	3	28	C
8/11/78	18	4	16-17	E
8/11/78	18	4	16-17	E
8/11/78	18	4	16-17	E
8/11/78	18	4	16-17	E
8/11/78	18	4	16-17	E
8-11-78	18	4	14	C
8/17/78	18	4	23	W
8/17/78	18	4	23	W
8-21-78	18	4	15	E
8-23-78	18	4	15	E
9/1/78	18	4	15	E
9-8-78	18	4	41	C
9-21-78	18	5	4-22	E
10-5-78	18	5	25	W

FURNACE
 (6) POLISHERS
 MICRO READER, PROJECTOR
 VAC PUMP
 ANALYZER, FRACTION COLLECTOR
 RECORDERS COUNTERS (8)
 127371-179291
 Dewar fife, safe, fife
 Welch Vacuum pump
 Vacuum gauge, Pils Cab, Calcd.
 Pump, GAUGE, TRANSFORMER, METER
 BALANCE, METER, PRINTER
 PUMP, SCALER, AMPLIFIER
 OSCILLOSCOPE
 DIFF. PUMP
 VACUUM PUMP, EVAPORATOR
 ANALYZER 400 Channel
 Repeater VHF Motorola
 Bridge, Tester, PULSER
 Blower, Sutorbitt
 (3) PUMPS
 GAUGES, TUBE TESTER
 (2) VAC. PUMPS
 CENTRIFUGE
 Pump, (4) CONTROLS AMPLIFIER
 BALANCE, PH METER, BATH
 (2) RATE METER, AMPLIFIER
 COOLER, PORT.
 (2) COUNTERS, (4) SAMPLERS
 VAC PUMP
 PUMP, CIRCULATING
 FURNACE
 VAC PUMP
 Recorder
 ELEC. FURNACE
 Direct Table
 microscope Reader, micro
 Glove Box
 FURNACE

1000000 NO.
 121549
 176481, 23616
 166034, 186987, 176479, 176
 271468, 271469
 144158
 185208, 185210
 233530-2292340
 157240 220972
 118937, 118921, 122346, 1074
 119383, 118992, 181178, 118920
 127371-179291
 137144-138976-054071
 249350
 14882, 139576, 17250
 18928, 12971, 193575, 205887, 21
 71512, 153980, 189437, 212408
 119354, 159128, 161476
 215294
 165133
 179632, 179631
 189859
 189807
 89140, 129999, 1496
 234266
 165022, 160357, 162469
 219957, 223290, 178991, 23669
 151168, 252347
 070490
 161877, 145877, 167209, 196712
 92588, 119310, 154167, 15640
 177689, 188058, 213210, 2
 179659, 179658, 181298
 225278
 118937, 118958, 118964, 118982, 1189
 118910, 182854, 118925, 118930, 11
 299989, 296730, 253
 299999
 173364
 P.N. 2740
 206129
 268699
 257606-192732-208358
 513)-1
 1000000-PNH 29676

4 ~~#~~ 3/25/63

Area "D" Pit #5

Eleven drums of D-38 chips & Turnings were placed in above location.

Personal Charge

6/25/63, Area C, Pit #5, posts 58/59 - Southside

Zim Riggere delivered a total of 41 drums containing D-38 (2 of these drums were from Dock #1, New Sigma) and the balance from SM-102 yardway. Also, 2 Tin pigs & 6 small lead pigs were picked up from 10 Site & delivered to above location by Zim Riggere.

Note: Above job cost \$206.02 as per call from Coburn, Eng-4-1-1
John Enders & Richard Harris

11/13/63

Area C Pit #5 - 57 barrels of D-38 Chips
Job supervised by Enders.

3/12/64 Area C Pit #5 Posts 74/46 South
3rd River deposited 56 drums containing D-38 chips from TA-3, Bu

Area C Pit #5 located @ South side
6/23/64 One truck load containing post #
"RADA CELL" equipment from TA-35
10 site, contaminated with Beta-Gamma &
Radiation level up to 2.5 R/hr @
contact and ~3 hr at 1 meter

11 Packages altogether (approx 6 yd)
(Bu C & D Form # 2944 B) C. Martiney

Area C Pit #5 located south-west side Post #1
6/25/64 One truck
load "RADA CELL" equipment from TA-35. Radiation level

40

DATE	AREA	WELL	FLUX LEVEL	ORIGIN OF WASTE	ID OF WASTE	HOW PACKAGED
11-9-66	C	1V	10 MR/HR	Waste container	Tritium container	None
11-9-66	C	1V	10 MR/HR	Waste container	Tritium container TRASH	Plastic - box
11-9-66	C	93	---	Waste container	D-35	20 gal metal can
11-10-66	C	93	---	HRK	Animal tissue	Cardboard box
11-16-66	C	1	12 MR/HR	Waste container	END BONE (FIRST ELEMENT)	None
11-17-66	C	93	---	Waste container	D-35 chips	1 gal cans
11-18-66	C	93	---	PPW # 313	D-38 & Normal Uranium	9 glass bottles
11-18-66	C	93	---	HRK	Animal tissue	Cardboard box
11-18-66	C	1	10 MR/HR	Waste container	TRASH	Cardboard box
11-23-66	C	93	---	HRK	Animal tissue	Cardboard box
11-30-66	C	93	---	Waste container	D-35 depleted	15 gal container
12-5-66	C	1	10 MR/HR	Wg 9 Can of	Support blocks (A-5) chips	2 gal cans
12-7-66	C	93	---	Waste container	D-38 chips "used"	15 gal container
12-8-66	C	93	---	HRK	Animal tissue	Cellulose bag
12-8-66	C	2	35 ne/hr	Wg 9 Can of	A-5 Suppt block parts (chips)	2-gal cans
12-15-66	C	2	50 MR/HR	K-1 waste	Iradiated steel	None
12-15-66	C	1V	10 MR/HR	Waste container	Tritium vials	Small plastic box
12-20-66	C	2	50 MR/HR	Waste container	Li ²⁷⁵ + U ²³⁵ METAL	TIN CAN & PLASTIC
12-23-66	C	93	---	HRK	Animal tissue	Plastic 15 gal
1-4-67	C	93	---	HRK	Animal tissue	Plastic 15 gal
1-9-67	C	1	---	Waste container	T ₂ container	None
1-9-67	C	1	---	Waste container	D-38 chips	1 gal cans
1-13-67	C	1	50 MR/HR	Waste container	END BONE (FUNCTIONAL)	None
1-17-67	C	103	10 MR/HR	Wg 9 Sm-29	HCl + H ₂ O ₂ WASTE	Plastic bottle + vial
1-17-67	C	2	250 MR/HR	Wg 9 Sm-29	PTC WASTE	1 gal, Tin cans
1-18-67	C	1	100 MR/HR	Sm-29 waste	Co ⁶⁰ source	None
1-18-67	C	2	300 MR/HR	Sm-29 waste	Co ⁶⁰ source	None
1-18-67	C	93	---	Waste container	D-35	Small cardboard
1-18-67	C	2	350 MR/HR	Wg 9 Sm-29	Vacuum filter Cell 7PS	Plastic Bags
1-19-67	C	2	350 MR/HR	Wg 9 Sm-29	A-5 Suppt blocks + other parts	Gallon Tin cans
1-20-67	C	2	300 MR/HR	Wg 9 Sm-29	EXHAUST FILTERS	Small square box
1-20-67	C	1	300 MR/HR	Wg 9 Sm-29	BRILLY samples	4 2 gal tin cans
1-27-67	C	2	350 MR/HR	HRK	Animal tissue	Plastic bags
1-25-67	C	2	350 MR/HR	Waste container	Co ⁵⁷ & T ₂ 1972	Small cardboard box
1-31-67	C	3	10 MR/HR	Wg 9 Pu back	Na waste Pu contaminated	Tin cans 1-gal
1-31-67	C	3	10 MR/HR	Wg 9 Can 14	A-5 filter strip leftovers (chips)	Tin cans 1-gal
1-31-67	C	3	10 MR/HR	Wg 9 Pu back	Na waste Pu contaminated	Tin cans 1-gal

68 7/10/70 Area "G" Pit 6 Layer 2 So Post 54
One truck load of mixed scrap
material from DFW was placed on
above location by "Zia Laboreis"
LB700564
Approx 22 yd³
C. Martiney

7/14/70 Area "G" Pit 6 Layer 2 So Post 13
One truck load of mixed material
from DFW was delivered to above
location by "Zia Laboreis"
LB700569
Approx 15 yd³
C. Martiney

7/15/70 Area "H" Pit #6 Layer 2 South Post 5
One load of electrical wiring & scrap material
from ten (10) site was delivered to above
location by Zia Laboreis.
LB700573
(~ 1 yd³)
Robert L. Anderson

7/17/70 Area "G" Pit 6 Layer 2 So Post 24
One 10 yd³ load containing mixed
scrap material from T-15 R-154
was placed on above location
by "Zia Diver"
LB700577
C. Martiney

7/17/70 Area "G" Pit 6 Layer 2 So Post 24
One truck load of mixed scrap
from DFW was delivered to above
location by "Zia Laboreis"
LB700578
Approx 15 yd³
C. Martiney

7/17/70 Area "G" Pit 6 Layer 2 So Post 49
Two steel tanks approx 300 gal each
from DFW were delivered to above location
by "Zia Laboreis"
LB700579
Approx 15 yd³
C. Martiney

Site	Mon. Year	Initial	Unit	# P.R.	# Payroll	# Box	PI RPP	PI RPP	# Box	Exp. Days	Other Days	Origin of Waste Material
12/7/71	DOM		G	6	2N	19				63		Spw Bed, 50 ^{End}
"	"	"	"	6	3N	6				18		Spw 4's
12/3/71	KRB		G	6	3N	20				75		SM-30
12/3/71	KRB		G	6	3N	19				52		TA-48
12/4/71	DOM		G	6	3N	7				18		Spw Bed 257
"	"	"	G	6	4 SO	21					9	TA-50
"	"	"	G	6	2N	16	26	11	3	2		Wg # 7 Com Bed
12/8/71	DOM		G	6	4N	14	19	1	2	13		Wg # 1 Com Bed
"	"	"	G	6	4N	16				47		Spw 141
"	"	"	G	6	4N	15				55		Doek # 5
12/9/71	DOM		G	6	4N	23				62		Spw W. Side Bed
"	"	"	G	6	4N	14				65		"
"	"	"	G	6	4N	23				55		Doek 5 Sigma
"	"	"	G	6	4N	23				63		Spw Bed 2-13
12/9/71	DOM		G	5	4SO	22					9	Spw Bed, 5
12/20/71	DOM		G	6	4N	21				62		Spw Bed 2 S Side
"	"	"	G	6	4N	19				63		Spw Bed Bed 9 ³⁴ 5 ⁵
"	"	"	G	6	4N	24				54		Sigma Doek 3
"	"	"	G	6	4N	20				48		TA-48 E Side
"	"	"	G	6	4N	22	8	4	2	7	21	Wg # 2 Com Bed
"	"	"	G	6	4N	24	46	18	2	7		Wg # 5 " "
12/4/71	DOM		G	6	4N	24	58	4	4	19		Wg # 3 " "
"	"	"	G	6	4N	24				45		Sigma Doek
"	"	"	G	6	3N	14				4		TA-50, Respirator
"	"	"	G	6	4N	26				54		TA-50
12/7/71	DOM		G	6	4N	26				48		TA-18 Kind 3
"	"	"	"	6	4N	26				18		TA-18 " 2
"	"	"	"	6	4SO	26					9	TA-50
"	"	"	"	6	4N	26				55		Sigma W. Side
12/6/71	DOM		G	6	4N	27				56		Doek 5 Sigma
"	"	"	"	6	4N	27				42		" 4 "
"	"	"	"	6	4N	27				62		Spw Bed 2 ³⁴ 5 ⁵
12/1/71	DOM		G	6	4N	28	79	30	8			Wg # 9 Com Bed
"	"	"	"	6	4N	28				42		Sigma Doek 1
"	"	"	"	6	4N	28				47		Spw 141
12/4/71	DOM		G	6	4N	27				63		Ref 9, 50 Spw
"	"	"	"	6	4N	29				22		Spw Bed Bed 24, 25

Note:

It is the intent to use this notebook to log delivery of material to Area "A" (Material Disposal Pit), located between DP East Site and DP West Site.

Logged data is to include date of delivery, source of material, identity of material, estimate volume (in ft.³), and, if possible, location of material within Area A.

~~July 1972~~

July 1972 - Approximately 2500 cu. ft. of exhaust duct work from Bldg. 5 (room 1A) was placed in Pit A. It was placed in the west end of the pit and approx. 1 ft. of dirt was used as a covering. After being covered, the duct work was crushed down (approx 1 ft.) by a bulldozer.
Wilbur Workman

3-13-1973

~~Security Key #96 13-3~~ (~~contaminated~~)
~~was found~~

WAS FOUND CONTAMINATED & SENT IN THE HOT WASTE BOXES TO TA-54

Security Key #96 13-3 WAS ALSO DISPOSED OF AS PER TELECON WITH Hasty

May, 1973 - Approximately 100 ft³ of contaminated building material pieces from Bldg. 12 were buried during May. This included such items as precipitation frames and filter frames which were packaged by wrapping in plastic.

AMW

3

July 2, 1973 - Approximately 6000 cu ft of contaminated building materials from Bldg. 12 (TA-21-12) was buried during June, 1973. Building material consisted mainly of structural lumber, concrete, beams, and dirt. ATW

July 31, 1973 - Approximately 400 cu ft of contaminated building materials from Bldg. 12 (TA-21-12) was buried during July 1973 - July 1 - thru July 31, 1973. Building materials consisted mainly of concrete, soil + dirt. E.M. Parvill

August 31, 1973 Approx 6 cu ft of misc. trash (waste + lumber) from Building 12 for the period August 1, 1973 thru August 31, 1973. E.M. Parvill

December 31, 1973 Approx 4 cu ft of Misc. trash (Elect. Wires + wire equipment from 21A trailer for the period Dec. 1, 1973 to Dec 31, 1973. E.M. Parvill

June 30, 1974 approximately 4 yds³ (108 ft³) of misc. trash (concrete blocks, wood framing, etc) was placed in Pit A.

Nov 4, 1974 - 44 cubic yards of contaminated dirt from the area between the two till fields at OP West was dumped into Pit A.

Nov. 1974 400 gal Two trailers, wood, 55 gal drums. Trailers PN 61192 and 61193

Dec 30, 1974 1 1/2 yd of dirt from Bldg 228 Area.

DATE REC	DATE Completed	Group	Sand #	PSWD	Remarks	Receiver
2/29/88	3/29/88	P-5	8330B	880387		RL 3/29/88
2/29/88	3/29/88	5701	12987B	881299		RL
2/29/88	3/29/88	7901	13408B	880017		RL
2/29/88	3/29/88	7903	13409B	880011		RL
2/29/88	3/29/88	7908	13410B	880018		RL
MARCH 1988						
3/1/88	3/1/88	7750	1288B	882405		RL 3/1/88
3/3/88	3/3/88	7501	13413B	882032		RL 3/3/88
3/5/88	3/5/88	MST-3	13631B	882058		RL 3/5/88
3/10/88	3/10/88	8311	13142B	881777		RL 3/10/88
3/25/88	3/25/88	8311	13146B	881774		RL 3/25/88
3/25/88	3/25/88	8901	12885B	882414		RL 3/25/88
3/25/88	3/25/88	8901 7903	12886B	882414		RL 3/25/88
3/25/88	3/25/88	8901 MST-3	2200		Oven Microwave	RL 3/25/88
3/25/88	3/25/88	WX-1	2199		Oven Microwave	RL 3/25/88
3/31/88	3/31/88	N-2	11633B	882576		3/31/88 RL
3/31/88	3/31/88	HSB-1	13055B	880628		3/31/88 RL
3/31/88	3/31/88	8901, 4, 7, 5, 8	13091B	880402		3/31/88 RL
3/31/88	3/31/88	N-2	11632B	882577		3/31/88 RL
3/31/88	3/31/88	MA7-8	12439B	881971		3/31/88 RL
3/31/88	3/31/88	INC-11	13111B	881704		3/31/88 RL
3/31/88	3/31/88			881703		3/31/88 RL
3/31/88	3/31/88			881705		3/31/88 RL
3/31/88	3/31/88	INC-11	13112B	881705		3/31/88 RL
3/31/88	3/31/88			881772		3/31/88 RL
3/31/88	3/31/88			881703		3/31/88 RL
3/31/88	3/31/88	INC-11	13151B	881704		3/31/88 RL
3/31/88	3/31/88	INC-11	13150B	881704		3/31/88 RL
3/31/88	3/31/88			881703		3/31/88 RL
3/31/88	3/31/88	INC-11	13141B	881703		3/31/88 RL
3/31/88	3/31/88			881704		3/31/88 RL
3/31/88	3/31/88			881770		3/31/88 RL
3/31/88	3/31/88	INC-11	13149B	881770		3/31/88 RL
3/31/88	3/31/88			881704		3/31/88 RL
3/31/88	3/31/88			881703		3/31/88 RL
3/31/88	3/31/88	INC-11	13148	881772		3/31/88 RL
3/31/88	3/31/88			881772		3/31/88 RL
3/31/88	3/31/88			881703		3/31/88 RL
3/31/88	3/31/88			881704		3/31/88 RL
3/31/88	3/31/88			881710		3/31/88 RL

DATE
REC

DATE
Completed

Group

C
D

DSWB

Remarks

71
Received

APRIL 1988

4/15/88	4/15/88	HSE-9(SM)	12989B	880307	RE
4/15/88	4/15/88	M-8(910)	18351B	881949	RE
4/15/88	4/15/88	AT-D0 (9004)	73210B	880403	RE
4/15/88	4/15/88	CLS-2C792	134150	880577	RE
4/15/88	4/15/88	CLS-2(7901)	13416B	880575	RE
4/15/88	4/15/88	CLS-2C792	13417B	880575	RE
4/15/88	4/15/88	ENG-5	6083B	881026	RE
4/15/88	4/15/88	MST-5(810)	13174B	880534	RE
4/15/88	4/15/88	MST-5 CLS-1	13175B	880573	RE
4/15/88	4/15/88	7901	13412B	880573	RE
4/15/88	4/15/88	(811)MST-12	12874B	882375	RE
4/15/88	4/15/88	(811)MST-12	12882B	882375	RE
4/22/88	4/22/88	8307	13145B	881780	RE
4/22/88	4/22/88	8604	11718B	883041	RE
4/22/88	4/22/88	LS-2	11714B	882966	RE
4/22/88	4/22/88	8603	11717B	883040	RE
4/22/88	4/22/88	8311	18278B	881784	RE
4/22/88	4/22/88	8311	13144B	881784	RE
4/22/88	4/22/88	8350	18276B	881784	RE
4/22/88	4/22/88	5710(104) 7290B	12990B	881784	RE
4/22/88	4/22/88	8307/8311	18280B	881783	RE
4/22/88	4/22/88	7903	12895B	882387	RE
4/22/88	4/22/88	7903	12897B	882387	RE
4/22/88	4/22/88	8136	12890B	882373	RE
4/22/88	4/22/88	7903	12896B	882434	RE
4/22/88	4/22/88	7906/7903 12894B	12894B	882387	RE
4/22/88	4/22/88	7903	12891B	882372	RE
4/22/88	4/22/88	8304	12892B	882380	RE
4/29/88	4/29/88	INVC-4	13143B	880578	RE
4/29/88	4/29/88	MST-5	13176B	880583	RE
4/29/88	4/29/88	8111	18602B	880583	RE
4/29/88	4/29/88	MST-00	18651B	880583	RE
4/29/88	4/29/88	MST-00	18601B	880583	RE
4/29/88	4/29/88	7903/7904	13425B	880583	RE
		9201			RE

APPENDIX F

**MIXED LOW-LEVEL WASTE CROSSWALK FROM WASTE
ANALYSIS PLAN TO SITE TREATMENT PLAN**

Mixed Low-Level Waste Crosswalk from Waste Analysis Plan to Site Treatment Plan

Waste Analysis Plan (WAP) Mixed Low-Level Waste (MLLW) Group	WAP MLLW Subgroup	Site Treatment Plan (STP) Treatability Group	STP Mixed Waste Inventory Report (MWIR) Waste Identification (ID)	STP MWIR Treatment ID	STP Treatment Method
Solid Homogeneous	Soils with heavy metals	Soil with heavy metals	LA-W904	----	Commercial stabilization
	Environmental Restoration (ER) soils	ER soils	LA-W905	----	Commercial stabilization
	Inorganic solid oxidizers	Inorganic solid oxidizers	LA-W923		Hydrothermal processing
Solid Heterogeneous	Lead for surface decontamination	Surface-contaminated lead	LA-W930	LA-S001	Lead decontamination
	Other lead wastes	Activated or inseparable lead	LA-W921	PX-S803	Macroencapsulation
		Lead requiring sorting	LA-W931	LA-S701	Sorting before treatment
		Lead wastes—to be determined (TBD)	LA-W924	LA-W924	Requires further characterization or technical assessment
		Lead blankets	LA-W903	LA-W903	Commercial stabilization
	Noncombustible debris	Noncombustible debris	LA-W922	PX-S803	Macroencapsulation
	Combustible debris	Combustible debris	LA-W912	PX-S803	Macroencapsulation
	Organic-contaminated noncombustible solids	Organic-contaminated noncombustible solids	LA-W919	GJ-S801B	Thermal desorption
Organic-contaminated combustible solids	Organic-contaminated combustible solids	LA-W911	GJ-S801B	Thermal desorption	
	Elemental mercury	LA-W920	PI-S801	Amalgamation	

Mixed Low-Level Waste Crosswalk from Waste Analysis Plan to Site Treatment Plan

Waste Analysis Plan (WAP) Mixed Low-Level Waste (MLLW) Group	WAP MLLW Subgroup	Site Treatment Plan (STP) Treatability Group	STP Mixed Waste Inventory Report (MWIR) Waste Identification (ID)	STP MWIR Treatment ID	STP Treatment Method
	Water-reactive wastes	Water-reactive wastes	LA-W916	LA-S003	Water-reactive metals treatment skid
	Mercury wastes	Mercury wastes	LA-W925	LA-S701	Requires further characterization or technology assessment
	Unused solid reagent chemicals	Biochemical laboratory wastes	LA-W927	LA-S701	Requires further characterization or technology assessment
Liquid	Spent solvents and contaminated solvent mixtures	Aqueous organic wastes	LA-W906	GJ-S801C	Evaporative Oxidation
		Halogenated organic liquids	LA-W907	----	Hydrothermal Processing
		Nonhalogenated organic liquids	LA-W908	----	Hydrothermal Processing
		IPA wastes	LA-W901	DS-S001	Commercial Thermal Treatment
		Scintillation fluids	LA-W902	DS-S001	Commercial Thermal Treatment
	Corrosive liquid wastes	Corrosive solutions	LA-W914	LA-S004	Chemical Plating Waste Treatment Skid
	Aqueous liquids contaminated with heavy metals	Aqueous wastes with heavy metals	LA-W913	LA-S004	Chemical Plating Waste Treatment Skid
		Aqueous cyanides, nitrates, chromates, and arsenates	LA-W915	LA-S004	Chemical Plating Waste Treatment Skid

Mixed Low-Level Waste Crosswalk from Waste Analysis Plan to Site Treatment Plan

Waste Analysis Plan (WAP) Mixed Low-Level Waste (MLLW) Group	WAP MLLW Subgroup	Site Treatment Plan (STP) Treatability Group	STP Mixed Waste Inventory Report (MWIR) Waste Identification (ID)	STP MWIR Treatment ID	STP Treatment Method
	Oil wastes	Bulk oils	LA-W909	----	Hydrothermal Processing
	Unused liquid reagent chemicals	Biochemical laboratory wastes	LA-W927	LA-S701	Requires further characterization or technology assessment
Gas Cylinder		Compressed gases requiring scrubbing	LA-W917	LA-S801	Gas-scrubbing skid
		Compressed gases requiring oxidation	LA-W918	LA-S801	Gas oxidation skid
		Compressed gases—to be determined	LA-W926	LA-S701	Requires further characterization or technology assessment

APPENDIX G

**COPY OF SWEIS YEARBOOK – 1999
LA-UR-00-5520**

Copies of this report were provided to
the New Mexico Environment Department.

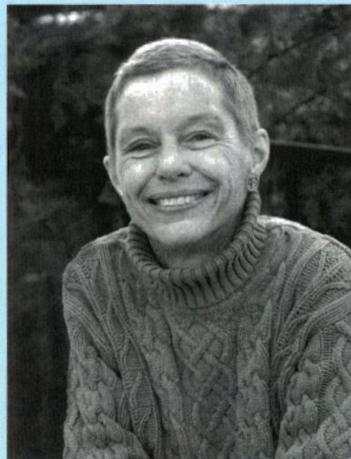
SWEIS Yearbook — 1999

LA-UR-00-5520



In memory of
Our Friend, Colleague, and
Cofounder of The SWEIS Yearbook

Ann Pendergrass



Cover inset photo: The first Waste Isolation Pilot Plant shipment leaving Los Alamos in March, 1999.

LA-UR-00-5520

December 2000

Approved for public release;
distribution is unlimited

Title: SWEIS Yearbook — 1999

Comparison of 1999 Data to Projections of the
Site-Wide Environmental Impact Statement for
Continued Operation of
the Los Alamos National Laboratory

Author(s): Site-Wide Issues Office
Environment, Safety, and Health Division

Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the U.S. Department of Energy under contract W-7405-ENG-36.

CONTENTS

List of Tables	vi
Preface	ix
Executive Summary	x
Acknowledgements	xiii
Acronyms	xv
1.0 Introduction	1-1
1.1 The SWEIS	1-1
1.2 Annual Yearbook	1-1
1.3 This Yearbook	1-1
2.0 Facilities and Operations	2-1
2.1 Plutonium Complex (TA-55)	2-3
2.1.1 Construction and Modifications at the Plutonium Complex	2-6
2.1.2 Operations at the Plutonium Complex	2-6
2.1.3 Operations Data for the Plutonium Complex	2-8
2.2 Tritium Facilities (TA-16 and TA-21)	2-9
2.2.1 Construction and Modifications at the Tritium Facilities	2-9
2.2.2 Operations at the Tritium Facilities	2-9
2.2.3 Operations Data for the Tritium Facilities	2-12
2.3 Chemistry and Metallurgy Research Building (TA-03)	2-12
2.3.1 Construction and Modifications at the CMR Building	2-12
2.3.2 Operations at the CMR Building	2-13
2.3.3 Operations Data for the CMR Building	2-14
2.4 Pajarito Site (TA-18)	2-15
2.4.1 Construction and Modifications at the Pajarito Site	2-15
2.4.2 Operations at the Pajarito Site	2-15
2.4.3 Operations Data for the Pajarito Site	2-16
2.5 Sigma Complex (TA-03)	2-18
2.5.1 Construction and Modifications at the Sigma Complex	2-18
2.5.2 Operations at the Sigma Complex	2-18
2.5.3 Operations Data for the Sigma Complex	2-19
2.6 Materials Science Laboratory (TA-03)	2-20
2.6.1 Construction and Modifications at the MSL	2-20
2.6.2 Operations at the MSL	2-20
2.6.3 Operations Data for the MSL	2-21
2.7 Target Fabrication Facility (TA-35)	2-21
2.7.1 Construction and Modifications at the Target Fabrication Facility	2-22
2.7.2 Operations at the Target Fabrication Facility	2-22
2.7.3 Operations Data for the Target Fabrication Facility	2-22
2.8 Machine Shops (TA-03)	2-23
2.8.1 Construction and Modifications at the Machine Shops	2-23
2.8.2 Operations at the Machine Shops	2-23
2.8.3 Operations Data for the Machine Shops	2-24

2.9	High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22 TA-28, TA-37)	2-25
2.9.1	Construction and Modifications at High Explosives Processing	2-25
2.9.2	Operations at High Explosives Processing	2-25
2.9.3	Operations Data for High Explosives Processing	2-27
2.10	High Explosives Testing (TA-14, TA-15, TA-36, TA-39, TA-40)	2-28
2.10.1	Construction and Modifications at High Explosives Testing	2-28
2.10.2	Operations at High Explosives Testing	2-28
2.10.3	Operations Data for High Explosives Testing	2-29
2.11	Los Alamos Neutron Science Center (TA-53)	2-30
2.11.1	Construction and Modifications at LANSCE	2-30
2.11.2	Operations at LANSCE	2-31
2.11.3	Operations Data for LANSCE	2-33
2.12	Health Research Laboratory (TA-43)	2-34
2.12.1	Construction and Modifications at HRL	2-34
2.12.2	Operations at HRL	2-35
2.12.3	Operations Data for HRL	2-37
2.13	Radiochemistry Facility (TA-48)	2-38
2.13.1	Construction and Modifications at the Radiochemistry Facility	2-38
2.13.2	Operations at the Radiochemistry Facility	2-38
2.13.3	Operations Data for the Radiochemistry Facility	2-40
2.14	Radioactive Liquid Waste Treatment Facility (TA-50)	2-41
2.14.1	RLWTF Construction and Modifications	2-41
2.14.2	RLWTF Capabilities	2-41
2.14.3	Operations Data for the RLWTF	2-42
2.15	Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)	2-43
2.15.1	Construction and Modifications at the Solid Radioactive and Chemical Waste Facility	2-44
2.15.2	Operations at the Solid Radioactive and Chemical Waste Facility	2-44
2.15.3	Operations Data for the Solid Radioactive and Chemical Waste Facility	2-46
2.16	Non-Key Facilities	2-47
2.16.1	Construction and Modifications at the Non-Key Facilities	2-48
2.16.2	Operations at the Non-Key Facilities	2-50
2.16.3	Operations Data for the Non-Key Facilities	2-51
2.17	Environmental Restoration Project	2-52
2.17.1	Operations of the ER Project	2-52
2.17.2	Operations Data for the ER Project	2-52
3.0	Site-Wide 1999 Operations Data	3-1
3.1	Air Emissions	3-1
3.1.1	Radioactive Air Emissions	3-1
3.1.2	Non-Radioactive Air Emissions	3-1
3.1.2.1	Emissions of Criteria Pollutants	3-1
3.1.2.2	Chemical Usage and Emissions	3-2
3.2	Liquid Effluents	3-3
3.3	Solid Radioactive and Chemical Wastes	3-7

3.3.1	Chemical Wastes	3-7
3.3.2	Low-Level Radioactive Wastes	3-8
3.3.3	Mixed Low-Level Radioactive Wastes	3-9
3.3.4	Transuranic Wastes	3-9
3.4	Utilities	3-10
3.4.1	Gas	3-10
3.4.2	Electricity	3-10
3.4.3	Water	3-11
3.5	Worker Safety	3-13
3.5.1	Accidents and Injuries	3-13
3.5.2	Ionizing Radiation and Worker Exposures	3-13
3.6	Socioeconomics	3-14
3.7	Land Resources	3-16
3.8	Groundwater	3-16
3.9	Cultural Resources	3-17
3.10	Ecological Resources	3-19
3.10.1	Threatened and Endangered Species Habitat Management Plan	3-19
3.10.2	Biological Assessments	3-20
4.0	Additive Analysis	4-1
5.0	Summary and Conclusion	5-1
5.1	Summary	5-1
5.2	Conclusions	5-3
5.3	To the Future	5-3
6.0	References	R-1
	Appendix A: Chemical Usage and Emissions Data	A-1

LIST OF TABLES

2.0-1	Key and Non-Key Facilities	2-3
2.1.2-1	Plutonium Complex/Comparison of Operations	2-7
2.1.3-1	Plutonium Complex/Operations Data	2-8
2.2.2-1	Tritium Facilities/Comparison of Operations	2-10
2.2.3-1	Tritium Facilities (TA-16 and TA-21)/Operations Data	2-12
2.3.1-1	CMR Upgrade Project/Phase I Status/December 1999	2-13
2.3.2-1	Chemistry and Metallurgy Research Building (TA-03)/Comparison of Operations	2-13
2.3.3-1	Chemistry and Metallurgy Research Building (TA-03)/Operations Data	2-15
2.4.2-1	Pajarito Site (TA-18)/Comparison of Operations	2-16
2.4.3-1	Pajarito Site (TA-18)/Operations Data	2-17
2.5.1-1	Upgrades Planned for Sigma, Building 03-66	2-18
2.5.2-1	Sigma Complex/Comparison of Operations	2-18
2.5.3-1	Sigma Complex (TA-03)/Operations Data	2-19
2.6.2-1	Materials Science Laboratory (TA-03)/Comparison of Operations	2-20

2.6.3-1	Materials Science Laboratory (TA-03)/Operations Data	2-21
2.7.2-1	Target Fabrication Facility (TA-35)/Comparison of Operations	2-22
2.7.3-1	Target Fabrication Facility (TA-35)/Operations Data	2-23
2.8.2-1	Machine Shops (TA-03)/Comparison of Operations	2-24
2.8.3-1	Machine Shops (TA-03)/Operations Data	2-24
2.9.2-1	High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Comparison of Operations	2-26
2.9.3-1	High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Operations Data	2-27
2.10.2-1	High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40)/ Comparison of Operations	2-28
2.10.3-1	High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40)/ Operations Data	2-29
2.11.1-1	Status of Projected Facility Changes at LANSCE	2-30
2.11.2-1	Los Alamos Neutron Science Center (TA-53)/Comparison of Operations	2-32
2.11.3-1	Los Alamos Neutron Science Center (TA-53)/Operations Data	2-34
2.12.2-1	Health Research Laboratory (TA-43)/Comparison of Operations	2-35
2.12.3-1	Health Research Laboratory (TA-43)/Operations Data	2-37
2.13.2-1	Radiochemistry Facility (TA-48)/Comparison of Operations	2-38
2.13.3-1	Radiochemistry Facility (TA-48)/Operations Data	2-40
2.14.2-1	Radioactive Liquid Waste Treatment Facility (TA-50)/Comparison of Operations	2-42
2.14.3-1	Radioactive Liquid Waste Treatment Facility (TA-50)/Operations Data	2-43
2.15.2-1	Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50)/ Comparison of Operations	2-45
2.15.3-1	Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50)/ Operations Data	2-47
2.16.2-1	Operations at the Non-Key Facilities	2-50
2.16.3-1	Non-Key Facilities/Operations Data	2-51
2.17.2-1	ER Project/Operations Data	2-52
3.1.2.1-1	Emissions of Criteria Pollutants	3-2
3.2-1	NPDES Discharges by Watershed	3-3
3.2-2	NPDES Discharges by Facility	3-5
3.2-3	NPDES Outfalls Deleted in 1999	3-6
3.3-1	LANL Waste Types and Generation	3-7
3.3.1-1	Chemical Waste Generators and Quantities	3-7
3.3.2-1	LLW Generators and Quantities	3-8
3.3.3-1	MLLW Generators and Quantities	3-9
3.3.4-1	Transuranic Waste Generators and Quantities	3-9
3.4.1-1	Gas Consumption (decatherms) at LANL/Fiscal Year 1999	3-10
3.4.1-2	Steam Production at LANL/Fiscal Year 1999	3-10
3.4.2-1	Electric Peak Coincident Demand/Fiscal Year 1999	3-11
3.4.2-2	Electric Consumption/Fiscal Year 1999	3-11
3.4.3-1	Water Consumption (thousands of gallons)	3-12

3.5.1-1	Total Recordable and Lost Workday Case Rates at LANL	3-13
3.5.2-1	Radiological Exposure to LANL Workers	3-13
3.6-1	LANL-Affiliated Work Force	3-14
3.6-2	County of Residence for UC Employees	3-15
3.6-3	UC Employee Index for Key Facilities	3-15
3.9-1	Acreage Surveyed, Cultural Resource Sites Recorded, and Cultural Resource Sites Eligible for the National Register of Historic Places at LANL Through FY99	3-17
4.0-1	Cumulative LLW and MLLW Volumes	4-1

APPENDIX

A-1	Comparison of Chemicals used in 1995 and 1999	A-1
A-2	Chemical and Metallurgy Research Building	A-1
A-3	High Explosives Processing Facilities	A-2
A-4	High Explosives Testing Facilities	A-3
A-5	HRL	A-4
A-6	LANSCE	A-5
A-7	Machine Shops	A-6
A-8	Material Science Laboratory	A-6
A-9	Pajarito Site	A-7
A-10	Plutonium Facility Complex	A-7
A-11	Radiochemistry Laboratory	A-8
A-12	Sigma Complex	A-10
A-13	Target Fabrication Facility	A-11
A-14	Tritium Facility	A-12
A-15	Waste Management Operations (WMO): Radioactive Liquid Waste Treatment Facility	A-12
A-16	Waste Management Operations: Solid Radioactive and Chemical Waste Facilities	A-13

LIST OF FIGURES

2-1	Location of Los Alamos National Laboratory	2-2
2-2	Location of Technical Areas	2-4
2-3	Location of Key Facilities	2-5
3-1	Location of Watershed Canyons	3-4

PREFACE

In the Record of Decision for Stockpile Stewardship and Management, the US Department of Energy (DOE) charged Los Alamos National Laboratory (LANL or Laboratory) with several new tasks, including war reserve pit production. DOE evaluated the potential environmental impacts of these assignments in the Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). This Site-Wide Environmental Impact Statement (SWEIS) provided the basis for DOE decisions to implement these new assignments at LANL through the Record of Decision (ROD) issued in September 1999.

The Annual Yearbook compares operational data with the projections of the SWEIS for the level of operations selected by the ROD. The SWEIS 1998 Yearbook was issued in December 1999. A special edition of the SWEIS Yearbook, "Wildfire 2000," was issued in August 2000, comparing the wildfire accident analysis of the SWEIS with the Cerro Grande fire that occurred in May 2000. This is the SWEIS Yearbook for 1999.

The SWEIS Yearbook for 2000 will include the effects of the Cerro Grande fire on operations and the environmental setting.

The Yearbooks will contain the data needed for trend analyses, will compare projections and actual operations, and will enable decision-makers to determine when and if an updated SWEIS or other National Environmental Policy Act analysis is necessary.

As with the special "Wildfire 2000" edition, the cover of this and future Yearbooks will include an insert photograph depicting an important event that happened during the calendar year under review. The photo selected for this cover highlights LANL's initial shipments of transuranic waste for disposal at the Waste Isolation Pilot Plant.

EXECUTIVE SUMMARY

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). DOE issued a Record of Decision (ROD) for this document in September 1999 (DOE 1999b).

To enhance the usefulness of this Site-Wide Environmental Impact Statement (SWEIS), DOE and Los Alamos National Laboratory (LANL) implemented an assessment tool, the annual yearbook, making comparisons between SWEIS projections and actual operations. Each yearbook focuses on operations during one calendar year and specifically addresses the following:

- facility and/or process modifications or additions,
- types and levels of operations during the calendar year,
- operations data for the Key Facilities, and
- site-wide effects of operations for the calendar year.

This Yearbook addresses capabilities and operations using the concept of the “Key Facility” as presented in the SWEIS. The definition of each Key Facility hinges upon operations (research, production, or services) and capabilities and is not necessarily confined to a single structure, building, or technical area (TA). Chapter 2 discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 1999, the types and levels of operations that occurred during 1999, and the 1999 operations data. Chapter 2 also discusses the “Non-Key Facilities,” which include all buildings and structures not part of a Key Facility, or the balance of LANL.

During 1999, planned construction and/or modifications continued at eight of the fifteen Key Facilities. Most of these activities were modifications within existing structures. At the High Explosives Testing Facility, construction continued on the Dual-Axis Radiographic Hydrodynamic Test facility. Installation and component testing of the accelerator and its associated control and diagnostics systems began in 1999. Additionally, five major construction projects were started or continued for the “Non-Key Facilities.”

Four projects were in the construction phase: Atlas, the Industrial Research Park, the Strategic Computing Complex, and the Nonproliferation and International Security Center. The other project, the Central Health Physics Calibration Laboratory, was in the design phase.

The ROD projected a total of 38 facility construction and modification projects for LANL. Thirteen projects have now been completed: seven in 1999 and six in 1998. Ten additional projects were started and/or continued in 1999. The seven projects completed in 1999 are

- replacement of the graphite collection systems at Sigma,
- modification of the industrial drain system at Sigma,
- replacement of electrical components at Sigma,
- relocation of the Weapons Components Testing Facility at High Explosives Processing,
- making the Low-Energy Demonstration Accelerator operational,
- bringing the new ultra-filtration and reverse osmosis process on-line at the Radioactive Liquid Waste Treatment Facility (RLWTF), and
- bringing the nitrate reduction equipment on-line at RLWTF.

A major modification project, elimination and/or rerouting of National Pollutant Discharge Elimination System (NPDES) outfalls, continued. During 1999, 16 additional outfalls were eliminated leaving LANL with only 20 outfalls on its NPDES permit.

This edition of the Yearbook is reporting chemical usage and calculated emissions (expressed as kilograms per year) for the Key Facilities, based on an improved chemical reporting system. The 1999 chemical usage amounts were extracted from the Laboratory’s Automated Chemical Inventory System. The quantities used for this report represent all chemicals procured or brought on site in 1999. The chemical comparison indicates that the number of chemicals used in 1999 at each of the Key Facilities and across the Laboratory was substantially less than that number evaluated by the ROD. These changes are believed to be a result of

more accurate chemical data collection. Information is presented in the Appendix related to actual chemical use and estimated emissions for each Key Facility. Additional information related to chemical use and emissions reporting can be found in "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999" (LANL 2000a).

Capabilities across LANL did not change during 1999 although some were defined more broadly while certain operations within a given capability were further refined. During 1999, 90 of the 95 identified capabilities were active. No activity occurred under five capabilities: Fabrication and Metallography at the Chemical and Metallurgy Research Building, Accelerator Transmutation of Wastes at the Los Alamos Neutron Science Center (LANSCE), Medical Isotope Production at LANSCE, Other Waste Processing at the Solid Radioactive and Chemical Waste Facility, and Size Reduction at the Solid Radioactive and Chemical Waste Facility.

As in 1998, only three of LANL's facilities operated during 1999 at levels approximating those projected by the ROD—the Materials Science Laboratory, the Health Research Laboratory, and the Non-Key Facilities. None of these facilities are major contributors to the parameters that lead to significant potential environmental impacts. The remaining 13 Key Facilities all conducted operations at or below projected activity levels.

Radioactive air emissions totaled about 1900 curies compared to 21,700 projected by the ROD. This results in a hypothetical maximum dose to a member of the public of 0.32 millirem (compared to 5.44 projected). Calculated NPDES discharges totaled 317 million gallons compared to a projected volume of 278 million gallons per year. While the number of outfalls has been reduced, the methodology for calculating the discharges changed, and may now result in an overestimate. In addition, the reduction often results from combining flows so that the total number of outfalls is less, but the overall flow is not reduced and exits from

a single discharge point. Quantities of solid radioactive and chemical wastes ranged from 3% (mixed low-level radioactive waste) to 475% (chemical waste) of projections. The extremely large quantities of chemical waste (15.4 million kilograms) are a result of Environmental Restoration Program activities (remediation of a former material disposal area). Most chemical wastes are shipped off-site for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs.

Workforce data were above ROD projections. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than projected. Electricity use during 1999 totaled 369 gigawatt-hours with a peak demand of 68 megawatts compared to projections of 782 gigawatt-hours with a peak demand of 113 megawatts. Water usage was 453 million gallons (compared to 759 million gallons projected), and natural gas consumption totaled 1.43 million decatherms (compared to 1.84 projected). The collective Total Effective Dose Equivalent for the LANL workforce during 1999 was 131 person-rem, which is considerably lower than the workforce dose of 704 person-rem projected by the ROD.

Measured parameters for ecological resources and groundwater were similar to ROD projections, and measured parameters for cultural resources and land resources were below ROD projections. For land use, the ROD projects the disturbance of 41 acres of new land at TA-54 because of the need for additional disposal cells for low-level radioactive waste. As of 1999, this expansion had not yet started. However, groundbreaking did occur on 30 acres of land that are being developed along West Jemez Road for the Industrial Research Park. This project has its own National Environmental Policy Act documentation, and the land is being leased to Los Alamos County for this privately owned development.

Cultural resources remained protected, and no excavation of sites at TA-54 or any other part of LANL has occurred. (The ROD projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at TA-54.)

As projected by the ROD, water levels in wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping has slowed or ceased, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period, and water levels in the regional aquifer have continued a gradual decline that started in about 1977. In addition, ecological resources are being sustained as a result of protection afforded by DOE ownership of LANL. These resources include biological resources

such as protected sensitive species, ecological processes, and biodiversity.

In conclusion, operations data mostly fell within projections. Exceptions were number of employees, which produces a positive impact on the economy of northern New Mexico, and quantities of chemical wastes, which largely resulted from restoration of a former material disposal area. Overall, the operations data indicate that the Laboratory was operating within the SWEIS environmental envelope.



ACKNOWLEDGMENTS

The concept of an Annual Yearbook was developed soon after the SWEIS Project Office was established and is described in the 1995 Quality Management Plan as “making recommendations regarding the ongoing evaluation of Laboratory operations and the environmental envelope established by the SWEIS process.” Ann Pendergrass (LANL), Connie Soden (DOE/AL), Corey Cruz (DOE/AL), and Doris Garvey (LANL) were the creators of this concept and watched over its development. Their oversight and guidance were critical in moving the concept to reality. Without their involvement, the Yearbook would not have happened.

DOE and Laboratory management provided support and encouragement to the idea. Tom Gunderson (LANL), Mike Baker (LANL), Scott Gibbs (LANL), Denny Erickson (LANL), and John Ordaz (DOE/DP/HQ) played particularly important roles. The Environment, Safety, and Health Division (LANL) Review Committee provided similar support and encouragement.

The Site-Wide Issues Office was the primary preparer of this report. Chief contributors were Doris

Garvey, Ken Rea, Chris Del Signore, Allen Valentine, Tony Grieggs, and Julie Meadows.

Jay Brown provided prompt review of the document for classification issues and helped solve several concerns.

Pauline McCormick provided administrative support to the Site-Wide Issues Office, keeping impeccable records so that information would not be lost.

Hector Hinojosa provided editorial support, and Randy Summers served as the designer using text and photographs for a final product.

Many individuals assisted in the collection of information and review of drafts. Data and information came from many parts of the Laboratory, including facility and operating personnel and those who monitor and track environmental parameters. The Yearbook could not have been completed and verified without their help. Though all individuals cannot be mentioned here, the table below identifies major players from each of the Key Facilities and other operations.

AREA OF CONTRIBUTION	CONTRIBUTOR
Air Emissions	Leland Maez
Air Emissions	Jackie Hurtle
Air Emissions	Scott Miller
Chemistry and Metallurgy Research Building	William Vigil
Environmental Restoration Project	Paula Bertino
Environmental Restoration Project	Dave McInroy
Environmental Restoration Project	Troy Eshleman
Health Research Laboratory	Julie Wilson
Health Research Laboratory	Sandra Zink
High Explosives Processing	Debbie Trujillo
High Explosives Testing	Michelle Cash
High Explosives Testing	Franco Sisneros
Liquid Effluents	Tina Marie Sandoval
Liquid Effluents	Carla Jacquez
Liquid Effluents	Mike Saladen
Liquid Effluents	Ann Sherrard
Liquid Effluents	Robin Cyr

AREA OF CONTRIBUTION	CONTRIBUTOR
Los Alamos Neutron Science Center	Charles (John) Graham
Los Alamos Neutron Science Center	Jim Amann
Los Alamos Neutron Science Center	Ginger Grant
Los Alamos Neutron Science Center	Kevin Jones
Los Alamos Neutron Science Center	Paul Lewis
Los Alamos Neutron Science Center	Dave Schneider
Los Alamos Neutron Science Center	Lorraine (Lisa) Stanford
Machine Shops	Debbie Trujillo
Materials Science Laboratory	Mike Stevens
Materials Science Laboratory	Kathleen Alexander
Materials Science Laboratory	George Peters
Pajarito Site	Barbara Q. Partain
Pajarito Site	Marilee (Mandy) Fuehrer
Plutonium Complex	T. J. Trapp
Radioactive Liquid Waste Treatment Facility	Rick Alexander
Radioactive Liquid Waste Treatment Facility	Dennis McLain
Radioactive Liquid Waste Treatment Facility	William (Dave) Moss
Radiochemistry Facility	Sarah Helmick
Sigma	George Peters
Sigma	Larry Austin
Socioeconomics	James VanHecke
Solid Radioactive and Chemical Waste Facilities	Anne White
Solid Radioactive and Chemical Waste Facilities	Debbie Finrock
Solid Radioactive and Chemical Waste Facilities	Tim Sloan
Solid Radioactive and Chemical Waste Facilities	Robert Murphy
Solid Radioactive and Chemical Waste Facilities	Kellie Art
Solid Radioactive and Chemical Waste Facilities	Julie Minton-Hughes
Solid Radioactive and Chemical Waste Facilities	Gilbert Montoya
Solid Radioactive and Chemical Waste Facilities	John Loughhead
Solid Radioactive and Chemical Waste Facilities	Steve Francis
Solid Radioactive and Chemical Waste Facilities	Pam Rogers
Solid Radioactive and Chemical Waste Facilities	Myrna Romero
Solid Radioactive and Chemical Waste Facilities	Gary Allen
Solid Radioactive and Chemical Waste Facilities	Patricia Leyba
Target Fabrication Facility	Janet Mercer-Smith
Target Fabrication Facility	George Peters
Tritium Facilities	Richard Carlson
Utilities	Mark Hinrichs
Utilities	Jerome Gonzales
Utilities	Gilbert Montoya
Worker Safety	Robin Devore

ACRONYMS

ACIS	Automated Chemical Inventory System
ALARA	as low as reasonably achievable
ATW	accelerator transmutation of wastes
BTF	Beryllium Technology Facility
Ci	curie
CMR	Chemical and Metallurgy Research
DARHT	Dual-Axis Radiographic Hydrodynamic Test (facility)
DMR	discharge monitoring report
DOE	Department of Energy
DVRS	Decontamination and Volume Reduction System
DX	Dynamic Experimentation (Division)
EPA	Environmental Protection Agency
ER	Environmental Restoration (Project)
ESA	Engineering Sciences and Application (Division)
FTE	full-time equivalent (employee)
GWH	gigawatt-hours
HEWTF	High Explosives Wastewater Treatment Facility
HMP	Habitat Management Plan
HRL	Health Research Laboratory
IRP	Industrial Research Park
JCNNM	Johnson Controls of Northern New Mexico
KW	kilowatt
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Science Center
LAPP	Los Alamos Power Pool
LEDA	Low-Energy Demonstration Accelerator
LIDAR	light detection and ranging
LIFT	Los Alamos International Facility for Transmutation
linac	linear accelerator
LLW	low-level radioactive waste
LPSS	Long-Pulse Spallation Source
LWC	Lost Workday Case Rate
m	meter
MDA	material disposal area
MEI	maximally exposed individual
MeV	million electron volts
MGY	million gallons per year
MLLW	mixed low-level radioactive waste
MSL	Materials Science Laboratory
MW	megawatt
NEPA	National Environmental Policy Act
NISC	Nonproliferation and International Security Center

NMED	New Mexico Environment Department
NMSF	Nuclear Materials Storage Facility
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
PNM	Public Service Company of New Mexico
PRS	potential release site
PTLA	Protection Technology Los Alamos
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RFI	RCRA facility investigation
RLW	radioactive liquid waste
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	record of decision
SCC	Strategic Computing Complex
SNM	special nuclear material
SWEIS	Site-Wide Environmental Impact Statement
SWS	Sanitary Wastewater System
TA	technical area
TEDE	total effective dose equivalent
TFF	Target Fabrication Facility
TRI	Total Recordable Incident Rate
TRU	transuranic
TSFF	Tritium Science and Fabrication Facility
TSTA	Tritium System Test Assembly (facility)
TWISP	Transuranic Waste Inspectable Storage Project
UC	University of California
UF/RO	ultrafiltration/reverse osmosis
WCRRF	Waste Characterization, Reduction, and Repackaging Facility
WETF	Weapons Engineering and Tritium Facility
WIPP	Waste Isolation Pilot Plant
WNR	Weapons Neutron Research (facility)

1.0 Introduction

1.1 The SWEIS

In 1999, the US Department of Energy (DOE) published a Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (DOE 1999a). DOE issued its Record of Decision (ROD) on this Site-Wide Environmental Impact Statement (SWEIS) in September 1999 (DOE 1999b). The ROD identified the decisions DOE made on the levels of operation for Los Alamos National Laboratory (LANL) for the foreseeable future.

1.2 Annual Yearbook

To enhance the usefulness of this SWEIS, a National Environmental Policy Act (NEPA) document, DOE and LANL implemented an assessment tool that makes annual comparisons between SWEIS projections and actual operations via an annual Yearbook. The Yearbook's purpose is not to present environmental impacts or environmental consequences, but rather to provide data that could be used to develop an impact analysis. The annual Yearbook focuses on

- Facility and process modifications or additions (Chapter 2). These include projected activities, for which NEPA coverage was provided by the SWEIS, and certain other activities for which environmental coverage was not provided in the SWEIS. In the latter case, the Yearbook identifies the additional NEPA analyses (i.e., categorical exclusions and environmental assessments) that were performed.
- The types and levels of operations during the calendar year (Chapter 2). Types of operations are described using the capabilities defined in the SWEIS. Levels of operations are expressed in units of production, numbers of researchers, numbers of experiments, hours of operation, and other descriptive units.
- Operations data for the Key Facilities, comparable to data projected in the SWEIS (Chapter 2). Data for each facility include waste generated, air emissions, liquid effluents, and number of workers.
- Site-wide effects of operations for the calendar year (Chapter 3). These include measures such as number of workers, radiation doses, workplace incidents, utility requirements, air emissions, liquid effluents, and solid wastes. These effects also include changes in the regional aquifer, ecological resources, and other resources for which the DOE has long-term stewardship responsibilities as an owner of federal lands.

Data for comparison come from a variety of sources, including facility records, operations reports, facility personnel, and the annual Environmental Surveillance Report. The focus on operations rather than on programs, missions, or funding sources is consistent with the approach of the SWEIS.

The annual Yearbooks provide DOE with information needed to evaluate adequacy of the SWEIS and will enable DOE to make a decision on when and if a new SWEIS is needed. The Yearbook will also be a guide to facilities and managers at the Laboratory in determining whether activities are within the SWEIS operating envelope. The report does not reiterate the detailed information found in other LANL documents, but rather points the interested reader to those documents for the additional detail. The Yearbook serves as a guide to environmental information collected and reported by the various groups at LANL.

1.3 This Yearbook

The ROD selected the levels of operations, and the SWEIS provided projections for these operations. This Yearbook compares data for calendar year 1999 to the appropriate SWEIS projections. Hence, this report uses the phrases "SWEIS ROD projections," "SWEIS ROD," or "ROD" to convey this concept, as appropriate.

The collection of data on facility operations is a unique effort. The type of information developed for the SWEIS is not routinely collected at LANL. Nevertheless, this information is the heart of the SWEIS and the Yearbook. Although this requires a special effort, the description of current operations and indications of future changes in operations is believed to be sufficiently important to warrant an incremental effort.

This Yearbook also presents the concept of additive analysis (Chapter 4). Though only two years of data exist, the concept is introduced and the groundwork laid for discussion in future years.



2.0 Facilities and Operations

LANL, which is located in northern New Mexico (Figure 2-1), has more than 2000 structures with approximately eight million square feet under roof, spread over an area of 43 square miles. In order to present a logical and comprehensive evaluation of LANL's potential environmental impacts, the SWEIS developed the Key Facility concept. Fifteen facilities were identified that were both critical to meeting mission assignments and

- housed operations that have the potential to cause significant environmental impacts, or
- were of most interest or concern to the public (based on comments in the SWEIS public hearings), or
- would be more subject to change because of DOE programmatic decisions.

The remainder of LANL was called "Non-Key," not to imply that these facilities were any less important to the accomplishment of critical research and development, but because they did not fit the above criteria (DOE 1999a, p. 2-17).

Taken together, the 15 Key Facilities represent the great majority of environmental risks associated with LANL operations. Specifically, the Key Facilities contribute

- more than 99% of all potential radiation doses to the public,
- more than 90% of all radioactive liquid waste (RLW) generated at LANL,
- more than 90% of the radioactive solid waste generated at LANL,
- more than 99% of all radiation doses to the LANL workforce, and
- approximately 30% of all chemical waste generated by LANL.

In addition, the Key Facilities comprise 42 of the 48 Category 2 and Category 3 nuclear facilities at LANL¹. Several changes have been made to the status of nuclear facility classifications. However, these changes were not incorporated in the December 1998 DOE List of Los Alamos National Laboratory Nuclear Facilities and therefore are not reported here. Once the DOE list is updated, those changes will be reflected in the appropriate LANL SWEIS yearbook.

The definition of each Key Facility hinges upon operations², capabilities, and location and is not necessarily confined to a single structure, building, or technical area (TA). In fact, the number of structures comprising a Key Facility ranges from one, the Material Sciences Laboratory (MSL), to more than 400 for the Los Alamos Neutron Science Center (LANSCE). Key Facilities can also exist in more than a single TA, as is the case with the High Explosives Processing and High Explosives Testing Key Facilities, which exist in all or parts of five and seven TAs, respectively.

¹ DOE Order 5480.23 (DOE 1992a) categorizes nuclear hazards as Category 1, Category 2, or Category 3. Because LANL has no Category 1 nuclear facilities (usually applied to nuclear reactors), definitions are presented for only Categories 2 and 3:

Category 2 Nuclear Hazard – has the potential for significant onsite consequences. DOE-STD-1027-92 (DOE 1992b) provides the resulting threshold quantities for radioactive materials that define Category 2 facilities.

Category 3 Nuclear Hazard – has the potential for only significant localized consequences. Category 3 is designed to capture those facilities such as laboratory operations, low-level radioactive waste handling operations, and research operations that possess less than Category 2 quantities of material. DOE-STD-1027-92 (DOE 1992b) provides the Category 3 thresholds for radionuclides.

The identification of nuclear facilities is based upon the official list maintained by DOE Los Alamos Area Office as of December 1998 (DOE 1998a).

² As used in the SWEIS and this Yearbook, facility operations include three categories of activities—research, production, and services to other LANL organizations. Research is both theoretical and practical. Examples include modeling (e.g., atmospheric weather patterns) to subatomic investigations (e.g., using the LANSCE linear accelerator [linac]) to collaborative efforts with industry (e.g., fuel cells for automobiles). Production involves the delivery of a product to a customer, such as radioisotopes to hospitals and the medical industry. Examples of services provided to other LANL facilities include utilities and infrastructure support, analysis of samples, environmental surveys, and waste management.

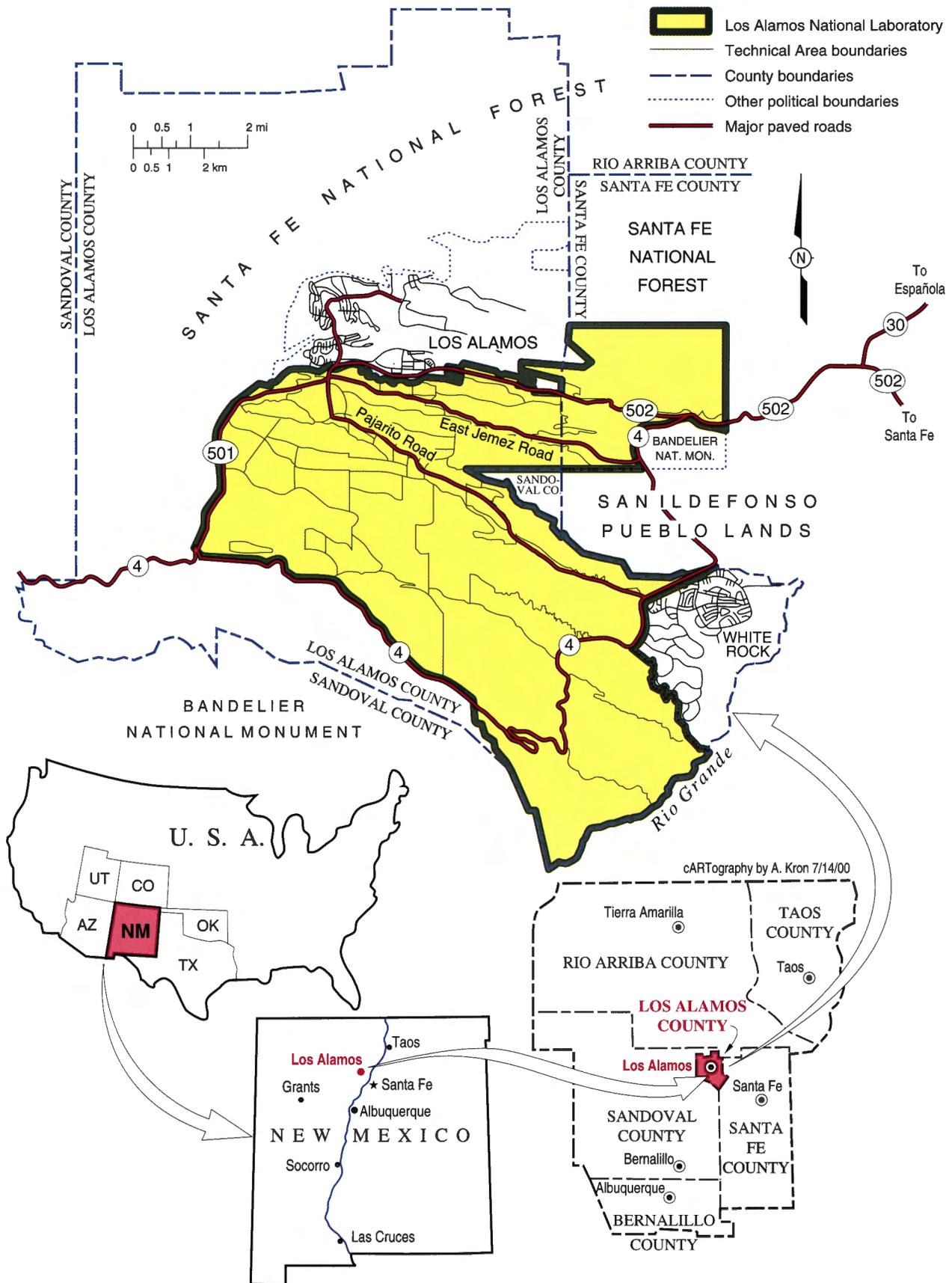


Figure 2-1 Location of Los Alamos National Laboratory

This chapter discusses each of the 15 Key Facilities from three aspects—significant facility construction and modifications that have occurred during 1999, types and levels of operations that occurred during 1999, and the 1999 operations data. Each of these three aspects is given perspective by comparing them to projections made by the ROD. This comparison provides an evaluation of whether or not data resulting from LANL operations continue to fall within the environmental envelope established by the ROD. It should be noted that construction activities projected by the ROD were for the ten-year period 1996–2005. All construction activities will not be complete and projected operations may not reach maximum levels until the end of the ten-year period.

This chapter also discusses the Non-Key Facilities, which include all buildings and structures not part of a Key Facility, or the balance of LANL. Although operations at the Non-Key Facilities do not contribute significantly to radiation doses or generation of radioactive wastes, the Non-Key Facilities represent a significant fraction of LANL. The Non-Key Facilities comprise all or the majority of 30 of LANL's 49 TAs (Figure 2-2), and approximately 15,500 of LANL's 27,820 acres. The Non-Key Facilities also employ about half the LANL workforce. This category includes such important buildings and operations as the Central Computing Facility, the Atlas Facility, the TA-46 sewage treatment facility, and the Main Administration Building. Table 2.0-1 identifies and compares the acreage of the 15 Key Facilities and the Non-Key Facilities, and Figure 2-3 shows the locations of the key facilities.

Table 2.0-1. Key and Non-Key Facilities

FACILITY	TECHNICAL AREAS	~SIZE (ACRES)
Plutonium Complex	TA-55	93
Tritium Facilities	TA-16 & TA-21	312
Chemical and Metallurgy Research Building (CMR)	TA-03	14
Pajarito Site	TA-18	131
Sigma Complex	TA-03	11
MSL	TA-03	2
Target Fabrication Facility (TFF)	TA-35	3
Machine Shops	TA-03	8
High Explosives Processing	TAs 08, 09, 11, 16, 22, 28, 37	1115
High Explosives Testing	TAs 15, 36, 39, 40	8691
LANSCE	TA-53	751
Health Research Laboratory (HRL)	TA-43	4
Radiochemistry Facility	TA-48	116
Radioactive Liquid Waste Treatment Facility (RLWTF)	TA-50	62
Solid Radioactive and Chemical Waste Facilities	TA-50 & TA-54	943
Subtotal, Key Facilities		12,256
Non-Key Facilities	30 of 49 TAs	15,560
LANL		27,816

2.1 Plutonium Complex (TA-55)

The Plutonium Complex Key Facility, a 93-acre site, consists of six primary buildings and a number of lesser buildings and structures. As presented in the SWEIS, this Key Facility contains one operational Category 2 nuclear facility (TA-55-4) and one potential Category 2 nuclear facility (TA-55-41), the Nuclear Material Storage Facility (NMSF), which was undergoing modification to bring it into operational status. In addition, the facility contains two Low Hazard chemical facilities (TA-55-3 and TA-55-5) and one Low Hazard energy source s facility (TA-55-7).

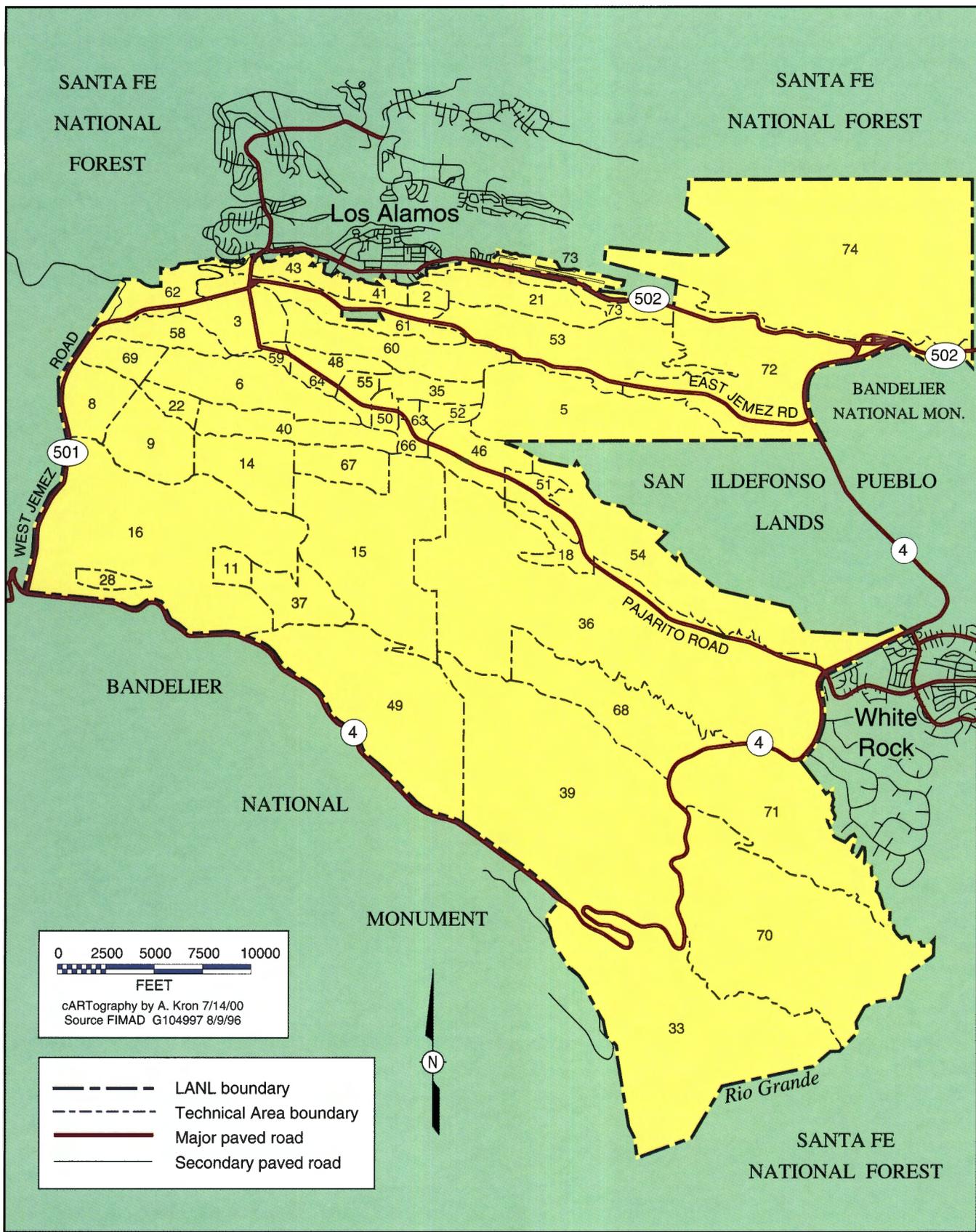


Figure 2-2 Location of Technical Areas

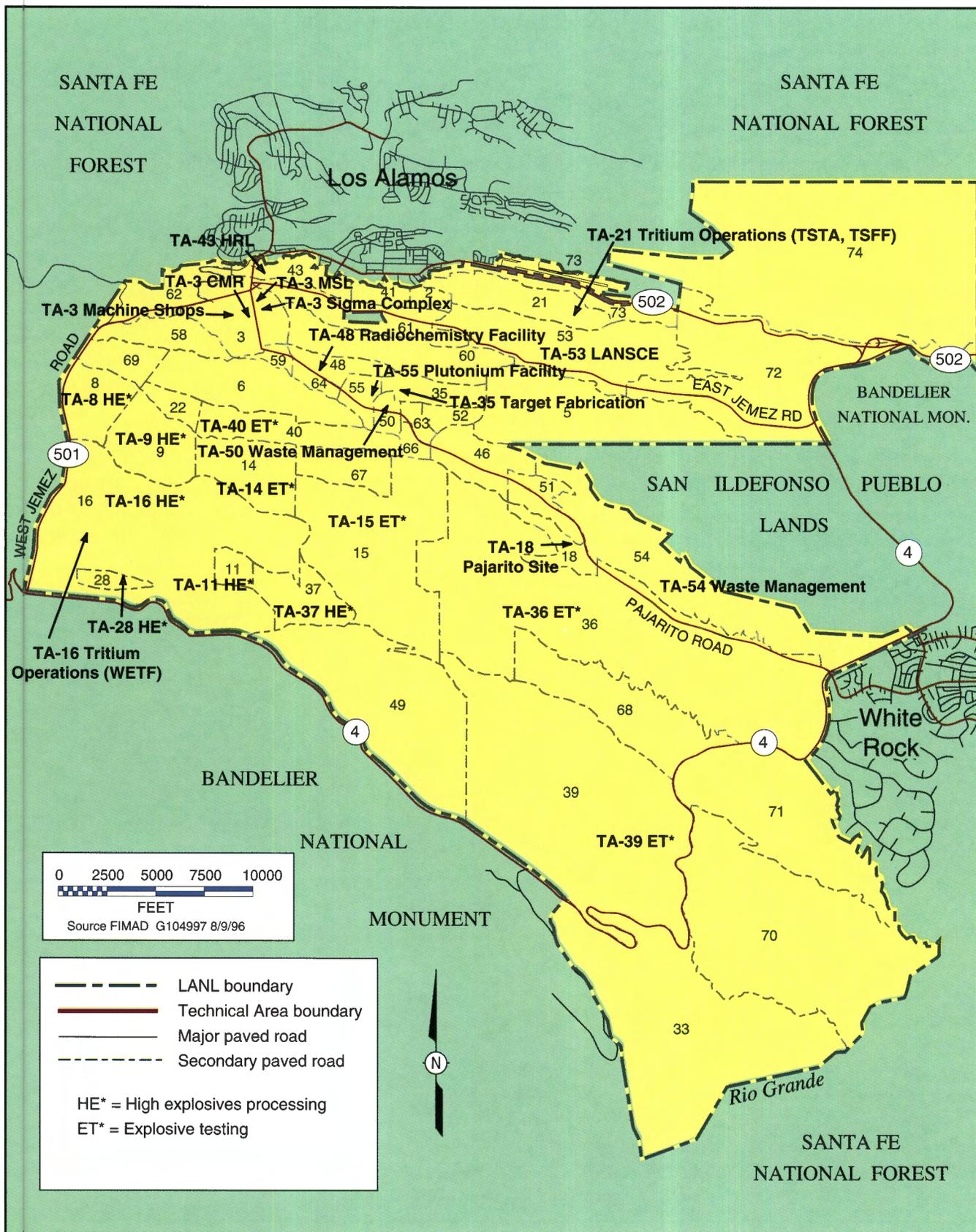


Figure 2-3 Location of Key Facilities

2.1.1 Construction and Modifications at the Plutonium Complex

The ROD projected four facility modifications:

- renovation of the NMSF (currently not in use);
- construction of a new administrative office building (constructed in 1999);
- upgrades within Building 55-4 to support continued manufacturing at the existing capacity of 14 pits per year; and
- further upgrades for long-term viability of the facility and to boost production to a nominal capacity of 20 pits per year.

During calendar year 1999, upgrades to maintain existing capacity were continued and a new office building was constructed at the TA-55 site (the Facilities Improvement Technical Support building). A categorical exclusion was issued for this project (LANL 1998a). Design efforts for renovation of the NMSF were halted. There are no current plans to continue the renovations of NMSF. None of the ongoing construction or modifications at the Plutonium Key Facility resulted in modification to the facility hazard categories by the close of calendar year 1999.

2.1.2 Operations at the Plutonium Complex

The ROD identified seven capabilities³ for this Key Facility. No new capabilities have been added, and none have been deleted. Research was conducted in all areas projected by the ROD, including the preparation of 10 kilograms of mixed oxide fuel. For all seven capabilities, activity levels were below those projected by the ROD. Table 2.1.2-1 presents details.



Plutonium Complex at TA-55

³As defined in the SWEIS, a capability refers to the combination of buildings, equipment, infrastructure, and expertise necessary to undertake types or groups of activities and to implement mission assignments. Capabilities at LANL have been established over time, principally through mission assignments and activities directed by DOE Program Offices.

Table 2.1.2-1. Plutonium Complex/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Plutonium Stabilization	Recover, process, and store the existing plutonium inventory in eight years.	Highest priority items have been stabilized. The implementation plan is being modified between DOE and the Defense Nuclear Facilities Safety Board with a longer completion schedule.
Manufacturing Plutonium Components	Produce nominally 20 war reserve pits/yr. (Requires minor facility modifications.)	There were no war reserve pits produced or accepted by DOE for transfer to the nuclear stockpile. Four development pits were fabricated in preparation for eventual war reserve fabrication.
Surveillance and Disassembly of Weapons Components	Pit disassembly: Up to 65 pits/yr disassembled. Pit surveillance: Up to 40 pits/yr destructively examined and 20 pits/yr nondestructively examined.	Less than 65 pits were disassembled during 1999. Less than 40 pits were destructively examined as part of the stockpile evaluation program (pit surveillance) in 1999.
Actinide Materials and Science Processing, Research, and Development	Develop production disassembly capacity. Process up to 200 pits/yr, including a total of 250 pits (over 4 years) as part of disposition demonstration activities.	Fewer than 200 pits were disassembled/converted in 1999.
	Process neutron sources up to 5000 curies/yr. Process neutron sources other than sealed sources.	Neutron sources are not currently being disassembled and chemically processed.
	Process up to 400 kilograms/yr of actinides. ^b Provide support for dynamic experiments.	Less than 400 kilograms/yr of actinides were processed. Support was provided for dynamic experiments. Less than 12 pits/yr were processed through tritium separations in 1999.
	Process 1 to 2 pits/month (up to 12 pits/yr) through tritium separation.	In 1999, less than 48 uranium components were decontaminated.
	Perform decontamination of 28 to 48 uranium components per month.	Research supporting DOE actinide cleanup activities continued at low levels. No plutonium residues from Rocky Flats were processed.
	Research in support of DOE actinide cleanup activities. Stabilize minor quantities of specialty items. Research and development on actinide processing and waste activities at DOE sites, including processing up to 140 kilograms of plutonium as chloride salts from the Rocky Flats Environmental Technology Site.	Sample preparation and characterization continued.
	Conduct plutonium research and development and support. Prepare, measure, and characterize samples for fundamental research and development in areas such as aging, welding and bonding, coatings, and fire resistance.	

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Actinide Materials and Science Processing, Research, and Development (Cont.)	Fabricate and study nuclear fuels used in terrestrial and space reactors. Fabricate and study prototype fuel for lead test assemblies.	Minimal terrestrial and space reactor fuel development occurred in 1999.
	Develop safeguards instrumentation for plutonium assay.	Continued support of safeguards instrumentation development.
	Analyze samples in support of actinide reprocessing and research and development activities.	Analysis of actinide samples at TA-55 continued in support of actinide reprocessing and research and development activities.
Fabrication of Ceramic-Based Reactor Fuels	Build mixed oxide test reactor fuel assemblies and continue research and development on fuels.	Manufactured approximately 10 kg of mixed oxide fuel in 1999.
Plutonium-238 Research, Development, and Applications	Process, evaluate, and test up to 25 kg/yr plutonium-238. Recycle residues and blend up to 18 kg/yr plutonium-238.	Recovered approximately 0.5 kg of plutonium-238 and processed approximately 1.0 kg of plutonium-238 for heat source fuel in 1999.
Special Nuclear Materials (SNM) Storage, Shipping and Receiving	Store up to 6600 kilograms SNM in NMSF; continue to store working inventory in the vault in Building 55-4; ship and receive as needed to support LANL activities.	NMSF is not operational as a storage vault and there are no current plans to complete the modifications required to use the facility as a storage vault. Building 55-4 vault levels remained approximately constant at 1996 levels.
	Conduct nondestructive assay on SNM at NMSF to identify and verify the content of stored containers.	NMSF not operational as a storage vault and was not used for nondestructive assay.

^a Includes renovation of NMSF, construction of new technical support office building, and upgrades to enable the production of nominally 20 war reserve pits per year.

^b The actinide activities at the CMR Building and at TA-55 are expected to total 400 kilograms/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections that are not specific to the facility (but are related directly to the activities themselves) are only projected for the total of 400 kilograms/yr.

2.1.3 Operations Data for the Plutonium Complex

Details of operational data are presented in Table 2.1.3-1. Radioactive air emissions were less than one percent of projections (less than 2 curies in 1999 compared to 1000 curies projected), and quantities of wastes were also less than projected.

Table 2.1.3-1. Plutonium Complex/Operations Data

PARAMETER	UNITS ^a	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Plutonium-239 ^b	Ci/yr	2.70E-5	1.2E-7
Americium-241	Ci/yr	Not projected ^c	5.4E-8
Tritium in Water Vapor	Ci/yr	7.50E+2	3.1E-1
Tritium as a Gas	Ci/yr	2.50E+2	1.45E+0
Uranium-234	Ci/yr	Not projected ^c	2.0E-8
Uranium-238	Ci/yr	Not projected ^c	5.1E-8
NPDES Discharge ^d 03A181 ^e	MGY	14	8.54

PARAMETER	UNITS ^a	SWEIS ROD	1999 OPERATIONS
Wastes:			
Chemical	kg/yr	8400	2539
LLW ^f	m ³ /yr	754 ^g	340
MLLW	m ³ /yr	13 ^g	4
TRU/Mixed TRU	m ³ /yr	339 ^h	160
TRU	m ³ /yr	237 ^h	94
Mixed TRU	m ³ /yr	102 ^h	66
Number of Workers	FTEs	1111	589 ⁱ

^a Ci/yr = curies per year; MGY = million gallons per year; FTEs = full-time equivalent workers.

^b Projections for the SWEIS ROD were reported as plutonium or plutonium-239, the primary material at TA-55.

^c The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

^d NPDES is National Pollutant Discharge Elimination System.

^e This outfall discharged all four quarters during calendar year 1999.

^f LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; TRU = transuranic.

^g Includes estimates of waste generated by the facility upgrades associated with pit fabrication.

^h The ROD provided the data for TRU and Mixed TRU wastes in Chapter 3 and Chapter 5 of the SWEIS. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.

ⁱ The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include Protection Technology Los Alamos (PTLA), Johnson Controls Northern New Mexico (JCNNM), and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only University of California (UC) employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.2 Tritium Facilities (TA-16 and TA-21)

This Key Facility consists of tritium operations at TA-16 and TA-21. The tritium operations are conducted in three buildings: The Weapons Engineering Tritium Facility (WETF, Building TA-16-205), the Tritium Systems Test Assembly (TSTA, Building TA-21-155N), and the Tritium Science and Fabrication Facility (TSFF, Building TA-21-209). Operations involving the removal of tritium from actinide material are conducted at LANL's TA-55 Plutonium Facility; however, these operations are small in scale and were not included as part of the Tritium Facilities in the SWEIS.

The three facilities, (WETF, TSTA, and TSFF) have tritium inventories greater than 30 grams and thus are Category 2 nuclear facilities.

2.2.1 Construction and Modifications at the Tritium Facilities

No major upgrades were added to WETF at TA-16. Several of the existing systems were upgraded to provide additional capabilities. The remodeling of Building TA-16-450 was continued during 1999.

There have been no facility modifications made to the TA-21 facilities. In November 1999, DOE determined that the TSTA facility has completed its mission and the tritium will be removed from TSTA in the next several years. Only a limited experimental program will be carried out in the facility, and this program should be complete by June 2000.

2.2.2 Operations at the Tritium Facilities

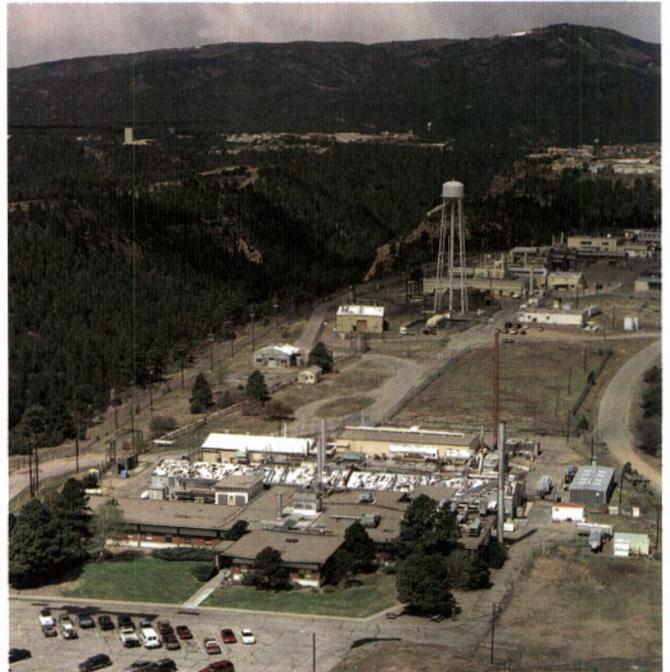
The ROD identified nine capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Table 2.2.2-1 lists the nine capabilities identified in the SWEIS and presents calendar year 1999 operational data for each of these capabilities. Operations in 1999 were below projections by the ROD and remained within the established environmental envelope. For example, approximately 19 high-pressure gas fill operations were conducted in 1999 (compared to 65 fills projected by the ROD), and approximately 14 gas boost system tests and gas processing operations were performed (compared to 35 projected by the ROD).

Table 2.2.2-1. Tritium Facilities/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
High-Pressure Gas Fills and Processing: WETF	Handling and processing of tritium gas in quantities of up to 100 grams at WETF with no limit on number of operations per year. Capability used approximately 65 times/yr.	Approximately 19 high-pressure gas fills and processing operations.
Gas Boost System Testing and Development: WETF	System testing and gas processing operations involving quantities of up to 100 grams. Capability used approximately 35 times/yr.	Approximately 14 gas boost tests and operations.
Cryogenic Separation: TSTA	Tritium gas purification and processing in quantities up to 200 grams. Capability used five to six times/yr.	One cryogenic separation operation.
Diffusion and Membrane Purification: TSTA, TSFF, WETF	Research on tritium movement and penetration through materials. Expect six to eight experiments/month. Capability also used continuously for effluent treatment.	Approximately zero. Capability not used for continuous effluent treatment.
Metallurgical and Material Research: TSTA, TSFF, WETF	Capability involves materials research including metal getter research and application studies. Small quantities of tritium supports tritium effects and properties research and development. Contributes <2% of LANL's tritium emissions to the environment.	Activities resulted in <1% tritium emissions from each facility.
Thin Film Loading: TSFF (WETF by 2001)	Chemical bonding of tritium to metal surfaces. Current application is for tritium loading of neutron tube targets; perform loading operations up to 3000 units/yr.	Approximately 600 units were loaded. Operations occurred at both TSFF and WETF.
Gas Analysis: TSTA, TSFF, WETF	Analytical support to current capabilities. Operations estimated to contribute <5% of LANL's tritium emissions to the environment.	Continues at all three facilities. No changes in facility emissions from this activity.
Calorimetry: TSTA, TSFF, WETF	This capability provides a measurement method for tritium material accountability. Contained tritium is placed in the calorimeter for quantity measurements. This capability is used frequently, but contributes <2% of LANL's tritium emissions to the environment.	Continues at WETF and TSFF. No changes in facility emissions from this activity.
Solid Material and Container Storage: TSTA, TSFF, WETF	Storage of tritium occurs in process systems, process samples, inventory for use, and as waste. On-site storage could increase by a factor of 10 over 1995 levels, with most of the increase occurring at WETF.	The storage at TSTA and TSFF remained constant. The storage at WETF has increased by approximately 10% over 1995 levels.

^a Includes the remodel of Building TA-16-450 to connect it to WETF in support of neutron tube target loading.

TA-21 Tritium Systems Test Assembly and Tritium
Science and Fabrication Facility



Weapons Engineering Tritium Facility



Typical glove box operation



2.2.3 Operations Data for the Tritium Facilities

Data for operations at the Tritium Facilities were below levels projected by the ROD. For example, radioactive air emissions totaled approximately 650 curies compared to 2500 curies projected by the ROD, and a total of 37 cubic meters of LLW were generated, compared to 480 projected. Operational data are summarized in Table 2.2.3-1.

Table 2.2.3-1. Tritium Facilities (TA-16 and TA-21)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
TA-16/WETF, Tritium as a gas	Ci/yr	3.00E+2	2.4E+1
TA-16/WETF, Tritium in water vapor	Ci/yr	5.00E+2	1.4E+2
TA-21/TSTA, Tritium as a gas	Ci/yr	1.00E+2	1.7E+1
TA-21/TSTA, Tritium in water vapor	Ci/yr	1.00E+2	4.9E+1
TA-21/TSFF, Tritium as a gas	Ci/yr	6.40E+2	9.2E+1
TA-21/TSFF, Tritium in water vapor	Ci/yr	8.60E+2	3.3E+2
NPDES Discharge: ^a			
Total Discharges	MGY	0.33	8.97
02A129 (TA-21)	MGY	0.11	8.83
03A158 (TA-21) ^b	MGY	0.22	0.14
Wastes:			
Chemical	kg/yr	1700	51.7
LLW	m ³ /yr	480	0
MLLW	m ³ /yr	3	0
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	123	28 ^c

^a Outfalls eliminated before 1999: 05S (TA-21), 03A036 (TA-21), 04A091 (TA-16).

^b This outfall only discharged two quarters during calendar year 1999.

^c The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.3 Chemistry and Metallurgy Research Building (TA-03)

The CMR Building Key Facility serves as a production, research, and support center for actinide chemistry and metallurgy research and analysis, uranium processing, and fabrication of weapon components. It consists of the main building (TA-3-29) and a pump house for RLW, TA-3-154. The main two-story building has a central corridor and seven wings. It is a Category 2 nuclear facility, primarily because of hot cell activities in Wing 9 and the quantities of nuclear material in the storage vault.

2.3.1 Construction and Modifications at the CMR Building

The ROD projected five facility modifications by December 2005:

- Phase I Upgrades to maintain safe operating conditions for 5 to 10 years;
- Phase II Upgrades (except seismic) to enable operations for an additional 20 to 30 years;
- modifications for production of targets for the molybdenum-99 medical isotope;
- modifications for the recovery of sealed neutron sources; and
- modifications for safety testing of pits in the Wing 9 hot cells.

During 1999, there was activity on two of these five, the Phase I Upgrades and the Phase II Upgrades. At the end of 1999, five of the 11 Phase I Upgrades remain to be completed. Projections of completion status for these project activities are shown in Table 2.3.1-1.

Table 2.3.1-1. CMR Upgrade Project/Phase I Status/December 1999

% COMPLETE	STATUS	UPGRADE
100	completed	0Continuous air monitors in building wings
080	continuing	0Wing electrical systems
070	work stopped ^a	0Power distribution system
090	work stopped ^a	0Stack monitoring system
090	continuing	0Interim improvements to the duct wash down system
040	work stopped ^a	0Improvements to acid vents and drains

^a Work stopped because of a hold put on CMR Phase I Upgrades by DOE.

Progress was made on three of the original 13 Phase II Upgrades during 1999. 'Upgrades to the Operations Center' and 'Upgrades to the Fire Protection System' were 25% complete at the end of 1999. The 'Standby Power for the Operations Center' activity was completed in 1999. No work was performed on the remaining 10 Phase II activities.

2.3.2 Operations at the CMR Building

The eight capabilities identified in the SWEIS for the CMR facility are presented in Table 2.3.2-1. For comparison purposes, levels at which these capabilities were operated during 1999 are listed.

Table 2.3.2-1. CMR Building (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Analytical Chemistry	Sample analysis in support of a wide range of actinide research and processing activities. Approximately 7000 samples/yr.	Approximately 2926 samples were analyzed.
Uranium Processing	Activities to recover, process, and store LANL highly enriched uranium inventory by 2005. Includes possible recovery of materials resulting from manufacturing operations.	Activities to recover and process highly enriched uranium were performed. Three shipments to Y-12 involved packaging and re-packaging.
Destructive and Nondestructive Analysis	Evaluate 6 to 10 secondaries/yr through destructive/nondestructive analysis and disassembly.	Performed nondestructive analysis on less than 10 secondaries.
Nonproliferation Training	Nonproliferation training involving SNM. No additional quantities of SNM, but may work with more types of SNM than in 1995.	Five weeks of SNM nonproliferation training conducted. Two weeks involved Category 2 quantities of SNM.
Actinide Research and Processing ^b	Process up to 5000 Ci/yr plutonium-238/beryllium and americium-241/beryllium neutron sources. Process neutron sources other than sealed sources. Stage up to 1000 plutonium-238/beryllium and americium-241/beryllium sources in Wing 9 floor holes.	No source processing activity.
	Introduce research and development effort on spent nuclear fuel related to long-term storage, and analyze components in spent and partially spent fuels.	No activity.

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Actinide Research and Processing ^b (Continued)	Metallurgical microstructural/chemical analysis and compatibility testing of actinides and other metals. Primary mission to study long-term aging and other material effects. Characterize about 100 samples/yr. Conduct research and development in hot cells on pits exposed to high temperatures.	Performed microstructural characterization tests on approximately 50 samples containing less than 20 grams of plutonium per sample. No research and development on pits exposed to high temperatures.
	Analysis of TRU waste disposal related to validation of the Waste Isolation Pilot Plant (WIPP) performance assessment models. TRU waste characterization. Analysis of gas generation such as could occur in TRU waste during transportation to WIPP. Performance Demonstration Program to test nondestructive analysis/nondestructive examination equipment. Demonstrate actinide decontamination technology for soils and materials. Develop actinide precipitation method to reduce mixed wastes in LANL effluents.	Final analysis conducted on experiments.
Fabrication and Metallography	Produce 1080 targets/yr, each containing approximately 20 grams uranium-235, for the production of molybdenum-99, plus an additional 20 targets/wk for 12 weeks. Separate fission products from irradiated targets to provide molybdenum-99. Ability to produce 3000 six-day curies of molybdenum-99/wk. ^c	No work performed.
	Support complete highly enriched uranium processing, research and development, pilot operations, and casting. Fabricate metal shapes, including up to 50 sets of highly enriched uranium components, using 1 to 10 kg highly enriched uranium per operation. Material recovered and retained in inventory. Up to 1000 kg annual throughput.	No activity.

^a Includes completion of Phase I and Phase II Upgrades, except for seismic upgrades, modifications for the fabrication of Molybdenum-99 (Mo-99) targets, modifications for the Radioactive Source Recovery Program, and modification for safety testing of pits.

^b The actinide activities at the CMR Building and at TA-55 are expected to total 400 kg/yr. The future split between these two facilities is not known, so the facility-specific impacts at each facility are conservatively analyzed at this maximum amount. Waste projections, which are not specific to the facility (but are related directly to the activities themselves), are only projected for the total of 400 kg/yr.

^c Mo-99 is a radioactive isotope that decays to form metastable Technetium-99, a radioactive isotope that has broad applications in medical diagnostic procedures. Both isotopes are short-lived, with half-lives (the time in which the quantity of the isotope is reduced by 50 percent) of 66 hours and 6 hours, respectively. These short half-lives make these isotopes both attractive for medical use (minimizes the radiation dose received by the patient) and highly perishable. Production of these isotopes is therefore measured in "six-day curies," the amount of radioactivity remaining after six days of decay, which is the time required to produce and deliver the isotope to hospitals and other medical institutions.

2.3.3 Operations Data for the CMR Building

Operations data from research, services, and production activities at the CMR Building were well below those projected by the ROD. Radioactive air emissions were less than one curie (compared to 1645 projected)—principally because processing of irradiated molybdenum-99 targets in the hot cells did not occur in 1999. In addition, only about ten percent of projected LLW were generated. Table 2.3.3-1 provides details of these and other operational data.

Table 2.3.3-1. Chemistry and Metallurgy Research Building (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Total Actinides ^a	Ci/yr	7.60E-4	3.0E-5
Krypton-85	Ci/yr	1.00E+2	Not measured ^b
Xenon-131m	Ci/yr	4.50E+1	Not measured ^b
Xenon-133	Ci/yr	1.50E+3	Not measured ^b
Tritium Water	Ci/yr	Negligible	Not measured ^b
Tritium Gas	Ci/yr	Negligible	Not measured ^b
Technetium-99	Ci/yr	Not projected ^c	9.2E-4
NPDES Discharge: 03A-021 ^d	MGY	0.53	4.45
Wastes:			
Chemical	kg/yr	10,800	6342
LLW	m ³ /yr	1820	188.5
MLLW	m ³ /yr	19	0.4
TRU/Mixed TRU	m ³ /yr	41 ^e	11.1
TRU	m ³ /yr	28 ^e	9.2
Mixed TRU	m ³ /yr	13 ^e	1.9
Number of Workers	FTEs	367	204 ^f

^a Includes uranium, plutonium, americium, and thorium.

^b Potential emissions during the period were sufficiently small that measurement of these radionuclides was not necessary to meet facility or regulatory requirements.

^c The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

^d This outfall discharged all four quarters during calendar year 1999.

^e The ROD provided the data for TRU and Mixed TRU wastes in Chapter 3 and Chapter 5 of the SWEIS. However, the projections made had to be modified to reflect the decision to produce nominally 20 pits per year.

^f The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.4 Pajarito Site (TA-18)

The Pajarito Site Key Facility is located entirely at TA-18. The facility consists of a main building (18-30), three outlying, remote-controlled critical assembly buildings known as kivas (18-23, -32, -116), and a number of additional support buildings, including the hillside vault (18-26). Principal activities are the design and performance of nuclear criticality experiments and detector development in support of emergency response, nonproliferation, and arms control. This Key Facility has five Category 3 nuclear facilities (the hillside vault for nuclear material storage, two kivas, and two additional research buildings) and one Category 2 nuclear facility (Kiva #2).

2.4.1 Construction and Modifications at the Pajarito Site

The ROD projected replacement of the portable linear accelerator (linac). However, this has not been done, nor did any major modifications or new construction projects occur during 1999.

2.4.2. Operations at the Pajarito Site

The SWEIS identified nine capabilities for this Key Facility. No new research capabilities have been added, and none have been deleted. The TA-18 facility experienced normal operations during 1999 and conducted 188 criticality experiments. This total of 188 experiments is approximately a factor of six below the ROD projection of a maximum of 1050 experiments in any given year. In addition, inventory levels remained essentially constant, and there was not a significant increase in nuclear weapons components and materials at the facility. Table 2.4.2-1 provides details.

Table 2.4.2-1. Pajarito Site (TA-18)/Comparison of Operations

ACTIVITIES	SWEIS ROD ^a	1999 OPERATIONS
Dosimeter Assessment and Calibration	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Detector Development	Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR ^b experiments, and materials processing. Increase nuclear materials inventory by 20%, and replace portable linac.	Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999. Did not replace the portable accelerator.
Materials Testing	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing.	Performed 188 experiments.
Subcritical Measurements	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.
Fast-Neutron Spectrum	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%, and increase nuclear weapons components and materials.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999. Slight increase in nuclear weapons components and materials in 1998, no additional increase in 1999.
Dynamic Measurements	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, LIDAR experiments, and materials processing. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.
Skyshine Measurements	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Vaporization	Perform up to 1050 criticality experiments per year.	Performed 188 experiments.
Irradiation	Perform up to 1050 criticality experiments per year. Develop safeguards instrumentation and perform research and development for nuclear materials, interrogation techniques, and field systems. Increase nuclear materials inventory by 20%.	Performed 188 experiments. Increased nuclear materials inventory by 5% in 1998, no additional increase in 1999.

^a Includes replacement of the portable linac. ^b Light detection and ranging.

2.4.3 Operations Data for the Pajarito Site

Research activities were well below those projected by the ROD; consequently, operations data were also well below projections. The chief environmental measure of activities at the Pajarito Site is the estimated radiation dose to a hypothetical member of the public, referred to as the maximally exposed individual (MEI). The dose estimated to result from 1999 activities was 2.6 millirem, compared to 28.5 millirem per year projected by the ROD. Chemical waste generation was below projections (1707 kilograms generated in 1999 compared to 4000 projected). Operational data are detailed in Table 2.4.3-1.

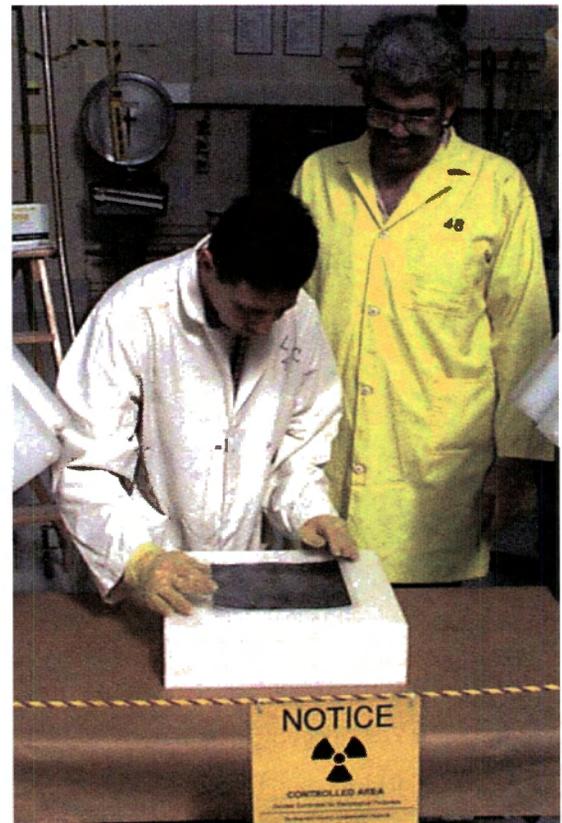
Table 2.4.3-1. Pajarito Site (TA-18)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions: Argon-41 ^a	Ci/yr	1.02E+2	4.9E-1
External Penetrating Radiation	mrem/yr	28.5 ^b	2.6
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	4000	1707
LLW	m ³ /yr	145	31.3
MLLW	m ³ /yr	1.5	7.9
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	95	70 ^c

^a These values are not stack emissions. The SWEIS ROD projections are from Gaussian plume dispersion modeling. Values are from the first 394-foot (120-meter) radius. Other isotopes (nitrogen-13 and oxygen-15) are not shown because of very short half-lives. Values for 1999 were estimated by using Monte Carlo modeling.

^b Page 5-116, Section 5.3.6.1, "Public Health," of the SWEIS.

^c The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time AND part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.



Class in criticality

Pajarito Site (TA-18)

2.5 Sigma Complex (TA-03)

The Sigma Complex Key Facility consists of four principal buildings: the Sigma Building (03-66), the Beryllium Technology Facility (BTF) (03-141), the Press Building (03-35), and the Thorium Storage Building (03-159). Primary activities are the fabrication of metallic and ceramic items, characterization of materials, and process research and development. This Key Facility has two Category 3 nuclear facilities (03-66 and 03-159).

2.5.1 Construction and Modifications at the Sigma Complex

The ROD projected significant facility changes for the Sigma Building itself. Table 2.5.1-1 below indicates that three of five planned upgrades have been completed.

Table 2.5.1-1. Upgrades Planned for Sigma, Building 03-66

DESCRIPTION	COMPLETED?
Seismic upgrades	No
Roof replacement	No ^a
Replacement of graphite collection systems	Yes—1998
Modification of the industrial drain system	Yes—1998
Replacement of electrical components	Yes—1999

^a Largely completed in 1998; continued into 1999.

In addition, although operations have not yet started, construction of the BTF, formerly known as the Rolling Mill Building, was completed during 1999. The BTF, a state-of-the-art beryllium processing facility, has 16,000 square feet of floor space, of which 13,000 are used for beryllium operations. The remaining 3000 square feet will be used for general metallurgical activities. Mission of the new facility is to maintain and enhance the beryllium technology base that exists at LANL, and to establish the capability for fabrication of beryllium powder components. Research will also be conducted at the BTF, and will include energy and weapons-related use of beryllium metal and beryllium oxide. As discussed in Section 2.8, Machine Shops, beryllium equipment will be moved from the shops into the BTF in stages, and the move should be completed in 2000.

2.5.2 Operations at the Sigma Complex

The SWEIS identified three capabilities for the Sigma Complex. No new capabilities have been added, and none have been deleted. As indicated in Table 2.5.2-1, activity levels for all capabilities were less than levels projected by the ROD.

Table 2.5.2-1. Sigma Complex (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Research and Development on Materials Fabrication, Coating, Joining, and Processing	Maintain and enhance capability to fabricate items from metals, ceramics, salts, beryllium, enriched uranium, depleted uranium, and other uranium isotope mixtures including casting, forming, machining, polishing, coating, and joining.	Capability maintained and enhanced, as projected.
Characterization of Materials	Maintain and enhance research and development activities on properties of ceramics, oxides, silicides, composites, and high-temperature materials. Characterize components for accelerator production of tritium.	Modest increase in research and development. Totals of 248 jobs and 1300 specimens.
	Analyze up to 36 tritium reservoirs/yr.	Less than 36 tritium reservoirs analyzed.

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Characterization of Materials (Continued)	Develop library of aged non-SNM materials from stockpiled weapons and develop techniques to test and predict changes. Store and characterize up to 2500 non-SNM component samples, including uranium.	Approximately 500 non-SNM materials samples and 500 non-SNM component samples stored in library.
Fabrication of Metallic and Ceramic Items	Fabricate stainless steel and beryllium components for about 80 pits/yr.	No development pits fabricated.
	Fabricate up to 200 tritium reservoirs per year.	Less than 200 tritium reservoirs fabricated.
	Fabricate components for up to 50 secondaries per year.	Fabricated components for less than 50 secondaries.
	Fabricate nonnuclear components for research and development: about 100 major hydrotests and 50 joint test assemblies/yr.	Fabricated components for less than 100 major hydrotests and for less than 50 joint test assemblies.
	Fabricate beryllium targets.	None produced.
	Fabricate targets and other components for accelerator production of tritium research.	Three radiofrequency cavities produced.
	Fabricate test storage containers for nuclear materials stabilization.	None produced.
	Fabricate nonnuclear (stainless steel and beryllium) components for up to 20 pit rebuilds/yr.	Fabricate nonnuclear (stainless steel and beryllium) components for less than 20 pit rebuilds/yr.

^a Includes Sigma Building renovation and modifications for BTF.

2.5.3 Operations Data for the Sigma Complex

Levels of research and operations were less than those projected by the ROD; consequently, operations data were also below projections. Waste volumes, radioactive air emissions, and NPDES discharge volumes were all lower than projected by the ROD. Table 2.5.3-1 provides details.

Table 2.5.3-1. Sigma Complex (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions: ^a			
Uranium-234	Ci/yr	6.60E-5	1.2E-6
Uranium-235	Ci/yr	Not projected ^b	4.5E-8
Uranium-238	Ci/yr	1.80E-3	1.3E-8
Thorium-230	Ci/yr	Not projected ^b	6.4 E-9
NPDES Discharge:			
Total Discharges	MGY	7.3	5.77
03A-022 ^c	MGY	4.4	5.77
03A-024	MGY	2.9	No discharge
Wastes:			
Chemical	kg/yr	10,000	3,208
LLW	m ³ /yr	960	61
MLLW	m ³ /yr	4	0.3
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	284	101 ^d

^a Only emissions from TA-3-35 were measured using stack sampling. Potential emissions from other Sigma facilities were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements. (continued)

^b The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

^c This outfall discharged all four quarters during calendar year 1999.

^d The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.6 Materials Science Laboratory (TA-03)

The MSL Key Facility is a single laboratory building (03-1698) containing 27 labs, 60 offices, 21 materials research areas, and support rooms. The building, a two-story structure with approximately 55,000 square feet of floor space, was first opened in November 1993. Activities are all related to research and development of materials science. This Key Facility is categorized as a Low Hazard nonnuclear facility.

2.6.1 Construction and Modifications at the MSL

There were no facility modifications during 1999. As indicated in the SWEIS, completion of the second floor is under consideration, but has not yet been funded.

2.6.2 Operations at the MSL

The SWEIS identified four major types of experimentation at MSL: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. No new capabilities have been added, and none have been deleted. In 1999, similar to 1998, MSL conducted operations at levels approximating those projected in the ROD. This is not surprising since MSL is a new facility that responds to the variability of research and development funding.

There were approximately 105 researchers and support staff at MSL, about 30% more than the 82 projected by the ROD. (The primary measurement of activity for this facility is the number of scientists doing research.) This increase was accomplished by having researchers share offices and labs and reflects the high value placed on the MSL because of its quality lab space. Table 2.6.2-1 compares 1999 operations to projections made by the ROD.

Table 2.6.2-1. MSL (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Materials Processing	Maintain seven research capabilities at 1995 levels: <ul style="list-style-type: none"> • Wet chemistry • Thermomechanical processing • Microwave processing • Heavy equipment materials • Single crystal growth • Amorphous alloys • Powder processing Expand materials synthesis/processing to develop cold mock-up of weapons assembly and processing. Expand materials synthesis/processing to develop environmental and waste technologies.	These capabilities were maintained as projected in the ROD.
Mechanical Behavior in Extreme Environment	Maintain two research capabilities at 1995 levels: <ul style="list-style-type: none"> • Mechanical testing • Fabrication and assembly Expand dynamic testing to include research and development for the aging of weapons materials. Develop a new research capability (machining technology).	Mechanical testing was maintained as projected. Research into materials failure and fracture continued.

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Advanced Materials Development	Maintain four research capabilities at 1995 levels of research: <ul style="list-style-type: none"> • New materials • Synthesis and characterization • Ceramics • Superconductors 	This capability was maintained as projected in the ROD.
Materials Characterization	Maintain four research capabilities at 1995 levels: <ul style="list-style-type: none"> • Surface science chemistry • X-ray • Optical metallography • Spectroscopy Expand corrosion characterization to develop surface modification technology. Expand electron microscopy to develop plasma source ion implantation.	Materials characterization continued to be maintained.

^a Includes completion of the second floor of MSL.

2.6.3 Operations Data for the MSL

The overall size of the MSL workforce has increased from approximately 80 workers in 1995 to about 105 in 1999 (including visiting staff, contractors, and others not included in the regular part-time and full-time LANL employees listed in Table 2.6.3-1) and significantly exceeds the workforce of 82 projected by the ROD. The operational effects of this increased workforce and of increased activity, however, have been smaller than projected. Waste quantities were lower than projected, and radioactive air emissions continue to be negligible and therefore were not measured. Table 2.6.3-1 provides details.

Table 2.6.3-1. MSL (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions	Ci/yr	Negligible	Not measured
NPDES Discharge Volume	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	600	154
LLW	m ³ /yr	0	0
MLLW	m ³ /yr	0	0
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	82	57 ^a

^a The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.7 Target Fabrication Facility (TA-35)

The TFF is a two-story building (35-213) housing activities related to weapons production and laser fusion research. This Key Facility is categorized a Low Hazard chemical facility. Exhaust air from process equipment is filtered before exhausting to the atmosphere. Sanitary wastes are piped to the LANL sewage facility at TA-46, and RLW is piped to the treatment facility at TA-50.

2.7.1 Construction and Modifications at the Target Fabrication Facility

The ROD did not project any facility changes through 2005, and there were none during 1999.

2.7.2 Operations at the Target Fabrication Facility

The SWEIS identified three capabilities for the TFF Key Facility. No new capabilities have been added, and none have been deleted. The primary measurement of activity for this facility is production of targets for research and testing (laser and physics testing). In 1999, approximately 1200 targets and specialized components were fabricated for testing purposes, which is less than the 6100 targets per year projected by the ROD. As seen in the Table 2.7.2-1, other operations at the TFF were also below levels projected by the ROD.

Table 2.7.2-1. Target Fabrication Facility (TA-35)/Comparison of Operations

CAPABILITY	SWEIS ROD	1999 OPERATIONS
Precision Machining and Target Fabrication	Provide targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Provided targets and specialized components for about 1200 tests. Supported high-explosive pulsed-power tests at 1995 levels. Supported about 25 high-energy-density physics tests.
Polymer Synthesis	Produce polymers for targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, and including about 100 high-energy-density physics tests.	Produced polymers for targets and specialized components for about 600 tests. Supported high-explosive pulsed-power tests at 1995 levels. Supported about 20 high-energy-density physics tests.
Chemical and Physical Vapor Deposition	Coat targets and specialized components for about 6100 laser and physics tests/yr, including a 20% increase over 1995 levels in high-explosive pulsed-power target operations, including about 100 high-energy-density physics tests, and including support for pit rebuild operations at twice 1995 levels.	Coated targets and specialized components for about 600 tests. Supported high-explosives pulsed-power tests at 1995 levels. Supported about 25 high-energy-density physics tests. Provided coatings for pit rebuild operations.

2.7.3 Operations Data for the Target Fabrication Facility

TFF activity levels are primarily determined by funding from fusion, energy, and other research-oriented programs, as well as funding from some defense-related programs. These programs, and hence operations at TFF, were at levels similar to those in 1995 and below levels projected by the ROD. This summary is supported by the current workforce, which is the same size as in 1995, and by 1999 waste volumes, which were less than projected. Table 2.7.3-1 details operations data for 1999.

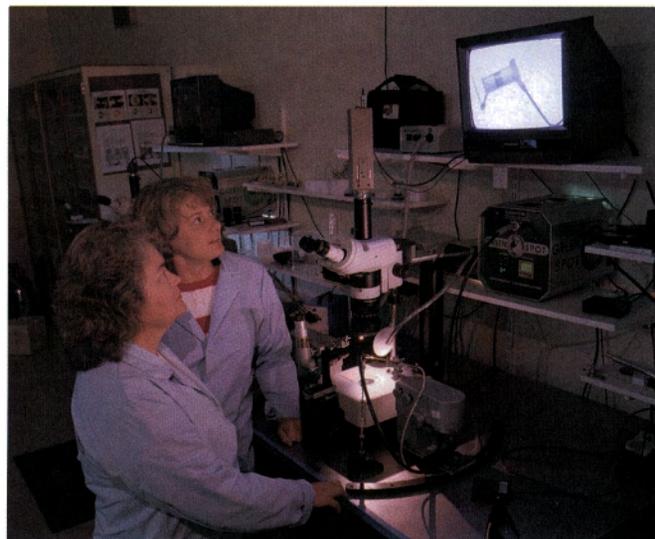


Table 2.7.3-1. Target Fabrication Facility (TA-35)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radiological Air Emissions	Ci/yr	Negligible	Not measured ^a
NPDES Discharge: ^b	No discharge	0	No outfalls
Wastes:			
Chemical	kg/yr	3800	595
LLW	m ³ /yr	10	0
MLLW	m ³ /yr	0.4	0
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	98	54 ^c

^a Potential emissions during the period were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.

^b Outfalls eliminated before 1999: 04A127 (TA-35)

^c The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 3.6, Socioeconomics) is not appropriate.

2.8 Machine Shops (TA-03)

The Machine Shops Key Facility consists of two buildings, the Beryllium Shop (Building 03-39) and the Uranium Shop (Building 03-102). Activities consist of machining and fabrication of various materials in support of major LANL operations, principally those related to the processing and testing of high explosives and weapons components. Building 03-39 is categorized as a Low Hazard chemical facility, attributed in part to beryllium operations, while Building 03-102 is categorized as a Low Hazard radiological facility, because of uranium operations.

2.8.1 Construction and Modifications at the Machine Shops

There was no new construction or major modifications to the shops in 1999. In the future, beryllium equipment will be moved from Room 16 in the north wing of Building 03-39 to Building 03-141, the BTF (part of the Sigma Key Facility). The move will be conducted in phases and should be completed in the year 2000.

2.8.2 Operations at the Machine Shops

As shown in Table 2.8.2-1, the SWEIS identified three major capabilities at the shops. These same three capabilities continue to be maintained to support customers at LANL. No new capabilities have been added to this Key Facility, and none have been deleted. All activities occurred at levels well below those projected by the ROD. The workload at the Shops is directly linked with high explosives testing and processing operations. Much of the effort of staff for high explosive testing and processing in 1999 was directed to the development and construction of the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility. This resulted in a significant decrease in high explosive testing and production, and subsequently, a significant reduction in workload for the Shops.



Machine Shops showing numerical-controlled machines

Table 2.8.2-1. Machine Shops (TA-03)/Comparison of Operations

CAPABILITY	SWEIS ROD	1999 OPERATIONS
Fabrication of Specialty Components	Provide fabrication support for the dynamic experiments program and explosives research studies. Support up to 100 hydrodynamic tests/yr. Manufacture up to 50 joint test assembly sets/yr. Provide general laboratory fabrication support as requested.	Specialty components were fabricated at levels far below those projected in the SWEIS ROD.
Fabrication Utilizing Unique Materials	Continue fabrication utilizing unique and unusual materials.	Fabrication with unique materials was conducted at levels far below those projected by the SWEIS ROD.
Dimensional Inspection of Fabricated Components	Provide appropriate dimensional inspection of above fabrication activities. Undertake additional types of measurements/inspections.	Dimensional inspection was provided for the above fabrication activities. Additional types of measurements and inspections were not undertaken.

2.8.3 Operations Data for the Machine Shops

Since activities were well below projections by the ROD, so too were operations data. Chemical waste generation was less than 0.1% of projected generation (3955 kilograms generated in 1999, compared to a ROD projection of 474,000 kilograms per year). Table 2.8.3-1 provides details.

Table 2.8.3-1. Machine Shops (TA-03)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Thorium-228	Ci/yr	Not projected ^a	2.5E-9
Thorium-230	Ci/yr	Not projected ^a	7.8E-10
Thorium-232	Ci/yr	Not projected ^a	5.4E-10
Uranium-234	Ci/yr	Not projected ^a	3.0E-7
Uranium-235	Ci/yr	Not projected ^a	1.2E-8
Uranium-238	Ci/yr	1.50E-4	1.3E-8
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes:			
Chemical	kg/yr	474,000	3955
LLW	m ³ /yr	606	40.4
MLLW	m ³ /yr	0	0.03
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	289	81 ^b

^a The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

^b The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.9 High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, TA-37)

The High Explosives Processing Key Facility is located in all or parts of seven TAs. Building types consist of production and assembly facilities, analytical laboratories, explosives storage magazines, and a facility for the treatment of high explosive contaminated wastewaters. Activities consist primarily of the manufacture and assembly of high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. Production activities are centered in buildings at TA-16, TA-09, and TA-22. Environmental and safety tests are performed at TA-11 and TA-09 while TA-08 houses radiography activities. This Key Facility has four Category 2 nuclear buildings in TA-08 (08-22, -23, -24, -70) and no Category 3 nuclear or Moderate Hazard nonnuclear facilities.

Operations at this Key Facility are performed by two separate Divisions: the Dynamic Experimentation (DX) Division and the Engineering Sciences and Applications (ESA) Division. As a result, information from both Divisions must be combined to completely capture operational parameters for this Key Facility.

2.9.1 Construction and Modifications at High Explosives Processing

The ROD projected four facility modifications for this Key Facility. All four projects were completed before 1999.

Facility changes that occurred during 1999 are described below.

(a) At TA-9, an above ground wastewater storage tank system was placed into service on December 17, 1999. This system collects wastewater that is then moved by truck to the High Explosive Wastewater Treatment Facility (HEWTF) TA-16 for treatment. This project is covered by a separate NEPA document (LANL 1998b).

(b) The real time, small component radiography capability installed in building TA-16-260 was not made fully operational in 1999. When this capability becomes fully operational, buildings TA-16-220, -222, -223, -224, -225, and -226 will be vacated (DOE 1997a).

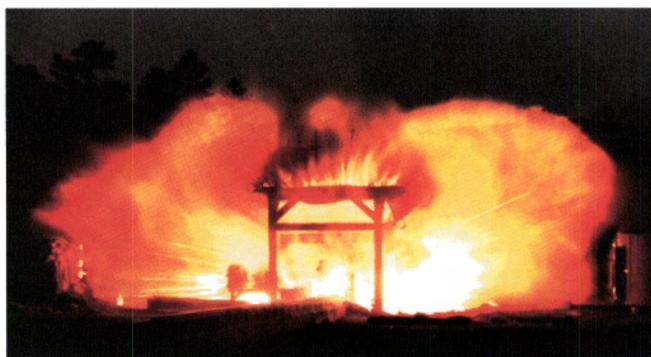
(c) Planning and modification work at TA-9 has continued to allow consolidation of high explosives formulation operations previously conducted at TA-16-340 with other TA-9 high explosives operations. Closure of building TA-16-340 will follow in fiscal year 2000 (DOE 1999c).

(d) In 1999, explosives stored at TA-28 were moved to TA-37 for storage. Although TA-28 is no longer used for storage, it remains part of the High Explosives Processing Key Facility.

2.9.2 Operations at High Explosives Processing

The ROD identified six capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. Activity levels during 1999 continued below those projected by the ROD. These projections were based on the possibility that LANL would take over high explosives production work being performed at Pantex Plant. DOE has decided, however, to keep high explosives production at the Pantex Plant.

As seen in Table 2.9.2-1, high explosives and plastics development and characterization operations remained below levels projected in the SWEIS ROD. Considerable effort was expended during 1999 in continued development of protocols for obtaining stockpile returned materials, developing new test methods, and procuring new equipment to support requirements for science-based studies on stockpile materials.



Typical nonnuclear high explosive test

Table 2.9.2-1. High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Comparison of Operations

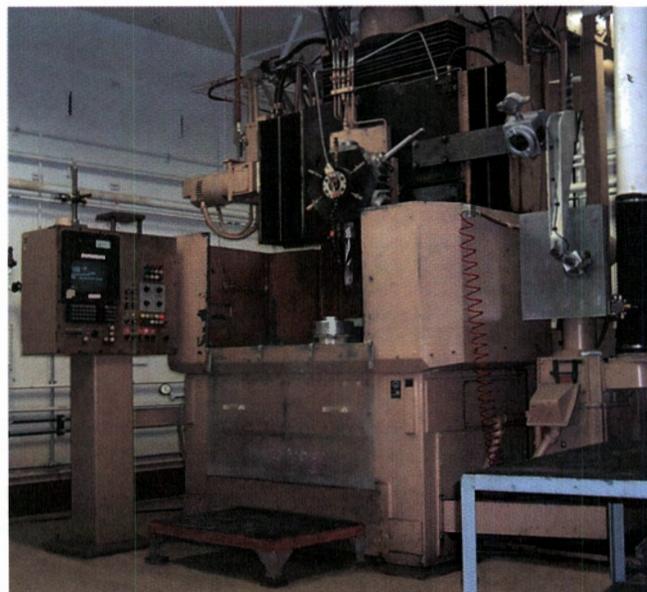
CAPABILITY	SWEIS ROD ^{a, b}	1999 OPERATIONS
High Explosives Synthesis and Production	Continue synthesis research and development, produce new materials, and formulate explosives as needed. Increase production of materials for evaluation and process development. Produce material and components for directed stockpile production.	The high explosives synthesis and production operations were less than those projected by the SWEIS ROD.
High Explosives and Plastics Development and Characterization	Evaluate stockpile returns. Increase (40%) efforts in development and characterization of new plastics and high explosives for stockpile improvement. Improve predictive capabilities. Research high explosives waste treatment methods.	High explosives formulation, synthesis, production, and characterization operations were performed at levels that were less than those projected by the SWEIS ROD.
High Explosives and Plastics Fabrication	Continue traditional stockpile surveillance and process development. Supply parts to Pantex for surveillance, stockpile rebuilds, and joint test assemblies. Increase fabrication for hydrodynamic and environmental testing.	DX Division fabricated approximate 3000 high explosive parts, and ESA Division fabricated approximately 870 high explosives parts in 1999. Therefore, approximately 3870 parts were fabricated in support of the weapons program including high explosives characterization studies, subcritical experiments, hydrotests, surveillance activities, environmental weapons tests, and safety tests.
Test Device Assembly	Increase test device assembly to support stockpile related hydrodynamic tests, joint test assemblies, environmental and safety tests, and increased research and development. Approximately 100 major assemblies per year.	ESA Division provided 10 major assemblies for hydrodynamic, Nevada Test Site subcritical, and joint environmental test programs.
Safety and Mechanical Testing	Increase (50%) safety and environmental tests related to stockpile assurance. Improve predictive models. Approximately 15 safety and mechanical tests per year.	DX Division performed 13 stockpile related safety and mechanical tests during 1999. ESA Division provided three re-validation and two certification assemblies in 1999.
Research, Development, and Fabrication of High-Power Detonators	Increase operations to support assigned stockpile stewardship management activities; manufacture up to 40 major product lines per year. Support DOE complex for packaging and transportation of electro-explosive devices.	High-power detonator activities by DX Division resulted in the manufacture of 20 product lines in 1999. In addition, ESA Division provided fourteen flux generator assemblies in 1999.

^a The total amount of explosives and mock explosives used across all activities is an indicator of overall activity levels for this Key Facility. Amounts projected by the ROD are 82,700 pounds of explosives and 2910 pounds of mock explosives. Actual amounts used in 1999 were 15,150 pounds of high explosive (DX Division, 8150 pounds and ESA Division, 7000 pounds), and 5279 pounds of mock high explosive (DX Division, 1750 pounds and ESA Division, 3529 pounds).

^b Includes construction of the HEWTF, the steam plant conversion, relocation of the Weapons Testing Facility, and outfall modifications.

In 1999, 15,664 pounds of high explosives and 5279 pounds of inert mock high explosives material were used. The level of high explosives usage was significantly below the ROD projection of 82,700 pounds of high explosives, while the usage of mock high explosives was almost twice the projection of 2910 pounds. However, the mock high explosive results in chemical waste that is shipped off-site for disposal and does not result in environmental impacts at LANL.

At the TA-16 Burn Ground, 5225 pounds of high explosives-contaminated materials were flashed, and 7514 pounds of high explosives and 3080 pounds of oil/solvent were open air burned. The HEWTF processed 95,778 gallons of high explosives-contaminated water. Again, these levels were well below those projected by the ROD. Three outfalls from High Explosives Processing remain on the NPDES permit: 03A130, 05A055 (the HEWTF), and 05A097.



Drill press used for machining high explosives

2.9.3 Operations Data for High Explosives Processing

The details of operations data are provided in Table 2.9.3-1. NPDES discharge volume was 118,000 gallons, compared to a projection of 12 million gallons. Waste quantities were similar to projections made by the ROD. Chemical waste volumes were slightly above projections; however, since chemical wastes are shipped off-site for disposal, this is not significant.

Table 2.9.3-1. High Explosives Processing (TA-08, TA-09, TA-11, TA-16, TA-22, TA-28, and TA-37)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Uranium-238	Ci/yr	9.96E-7	^a
Uranium-235	Ci/yr	1.89E-8	^a
Uranium-234	Ci/yr	3.71E-7	^a
NPDES Discharge: ^b			
Number of outfalls		22	3
Total Discharges	MGY	12.4	0.118
03A130 (TA-11) ^c	MGY	0.04	0.022
05A055 (TA-16)	MGY	0.13	0.096
05A097 (TA-11)	MGY	0.01	No discharge
Wastes:			
Chemical	kg/yr	13,000	13,329
LLW	m ³ /yr	16	8.3
MLLW	m ³ /yr	0.2	0
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	335	96 ^d

^a No stacks require monitoring; all non-point sources are measured using ambient monitoring.

^b Outfalls eliminated before 1999: 02A007 (TA-16), 04A070 (TA-16), 04A083 (TA-16), 04A092 (TA-16), 04A115 (TA-8), 04A157 (TA-16), 05A053 (TA-16), 05A056 (TA-16), 05A066 (TA-9), 05A067 (TA-9), 05A068 (TA-9), 05A069 (TA-11), 05A071 (TA-16), 05A072 (TA-16), 05A096 (TA-11), 06A073 (TA-16), 06A074 (TA-8), and 06A075 (TA-8).

^c This outfall discharged only one quarter during calendar year 1999.

^d The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.10 High Explosives Testing (TA-14, TA-15, TA-36, TA-39, TA-40)

The High Explosives Testing Key Facility is located in all or parts of five TAs, comprises about one-third of the land area occupied by LANL, and has 13 associated firing sites. All firing sites are in remote locations and/or within canyons. Major buildings are located at TA-15 and include the DARHT facility (Building TA-15-312), PHERMEX (TA-15-184), and the TA-15-306 firing site supporting the Ector Multidiagnostic Hydrodynamic Test Facility. Building types consist of preparation and assembly facilities, bunkers, analytical laboratories, explosives storage magazines, and offices. Activities consist primarily of testing high explosives components for nuclear weapons and for Science-Based Stockpile Stewardship Program tests and experiments. This Key Facility has no Category 2 or Category 3 nuclear buildings and no Moderate Hazard nonnuclear facilities.

2.10.1 Construction and Modifications at High Explosives Testing

Construction of DARHT, the only high explosive testing facility projected for construction or modification by the ROD, continued. This facility was evaluated in a separate environmental impact statement (DOE 1995). Installation and component testing of the accelerator and its associated control and diagnostics systems began in 1999.

The Applied Research Optics Electronics Laboratory (TA-15-494) was also under construction in 1999. This is a new office and laboratory building with an adjacent parking lot to consolidate and upgrade existing computer operations at TA-15 and to provide space for visiting scientists. This project has a NEPA categorical exclusion (LANL 1998c).

In addition, outfall 06A106 located at TA-36 was eliminated from the NPDES permit during 1999.

2.10.2 Operations at High Explosives Testing

The ROD identified seven capabilities for this Key Facility. None of these have been deleted, and no new capabilities have been introduced. Levels of research were below those predicted by the ROD and, for some capabilities, below research levels of prior years. Table 2.10.2-1 identifies the operational capabilities discussed in the SWEIS and presents 1999 operational data for comparative purposes. The total amount of depleted uranium expended during testing (all capabilities) is an indicator of overall activity levels at this Key Facility. A total of 67 kilograms were expended in 1999, compared to approximately 3900 kilograms projected by the ROD.

Table 2.10.2-1. High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40)/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Hydrodynamic Tests	Conduct up to 100 hydrodynamic tests/yr. Develop containment technology. Conduct baseline and code development tests of weapons configuration. Depleted uranium use of 6900 lb/yr (over all activities).	Hydrodynamic tests were conducted in 1999 at a level far below those projected in the SWEIS
Dynamic Experiments	Conduct dynamic experiments to study properties and enhance understanding of the basic physics of state and motion for materials used in nuclear weapons including some experiments with SNM.	Dynamic experiments were conducted at a level far below those projected in the SWEIS
Explosives Research and Testing	Conduct high explosives tests to characterize explosive materials.	Explosives research and testing were conducted at a level far below those projected in the SWEIS
Munitions Experiments	Continued support of Department of Defense in conventional munitions. Conduct experiments with projectiles and study other effects on munitions.	Munitions experiments were conducted at a level far below those projected in the SWEIS

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
High-Explosives Pulsed-Power Experiments	Conduct experiments and development tests.	Experiments were conducted at a level far below those projected in the SWEIS
Calibration, Development, and Maintenance Testing	Conduct tests to provide calibration data, instrumentation development, and maintenance of image processing capability.	Calibration, development, and maintenance testing were conducted at a level far below those projected in the SWEIS
Other Explosives Testing	Develop advanced high explosives or weapons evaluation techniques.	Other explosives testing were conducted at a level far below those projected in the SWEIS

^a Includes completion of construction for the DARHT facility and its operation.

2.10.3 Operations Data for High Explosives Testing

Much staff effort for high explosives processing and testing in 1999 was directed to the development and construction of DARHT. This resulted in a significant decrease in high explosives testing and production operations from historical levels. As a result, and as presented in Table 2.10.3-1, operations data indicate that materials used and the effects of research during 1999 were considerably less than projections made by the ROD. For example, only 1015 kilograms of chemical waste were generated in 1999 compared to a projected 35,300 kilograms per year. Only 0.01 cubic meters of LLW was generated compared to the projection of 940 cubic meters. In addition, no other radioactive wastes (MLLW, TRU wastes, or mixed TRU wastes) were generated in 1999.

Table 2.10.3-1. High Explosives Testing (TA-14, TA-15, TA-36, TA-39, and TA-40) Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions: Depleted Uranium	Ci/yr	1.5E-1 ^a	^b
Chemical Usage: ^c			
Aluminum ^d	kg/yr	45,450	688
Beryllium	kg/yr	90	0.5
Copper ^d	kg/yr	45,630	41
Depleted Uranium	kg/yr	3930	67
Lead	kg/yr	240	0.5
Tantalum	kg/yr	300	0.2
Tungsten	kg/yr	300	0
NPDES Discharge:			
Number of outfalls ^e	----	14	2
Total Discharges	MGY	3.6	14.23
03A028 (TA-15) ^f	MGY	2.2	2.81
03A185 (TA-15) ^g	MGY	0.73	11.42
Wastes:			
Chemical	kg/yr	35,300	1015
LLW	m ³ /yr	940	0.01
MLLW	m ³ /yr	0.9	0
TRU/Mixed TRU ^h	m ³ /yr	0.2	0
Number of Workers	FTEs	619	227 ⁱ

^a The isotopic composition of depleted uranium is approximately 99.7% uranium-238, approximately 0.3% uranium-235, and approximately 0.002% uranium-234. Because there are no historic measurements of emissions from these sites, projections are based on estimated release fractions of the materials used in tests.

(Continued)

^b No stacks require monitoring; all non-point sources are measured using ambient monitoring. During 1999, a total of 67 kg of depleted uranium was expended during these activities.

^c Usage listed for the SWEIS ROD includes projections for expanded operations at DARHT as well as the other TA-15 firing sites (the highest foreseeable level of such activities that could be supported by the LANL infrastructure). No proposals are currently before DOE to exceed the material expenditures at DARHT that are evaluated in the DARHT Environmental Impact Statement (DOE 1995).

^d The quantities of copper and aluminum involved in these tests are used primarily in the construction of support structures. These structures are not expended in the explosive tests, and thus, do not contribute to air emissions.

^e Outfalls eliminated before 1999: 04A101 (TA-40), 04A139 (TA-15), 04A141 (TA-39), 04A143 (TA-15), 04A156 (TA-39), 06A080 (TA-40), 06A081 (TA-40), 06A082 (TA-40), 06A099 (TA-40), and 06A123 (TA-15).

^f This outfall discharged during three quarters of calendar year 1999. The annual quantity of discharge was calculated by using the average daily flow and multiplying by 365 days in the year; this results in an overestimate of volume.

^g This outfall discharged during all four quarters of calendar year 1999. The annual quantity of discharge was calculated by using the average daily flow and multiplying by 365 days in the year; this results in an overestimate of volume.

^h TRU waste (steel) will be generated as a result of DARHT's Phased Containment Option (see DARHT Environmental Impact Statement [DOE 1995]).

ⁱ The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (full-time and part-time regular). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.11 Los Alamos Neutron Science Center (TA-53)

The LANSCE Key Facility lies entirely within TA-53. The facility has more than 400 buildings, including one of the largest at LANL. Building 53-03 houses the linac. Activities consist of neutron science research, the development of accelerators and diagnostic instruments, and the production of medical radioisotopes. The majority of the LANSCE Key Facility is composed of the 800-MeV linac, a Proton Storage Ring, and three experimental areas: the Manuel Lujan Neutron Scattering Center, the Weapons Neutron Research (WNR) facility, and Experimental Areas A/B/C. Experimental Area C is the location of proton radiography experiments for the Stockpile Stewardship Program. Experimental Area A, formerly used for materials irradiation experiments and isotope production, is currently inactive, and a new isotope production facility will be constructed at Experimental Area A in the near future. Construction of a second accelerator, the Low-Energy Demonstration Accelerator (LEDA), began in 1997. LEDA is currently in the commissioning phase.

This Key Facility has two Category 3 nuclear activities, experiments using neutron scattering by actinides in Experimental Areas ER-1 and ER-2 (Buildings 53-07 and 53-30) and the 1L neutron production target (Building 53-07). There are no Category 2 nuclear facilities and no Moderate Hazard nonnuclear facilities at TA-53.

2.11.1 Construction and Modifications at LANSCE

The ROD projected significant facility changes and expansion to occur at LANSCE by December 2005. Table 2.11.1-1 below indicates that one project has been completed and that two have been started.

Table 2.11.1-1. Status of Projected Facility Changes at LANSCE

DESCRIPTION	SWEIS REF.	COMPLETED?
Closure of two former sanitary lagoons	2-88-R	Started ^a
LEDA to become operational in late 1998	2-89-R	Yes - 1999 ^b
Short-Pulse Spallation Source enhancements	2-90-L	Started ^c
One-MW target/blanket	2-91-L	No
New 100-MeV Isotope Production Facility	2-92-L	No ^d
Long-Pulse Spallation Source (LPSS), including decontamination and renovation of Area A	3-25-L	No
Dynamic Experiment Lab	3-25-R	No ^e
Los Alamos International Facility for Transmutation (LIFT)	3-25-R	No
Exotic Isotope Production Facility	3-27-L	No
Decontamination and renovation of Area A-East	3-27-L	No

^a Remediation started in 1999.

^b LEDA started high-power conditioning of the radio-frequency quadrupole power supply in November 1998. It has been designed for a maximum energy of 12 MeV, not the 40 MeV projected by the ROD. The first trickle of proton beam was produced in March 1999. Maximum power was achieved in September 1999.

(Continued)

^c Part of the Short-Pulse Spallation Source upgrades have been performed. Upon completion, the project will upgrade the Proton Storage Ring to 200 microamperes and 30 hertz (vs. 70 microamperes and 20 hertz in 1995); will increase the Lujan spallation target power to 160 KW (vs. 55 KW in 1995); and will add five neutron-scattering instruments. Through the end of 1998, the first phase of the Proton Storage Ring upgrade had been completed. Installation of new instruments began in 1999. The complete upgrade is expected in 2002.

^d Preparations began in the spring of 1999 for construction of the new 100-MeV Isotope Production Facility. Construction started in 2000.

^e The Stockpile Stewardship Program is currently using Experimental Area C, Building 53-03P, for proton radiography, and the Blue Room, in Building 53-07 for neutron resonance spectroscopy. The concept of combining these experiments in a new Dynamic Experiment Laboratory has not yet materialized.

In addition to these projected construction activities, a new RLW treatment facility was constructed during 1999 and began treating water in December 1999. RLW comes primarily from floor drains and accelerator and magnet cooling water. Water flows by gravity into lift stations constructed adjacent to Experimental Area A (Building 53-03M) and the Lujan Center (Building 53-07). The RLW is pumped from the lift stations through double-walled piping to one of three 30,000-gallon horizontal fiber glass tanks located in new Building 53-945 at the east end of TA-53. The tanks are sized to allow decay of radioisotopes generated by the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one (the western) of two evaporative basins. Each of the basins is above ground, 75 feet by 75 feet by 3 feet in dimension, with a capacity to hold 125,000 gallons of water. Basins are concrete, have a nonpermeable liner, and are instrumented to detect leaks. In the event of extremely high RLW generation rates, the west basin would overflow to the east basin. The basins are sized, however, such that the east basin is not likely to ever be used.

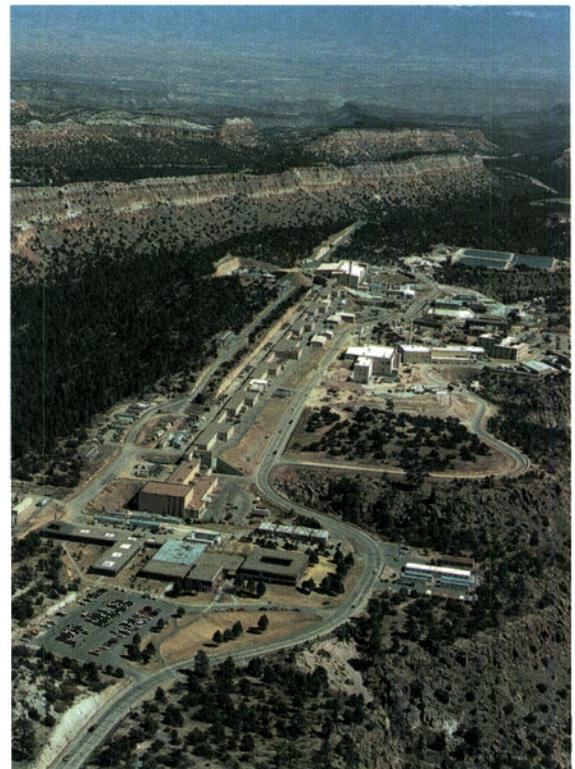
2.11.2 Operations at LANSCE

The SWEIS identified seven capabilities for the LANSCE Key Facility. No new capabilities have been added, and none have been deleted. LANSCE operated the Lujan Center and the WNR facility in mid-January 1999 through early February 1999; then went into stand-down. WNR came back on-line in mid-summer and ran through the end of the year, while the Lujan Center stayed off-line for the remainder of the year.

The primary indicator of activity for this facility is production of the 800-MeV LANSCE proton beam. In 1999, H⁺ beam was not produced. H⁻ beam was delivered as follows:

- (a) to the Lujan Center for 239 hours at an average current of 93 microamperes,
- (b) to WNR Target 2 for 587 hours in a "pulse on demand" mode of operation, with average current too small to measure,
- (c) to WNR Target 4 for 1993 hours at an average current of five microamperes, and
- (d) through Line X to Lines B and C in a "pulse on demand" mode of operation, with average current too small to measure.

These production figures are all less than the 6400 hours at 1250 microamperes projected by the ROD. In turn, the reduced beam time meant that those activities reliant upon the 800-MeV beam also were conducted at lower levels. These activities include experiments using neutrons and weapons-related experiments using either protons or neutrons. In addition, there were no experiments conducted for transmutation of wastes. There was also no production of medical isotopes during 1999, although plans for the new Isotope Production Facility neared completion by the end of the year. Table 2.11.2-1 provides details.



Aerial view of TA-53

Table 2.11.2-1. LANSCE/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Accelerator Beam Delivery, Maintenance, and Development	Deliver LANSCE linac beam to Areas A, B, C, WNR facility, Manuel Lujan Center, Dynamic Experiment Facility, and new isotope production facility for 10 months/yr (6400 hrs). Positive ion current 1250 microampere and negative ion current of 200 microampere.	There was no positive ion beam in 1999. Negative ion beam delivered, at maximum current of 93 microamperes, to Lines B and C (505 hours), WNR facility (1993 hours), and Lujan Center (239 hours). Area A did not receive beam.
	Reconfigure beam delivery and support equipment to support new facilities, upgrades, and experiments. ^a	No major upgrades to the beam delivery complex.
	Commission/operate/maintain LEDA for 10 to 15 yrs; operate up to approximately 6600 hrs/yr.	Full power (100 milliamps and 6.7 MeV) achieved in September 1999.
Experimental Area Support	Full-time remote handling and radioactive waste disposal capability required during Area A interior modifications and Area A-East renovation.	Full-time capability maintained. (Note: Modifications and renovations were not undertaken, however.)
	Support of experiments, facility upgrades, and modifications.	Support activities conducted, per projections of the SWEIS ROD.
	Increased power demand for LANSCE linac and LEDA radio-frequency operation.	A 700-MHz klystron was developed for use with LEDA.
Neutron Research and Technology ^b	Conduct 1000 to 2000 experiments/yr using Manuel Lujan Center, WNR facility, and LPSS. Establish LPSS in Area A (requires modification).	A far fewer number of experiments, since the Lujan Center was idle from February into July. LPSS was not constructed.
	Construct Dynamic Experiment Laboratory adjacent to WNR Facility. Support contained weapons-related experiments: <ul style="list-style-type: none"> - With small quantities of actinides, high explosives, and sources (up to approximately 80/yr) - With nonhazardous materials and small quantities of high explosives (up to approximately 200/yr) - With up to 4.5 kg high explosives and/or depleted uranium (up to approximately 60/yr) - Shock wave experiments involving small amounts, up to (nominally) 50 grams plutonium. 	The Dynamic Experiment Laboratory was not constructed, but weapons-related experiments were conducted: <ul style="list-style-type: none"> - None with actinides - Some with nonhazardous materials and high explosives - Some with high explosives, but none with depleted uranium. - No shock wave experiments.
	Provide support for static stockpile surveillance technology research and development.	Support was not provided for surveillance research and development.

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Accelerator Transmutation of Wastes (ATW) ^c (Continued)	Conduct lead target tests for two yrs at Area A beam stop.	No tests.
	Implement LIFT (Establish one-megawatt, then five-megawatt ATW target/blanket experiment areas) adjacent to Area A.	Neither the target/blanket experiment nor LIFT were constructed.
	Conduct five-megawatt experiments for 10 months/yr for four yrs using about three kg of actinides.	No experiments.
Subatomic Physics Research	Conduct 5 to 10 physics experiments/yr at Manuel Lujan Center, WNR facility, and LPSS.	UCN ran on 5 occasions in the Blue Room.
	Conduct proton radiography experiments, including contained experiments with high explosives.	Experiments involving contained high explosives were conducted on 10 days in 1999
Medical Isotope Production	Irradiate up to approximately 50 targets/yr for medical isotope production.	No production in 1999.
	Added production of exotic, neutron-rich, and neutron-deficient isotopes (requires modification of an existing target area).	No production in 1999.
High-Power Microwaves and Advanced Accelerators	Conduct research and development in these areas, including microwave chemistry research for industrial and environmental applications.	Research and development was conducted.

^a Includes the completion of proton and neutron radiography facilities, the LEDA, the isotope production facility relocation, the Short-Pulsed Spallation Source enhancement, and the LPSS.

^b Numbers of neutron experiments represent plausible levels of activity. Bounding conditions for the consequences of operations are primarily determined by i) length and power of beam operation and ii) maintenance and construction activities.

^c Formerly, Accelerator-Driven transmutation Technology. H(+) = proton (positively charged hydrogen ion), H(-) = negatively charged hydrogen ion

2.11.3 Operations Data for LANSCE

Since levels of operations were less than those projected by the ROD (LANSCE had a safety stand-down for part of the year), operations data were also less than projected. Radioactive air emissions are a key parameter since LANSCE emissions have historically accounted for more than 95% of the total LANL off-site dose. Emissions in 1999, however, totaled only 300 curies, about 15% of total LANL radioactive air emissions. The 1999 total was also significantly less than projections of the ROD (4185 curies). These small emissions can be attributed to non-use of the Area A beam stop.

Waste generation, NPDES discharge volumes, and utility consumption were also all below projected quantities. Table 2.11.3-1 provides details.

A new load frame will allow scientists to measure the effect of compressive or tensile stresses on the structure of materials. Tests of this sort on engineering components allow better predictions of failure modes and lifetimes during actual operation



Table 2.11.3-1. LANSCE/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Argon-41	Ci/yr	7.44E+1	1.4E+1
Bromine-76	Ci/yr	Not projected ^a	2.3E-4
Bromine-82	Ci/yr	Not projected ^a	6.3E-4
Carbon-10	Ci/yr	2.65E+0	4.2E-2
Carbon-11	Ci/yr	2.96E+3	2.8E2
Cobalt-60	Ci/yr	Not projected ^a	4.0E-6
Mercury-197	Ci/yr	Not projected ^a	1.6E-3
Nitrogen-13	Ci/yr	5.35E+2	1.6E+0
Nitrogen-16	Ci/yr	2.85E-2	1.50E-2
Oxygen-14	Ci/yr	6.61E+0	1.0E-1
Oxygen-15	Ci/yr	6.06E+2	1.9E+1
Tritium as Water	Ci/yr	Not projected ^a	2.3E+0
LEDA Projections (8-yr average):			
Oxygen-19	Ci/yr	2.16E-3	Not measured ^b
Sulfur-37	Ci/yr	1.81E-3	Not measured ^b
Chlorine-39	Ci/yr	4.70E-4	Not measured ^b
Chlorine-40	Ci/yr	2.19E-3	Not measured ^b
Krypton-83m	Ci/yr	2.21E-3	Not measured ^b
Others	Ci/yr	1.11E-3	Not measured ^b
NPDES Discharge: ^c			
Total Discharges	MGY	81.8	37.2
03A047	MGY	7.1	3.4
03A048	MGY	23.4	19.7
03A049	MGY	11.3	10.8
03A113	MGY	39.8	3.3
Wastes:			
Chemical	kg/yr	16,600	11,060
LLW	m ³ /yr	1085 ^d	70
MLLW	m ³ /yr	1	0.5
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	856	560 ^e

^a The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

^b Potential emissions from LEDA were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.

^c Outfalls eliminated before 1999: 03A125 (TA-53), 03A145 (TA-53), and 03A146 (TA-53).

^d LLW volumes include decommissioning and renovation of Experimental Area A (Building 53-03M).

^e The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.12 Health Research Laboratory (TA-43)

The HRL Key Facility includes the main HRL (Building 43-01) and 13 support buildings also located at TA-48. Research focuses on the study of intact cells, cellular components (RNA, DNA, and proteins), and cells and cellular systems (repair, growth, and response to stressors). There are several Low Hazard nonnuclear buildings within this Key Facility, but no Moderate Hazard nonnuclear facilities and no nuclear facilities.

2.12.1 Construction and Modifications at HRL

In calendar year 1999, HRL eliminated the entire animal colony. Outfall 03A040 was eliminated from the NPDES permit on January 11, 1999. The discharge from this outfall was redirected to the Los Alamos County sewage treatment plant in Bayo Canyon in 1998.

Research activities involving radioactive material were moved into the space previously occupied by the animal colony. The volume of radioactive work at HRL has significantly diminished from previous years. This is attributed to technological advances and new methods, such as the use of laser-based instrumentation and chemiluminescence, which do not require the use of radioactive materials. For instance, DNA sequencing predominantly uses laser analysis of fluorescent dyes hooked onto DNA bases instead of radioactive techniques.

Currently, HRL has Biosafety Level 1 and Level 2 work, which will include in the next one to two years limited work with potentially infectious microbes and low-toxicity biotoxins. These activities are regulated by the Centers for Disease Control, LANL's Institutional Biosafety Committee, and the Biosafety Officer.

2.12.2 Operations at HRL

The SWEIS identified eight capabilities for the HRL Key Facility. In 1998, neurobiology research was moved to another facility (the Physics Building at TA-03). In 1999, as part of the establishment of the Bioscience Division, three of the capabilities were renamed, two were combined at a higher level, and one was further defined into two operations as shown below:

- Genomic Studies was renamed Genomics
- Environmental Effects was renamed Environmental Biology
- Structural Cell Biology was renamed Structural Biology
- Cell Biology and DNA Damage and Repair were combined to form Molecular Cell Biology
- Cytometry was further defined as operations in Measurement Science and operations in Diagnostics and Medical Applications

The Bioscience Division developed three other operations in 1999 (Biologically Inspired Materials and Chemistry, Computational Biology, and Molecular Synthesis). These activities were just started and will be covered in the 2000 Yearbook. Since the development of information for the SWEIS, Bioscience Division has grown beyond its single facility, HRL. Therefore, the 2000 Yearbook will handle Bioscience Division similar to other Key Facilities where its various parts are in multiple buildings or TAs.

Table 2.12.2-1 compares 1999 operations to those predicted by the ROD. The table includes the number of FTEs per capability to measure activity levels to the ROD. These FTEs are not measured the same as the index shown in Table 2.12.3-1 and these numbers cannot be directly compared. Three of the existing capabilities currently have activity levels greater than those projected by the ROD, and the other four are conducted at levels equal to or lower than those projected by the ROD.

Table 2.12.2-1. Health Research Laboratory (TA-43)/Comparison of Operations

CAPABILITIES	SWEIS ROD	1999 OPERATIONS
Genomic Studies – Renamed Genomics in 1999	Conduct research utilizing molecular and biochemical techniques to analyze the genes of animals, particularly humans. Develop strategies at current levels to analyze the nucleotide sequence of individual genes, especially those associated with genetic disorders, and to map genes and/or genetic diseases to locations on individual chromosomes. Part of this work is to map each nucleotide, in sequence, of each in all 46 chromosomes. (50 FTEs) ^a	In 1999, 61 FTEs were associated with Genomics. This exceeds the SWEIS ROD of 50 FTEs and is an increase of 56% over 1995 levels.

CAPABILITIES	SWEIS ROD	1999 OPERATIONS
Cell Biology and DNA Damage and Repair – Combined into Molecular Cell Biology in 1999	Conduct research at current levels utilizing whole cells and cellular systems, both in-vivo and in-vitro, to investigate the effects of natural and catastrophic cellular events like response to aging, harmful chemical and physical agents, and cancer. (35 FTEs) Conduct research using isolated cells to investigate DNA repair mechanisms. (35 FTEs)	In 1999, 30 FTEs were associated with Molecular Cell Biology. This is less than half of the 70 FTEs projected in the ROD. In 1995, a total of 50 FTEs were associated with Cell Biology and DNA Damage and Repair.
Cytometry	Conduct research utilizing laser imaging systems to analyze the structures and functions of subcellular systems. (40 FTEs)	In 1999, 25 FTEs were associated with Measurement Science and Diagnostics a specialized application of cytometry, microscopy, spectroscopy, and other techniques for molecular detection and diagnosis. In 1999, 10 FTEs were associated with Medical Applications utilizing laser based molecular analysis techniques to develop tools for clinical diagnosis of disease. The 35 total FTEs in Cytometry is below the 40 FTEs projected in the ROD.
Environmental Effects – Renamed Environmental Biology in 1999.	Research identifies specific changes that occur in DNA and proteins in certain microorganisms after events in the environment. (25 FTEs)	In 1999, 25 FTEs were associated with Environmental Biology. This equals the SWEIS ROD and is an increase of 25% over 1995 levels.
Structural Cell Biology – Renamed Structural Biology in 1999.	Conduct research utilizing chemical and crystallographic techniques to isolate and characterize the properties and three-dimensional shapes of DNA and protein molecules. (15 FTEs)	In 1999, there were 60 FTEs associated with this capability. This exceeds the SWEIS ROD of 15 FTEs and is an increase of 500% over 1995 levels.
Neurobiology	Conduct research using magnetic fields produced in active areas of the brain to map human brain locations associated with certain sensory and cognitive functions. Instrumentation in sensitive magnetic detection devices. (9 FTEs)	Not applicable. Relocated to another LANL facility in 1998 (the Physics Building in TA-03).
In-Vivo Monitoring	Perform 3000 whole-body scans per year as a service to the LANL personnel monitoring program, which supports operations with radioactive materials conducted elsewhere at LANL. (5 FTEs)	Conducted 1250 whole-body scans and 1733 other counts (detector studies, quality assurance measurements, etc.). In 1999, there were 3 FTEs associated with this capability.

^a FTEs: full-time-equivalent scientists, researchers, and other staff supporting a particular research capability.

2.12.3 Operations Data for HRL

Research levels have remained relatively constant from 1998 to 1999. However, the research focus is changing as seen by the changes in capabilities and also the advances in technology.

Table 2.12.3-1 presents the operations data as measured by radioactive air emissions, NPDES discharges, generated waste volumes, and number of workers. The generation of most waste (chemical, biological, and MLLW) has decreased from historical levels and was smaller than projections.

Table 2.12.3-1. Health Research Laboratory (TA-43)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions	Ci/yr	Not estimated	Not measured ^a
NPDES Discharge: ^b 03A040	MGY	2.5 ^c	Eliminated ^d
Wastes:			
Chemical	kg/yr	13,000	1691
Biomedical Waste	kg/yr	280 ^e	0
LLW	m ³ /yr	34	14
MLLW	m ³ /yr	3.4	0.01
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	250	98 ^f

^a Potential emissions during the period were sufficiently small that measurement systems were not necessary to meet regulatory or facility requirements.

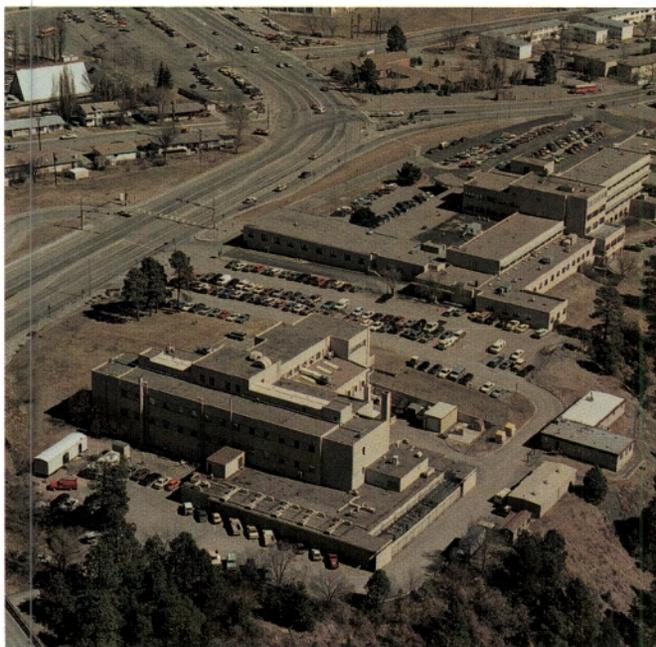
^b Outfall 03A040 consisted of one process outfall and nine storm drains.

^c Storm water only.

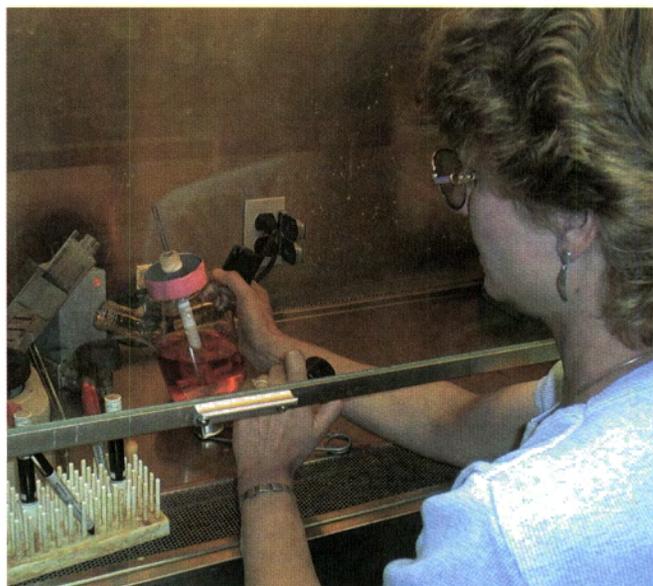
^d Outfall was eliminated 1/11/99.

^e Animal colony and the associated waste. The animal colony was eliminated in 1999.

^f The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD or FTE numbers by capability (see Section 3.6, Socioeconomic) is not appropriate.



HRL (lower left) adjacent to the Los Alamos Medical Center



3-D Multicellular Spheroid Model, mimics the microenvironment surrounding cells in a solid tumor. Shown here is a technician replenishing the culture medium for the spheroid cells.

2.13 Radiochemistry Facility (TA-48)

The Radiochemistry Key Facility includes all of TA-48 (116 acres). This facility fills three roles—research, production of medical radioisotopes, and support services to other LANL organizations, primarily through radiological and chemical analysis of samples. TA-48 contains five major research buildings: the Radiochemistry Laboratory (Building 48-01), the Isotope Separator Facility (48-08), the Diagnostic Instrumentation and Development Building (48-28), the Advanced Radiochemical Diagnostics Building (48-45), and the Analytical Facility (48-107). The Radiochemistry Laboratory (Building 48-01) is a candidate Category 3 nuclear facility.

2.13.1 Construction and Modifications at the Radiochemistry Facility

The ROD projected no facility changes through 2005. Consistent with this projection, only minor maintenance activities occurred during 1999. For example, there were some office modifications, a chiller was replaced, and some basement ventilation was removed.

In addition, the only remaining NPDES outfall, 03A045, was eliminated from the Laboratory's NPDES permit on December 6, 1999. Industrial sources that had previously discharged to this outfall (a cooling tower and basement floor drains) have been eliminated or redirected. The cooling tower was removed from service in 1996 and the floor drains were either plugged or piped to the Laboratory's sanitary wastewater system (SWS). The elimination of outfalls was evaluated through an environmental assessment (DOE 1996a) and subsequent Finding of No Significant Impact.

2.13.2 Operations at the Radiochemistry Facility

The SWEIS identified ten capabilities for the Radiochemistry Key Facility. No new capabilities have been added, and none have been deleted. The primary measure of activity for this Key Facility is the number of personnel conducting research. In 1999, approximately 170 chemists and scientists were employed, far below the 250 projected by the ROD. As seen in Table 2.13.2-1, only three of the ten capabilities were active at levels projected by the ROD: radionuclide transport studies, actinide and TRU chemistry, and sample counting. The number of FTEs shown by capability is not calculated the same as the index shown in Table 2.13.3-1, and these numbers cannot be directly compared.

Table 2.13.2-1. Radiochemistry Facility (TA-48)/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS ^a
Radionuclide Transport Studies	Actinide transport, sorption, and bacterial interaction studies. Development of models for evolution of groundwater. Assessment of performance or risk of release for radionuclide sources at proposed waste disposal sites. Increased level of operations, approximately twice the current (1995) levels. (28 to 34 FTEs) ^b	Increased level of operations, approximately twice 1995 levels. (35 FTEs)
Environmental Remediation Support	Background contamination characterization pilot studies. Performance assessments, soil remediation research and development, and field support. Increased level of operations, approximately twice the current (1995) levels. (34 FTEs)	Decreased level of operations, approximately half 1995 levels. (10 FTEs)
Ultra-Low-Level Measurements	Isotope separation and mass spectrometry. Increased level of operations, approximately twice the current (1995) levels. (30 FTEs)	Level of operations was approximately the same as in 1995. (14 FTEs)

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS ^a
Nuclear/Radiochemistry	Radiochemical operations involving quantities of alpha-, beta-, and gamma-emitting radionuclides for non-weapons and weapons work. Slight increase over current (1995) levels of operation. (44 FTEs)	Slightly decreased level of operations, but approximately the same as 1995 levels. (35 FTEs)
Isotope Production	Target preparation. High-level beta/gamma chemistry and target processing to recover isotopes for medical and industrial application. Increased level of operations, approximately twice the current (1995) levels. (15 FTEs)	Slightly increased level of operations, approximately the same as in 1995. (11 FTEs)
Actinide/TRU Chemistry	Radiochemical operations involving significant quantities of alpha-emitting radionuclides. Increased level of operations, approximately twice the current (1995) levels. (12 FTEs)	Increased operations, approximately twice 1995 levels. (13 FTEs)
Data Analysis	Re-examination of archive data and measurement of nuclear process parameters of interest to weapons radiochemists. Increased level of operations, approximately twice the current (1995) levels. (10 FTEs)	Slight increase from 1995 to six FTEs, but less than projected by the SWEIS ROD.
Inorganic Chemistry	Synthesis, catalysis, actinide chemistry: <ul style="list-style-type: none"> - Chemical synthesis of new organo-metallic complexes - Structural and reactivity analysis, organic product analysis, and reactivity and mechanistic studies - Synthesis of new ligands for radiopharmaceuticals Environmental technology development: <ul style="list-style-type: none"> - Ligand design and synthesis for selective extraction of metals - Soil washing - Membrane separator development - Ultrafiltration Increased level of operations, approximately 50% more than the current (1995) levels. (49 FTEs—total for both activities)	Same level of activity as in 1995 (35 FTEs), but below projections of the SWEIS ROD.
Structural Analysis	Synthesis and structural analysis of actinide complexes at current levels. X-ray diffraction analysis of powders and single crystals at current levels. Increased level of operations, approximately twice the current (1995) levels. (22 FTEs)	Decreased level of operations from 1995, and about 1/3 of those projected by the SWEIS ROD. (8 FTEs)
Sample Counting	Measurement of the quantity of radioactivity in samples using alpha-, beta-, and gamma-ray counting systems. Level of operations, similar to the current (1995) levels. (5 FTEs)	Approximately the same as SWEIS ROD. (6 FTEs)

^a Projections in the ROD were made as increments to the current level of operations as expressed by the "No Action" alternative for the current (1995) year. Thus, 1999 operations must use increments from 1995 operational levels for comparison purposes.

^b FTEs: full-time-equivalent scientists, researchers, and other staff supporting a particular research capability.

2.13.3 Operations Data for the Radiochemistry Facility

The overall level of activity at the Radiochemistry Facility was below that projected by the ROD. Three of the ten capabilities at this Key Facility were conducted at levels projected by the ROD; the others were at or below activity levels of 1995. As a result, operations data were also below those projected by the ROD, as shown in Table 2.13.3-1.

Table 2.13.3-1. Radiochemistry Facility (TA-48)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Mixed Fission Products	Ci/yr	1.4E-4	Not reported ^a
Plutonium-239	Ci/yr	1.1E-5	None detected ^b
Uranium-235	Ci/yr	4.4E-7	None detected ^b
Mixed Activation Products	Ci/yr	3.1E-6	Not reported ^a
Uranium-238	Ci/yr	Not projected ^c	6.0E-10
Arsenic-72	Ci/yr	1.1E-4	None detected ^b
Arsenic-73	Ci/yr	1.9E-4	1.8E-5
Arsenic-74	Ci/yr	4.0E-5	4.5E-5
Beryllium-7	Ci/yr	1.5E-5	None detected ^b
Bromine-77	Ci/yr	8.5E-4	1.2E-5
Germanium-68	Ci/yr	1.7E-5	1.7E-3
Gallium-68	Ci/yr	1.7E-5	1.7E-3
Rubidium-86	Ci/yr	2.8E-7	None detected ^b
Selenium-75	Ci/yr	3.4E-4	3.5E-4
Silicon-32	Ci/yr	Not projected ^d	5.1E-6
NPDES Discharge: ^e			
Total Discharges	MGY	4.1	No discharge
03A-045	MGY	0.87	Eliminated ^f
Wastes:			
Chemical	kg/yr	3300	1513
LLW	m ³ /yr	270	40
MLLW	m ³ /yr	3.8	0.6
TRI/Mixed TRU ^g	m ³ /yr	0	0
Number of Workers	FTEs	248	128 ^h

^a Emission categories of 'mixed fission products' and 'mixed activation products' are no longer used. Instead, where fission or activation products are measured, they are reported as specific radionuclides, e.g., Cs-137 or Co-60.

^b Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.

^c The radionuclide was not projected in the ROD because it was either dosimetrically insignificant or not isotopically identified.

^d The Si-32 emissions were not expected. There was a slight process problem that resulted in these emissions. The dose from these emissions was not significant.

^e Outfalls eliminated before 1999: 04A016 (TA-48), 04A131 (TA-48), 04A152 (TA-48), and 04A153 (TA-48).

^f This outfall was eliminated from the NPDES permit on 12/6/99.

^g TRU waste was projected to be returned to the generating facility.

^h The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.14 Radioactive Liquid Waste Treatment Facility (TA-50)

The RLWTF is located at TA-50 and consists of the treatment facility (Building 50-01), support buildings, and liquid and chemical storage tanks. The primary activity is the treatment of liquid wastes generated at other LANL facilities, but decontamination of equipment and waste items is also performed. There are four Category 3 nuclear structures at this Key Facility – the RLWTF itself (Building 50-01), the tank farm and pumping station (50-02), the acid and caustic solution tank farm (50-66), and a 100,000-gallon influent holding tank (50-90). There are no other nuclear facilities, and no Moderate Hazard nonnuclear buildings within this Key Facility. Five capabilities were identified in the SWEIS.

2.14.1 RLWTF Construction and Modifications

The new UF/RO (ultrafiltration and reverse osmosis) process was installed in 1998 and became operational March 22, 1999. Similarly, nitrate reduction equipment was installed in 1998 and became operational on March 15, 1999. These modifications contributed to improved effluent quality. There were zero violations of the new State of New Mexico discharge limit for nitrates (10 mg/L) from March through the end of 1999. And despite a longer break-in period for the UF/RO equipment, all discharges were below DOE's guidelines for radioactivity beginning December 10, 1999.

While enabling the RLWTF to meet all discharge limits and guidelines, the UF/RO equipment introduced significant process difficulties. In order to overcome the process difficulties, facility personnel installed an electro dialysis reversal unit and began construction of an evaporator in the autumn. Both units are designed to process the waste stream from the reverse osmosis unit. The SWEIS ROD projected neither of these facility modifications. They received NEPA review, however, through Categorical Exclusions (#7428, approved February 23, 1999, and #7737, approved October 29, 1999, respectively).

2.14.2 RLWTF Capabilities

The SWEIS identified five capabilities for the RLWTF Key Facility. No new capabilities were added in 1999, and none were deleted. The primary measurement of activity for this facility is the volume of RLW processed through the main treatment equipment. In 1999, this volume was 20 million liters of treated RLW discharged to Mortandad Canyon, which is less than the discharge volume of 35 million liters per year projected in the SWEIS ROD. As seen in Table 2.14.2-1, other operations at the RLWTF were also below levels projected by the ROD.



Top: Removal of ion exchange column to make room for new membrane treatment processes

Middle: View of the new tubular ultrafilter

Bottom: View of the new tubular ultrafilter and motor control center

Table 2.14.2-1. RLWTF (TA-50)/Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Waste Characterization, Packaging, Labeling	Support, certify, and audit generator characterization programs.	As projected.
	Maintain waste acceptance criteria for radioactive liquid waste treatment facilities.	As projected.
Waste Transport, Receipt, and Acceptance	Collect RLW from generators and transport to TA-50.	As projected.
RLW Pretreatment	Pretreat 900,000 liters/yr of RLW at TA-21. Pretreat 80,000 liters/yr of RLW from TA-55 in Room 60.	Pretreated 45,000 liters at TA-21. Pretreated less than 80,000 liters/yr of radioactive liquid waste from TA-55 in Room 60.
	Solidify, characterize, and package 3 m ³ /yr of TRU waste sludge in Room 60.	Solidified 5 m ³ of TRU waste sludge in Room 60.
RLW Treatment	Install UF/RO equipment in 1997.	UF/RO equipment installed 1998, and operational in March 1999.
	Install equipment for nitrate reduction in 1999.	Nitrate reduction equipment installed 1998; operational March 1999.
	Treat 35 million liters/yr of radioactive liquid waste.	Treated 20 million liters of RLW.
	De-water, characterize, and package 10 m ³ /yr of LLW sludge.	De-watered 37 m ³ of LLW sludge.
Decontamination Operations	Solidify, characterize, and package 32 m ³ /yr of TRU waste sludge.	No TRU waste sludge was solidified.
	Decontaminate LANL personnel respirators for reuse (approximately 700/month).	Decontaminated 425 personnel respirators per month.
	Decontaminate air-proportional probes for reuse (approximately 300/month).	Decontaminated 93 faces and 94 bodies per month (air-proportional probes).
	Decontaminate vehicles and portable instruments for reuse (as required).	Decontaminated 26 drill bits, 12 augers, four collars, and six portable instruments per month.
	Decontaminate precious metals for resale (acid bath).	Decontaminated platinum from TRU waste to LLW.
	Decontaminate scrap metals for resale (sand blast).	Decontaminated no scrap metals.
	Decontaminate 200 m ³ of lead for reuse (grit blast).	Decontaminated 2.3 m ³ of lead.

^a Includes installation of UF/RO and nitrate reduction processes in Building 50-01 and installation of above ground tanks for the collection of influent RLW.

2.14.3 Operations Data for the RLWTF

Although levels of operation were less than projected in the SWEIS, only some consequences were lower than projected. Radioactive air emissions continued to be negligible (less than one microcurie). NPDES discharge volume was 5.3 million gallons compared to a projected 9.3 million gallons, and chemical waste was one-tenth of projections (201 kilograms/year compared to 2200 kilograms/year). TRU/mixed TRU waste quantities were also less than projected (4.6 cubic meters per year compared to 30 cubic meters per year). However, LLW and MLLW exceeded projections. Table 2.14.3-1 provides details.

Table 2.14.3-1. RLWTF (TA-50)/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions:			
Americium-241	Ci/yr	Negligible	1.3E-7
Plutonium-238	Ci/yr	Negligible	3.4E-8
Plutonium-239	Ci/yr	Negligible	1.8E-8
Thorium-230	Ci/yr	Negligible	3.7E-8
Uranium-234	Ci/yr	Negligible	None detected ^a
NPDES Discharge: 051	MGY	9.3	5.3
Wastes:			
Chemical	kg/yr	2200	201
LLW	m ³ /yr	160	176
MLLW	m ³ /yr	0	3.2
TRU/Mixed TRU	m ³ /yr	30	4.6
TRU	m ³ /yr	30	0
Mixed TRU	m ³ /yr	0	4.6
Number of Workers	FTEs	110	62 ^b

^a Although stack sampling systems were in place to measure these emissions, any emissions were sufficiently small to be below the detection capabilities of the sampling systems.

^b The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.15 Solid Radioactive and Chemical Waste Facilities (TA-50 and TA-54)

The Solid Radioactive and Chemical Waste Key Facility is located at TAs 50 and 54. Activities are all related to the management (packaging, characterization, receipt, transport, storage, and disposal) of radioactive and chemical wastes generated at other LANL facilities.

The Solid Radioactive and Chemical Waste Facilities have numerous nuclear facilities on site. According to the DOE "List of Los Alamos National Laboratory Nuclear Facilities," December 1998, there are eight Category 2 nuclear buildings: the Radioactive Materials Research Operations and Demonstration Facility (Building 50-37); the liquid waste tank (Structure 50-190) at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF); and six fabric domes at TA-54 for the storage of retrieved TRU wastes (Domes 226, 229–232, and 375).

There are also six Category 3 nuclear buildings within this Key Facility: the Radioactive Assay and Nondestructive Test Facility (Building 54-38); WCRRF itself (Building 50-69); and four fabric domes for the storage of TRU wastes (Domes 54-048, -049, -153, and -283).

In addition, the LLW disposal cells, shafts, and trenches are listed in the December 1998 DOE list as a Category 2 "facility." There are no Moderate Hazard nonnuclear buildings within this Key Facility.

Several changes were made to the status of nuclear facility classifications, and several nuclear facilities were added to this Key Facility. However, these changes were not incorporated in the December 1998 DOE List of Los Alamos National Laboratory Nuclear Facilities and therefore are not reported here. Once the DOE list is updated, those changes will be reflected in the appropriate SWEIS Yearbook.

2.15.1 Construction and Modifications at the Solid Radioactive and Chemical Waste Facility

The construction of a new TRU waste storage dome (54-375) was completed in calendar year 1999. In addition, construction of the Decontamination and Volume Reduction Systems (DVRS) began in calendar year 1999. The DVRS is designed to segregate, decontaminate, and volume-reduce old TRU waste packages thereby resulting in efficient, WIPP-compliant TRU packages. As an added benefit, a major fraction of the historical waste packaging and secondary waste is anticipated to be LLW, and thus will not need to be shipped to WIPP for disposal. An environmental assessment was prepared (DOE 1999d) and a Finding of No Significant Impact was issued on June 25, 1999.

2.15.2 Operations at the Solid Radioactive and Chemical Waste Facility

The SWEIS identified eight capabilities for this Key Facility. No new capabilities have been added, and none have been deleted. The primary measurements of activity for this facility are the volumes of newly generated chemical, low-level, and TRU wastes to be managed and the volumes of legacy TRU waste and MLLW in storage. A comparison of calendar year 1999 to projections made by the ROD can be summarized as follows:

Chemical wastes: A total of 882 metric tons were shipped for off-site treatment and/or disposal, compared to an average quantity of 3250 metric tons per year projected by the ROD.

LLW: A total of 1320 cubic meters were placed into disposal cells and shafts at Area G, compared to an average volume of 12,230 cubic meters per year projected by the ROD. No new disposal cells were constructed, and disposal operations did not expand into either Zone 4 or Zone 6 at TA-54. Operations are not expected to expand for at least another three years.

MLLW: A total of 96 cubic meters (13 newly generated and 83 legacy) were shipped for off-site treatment and/or disposal, compared to an average volume of 632 cubic meters per year projected by the ROD. The ROD projected that the inventory of legacy mixed wastes would be reduced to zero by 2006.

TRU wastes: In calendar year 1999, 192 cubic meters of newly generated TRU wastes were added to storage. Additionally, 244 cubic meters have also been added to storage because of the Transuranic Waste Inspectable Storage Project (TWISP). In March of 1998, TWISP completed retrieving drums from Pad 1. The project started retrieving drums from Pad 4 in December 1998 and finished retrieval in December 1999. Retrieval of drums from Pad 2 is expected to start in calendar year 2000. In 1999, TWISP operations recovered 2195 cubic meters, and as of December 1999, a total of 4146 cubic meters had been recovered. The ROD projects that TWISP will retrieve all 4700 cubic meters from underground pads by December 2004.

Legacy TRU waste shipments to WIPP began on March 26, 1999. In calendar year 1999 there were 17 shipments of TRU waste to WIPP. The amount of material that was removed from LANL inventory was equivalent to 30 drums. However, because of the wattage of the material, the 30 drums were repackaged into 102 drums. Each of the 102 drums was then placed into a standard waste box. Each of the 17 shipments consisted of six standard waste boxes.

In summary, chemical and radioactive waste management activities were at levels below those projected by the ROD. These and other operational details appear in Table 2.15.2-1. The one anomaly that should be mentioned is the 4003 cubic meters of solid wastes disposed in pits at Area J. These administratively controlled wastes resulted from Environmental Restoration (ER) Project remedial activities at Material Disposal Area (MDA) P, and far exceeded the projections of 100 cubic meters per year. However, this material was nonhazardous wastes, soil, concrete rubble, and debris placed in MDA-J as fill in preparation of capping (1999 Annual Report Questionnaire for the Los Alamos National Laboratory, Technical Area 54, Area J Landfill).

Table 2.15.2-1. Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50) / Comparison of Operations

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Waste Characterization, Packaging, and Labeling	<p>Support, certify, and audit generator characterization programs.</p> <p>Maintain waste acceptance criteria for LANL waste management facilities.</p> <p>Characterize 760 m³ of legacy MLLW.</p> <p>Characterize 9010 m³ of legacy TRU waste.</p> <p>Verify characterization data at the Radioactive Assay and Nondestructive Test Facility for unopened containers of LLW and TRU waste.</p> <p>Maintain waste acceptance criteria for off-site treatment, storage, and disposal facilities.</p> <p>Overpack and bulk waste as required.</p> <p>Perform coring and visual inspection of a percentage of TRU waste packages.</p> <p>Ventilate 16,700 drums of TRU waste retrieved during TWISP.</p> <p>Maintain current version of WIPP waste acceptance criteria and liaison with WIPP operations.</p>	<p>Activities were as projected in the SWEIS ROD with the following differences:</p> <p>Characterized 83 m³ of legacy MLLW in 1999.</p> <p>Characterized 6.25 m³ of legacy TRU waste during 1999.</p> <p>Verified characterization data at Radioactive Assay and Nondestructive Test Facility for TRU wastes, but not for LLW.</p> <p>Six drums were cored and inspected in calendar year 1999.</p> <p>Ventilated 8426 drums as of December 1999.</p>
Compaction	Compact up to 25,400 m ³ of LLW.	280 m ³ compacted into 77 m ³ LLW.
Size Reduction	Size reduce 2900 m ³ of TRU waste at WCRRF and the Drum Preparation Facility.	Size reduction was not performed in 1999.
Waste Transport, Receipt, and Acceptance	<p>Collect chemical and mixed wastes from LANL generators and transport to TA-54.</p> <p>Begin shipments to WIPP in 1999.</p> <p>Over the next 10 years:</p> <p>Ship 32,000 metric tons of chemical wastes and 3640 m³ of MLLW for off-site land disposal restrictions, treatment, and disposal.</p> <p>Ship no LLW for off-site disposal.</p> <p>Ship 9010 m³ of legacy TRU waste to WIPP.</p> <p>Ship 5460 m³ of operational and environmental restoration TRU waste to WIPP.</p> <p>Ship no environmental restoration soils for off-site solidification and disposal.</p>	<p>Collected and transported chemical and mixed wastes.</p> <p>Shipments to WIPP began 3/26/1999.</p> <p>Shipments in 1999:</p> <p>882 metric tons of chemical wastes and 96 m³ of MLLW for off-site treatment and disposal.</p> <p>No LLW for off-site disposal.</p> <p>6.25 m³ of legacy TRU waste was shipped in 1999.</p> <p>No operational or environmental restoration TRU wastes shipped to WIPP.</p> <p>No environmental restoration soils for solidification and disposal.</p>

CAPABILITY	SWEIS ROD ^a	1999 OPERATIONS
Waste Transport, Receipt, and Acceptance (Cont.)	Annually receive, on average, 5 m ³ of LLW and TRU waste from off-site locations in 5 to 10 shipments.	No LLW or TRU waste receipts from off-site locations.
Waste Storage	Stage chemical and mixed wastes before shipment for off-site treatment, storage, and disposal.	Chemical and mixed wastes staged before shipment.
	Store legacy TRU waste and MLLW.	Legacy TRU waste and MLLW stored.
	Store LLW uranium chips until sufficient quantities have accumulated for stabilization.	LANL still generates this waste; however, TA-54 no longer accepts them for storage. The generator is required to process this waste to make it acceptable for disposal at TA-54.
Waste Retrieval	Begin retrieval operations in 1997.	Retrieval begun in 1997.
	Retrieve 4700 m ³ of TRU waste from Pads 1, 2, 4 by 2004.	Retrieved 2195 m ³ in calendar year 1999. Retrieved 4146 m ³ total through Dec. 1999.
Other Waste Processing	Demonstrate treatment (e.g., electrochemical) of MLLW liquids.	No activity.
	Land farm oil-contaminated soils at Area J.	No oil-contaminated soils were land-farmed.
	Stabilize 870 m ³ of uranium chips.	No uranium chips stabilized in 1999.
	Provide special-case treatment for 1030 m ³ of TRU waste.	None.
	Solidify 2850 m ³ of MLLW (environmental restoration soils) for disposal at Area G.	No environmental restoration soils solidified.
Disposal	Over next 10 years: Dispose of 420 m ³ of LLW in shafts at Area G. Dispose of 115,000 m ³ of LLW in disposal cells at Area G. (Requires expansion of on-site LLW disposal operations beyond existing Area G footprint.) Dispose of 100 m ³ /yr administratively controlled industrial solid wastes in pits at Area J. Dispose of nonradioactive classified wastes in shafts at Area J.	During 1999: 23 m ³ of LLW were disposed in shafts at Area G. 1320 m ³ of LLW disposed in cells. Area G was not expanded. 4003 m ³ solid wastes disposed in pits at Area J. ^b 0.28 m ³ of classified solid wastes disposed in shafts at Area J.

^a Includes the construction of four new storage domes for the TWISP.

^b This volume exceeds projections because of excavation of MDA-P by the ER Project.

2.15.3 Operations Data for the Solid Radioactive and Chemical Waste Facility

Levels of operation in 1999 were less than projected by the ROD for air emissions and most wastes. However, TRU/mixed TRU waste quantities were higher than those projected. Table 2.15.3-1 provides details.

**Table 2.15.3-1. Solid Radioactive and Chemical Waste Facilities (TA-54 and TA-50)
Operations Data**

PARAMETER	UNITS	SWEIS ROD	1999 OPERATIONS
Radioactive Air Emissions: ^a			
Tritium	Ci/yr	6.09E+1	^a
Americium-241	Ci/yr	6.60E-7	^a
Plutonium-238	Ci/yr	4.80E-6	9.9E-11
Plutonium-239	Ci/yr	6.80E-7	^a
Uranium-234	Ci/yr	8.00E-6	1.7E-8
Uranium-235	Ci/yr	4.10E-7	^a
Uranium-238	Ci/yr	4.00E-6	2.3E-9
NPDES Discharge	MGY	No outfalls	No outfalls
Wastes: ^b			
Chemical	kg/yr	920	30
LLW	m ³ /yr	174	21
MLLW	m ³ /yr	4	0
TRU/Mixed TRU	m ³ /yr	27	40
TRU	m ³ /yr	27	40
Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	225	65 ^c

^a Data for 1999 are for stacks monitored at WCRRF and the Radioactive Materials Research, Operations, and Demonstration facility at TA-50. No stacks require monitoring at TA-54. All non-point sources at TA-50 and TA-54 are measured using ambient monitoring.

^b Secondary wastes are generated during the treatment, storage, and disposal of chemical and radioactive wastes. Examples include repackaging wastes from the visual inspection of TRU waste, high-efficiency particulate air filters, personnel protective clothing and equipment, and process wastes from size reduction and compaction.

^c The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular part-time and full-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.16 Non-Key Facilities

The balance, and majority, of LANL buildings are referred to in the SWEIS as the Non-Key Facilities. Non-Key Facilities house operations that do not have potential to cause significant environmental impacts. These buildings and structures are located in 30 of LANL's 49 TAs and comprise approximately 15,500 of the LANL's 27,820 acres. As discussed in Section 2.16.2 below, activities in the Non-Key Facilities encompass seven of the eight LANL direct-funded activities (DOE 1999a, page 2-2).

There are five Category 3 nuclear facilities among the Non-Key Facilities:

- Calibration Building (TA-03, Building 130)
- Physics Building (TA-03, Building 40)
- High-Pressure Tritium Facility (TA-33, Building 86)
- Nuclear Safeguards Research Building (TA-35, Building 02)
- Nuclear Safeguards Laboratory (TA-35, Building 27)

Four of these buildings hold only sealed radioactive sources. The High-Pressure Tritium Facility is in safe shutdown mode awaiting decontamination and decommissioning.

2.16.1 Construction and Modifications at the Non-Key Facilities

LANL plans for the next ten years call for the construction or modification of many buildings that are not included in the 15 Key Facilities. These changes are discussed in the following paragraphs.

a) Atlas: Atlas will be used for research and development in the fields of physics, chemistry, fusion, and materials science that will contribute to predictive capability for aging and performance of secondary components of nuclear weapons. The facility will require about 5 MWH of electrical energy annually (1% to 2% of total LANL consumption); will have a peak electrical demand of 12 megawatts (about 12% of total LANL demand); and will employ about 15 people. The heart of the Atlas facility is a pulsed-power capacitor bank that will deliver a large amount of electrical and magnetic energy to a centimeter-scale target in less than ten microseconds. Each experiment will require extensive preparation of the experimental assembly and diagnostic instrumentation (DOE 1996b).

Atlas is being constructed in parts of five buildings at TA-35:

- 35-124/125, Experimental Area, Control Room, and Coordination Center
- 35-126, Mechanical Services Building
- 35-294, Power Supply Building
- 35-301, Generator Building

Through 1999, \$36 million had been spent. Another \$13 million, budgeted for 2000 and 2001, will complete the facility (LANL 1999a).

b) Industrial Research Park (IRP): Construction of the IRP started in 1999. A maximum of 30 acres will be developed along West Jemez Road, across from Otowi Building and the Wellness Center, and along West Road, in the vicinity of the ice rink. Up to ten buildings may be constructed, with a total floor space of 300,000 square feet and parking for 1400 cars (DOE 1997b). The IRP is a private development on DOE land leased to Los Alamos County. Because the land still belongs to DOE, land-use impacts must be considered in the Yearbook.

c) Strategic Computing Complex (SCC): Construction of this new building, to house the world's fastest supercomputer, also got underway in 1999. The SCC will be a three-story structure with 267,000 square feet under roof. About 300 designers, computer scientists, code developers, and university and industrial scientists will occupy the building. The building will be connected to existing sewer, water, and natural gas lines, but will require a new 115/13.8 kV substation transformer at the TA-03 Power Plant. Six cooling towers are to be constructed, requiring an estimated 63 million gallons of cooling water per year. This water will be derived, however, from treated waters from the sewage facility, which total more than 100 million gallons annually. The SCC is projected to have a maximum electricity load requirement of seven megawatts, or about 7% of total LANL demand (DOE 1998b). Through the end of 1999, \$4 million had been spent on this \$107-million construction project (LANL 1999a).

d) Nonproliferation and International Security Center (NISC): Construction of this new building also began in 1999. The NISC will be a four-story building plus basement, will have 164,000 square feet under roof, and will have a capacity to house 465 people. It is being constructed adjacent to the new SCC within the heart of TA-03. The building will have laboratories, a machine shop for fabrication of satellite parts, a high-bay fabrication area, an area for the safe handling of sealed radioactive sources, and offices. Building heating and cooling will be by closed-loop water systems. Because all occupants are to be relocated from other LANL buildings, there is no expected increase in quantities of sewage, solid wastes, or chemical wastes, nor should there be increased demand for utilities. In order to accommodate both the SCC and NISC, nearby parking lots are to be expanded to fit an additional 800 to 900 vehicles (DOE 1999e). Through the end of 1999, \$2 million had been spent on this \$63-million construction project (LANL 1999a).



Top: Conceptual drawing of NISC (left) and SCC
Above: Industrial Research Park
Right: Construction site

e) *Central Health Physics Calibration Laboratory*: A new Central Health Physics Calibration Laboratory was approved for line-item funding in calendar year 1999. The new facility, to be located at TA-36, will consolidate existing health physics calibration, maintenance, and repair functions into one location. Currently, these functions are undertaken in three separate structures in TA-3. Construction activities will include renovation of an existing building and a 500-square-foot addition to a second existing building. TA-36 is remote from densely populated areas of the Laboratory, is served by paved roads, and is located in a secure area. The proposal was categorically excluded from further NEPA review.

f) *NPDES Outfall Project*: During 1999, 13 outfalls from Non-Key Facilities were eliminated from the NPDES permit (Sandoval 2000). Responsibility for nine of the 13 was transferred to Los Alamos County when the County assumed ownership of water supply wells, pumping stations, storage tanks, and piping. Discharges from the remaining four outfalls were eliminated when the source activities were eliminated and were associated with water supply wells that were removed from service. Table 3.2-3 in Section 3.2, Liquid Effluents, shows the final disposition for all of the eliminated outfalls and the drainage basins to which they discharged.

Coupled with the 10 outfalls deleted during 1997 and 1998, a total of 24 of 27 outfalls from the Non-Key Facilities have now been eliminated. The only remaining outfalls for Non-Key Facilities are the following:

- 001 at TA-03-22 serves the Power Plant. The outfall, which discharges daily into a tributary of Sandia Canyon receives effluent from boiler blowdown, neutralized demineralizer regeneration brine, once-through cooling water from the sample cooling heat exchanger, blowdown from cooling towers, and floor washings from a floor drain and sink drain in the chlorine building. Also, treated effluent from the sanitary wastewater treatment plant at TA-46 is piped to the Power Plant for use in the cooling towers or to be discharged through 001.
- 13S serves the sanitary wastewater treatment plant at TA-46 but is piped to, and discharged through, outfall 001 at TA-3.
- 03A027 also discharges into a tributary of Sandia Canyon. This outfall receives treated cooling water and fire protection water from an old cooling tower (TA-3-285) that functions as a “back-up” to the cooling towers that serve refrigerant condensers for 4 to 8 chillers located at the TA-3 Laboratory Data Communications Center and Central Computing Facility. The 03A027 outfall discharges very infrequently and any discharge is usually a result of cooling tower maintenance or testing of the fire protection system. Testing of the fire protection system generally occurs up to six times per year.
- 03A160 from Building 35-124, the Antares Target Hall, discharges into Mortandad Canyon.

2.16.2 Operations at the Non-Key Facilities

Non-Key Facilities are host to seven of the eight categories of activities at LANL (DOE 1999a, pp. 2-2 through 2-9) as shown in Table 2.16.2-1 below. The eighth category, environmental restoration is discussed in Section 2.17. During 1999, no new capabilities were added to the Non-Key Facilities, and none of the above seven were deleted.

Table 2.16.2-1. Operations at the Non-Key Facilities

CAPABILITY	EXAMPLES
1. Theory, modeling, and high performance computing	Modeling of atmospheric and oceanic currents. Theoretical research in areas such as plasma and beam physics, fluid dynamics, and super-conducting materials.
2. Experimental science and engineering	Experiments in nuclear and particle physics, astrophysics, chemistry, and accelerator technology. Also includes laser and pulsed-power experiments (e.g., Atlas).
3. Advanced and nuclear materials research and development and applications	Research and development into physical and chemical behavior in a variety of environments; development of measurement and evaluation technologies.

CAPABILITY	EXAMPLES
4. Waste management	Management of municipal solid wastes. Sewage treatment. Recycle programs.
5. Infrastructure and central services	Human resources activities. Management of utilities (natural gas, water, electricity). Public interface.
6. Maintenance and refurbishment	Painting and repair of buildings. Maintenance of roads and parking lots. Erecting and demolishing support structures.
7. Management of environmental, ecological, and cultural resources	Research into, assessment of, and management of plants, animals, cultural artifacts, and environmental media (groundwater, air, surface waters).

The LANL workforce increased by 404 employees during 1999 bringing the total workforce up to 12,412 employees or 1061 more employees than were anticipated under the ROD. Approximately 27% of these new employees were either JCNNM (17%) or PTLA (10%). This reflects the new construction going on at LANL and the increased efforts in security upgrades as LANL moves forward with its assignments for Stockpile Stewardship and Management. Approximately 40% of these new employees are regular (full-time and part-time) UC employees, of which about 60% are assigned to the Key Facilities. This increase in employment at the Key Facilities during 1999 reflects the increase in Defense Program-related activities.

2.16.3 Operations Data for the Non-Key Facilities

Even though the Non-Key Facilities occupy more than half of LANL and employ about half the workforce, activities in these facilities contribute less than 10% of most operational effects. The 286 cubic meters of LLW constituted only 17% of the LANL total LLW volume. Table 2.16.3-1 presents details. Radioactive emissions from these facilities show 950 curies of tritium from off-gassing, which is slightly higher than the 910 curies projected by the ROD and about 50% of total emissions. Chemical waste also exceeds projections made by the ROD, and was driven by ER Project clean up of potential release sites (PRSs). Most chemical waste is shipped off-site for disposal and therefore will not result in environmental impacts at LANL. See Section 3.3 for a more detailed description of waste management activities at LANL.

Table 2.16.3-1. Non-Key Facilities/Operations Data

PARAMETER	UNITS	SWEIS ROD	1999
Radioactive Air Emissions: ^a			
Tritium	Ci/y	9.1E+2	9.5E+2
Plutonium	Ci/y	3.3E-6	No data ^b
Uranium	Ci/y	1.8E-4	No data ^b
NPDES Discharge	MGY	142	232
Wastes:			
Chemical	kg/yr	651,000	765,000
LLW	m ³ /yr	520	286
MLLW	m ³ /yr	30	3
TRU/Mixed TRU	m ³ /yr	0	0
Number of Workers	FTEs	6579	4601 ^c

^a Stack emissions from previously active facilities (TA-33 and TA-41); these were not projected as continuing emissions in the future. Does not include nonpoint sources.

^b Most of the stacks in the Non-Key Facilities are not sampled for radioactive airborne emissions because the potential emissions from these stacks are sufficiently small that measurement systems are not necessary to meet regulatory or facility requirements.

^c The number of employees for 1999 operations cannot be directly compared to numbers projected by the SWEIS ROD. The employee numbers projected by the ROD represent total workforce size and include PTLA, JCNNM, and other subcontractor personnel. The number of employees for 1999 operations is routinely collected information and represents only UC employees (regular full-time and part-time). Because the two sets of numbers do not represent the same entity, a direct comparison to numbers projected by the ROD (see Section 4.6, Socioeconomics) is not appropriate.

2.17 Environmental Restoration Project

The ER Project may be a major contributor to LANL's environmental effluents, and therefore, is included as a section of Chapter 2. The ROD forecast that the ER Project would contribute 60% of the chemical wastes, 35% of the LLW, and 75% of the MLLW generated at LANL over the ten years from 1996–2005. The ER Project will also affect land resources in and around LANL.

The DOE established the ER Project in 1989 to characterize and remediate sites that were known or suspected to be contaminated from historical operations. An assessment in the late 1980s resulted in the identification of over 2100 potential release sites (PRSs). Many of the sites identified remain under DOE control; however, some have been transferred into private ownership. In 1999, ER Project activities included remedial site assessments and site cleanups. Assessment resulted in the submission of eight Resource Conservation Recovery Act (RCRA) facility investigation (RFI) reports to the New Mexico Environment Department (NMED) and continuing RFI fieldwork on numerous other sites. Cleanup entailed seven sites including an inactive firing site, septic tanks, and areas with contaminated soil.

By the end of 1999, LANL was in some phase of characterization of 1206 PRSs. The ER Project had remediated 130 sites and recommended 792 sites to the regulatory authority for no further action by the end of 1999 (Bertino 2000).

2.17.1 Operations of the ER Project

To date, the total number of PRSs removed from the permit remains at 102. Of the 102 PRSs that have been removed from the permit, three were removed during the period 1989–1998 and an additional 99 were removed during 1998. During 1999, the ER Project recommended an additional 47 PRSs for no further action. These recommendations are in various stages of NMED review and public comment.

As a result of an annual audit conducted by NMED in 1999, 388 PRSs were consolidated with other PRSs for the purpose of investigation and remediation. This consolidation was also conducted to correct a faulty numbering scheme imposed on the ER Project in the early 1990s. The total number of discrete sites that are continuing to be investigated by the ER Project has been reduced to 1206.

2.17.2 Operations Data for the ER Project

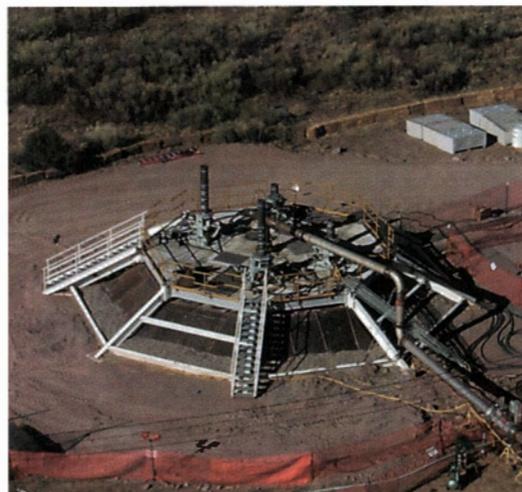
Waste quantities generated during 1999 are shown in Table 2.17.2-1 below. Only chemical waste is above the quantity predicted in the SWEIS because of the disposal of extensive amounts of soil for the MDA-P project. See Section 3.3, Solid and Chemical Wastes, for a more detailed discussion of wastes generated by the ER Project.

Cleanup activities also generated solid wastes, which were disposed at the County landfill.

Table 2.17.2-1. ER Project/Operations Data

WASTE TYPE	UNITS	SWEIS ROD	1999 OPERATIONS ^a
Chemical	kgs/yr	2,000,000	14,547,936
LLW	m ³ /yr	4260	407
MLLW	m ³ /yr	548	1.25
TRU	m ³ /yr	11	0
Mixed TRU	m ³ /yr	0	0

^a Memo, J.C. Del Signore to K.H. Rea, 10/3/2000



In-situ vitrification demonstration project

3.0 Site-Wide 1999 Operations Data

The role of the Yearbook is not to present environmental impacts or environmental consequences. The Yearbook's role is to provide data that could be used to develop an impact analysis. In this chapter, the Yearbook summarizes operational data at the site-wide level. In some cases, the Yearbook does include impacts for very specific areas—worker doses and doses from radioactive air emissions. These impact assessments are routinely undertaken by LANL, using standard methodologies that duplicate those used in the SWEIS; hence, they have been included for the sake of providing the base for future trend analysis.

This chapter of the Yearbook compares actual operating data to projected effects for about half of the parameters discussed in the SWEIS. These include effluent, workforce, regional, and long-term environmental effects. Some of the parameters used for comparison had to be derived from information contained in both the main text and appendices of the SWEIS. Many parameters cannot be compared because data are not routinely collected. In these cases, projections made in the SWEIS resulted only from the expenditure of considerable special effort, and such extra costs were avoided when preparing the Yearbook.

3.1 Air Emissions

3.1.1 Radioactive Air Emissions

Radioactive airborne emissions from point sources (i.e., stacks) during 1999 totaled approximately 1900 curies, less than 10% of the ten-year average of 21,700 curies projected by the ROD.⁴ These low emissions result from operations at the Key Facilities not being performed at projected levels. LANL is still gearing up to initiate its new assignments. In addition, a major source of these emissions (the Area A beam stop at LANSCE) was not used.

The two largest contributors to radioactive air emissions were tritium from the Tritium Facilities (both Key and Non-Key) and activation products from LANSCE. Stack emissions from the Tritium Key Facilities were about 650 curies, and tritium emissions from the Non-Key Facilities were 950 curies. This 950 curies represents off gassing from operations no longer in use at TA-33 (High Pressure Tritium Facility) and TA-41 (Tritium Laboratory). LANSCE emissions totaled 300 curies and accounted for about 15% of the LANL total, but were only about 2% of the projected ten-year average of about 16,800 curies for LANSCE.

Non-point sources of radioactive air emissions are present at LANSCE, Area G, TA-18, and other locations around the Laboratory. Non-point emissions, however, are small compared to stack emissions. For example, non-point air emissions from LANSCE were less than 20 curies. Additional detail about radioactive air emissions is provided in the Laboratory's annual compliance report to the Environmental Protection Agency (EPA; Jacobson 2000) and in Chapter 4 of the 1999 Environmental Surveillance Report (LANL 2000b).

The calculated dose to the MEI by the air pathway for 1999 was 0.32 millirem, including contributions from stack emissions and non-point sources such as Area G and the firing sites.

The calculated MEI dose attributable to LANSCE was less than 0.1 millirem. These values are less than one-tenth of the 5.44 millirem projected by the ROD and are well below the EPA emission standard of 10 mrem/yr.

3.1.2 Non-Radioactive Air Emissions

3.1.2.1 Emissions of Criteria Pollutants

Criteria pollutant emissions (oxides of nitrogen, sulfur oxides, carbon monoxide, and particulate matter) from fuel burning equipment are reported in the "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999" (LANL 2000a). The report provides emission estimates for the Laboratory's steam plants, nonexempt boilers, asphalt plant, and the water pump. In addition, emissions from the paper shredder, rock crusher, degreaser, and beryllium machining operations are reported. Information on total volatile organic compounds released from painting and research and development operations is presented.

⁴ These values represent a summation of the data presented in the data tables, Chapter 3, of the SWEIS.

LANL, in comparison to industrial sources and power plants, is a relatively small source of non-radioactive air pollutants. As such, the Laboratory is required to estimate emissions, rather than perform actual stack sampling. Calculated emissions for criteria pollutants during 1999 were less than amounts assumed for the ROD as shown in Table 3.1.2.1-1 below.

Table 3.1.2.1-1 Emissions of Criteria Pollutants

POLLUTANTS	UNITS	SWEIS ROD	1999
Carbon monoxide	Tons/year	58	32
Nitrogen oxides	Tons/year	201	88
Particulate matter	Tons/year	11	4.5
Sulfur oxides	Tons/year	0.98	0.55

Since the analysis of ROD emissions of criteria pollutants indicated no adverse air quality impacts, this same conclusion can be drawn for 1999 emissions.

3.1.2.2 Chemical Usage and Emissions

The SWEIS contained projections for toxic air pollutants, based on chemical use at each TA, rather than at each Key Facility; these projections were then compared to a screening level. Emissions from only one Key Facility, High Explosive Testing, exceeded the screening level of the analysis. Therefore, chemical use (the relevant parameter) was only included in the table of parameters for this Key Facility. However, usage of non-radioactive materials in firing site operations was also well below the amounts projected. Therefore, estimated air concentrations for 1999 were less than projected by the ROD.

This edition of the Yearbook is proposing to report chemical usage and calculated emissions for the Key Facilities, based on an improved chemical reporting system. The 1999 estimates of chemical usage were obtained from the Laboratory's Automated Chemical Inventory.

System (ACIS). The quantities used for this report represent all chemicals procured or brought on site in 1999. This methodology is the same as that used by the Laboratory for reporting under the Superfund Amendments and Reauthorization Act, specifically Section 313 of the Emergency Planning Community Right-to-Know Act.

An overview of the 1995 data used for the SWEIS compared to the 1999 data shows some substantial differences. The 1999 data are believed to be more accurate and up-to-date for two reasons. First, in 1998 the Laboratory instituted a chemical management standard. The standard requires that all chemicals appear on ACIS. Secondly, in 1998-1999, a wall-to-wall inventory of the Laboratory was conducted to update ACIS.

Air emissions shown in Tables A-2 through A-16 of the Appendix are divided into emissions by Key Facility. Emission estimates (expressed as kilograms per year) were performed in the same manner as that reported in the ROD. First, the usage of the listed chemicals was summed by facility. It was then estimated that 35% of the chemical used was released to the atmosphere. However, emission estimates for mercury and solid metals were assumed to vent at levels below 1% of the total used. It was presumed that metal emissions would come from cutting, and possibly, melting operations. Fuels such as propane were assumed to be combusted.

As expected, a number of chemicals evaluated in the ROD were not used in 1999 and vice versa. Table A-1 (Appendix) lists, by TA, the number of chemicals used in 1995 but not used in 1999 and the number of chemicals used in 1999 but not used in 1995.

The chemical comparison above indicates that the number of chemicals used in 1999 at each of the Key Facilities was substantially less than that evaluated in the ROD. These changes are believed to be a result of more accurate chemical data collection. Information related to actual chemical use and estimated emissions for each Key Facility is shown in the Appendix.

Overall chemical use and emissions resulting from that use have decreased from that reported in the 1995 ROD. Additional information related to emissions reporting can be found in the “Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 (20 NMAC 2.73) for Calendar Year 1999” (LANL 2000a).

3.2 Liquid Effluents

Based on average daily flows as reported by the Laboratory’s Water Quality and Hydrology Group and on operational records when available, effluent flow through NPDES outfalls totaled an estimated 317.2 million gallons in 1999, compared to 278 million gallons projected by the ROD.⁵ Key Facilities accounted for approximately 84.5 million gallons of that total. This flow can be examined by watershed (Figure 3-1) in Table 3.2-1 and by facility in Table 3.2-2 to understand differences from projections.

Table 3.2-1. NPDES Discharges by Watershed

WATERSHED	# OUTFALLS (SWEIS ROD)	# OUTFALLS ^a (1999)	DISCHARGE ^b (SWEIS ROD)	DISCHARGE ^{a,b} (1999)
Cañada del Buey	3	3 ^c	6.4	2.6
Guaje	7	6 ^d	0.7	1.7
Los Alamos	8	7	44.8	45.2
Mortandad	7	6	37.4	39.3
Pajarito	11	2 ^e	2.6	0
Pueblo	1	1	1.0	0.9
Sandia	8	6	170.7	213.2 ^c
Water	10	5 ^f	14.2	14.3
Totals	55	36	278.0	317.2

^a Includes outfalls that were eliminated during 1999, some of which had flow. Twenty outfalls discharged during 1999.

^b Millions of gallons per year.

^c Includes effluent from SWS, which is piped to TA-3 and ultimately discharges to Sandia Canyon via outfall 001.

^d Includes 04A176 discharge to Rendija Canyon, a tributary to Guaje Canyon.

^e Includes 06A106 discharge to Three-Mile Canyon, a tributary to Pajarito Canyon. See Table 3.2-3.

^f Includes 05A055 discharge to Valle Canyon, a tributary to Water Canyon.

The number of outfalls listed in the NPDES permit had decreased by 16, to 20, at the end of 1999, see Table 3.2-3. Three of the 16 outfalls eliminated during 1999, 03A040, 03A045, and 06A106, were associated with the HRL, Radiochemistry Laboratory, and High Explosives Testing Key Facilities, respectively; and, each was eliminated after cessation of source activities and processes or redirecting flows to other outfalls, primarily to the sanitary system. Most of the reductions (9 of the 16) during 1999 were the result of transferring the water supply system from the DOE to Los Alamos County. Those outfalls were removed from the Laboratory’s NPDES permit and added to the Los Alamos County NPDES permit application. Four other water supply wells were taken out of production, their pumping equipment removed, and their outfalls eliminated. Table 3.2-3 also shows the final disposition for each of the eliminated outfalls and the drainage basins to which they discharged.

Table 3.2-2 compares NPDES discharges by facility. The Non-Key Facilities had the largest differences between 1999 discharges and discharges projected by the ROD. For the Non-Key Facilities, discharges from the outfall at the TA-3 power plant were appreciably higher, 165 million gallons discharged in 1999 compared to a projected discharge of 114 million gallons. Approximately 106 million gallons of the discharge from outfall 001 at the power plant are attributable to sanitary effluent piped from TA-46 to TA-3 to be used as makeup water. The combined flows of the sanitary waste treatment plant and the TA-3 Steam Plant account for about half of the total

⁵ For some facilities, flows are determined by recorders installed at the end of the pipe. This was the case for outfalls at the SWS, HEWTF, RLWTF, and the Power Plant. For all other outfalls, annual totals were calculated from discharge monitoring reports (DMRs) provided by the Laboratory’s Water Quality and Hydrology Group. This latter method substantially overestimates the quantity of wastewater discharged because it is based on infrequent sampling and the DMRs assume round-the-clock flow for all outfalls.

discharge from Non-Key Facilities and one-third of the water discharged by the Laboratory. Additionally, flows from two outfalls removed from the permit during 1999 had previously been redirected to the sanitary system, see Table 3.2-3. –For Key Facilities, LANSCE discharged approximately 37.2 million gallons for 1999, accounting for nearly half of the total discharges from all Key Facilities, see Table 3.2-2.

Treated waters released from LANL outfalls rarely leave the site. An indicator of this is provided by stream gage measurements near downstream site boundaries in seven watersheds as reported in “Surface Water Data at Los Alamos National Laboratory; 1999 Water Year” (Shaull et al. 2000).



Typical NPDES-regulated outfall

Table 3.2-2. NPDES Discharges by Facility

FACILITY ^a	# OUTFALLS (SWEIS ROD)	# OUTFALLS ^b (1999)	DISCHARGE ^c (SWEIS ROD)	DISCHARGE ^{b,c} (1999)
Plutonium Complex	1	1	14.0	8.6
Tritium Facility	2	2	0.3	9
CMR Building	1	1	0.5	4.5
Sigma Complex	2	2	7.3	5.9
High Explosives Processing	11	3	12.4	0.2
High Explosives Testing	7	3	3.6	14.3
LANSCE	5	4	81.8	37.2
HRL	1	1	2.5	0
Radiochemistry Facility	2	1	4.1	0
RLWTF	1	1	9.3	5.3
Pajarito Site		0	0	0
MSL		0	0	0
TFF		0	0	0
Machine Shops		0	0	0
Waste Management Operations		0	0	0
Non-Key Facilities	22	17	142.1	232
Totals	55	36	278.0	317.2

^a No outfalls for Pajarito Site, MSL, TFF, Shops, and the Solid Radioactive and Chemical Waste Facility.

^b Includes 16 outfalls that were eliminated during 1999, some of which had flow for part of the year.

^c Millions of gallons per year.

LANL has three principal wastewater treatment facilities—the sewage plant (SWS) at TA-46, the RLWTF at TA-50, and the HEWTF at TA-16. The sewage treatment plant at TA-46 processed 106 million gallons of treated wastewater and sewage during 1999. From TA-46, treated liquid effluent is pumped to the TA-3 power plant where it is either used to provide make up water for the cooling towers or is discharged directly into Sandia Canyon via outfall 001. For 1999 the reported total discharge from the power plant into Sandia Canyon was approximately 166 million gallons based on averaged daily flows

The RLWTF, Building 50-01, outfall 051 discharges into Mortandad Canyon. Process modifications projected by the ROD were installed during 1997 and 1998, but did not become operational until March of 1999. These

modifications are designed to achieve compliance with more stringent NMED effluent limits for nitrates, fluoride, other NPDES permit limits, and DOE Derived Concentration Guidelines for radioactive constituents released to the environment. During 1999, 5.3 million gallons of treated radioactive liquid waters were released to Mortandad Canyon, compared to 9.3 million gallons projected by the ROD.

The TA-16 HEWTF, discharged a total of 0.096 million gallons compared to 0.13 projected in the ROD. Effluent quality was similar to that of recent years. Details on all non-compliance situations are provided in the 1999 Annual Environmental Surveillance Report (LANL 2000b).

Table 3.2-3. NPDES Outfalls Deleted in 1999

OUTFALL	LOCATION	DRAINAGE	DATE	FINAL DISPOSITION
03A-040	TA-43-1	Los Alamos	1/11/99	Seven sub-basement floor drains discharging cooling water blowdown were re-routed to the sanitary waste line on 3/6/97. Thirteen roof drains and two sub-basement floor drains continue to discharge storm water through the existing outfall piping.
03A-045	TA-48-1	Mortandad	12/6/99	Cooling water blowdown discharging to a basement floor sink drain was re-routed to the sanitary waste line on 12/10/96. Twenty-six roof drains continue to discharge storm water through the existing outfall piping.
04A-118 04A-161 04A-163 04A-164 04A-165 04A-166 04A-172 04A-177 04A-186	Pajarito #4 Otowi #1 Pajarito #1 Pajarito #2 Pajarito #3 Pajarito #5 Guaje #1A Guaje Booster Otowi #4	Cañada del Buey Pueblo Sandia Pajarito Sandia Cañada del Buey Guaje Guaje Los Alamos	10/13/99	The nine water wells and associated NPDES-Permitted outfalls are part of the Los Alamos Municipal Water Supply System. The U.S. DOE leased the water supply system on 9/8/98 to the Los Alamos County. The nine outfalls associated with these water supply wells were deleted from the Laboratory's NPDES permit following the submittal of an NPDES Application by the County.
04A-171 04A-175 04A-176	Guaje #1 Guaje #5 Guaje #6	Guaje Guaje Guaje	8/23/99	These three water supply wells and outfalls are no longer operational. Pumping equipment has been removed and well house structures have been demolished.
04A-173	Guaje #2	Guaje	9/21/99	The water supply well and associated outfall are no longer in operation. Pumping equipment has been removed and the well house structure has been demolished.
06A-106	TA-36-1 ^a	Three Mile	1/11/99	All drains in Rooms 7 and 8 associated with the photo-processing lab were plugged and the process equipment has been removed.

^a Key Facility, Three-Mile Canyon is a tributary to Pajarito Canyon.

3.3 Solid Radioactive and Chemical Wastes

LANL generates radioactive and chemical wastes as a result of research, operations, maintenance, construction, and environmental restoration activities. These wastes are categorized as one of five types. The management of each type has different regulatory requirements. Waste generators can be assigned to one of three categories—Key Facilities, Non-Key Facilities, and the ER Project.

Comparisons of 1999 waste quantities to projections made by the ROD are made in the following paragraphs on the basis of waste type, generator category, or both. No distinction has been made between routine wastes (such as those generated from ongoing operations) and non-routine wastes (such as those generated from the decontamination and decommissioning of buildings). A summary of this comparison appears in Table 3.3-1 below.

Table 3.3-1. LANL Waste Types and Generation

WASTE TYPE	UNITS	SWEIS ROD	1999	% OF ROD	REASONS FOR 1999 DIFFERENCES
Chemical	10 ³ kg/yr	3250	15,443	475	ER Project
LLW	m ³ /yr	12,200	1710	14	ER Project, High Explosives
MLLW	m ³ /yr	632	21	3	ER Project
TRU/Mixed TRU	m ³ /yr	448	215	48	Pits
TRU	m ³ /yr	333	143	43	Pits
Mixed TRU	m ³ /yr	115	72	63	Pits

Projections in the ROD and actual quantities generated in 1999 differed significantly for three of the five waste types. The ER Project played a significant role in differences for all three types. Large quantities of chemical waste, primarily contaminated soil, were generated by the ER Project from remediation of MDA-P. On the other end of the spectrum, MLLW generation was significantly lower than projected in the ROD because the ER Project generated only one cubic meter (versus 548 projected). Finally, LLW generation continued to be significantly lower than projections because CMR, Sigma, and the High Explosives Facilities (Shops, Processing, and Testing) had lower-than-projected levels of activity. Combined, these five facilities generated just 325 cubic meters of LLW versus 4342 cubic meters projected by the ROD.

3.3.1 Chemical Wastes

Chemical waste generation in 1999 exceeded waste volumes projected by the ROD by a factor of five. These large quantities of chemical waste will not result in as significant an on-site environmental impact as the waste volume suggests because most chemical waste is shipped to commercial disposal facilities. Examination of the generator categories (Table 3.3.1-1) sheds some light on where these large quantities are generated.

Table 3.3.1-1. Chemical Waste Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	1999
Key Facilities	10 ³ kg/yr	600	129
Non-Key Facilities	10 ³ kg/yr	650	765
ER Project	10 ³ kg/yr	2000	14,548
LANL	10 ³ kg/yr	3250	15,443

As can be seen in Table 3.3.1-1, cleanup efforts of the ER Project accounted for the large waste volumes, almost 95% of the total. While the ER Project generated wastes from investigation and remediation of several sites, most of the 14.5 million kilograms of chemical waste generated by the ER Project resulted from remediation of PRSs at TA-16, particularly MDA-P. MDA-P is being exhumed as part of a clean-closure under the RCRA. The bulk of the material removed from MDA-P was soil overburden and soil beneath the scrap metal and other wastes

that had been disposed in the site. Soil, scrap metal, containers, and miscellaneous equipment and debris that were characterized as hazardous waste were shipped off-site for treatment and disposal since LANL has no on-site capacity for disposal of hazardous waste. Some nonhazardous wastes, soil, concrete rubble, and debris were disposed in MDA-J at TA-54, a solid waste landfill undergoing closure. Approximately 4.7 million kilograms of soil and concrete rubble from MDA-P were placed in MDA-J as fill in preparation for capping (1999 Annual Report Questionnaire for the Los Alamos National Laboratory, Technical Area 54, Area J Landfill). Substantial quantities of scrap metal exhumed from MDA-P were decontaminated on-site at TA-16 and subsequently shipped off-site to scrap metal recyclers.

Overall, the Laboratory generated approximately 4.5 million kilograms of hazardous and mixed wastes during 1999 (LANL 2000c). Again, nearly 3.9 million kilograms were generated by the ER Project while investigating and remediating solid waste management units. The ER Project is discussed in more detail in Section 2.17. The remainder of the chemical waste was generated by a variety of organizations and activities associated with research, decommissioning and decontamination, and facilities maintenance.

Four of the Key Facilities also had substantial departures from projections. The Machine Shops generated less than 1% of the projected waste quantity for the Expanded Alternative (474,000 kilograms projected compared to 3955 actual). The lower than expected waste generation at the Shops resulted from a combination of waste minimization efforts and a much lower workload than projected in the SWEIS. Additionally, the workload at the Shops is directly linked with high explosives testing and processing operations. Chemical waste volumes also differed from projections for the High Explosives Testing Facility (35,300 kilograms projected compared to 1015 actual). Finally, the High Explosives Processing Key Facility generated larger quantities of chemical wastes (13,000 kilograms projected compared to 95,184 actual). However, approximately 81,855 kilograms were generated from the updating or closure of filter beds and open burning sites (TA-16-401, -406, -388, -399, -394) used to treat waste high explosives.

3.3.2 Low-Level Radioactive Wastes

LLW generation in 1999 was less than 15% of waste volumes projected by the ROD. As can be seen in Table 3.3.2-1, cleanup efforts of the ER Project generated only about 10% of projected LLW volumes. Key Facilities account for most of the departure from projections, however. Large differences occurred at the CMR Building (1820 cubic meters projected compared to 189 actual), LANSCE (1085 cubic meters projected compared to 70 actual), the Sigma Complex (960 cubic meters projected compared to 61 actual), the Machine Shops (606 cubic meters projected compared to 40 actual), and High Explosive Testing (940 cubic meters projected compared to zero actual). LANSCE generated lower volumes than projected because decommissioning and renovation of Experimental Area A did not occur. Low workloads accounted for low waste volumes at the other four Key Facilities.

Table 3.3.2-1. LLW Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	1999
Key Facilities	m ³ /yr	7450	1017
Non-Key Facilities	m ³ /yr	520	286
ER Project	m ³ /yr	4260	407
LANL	m ³ /yr	12,230	1710

3.3.3 Mixed Low-Level Radioactive Wastes

Generation in 1999 was less than 5% of MLLW volumes projected by the ROD. Table 3.3.3-1 examines these wastes by generator categories.

Table 3.3.3-1. MLLW Generators and Quantities

WASTE GENERATOR	UNITS	SWEIS ROD	1999
Key Facilities	m ³ /yr	54	17
Non-Key Facilities	m ³ /yr	30	3
ER Project	m ³ /yr	548	1
LANL	m ³ /yr	632	21

As can be seen in the table, small waste quantities from the ER Project account for nearly all the difference between SWEIS projections and 1999 actual generation of MLLW.

3.3.4 Transuranic/Mixed Transuranic Wastes

Generation of TRU/mixed TRU waste in 1999 was less than half of volumes projected by the ROD. As projected, TRU wastes are expected to be generated in five facilities (the Plutonium Facility Complex, the CMR Building, the High Explosive Testing Facilities, the RLWTF, and the Solid Radioactive and Chemical Waste Facility) and by the ER Project. Mixed TRU wastes are only expected from two facilities (the Plutonium Facility Complex and the CMR Building). Table 3.3.4-1 examines these wastes by generator categories.

Table 3.3.4-1. 1999 Transuranic/Mixed Transuranic Waste Generators and Quantities

CATEGORY	UNITS	KEY FACILITIES	NON-KEY FACILITIES	ER PROJECT	LANL
SWEIS ROD (TRU/Mixed TRU)	m ³ /yr	437	0	11	448
SWEIS ROD (TRU)	m ³ /yr	322	0	11	333
SWEIS ROD (Mixed TRU)	m ³ /yr	115	0	0	115
1999 TRU/Mixed TRU	m ³ /yr	215	0	0	215
1999 TRU	m ³ /yr	143	0	0	143
1999 Mixed TRU	m ³ /yr	72	0	0	72

The departure from projections in 1999 is almost entirely accounted for in two Key Facilities—the Plutonium Complex and the RLWTF. The Plutonium Complex was projected at 339 cubic meters and only produced 160 cubic meters of TRU/mixed TRU waste. The RLWTF was projected at 30 cubic meters and only produced 4.6 cubic meters. These differences exist because manufacture of war reserve pits had not begun at the Plutonium Complex and configuration of the new membrane treatment process at the RLWTF was slightly different than originally designed.

Personnel loading a Transuranic Packaging Transporter Model 2 (TRUPACT II) for shipping waste to the pilot plant



3.4 Utilities

Ownership and distribution of utility services continues to be split between DOE and Los Alamos County. DOE owns and distributes most utility services to LANL facilities, and the County provides these services to the communities of White Rock and Los Alamos. Routine data collection for both gas and electricity are done on a fiscal year basis, and keeping with the goal of using routinely collected data, this information is presented by fiscal year in the Yearbook. Water data, however, are routinely collected and summarized by calendar year.

3.4.1 Gas

There was a change in ownership to the DOE Natural Gas Transmission Line in August 1999. DOE sold 130 miles of gas pipeline and metering stations to the Public Service Company of New Mexico (PNM). This gas pipeline transverses the area from the Kutz Canyon Processing Plant south of Bloomfield, New Mexico, to Los Alamos. Approximately 4 miles of the gas pipeline are within LANL. Table 3.4.1-1 presents gas usage by LANL for fiscal year 1999. Approximately 90% of the gas used by LANL continued to be used for heating (both steam and hot air). The remainder was used for electrical production. The electrical generation was used to fill the difference between peak loads and the electric contractual import rights.

As shown in Table 3.4.1-1, total gas consumption for fiscal year 1999 was less than the projected use in the ROD. During fiscal year 1999, less natural gas was used for heating because of the warmer than normal weather pattern, but more natural gas was used for electric generation at the TA-03 Power Plant. In addition, as shown in Table 3.4.1-2, the TA-16 steam production plant was shut down in 1997 when the new heating systems for TA-16 became fully operational.

Table 3.4.1-1. Gas Consumption (decatherms^a) at LANL/Fiscal Year 1999

SWEIS ROD	TOTAL LANL CONSUMPTION	TOTAL USED FOR ELECTRIC PRODUCTION	TOTAL USED FOR HEAT PRODUCTION	TOTAL STEAM PRODUCTION
1,840,000	1,428,568	241,490	1,187,078	Table 3.4.1-2

^a A decatherm is equivalent to 1000-1100 cubic feet of natural gas.

Table 3.4.1-2. Steam Production at LANL/Fiscal Year 1999

TA-3 STEAM PRODUCTION (klb ^a)	TA-16 STEAM PRODUCTION (klb)	TA-21 STEAM PRODUCTION (klb)	TOTAL STEAM PRODUCTION (klb)
576,548 ^b	Eliminated Feb 1997 ^c	29,468	606,016

^a klb: Thousands of pounds

^b TA-3 steam production has two components: that used for electric production (262,100 klb in 1999) and that used for heat (312,448 klb in 1999).

^c Steam production at the TA-16 central steam plant ceased in February 1997 when new heating systems became operational.

3.4.2 Electricity

LANL is supplied with electrical power through a cooperative arrangement with Los Alamos County, known as the Los Alamos Power Pool (LAPP), which was established in 1985. The DOE Albuquerque Operations Office and Los Alamos County have entered into a 10-year contract known as the Electric Coordination Agreement whereby each entity's electric resources are consolidated or pooled. The capacity rating of LAPP resources, less losses, is 110 megawatts and 88 megawatts (summer and winter seasons, respectively). The transmission import capacity is contractually limited to 95 megawatts and 73 megawatts (summer and winter seasons, respectively).

The ability to accept additional power into the LAPP grid is limited by the regional electric import capability of the existing northern New Mexico power transmission system. In recent years, the population growth in

northern New Mexico, together with expanded industrial and commercial usage, has greatly increased the power demands on the northern New Mexico regional power system. Several proposals for bringing additional power into the region have been considered. Power line corridor locations remain under consideration, but it is uncertain when any new regional power lines would be constructed and become serviceable. An additional limitation to additional power is the contractual rights held by the LAPP for importing power from the regional transmission network.

Table 3.4.2-1 shows peak demand and Table 3.4.2-2 shows annual use of electricity for fiscal year 1999. LANL's electrical energy use remains below projections in the ROD. The ROD projected peak demand to be 113,000 kilowatts with 63,000 kilowatts being used by LANSCE and about 50,000 kilowatts being used by the rest of the Laboratory. In addition, the ROD projected annual use to be 782,000 megawatts with 437,000 megawatts being used by LANSCE and about 345,000 megawatts being used by the rest of the Laboratory. Actual use has fallen below these values, and the projected periods of brownouts have not occurred. However, on a regional basis, failures in the PNM system have caused blackouts in northern New Mexico and elsewhere.

Table 3.4.2-1. Electric Peak Coincident Demand/Fiscal Year 1999

CATEGORY	LANL BASE	LANSCE	LANL TOTAL	COUNTY TOTAL	POOL TOTAL
SWEIS ROD	50,000 ^a	63,000	113,000	Not projected	Not projected
FY1999	43,976	24,510	68,486	14,399	82,885

^a All figures in kilowatts.

Table 3.4.2-2. Electric Consumption/Fiscal Year 1999

CATEGORY	LANL BASE	LANSCE	LANL TOTAL	COUNTY	POOL TOTAL
SWEIS ROD	345,000 ^a	437,000	782,000	Not projected	Not projected
FY1999	255,562	113,759	369,321	106,547	475,868

^a All figures in megawatt-hours.

3.4.3 Water

Before September 8, 1998, DOE supplied all potable water for LANL, Bandelier National Monument, and Los Alamos County, including the towns of Los Alamos and White Rock. This water was obtained from DOE's groundwater right to withdraw 5541.3 acre-feet/year or about 1806 million gallons of water per year from the main aquifer. On September 8, 1998, DOE leased these water rights to Los Alamos County. This lease also included DOE's contracted annual right obtained in 1976 to 1200 acre-feet/year of San Juan-Chama Transmountain Diversion Project water. The lease agreement is effective for three years, although the County can exercise an option to buy sooner than three years. DOE expects to convey 70% of the water rights to Los Alamos County and lease the remaining 30% to them. The San Juan-Chama rights will be transferred in their entirety to the County. The agreement between DOE and the County does not preclude provision of additional waters in excess of the 30% agreement, if available. However, the agreement also states that should the County be unable to provide water to its customers, the County shall be entitled to reduce water services to DOE in an amount equal to the water deficit.

The DOE and LANL recognize the need to adhere to the provisions of the lease agreement. However, it is important to make a distinction between water rights and water use. For example, in 1997, LANL used 38% of the total water used, and Los Alamos County used the remaining 62%, for the 100% total. However, this water use did not use 100% of the water rights. LANL used only 27% of the water rights, while Los Alamos County used 44% of the water rights, leaving 29% of the water rights unused. That unused portion of water rights is available for sale, according to the agreement. The future development of the County could, however, increase the County's water use. Thus, the Laboratory is neither guaranteed 1662 acre-feet/year (542 million gallons/year) nor necessarily limited to 1662 acre-feet/year.

In addition, it is also important to understand how the Laboratory water use has been determined. Up to the transfer of the water production system to the County, the Laboratory was responsible for water production. Water usage by the County was metered. The Laboratory water usage was estimated by subtracting the county usage from the known well production. Until the transfer, users such as Bandelier National Monument and others were included in the Laboratory total, as were losses in the supply system, such as would occur from the purging of wells.

Metering of LANL's actual water usage began in October 1998 after Los Alamos County took over the water production system on September 8, 1998. Meters are planned to be added at selected facilities/equipment and trunk lines to begin to determine specific use at LANL.

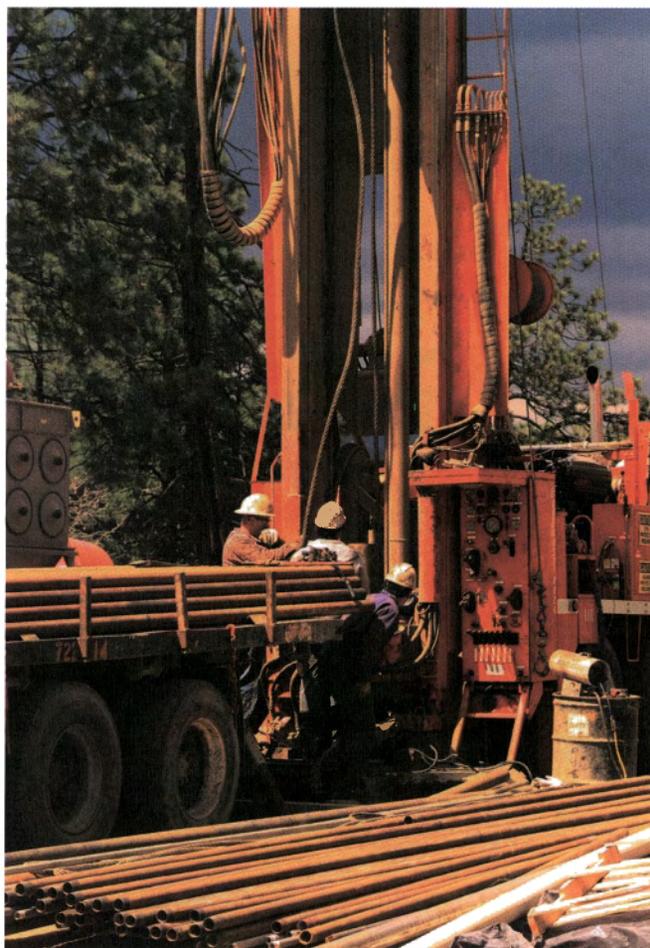
Table 3.4.3-1 shows water consumption in thousands of gallons for calendar year 1999. Under the expanded alternative, water use for LANL was projected to be 759 million gallons per year with 265 million gallons being used by LANSCE and 494 million gallons being used by the rest of the Laboratory. Actual use by LANL in 1999 was about 300 million gallons less than the projected consumption and 89 million gallons less than the 542 million gallons/year under the agreement with the County. The calculated NPDES discharge of 317 million gallons was about 70% of the total LANL usage of 453 million gallons.

Table 3.4.3-1. Water Consumption (thousands of gallons) for Calendar Year 1999

CATEGORY	LANL	LOS ALAMOS COUNTY	TOTAL
SWEIS ROD	759,000	Not Available ^a	Not Available ^a
Calendar Year 1999	453,094	Not Available ^a	Not Available ^a

^a On September 8, 1998, Los Alamos County acquired the water supply system and LANL no longer collects this information.

As a result of the lease, LANL no longer maintains records for total water consumption or usage by Los Alamos County. The County now bills LANL for water, and all future water use records maintained by LANL will be based on those billings. Along with this transfer, Los Alamos County accepted responsibility for all chlorinating stations, and the County now operates these stations. The distribution system remaining under LANL control, and being used to supply water to LANL facilities, now consists of a series of reservoir storage tanks, pipelines, and fire pumps. The LANL system is gravity fed with fire pumps for high-demand situations.



Deep well drilling rig

3.5 Worker Safety

Working conditions at LANL have remained essentially the same as those identified in the SWEIS. DARHT and Atlas—major construction activities—were reflected in the SWEIS analysis. Few other major construction projects have been undertaken, and more than half the workforce remains routinely engaged in activities that are typical of office and computing industries. Much of the remainder of the workforce is engaged in light industrial and bench-scale research activities. Approximately one-tenth of the general workforce at LANL continues to be engaged in production, services, maintenance, and research and development within Nuclear and Moderate Hazard facilities.

3.5.1 Accidents and Injuries

Occupational injury and illness rates for workers at LANL declined during calendar year 1999 as shown in Table 3.5.1-1. These rates correlate to 258 reportable injuries and illnesses during the year, compared to 507 projected by the ROD.

Table 3.5.1-1. Total Recordable and Lost Workday Case Rates at LANL

CALENDAR YEAR	UC WORKERS ONLY		LANL (ALL WORKERS)	
	TRI ^a	LWC ^b	TRI	LWC
1999	2.37	1.24	2.52	1.37

^a TRI: Total Recordable Incident rate, number per 200,000 hours worked

^b LWC: Lost Workday Cases, number of cases per 200,000 hours worked

3.5.2 Ionizing Radiation and Worker Exposures

Occupational radiation exposures for workers at LANL during calendar year 1999 are summarized in Table 3.5.2-1. The collective Total Effective Dose Equivalent, or collective TEDE, for the LANL workforce during 1999 was 131 person-rem, considerably lower than the workforce dose of 704 person-rem projected for the ROD.

Table 3.5.2-1. Radiological Exposure to LANL Workers

PARAMETER	UNITS	SWEIS ROD	VALUE FOR 1999
Collective TEDE (external + internal)	person-rem	704	131
Number of workers with non-zero dose	number	3548	1427
Average non-zero dose:			
external + internal	millirem	Not projected	92
external only	millirem	Not projected	90

These reported doses for 1999 could change with time. Estimates of committed effective dose equivalent in many cases are based on several years of bioassay results, and as new results are obtained the dose estimates may be modified accordingly.

Of the 131 person-rem collective TEDE reported for 1999, external radiation and tritium exposure accounted for 128 person-rem. The remainder is from internal exposure. It is not possible to identify a single reason for the decrease in collective TEDE in 1999 from the 208 person-rem of 1993–1995. Rather, the decrease is an aggregation of several reasons, the more important of which include the following:

Work and Workload: Changes in workload and types of work have resulted in a decreased collective TEDE. The SWEIS used the 1993–1995 time frame as its base. For example, at that time the radionuclide power source for the Cassini spacecraft was being constructed at TA-55. This project incurred higher neutron exposure for the workers. After the project was completed in the 1995–1996 time frame, the LANL collective TEDE was reduced.

As Low As Reasonably Achievable (ALARA) Program: Improvements from the ALARA program, such as the continuing addition of shielding at LANL workplaces, have also resulted in lower worker exposures and consequently a reduced collective TEDE for the Laboratory.

Improved personnel dosimeter: An improved personnel dosimeter was introduced on a Laboratory-wide basis in April 1998. The dosimeter's increased accuracy in measuring the external neutron dose removed some conservatism that had been previously used in estimating the dose, which resulted in lower reported doses. (The actual dose did not change, but the ability to measure it accurately improved.)

Internal dose: Finally, the TEDE in 1999 was also lower because the 1999 internal collective effective dose equivalent was lower than that of 1993–1995.

In addition to being less than the TEDE levels in 1993–1995, the TEDE for 1999 is also less than the TEDE projected in the ROD. Because the ROD was not signed until September 1999, the implementation of war reserve pit manufacture was not fully operational at LANL. This also contributed to lower doses than projected in the SWEIS.

Collective TEDEs for Key Facilities In general, TEDEs by Key Facility or TA are difficult to determine because these data are collected at the Group level, and members of many groups and/or organizations receive doses at several locations. The fraction of a group's collective TEDE coming from a specific Key Facility or TA can only be estimated. For example, personnel from the Health Physics Operations Group and JCNNM are distributed over the entire Laboratory, and these two organizations account for a significant fraction of the total LANL collective TEDE. Nevertheless, because the groups working at TA-55 and TA-18 are relatively well defined, an estimate was made of the 1999 collective TEDE for the Plutonium Complex (93 person-rem) and the Pajarito Site (1.8 person-rem) Key Facilities. The estimate for TA-55 demonstrates that approximately two-thirds of the total Laboratory TEDE is a result of operations at the Plutonium Complex.

3.6 Socioeconomics

The LANL-affiliated workforce continues to include UC employees and subcontractors. As shown in Table 3.6-1, there has been a steady growth in number of employees. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than were anticipated under the ROD, which projected a workforce of 11,351 based on the 10,593 employees identified for the index year (employment as of March 1996) in the SWEIS.

Table 3.6-1. LANL-Affiliated Work Force

CATEGORY	UC EMPLOYEES	TECHNICAL CONTRACTOR	NON-TECHNICAL CONTRACTOR	JCNNM	PTLA	TOTAL
SWEIS ROD ^a	8740	795	Not projected ^b	1362	454	11,351
calendar year 1999	9185	1064	214	1461	488	12,412

^a Total number of employees was presented in the ROD, the breakdown had to be calculated based on the percentage distribution shown in the ROD for the base year.

^b Data were not presented for non-technical contractors or consultants.

This increase in employees has had a positive economic impact on northern New Mexico. Through 1998, DOE published a report each fiscal year regarding the economic impact of LANL on north-central New Mexico as well as the State of New Mexico (Lansford et al., 1997, 1998, and 1999). The findings of these reports indicate that LANL's activities resulted in a total increase in economic activity in New Mexico of about \$3.2 billion in 1996, \$3.9 billion in 1997, and \$3.8 billion in 1998. Based on number of employees and payroll, it is expected that LANL's 1999 economic contribution was similar to the previous three years.

The residential distribution of the new UC employees (e.g., the total 240 additional employees in 1999) reflects the housing market dynamics of three counties. As seen in Table 3.6-2, more than 90% of the UC employees continue to reside in the three counties of Los Alamos, Rio Arriba, and Santa Fe.

Table 3.6-2. County of Residence for UC Employees^a

CALENDAR YEAR	LOS ALAMOS	RIO ARRIBA	SANTA FE	OTHER NM	TOTAL NM	OUTSIDE NM	TOTAL
SWEIS ROD ^b	4279	1762	1678	671	8390	350	8740
calendar year 1999	4833	1523	1805	529	8690	495	9185

^a Includes both Regular and Temporary employees, including students who may not be at the Laboratory for much of the year.

^b Total number of employees was presented in the ROD, the breakdown had to be calculated based on the percentage distribution shown in the ROD for the base year.

Laboratory records contain the TA and building number of each employee's office. This information does not necessarily indicate where the employee actually performs his or her work; but rather, indicates where this employee gets mail and officially reports to duty. However, for purposes of tracking the dynamics of changes in employment across Key Facilities, this information provides a useful index. Table 3.6-3 identifies UC employees by Key Facility based on the facility definitions contained in the SWEIS. The employee numbers contained in the category "Rest of LANL," were calculated by subtracting the Key Facility numbers from the calendar year total.

The numbers in Table 3.6-3 cannot be directly compared to numbers in the SWEIS. The employee numbers for Key Facilities in the SWEIS represent total workforce, and include PTLA, JCNNM, and other subcontractor personnel. The new index (shown in Table 3.6-3) is based on routinely collected information and only represents full-time and part-time regular UC employees. It does not include employees on leave of absence, students (high school, cooperative, undergraduate, or graduate), or employees from special programs (i.e., limited-term or long-term visiting staff, post-doctorate, etc.). Because the two sets of numbers do not represent the same entity, a comparison to numbers in the SWEIS is not appropriate. This new index will be used throughout the lifetime of the Yearbook; hence, future comparisons and trending will be possible.

Table 3.6-3. UC Employee^a Index for Key Facilities

KEY FACILITY	CALENDAR YEAR 1999
Plutonium Complex	589
Tritium Facilities	28
CMR	204
Pajarito Site	70
Sigma Complex	101
MSL	57
Target Fabrication	54
Machine Shops	81
High Explosive Testing	227
High Explosive Processing	96
LANSCCE	560
HRL	98
Radiochemistry Laboratory	128
Waste Management – Radioactive Liquid Waste	62
Waste Management – Radioactive Solid and Chemical Waste	65
Rest of LANL	4601
Total Employees	7021

^a Includes full-time and part-time regular employees; it does not include students who may be at the Laboratory for much of the year nor does it include special programs personnel. This definition was incorrectly stated in the 1998 Yearbook. A similar index does not exist in the ROD, which used a very time-intensive method to calculate this index.

3.7 Land Resources

Land resources (i.e., undeveloped and developed lands) at LANL and the surrounding area had several changes during 1999. Major construction projects included the SCC, NISC, and IRP. Each of these projects had their own NEPA documentation. The SCC and NISC are being constructed in areas previously disturbed for parking lots or other structures. The IRP represents green-field construction and will ultimately result in a loss of about 30 acres. The remainder of the construction was done within existing facilities.

The SWEIS projected a habitat reduction of 41 acres under the Expanded Alternative because of the expansion of Area G. In 1999, this expansion was not undertaken.

In 1999, the only major construction project identified in the ROD outside of existing facilities at LANL was DAHRT. The actual habitat loss and ground breaking activities associated with this project happened during construction start-up in 1992 and 1993 when the land was cleared of vegetation and the “footprint” of this facility was established.

3.8 Groundwater

As projected by the ROD, water levels in supply wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping is reduced, water levels show some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period. Regionally, water levels in the aquifer have continued a gradual decline that started in about 1977.

Analysis of samples from the production wells showed that water quality continued to meet drinking water standards and continued to indicate no problematic trends. Water quality measurements for test wells, however, continue to show the presence of contamination from the Laboratory at the top of the regional aquifer, but at concentrations mostly below drinking water standards. In 1998, drilling of the characterization well R-25 at TA-16 revealed the presence of high explosives constituents at concentrations that are above the EPA Health Advisory guidance values for drinking water. Although the extent of high explosives constituents in the regional aquifer is presently unknown, continued testing in 1999 shows no high explosives constituents in water supply wells. Nitrate concentrations in TW-1 in Pueblo Canyon have been near the EPA maximum contaminant level since 1980. The source of the nitrate might be infiltration of sewage effluent in Pueblo Canyon, or it might be residual nitrates from the now-decommissioned TA-45 RLWTF that discharged into upper Pueblo Canyon until 1964.

Work underway as part of the Hydrogeologic Workplan provided new information on the regional aquifer and details of hydrogeologic conditions. By the end of 1999, four new wells had been drilled into the regional aquifer. Two were located near the eastern boundary of the Laboratory in Los Alamos Canyon (R-9) and Sandia Canyon (R-12). These two wells encountered several intermediate-depth perched zones of varying hydrologic and chemical quality. Both wells show that minor contamination has infiltrated from the surface into the perched zones and the uppermost regional aquifer.

R-25 was located near the western boundary in TA-16. This well encountered a thick perched zone at an elevation several hundred feet above the top of the regional aquifer. This perched zone was anticipated because



Well R-25, located near the western boundary of TA-16

of results of an earlier well drilled nearby. Based on preliminary findings in R-25, high explosives contaminants were found throughout the perched zone and also several hundred feet into the regional aquifer. The source of these contaminants is probably the discharge of high explosives wastewater at TA-16 since the late 1940s.

R-15 is located on the floor of Mortandad Canyon, approximately one mile upstream of the eastern Laboratory boundary. The well is downstream of the TA-50 RLWTF effluent discharge point. During drilling, tritium levels of approximately 4000 pCi/L were found in a perched groundwater zone at 646 feet, indicating Laboratory impacts. However, tritium levels of <3 pCi/L in the regional aquifer indicated no contamination. R-15 has been cased and developed.

None of the contaminants found in these new test wells exceed current drinking water standards. However, the uranium concentration in one perched zone in well R-9 is greater than the proposed EPA drinking water maximum concentration level, and TNT and RDX concentrations in well R-25 are greater than EPA Health Advisory values. Following the discovery of high explosives in well R-25, the nearest water supply wells were sampled and no high explosives contamination was detected (LANL 1999b).

These and other findings from the Hydrogeologic Workplan are adding to the understanding of the hydrologic setting at Los Alamos. Findings include (a) recognition of more perched zones above the regional aquifer than previously discovered; (b) confirmation that there is significant groundwater recharge along the flank of the Jemez Mountains; (c) recognition that there may be more groundwater recharge from canyon bottom alluvial groundwater than previously believed; and (d) the finding of Laboratory contaminants in perched zones and the regional aquifer at predicted locations where wells had not previously been drilled. These findings extend the areas that have been investigated by drilling, rather than change the picture of the hydrological system. Work continues under the Hydrogeologic Workplan to increase understanding of the hydrogeologic conditions and to ensure the safety of the drinking water supply.

3.9 Cultural Resources

The LANL site has a large number of diverse archaeological sites. Approximately 60% of LANL lands have been systematically surveyed and approximately 1600 archaeological sites have been identified in this process. Within LANL's limited access boundaries, there are ancestral villages, shrines, petroglyphs, sacred springs, trails, and traditional use areas that could be identified by Pueblo and Athabascan communities as traditional cultural properties.

The SWEIS reported 3668 inventoried resources. These resources included 1295 prehistoric resources (BC 4000–1600 AD), 87 historic homesteading and commercial resources (1600–1942 AD), 2232 World War II-Late Cold War era buildings and facilities (1943–1989 AD), and 54 areas within LANL identified by consulting communities (Native American pueblos, tribes, and local Hispanic communities) as having traditional cultural properties. Since the ROD, LANL surveys have identified an additional 91 archaeological sites (Table 3.9-1). All of these resources continue to be protected. No excavation of sites at TA-54 (as projected by the ROD) or at any other part of LANL has occurred. The following paragraphs provide details.

Table 3.9-1 Acreage Surveyed, Cultural Resource Sites Recorded, and Cultural Resource Sites Eligible for the National Register of Historic Places at LANL Fiscal Year 1999^a

FISCAL YEAR	TOTAL ACREAGE SURVEYED	TOTAL ACREAGE SURVEYED TO DATE	TOTAL ARCHAEOLOGICAL SITES RECORDED TO DATE (CUMULATIVE)	NUMBER OF ELIGIBLE & POTENTIALLY ELIGIBLE NRHP ^b SITES	NUMBER OF NOTIFICATIONS TO INDIAN TRIBES
LANL SWEIS	Not reported	Not Reported	3668	1092	23
1999	1074	19,011	3759	1288	12

^a Source: The Secretary of Interior's Report to Congress on Federal Archaeological Activities. Information on LANL is from DOE/Los Alamos Area Office and LANL Cultural Resources Management Team.

^b NRHP is National Register of Historic Places.

The Laboratory and National Park Service continued a long-term monitoring program at the prehistoric pueblo of *Nake'muu*. This is the only pueblo within LANL that has standing walls. The pueblo's architecture has been mapped, photographed, and drawn to provide a baseline for comparison. This information is monitored on an annual basis, with continual assessments made of site condition, rate of deterioration, and possible sources of impact (e.g., vibrations from high explosives testing). An increased frequency in explosive testing at LANL presents a potential for shrapnel impacts and vibration damage to this sensitive cultural resource. *Nake'muu* will continue to be monitored for all types of deterioration or destruction, including monitoring the effects of explosives vibrations on the pueblo's walls.



Typical Mortandad Canyon
cavate petroglyph



Nake'muu—one of the best
preserved ruins at LANL

3.10 Ecological Resources

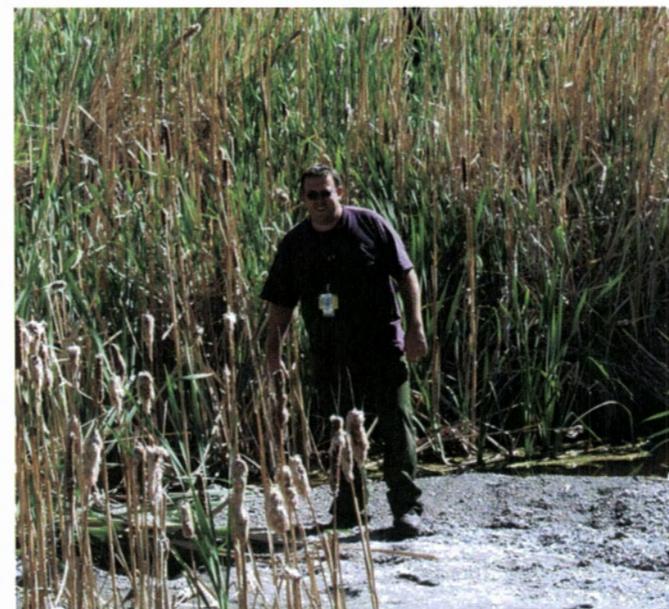
The historic presence of LANL, with its highly restricted access and other unique land use practices, continues to support a rich diversity of natural resources within northern New Mexico.

No significant adverse impacts to biological resources, ecological processes, or biodiversity, including threatened and endangered species, were projected by the ROD. Data collected for 1999 support this projection. These data are reported in the Environmental Surveillance Report for 1999 (LANL 2000b).

3.10.1 Threatened and Endangered Species Habitat Management Plan

The Threatened and Endangered Species Habitat Management Plan (HMP) received US Fish and Wildlife Service concurrence on February 12, 1999. The plan is used in project reviews to provide guidelines to project managers for assessing potential impact to Federally listed threatened and endangered species including the Mexican spotted owl, southwestern willow flycatcher, and bald eagle. The US Fish and Wildlife Service removed the American peregrine falcon from the endangered species list, and the HMP was updated to reflect this change. The HMP was incorporated into the NEPA, Cultural, and Biological Laboratory Implementing Requirements document developed during 1999.

In 1999, the Laboratory completed several contaminant studies and continued risk assessment studies on the food chain for threatened and endangered species inhabiting Laboratory lands. These studies included assessment of organic and metal contamination in the food chain for selected endangered species. Additional studies were done to assess the impact of burrowing animals on the redistribution of buried radioactive waste at Area G.



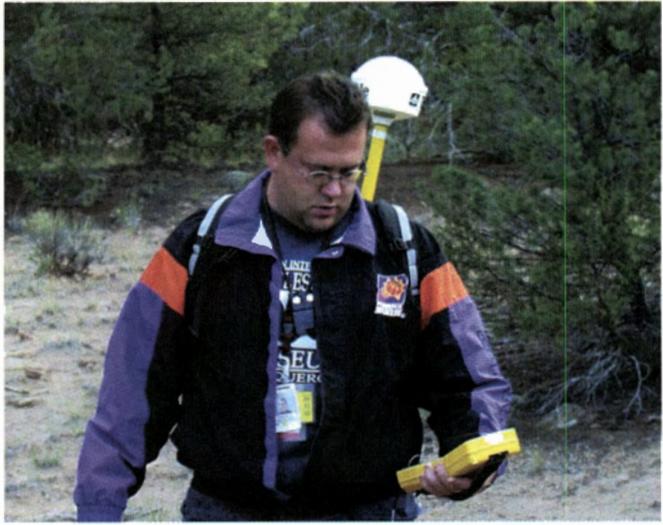
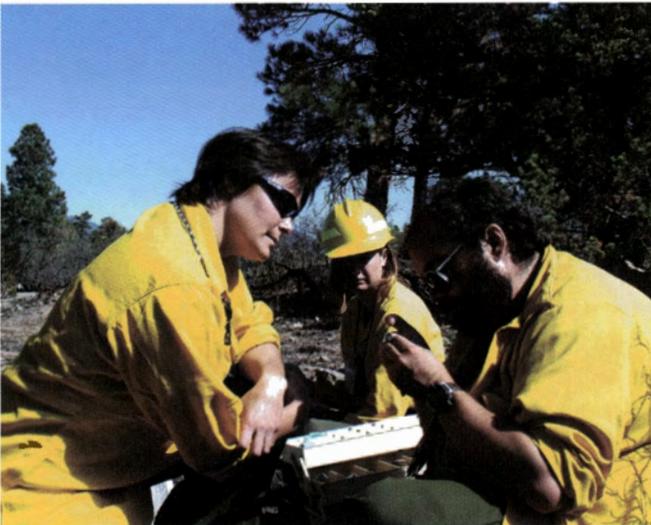
Biological field work

3.10.2 Biological Assessments

In January 1999, DOE submitted an amended biological assessment for the SWEIS to the US Fish and Wildlife Service for concurrence.

No floodplain and wetland assessments were conducted during 1999.

During 1999, the Laboratory also reviewed approximately 475 proposed activities and projects for potential impact on biological resources including Federal or State listed threatened and endangered species. These reviews evaluate the amount of previous development or disturbance at the proposed construction site to determine the presence of wetlands or floodplains in the project area, and to determine whether habitat evaluations or species-specific surveys are needed. The Laboratory adhered to protocols set by the US Fish and Wildlife Service and to permit requirements of the New Mexico State Game and Fish Department.



4.0 Additive Analysis

To enhance the usefulness of the Yearbook, data conducive to an additive analysis (i.e., the annual accumulation of radioactive waste compared to the capacity of Area G) or data that shows annual trends (i.e., decline in worker injuries over time) will be presented here. Full implementation of this section is anticipated in the 2000 Yearbook. The presentation made here is to demonstrate the type of analysis expected for the various parameters to be examined.

Solid Radioactive and Chemical Waste: Although the ROD identifies LLW and MLLW as the only waste types disposed on-site, LANL also disposes some solid wastes on-site. However, most chemical waste is shipped off-site to commercial treaters, disposers, or recyclers. Certain other wastes are held in storage pending availability of commercial treatment and disposal, development of appropriate technologies, or in the case of TRU and MTRU wastes, shipment to WIPP.

Existing capacity for LLW disposal at Area G was estimated at 36,000 cubic meters, and the Expanded Alternative estimated the need for disposal of 112,000 cubic meters. Thus, the ROD evaluated the need for an expansion of Area G to dispose the projected volume of LLW and identified several options, any of which would handle the estimated volumes of LLW.

As shown in Table 4.0-1, the cumulative waste volume is 3610 cubic meters or about 10% of the existing volume capacity of Area G.

Table 4.0-1 Cumulative LLW and MLLW Volumes

Waste Type	Units	SWEIS ROD	1998	1999	Cumulative Volume
LLW	m ³ /yr	12,200	1807	1710	3517
MLLW	m ³ /yr	632	72	21	93
Combined	m ³ /yr	12,832	1879	1731	3610



5.0 Summary and Conclusion

5.1 Summary

The SWEIS Yearbook for 1999 reviews calendar year 1999 operations for the 15 Key Facilities (as defined by the SWEIS) at LANL and compares those operations to levels projected by the ROD. The Yearbook also reviews the environmental parameters associated with operations at the same 15 Key Facilities and compares this data with ROD projections. In addition, the Yearbook presents a number of site-wide effects of those operations and environmental parameters. The more significant results presented in the Yearbook are as follows:

Facility Construction and Modifications: The ROD projected a total of 38 facility construction and modification projects for LANL facilities. Ten of these projects were listed only in the Expanded Operations Alternative, such as modifications at CMR for safety testing of pits in the Wing 9 hot cells, expansion of the LLW disposal area at TA-54, Area G, and the LPSS at TA-53. These ten projects could not proceed until DOE issued the ROD in September 1999. However, the remaining 28 construction projects were projected in the No Action Alternative. These included facility upgrades (e.g., safety upgrades at the CMR Building and process upgrades at the RLWTF), facility renovation (e.g., conversion of the former Rolling Mill, Building 03-141, to the BTF), and the erection of new storage domes at TA-54 for TRU wastes. Since these projects had independent NEPA documentation, they could proceed while the SWEIS was still in process.

Activities have proceeded on many of the 38 projects. Thirteen projects have now been completed, seven in 1999 and six in 1998. Additionally, another 10 projects were begun or continued in 1999. The seven projects completed in 1999 were

- replacement of the graphite collection systems at Sigma;
- modification of the industrial drain system at Sigma;
- replacement of electrical components at Sigma;
- relocation of the Weapons Components Testing Facility at High Explosives Processing;
- making LEDA operational;
- bringing the new UF/RO process on-line at RLWTF; and
- bringing the nitrate reduction equipment on-line at RLWTF.

In addition to facility modification and construction projects forecast by the ROD, several other projects were started during 1999. Four projects were in the construction phase: Atlas, the IRP, the SCC, and the NISC. The other project, the Central Health Physics Calibration Laboratory, was in the design phase. These are discussed in Chapter 2 of the Yearbook, along with references to the NEPA document (categorical exclusion or environmental assessment) that preceded the project.

Facility Operations: The SWEIS grouped LANL into 15 Key Facilities, identified the operations at each, and then projected the level of activity for each operation. These operations were grouped under 95 different capabilities for the Key Facilities. During 1999, there was activity under 90 of these capabilities. The five not used were Fabrication and Metallography at the CMR, ATW at LANSCE, Medical Isotope Production at LANSCE, Other Waste Processing at the Solid Radioactive and Chemical Waste Facility, and Size Reduction at the Solid Radioactive and Chemical Waste Facility.

While there was activity under nearly all capabilities, the levels of these activities were mostly below levels projected by the ROD. For example, the LANSCE linac generated an H⁻ proton beam for 2737 hours in 1999, at an average current of 93 microamps, compared to 6400 hours at 200 microamps projected by the ROD. Similarly, a total of 188 criticality experiments were conducted at Pajarito Site, compared to the 1050 projected experiments.

As in 1998, only three of LANL's facilities operated during 1999 at levels approximating those projected by the ROD—the MSL, the HRL, and the Non-Key Facilities. None of these facilities are major contributors to

parameters that lead to significant potential environmental impacts. The remaining 13 Key Facilities all conducted operations at or below projected activity levels.

Operations Data and Environmental Parameters: This 1999 Yearbook evaluates the effects of LANL operations in three general areas—effluents to the environment, workforce and regional consequences, and changes to environmental areas for which the DOE has stewardship responsibility as the owner of a large tract of land.

Effluents include air emissions, liquid effluents regulated through the NPDES program, and solid wastes. Radioactive air emissions totaled about 1900 curies compared to 21,700 projected by the ROD. This results in a hypothetical maximum dose to a member of the public of 0.32 millirem (compared to 5.44 projected). Calculated NPDES discharges totaled 317 million gallons compared to a projected volume of 278 million gallons per year. While the number of outfalls has been reduced, the methodology for calculating the discharges may result in an overestimate. For some facilities, outfall flows are recorded on a continuous basis; this was the case for outfalls at SWS, HEWTF, RLWTF, LANSCE, and the Power Plant. For all other outfalls, annual totals were calculated from average flows documented in the Laboratory's DMRs. The latter method substantially overestimates the quantity of wastewater discharged because it is based on infrequent sampling and the DMRs assume round-the-clock flow for all outfalls. As in the SWEIS Yearbook for 1998, operational knowledge relative to water supply wells and pump stations allowed more realistic estimates of flows for those outfalls by eliminating the need to assume 24-hour flow.

Solid radioactive and chemical wastes ranged from 3% (MLLW) to 475% (chemical waste) of projected quantities (see Table 3.3-1). These extremely large quantities of chemical waste are a result of ER Program activities (remediation of old MDAs). Most chemical wastes are shipped off-site for disposal at commercial facilities; therefore, these large quantities of chemical waste will not impact LANL environs. The one anomaly in 1999 is the 4003 cubic meters of solid wastes disposed in pits at Area J. These administratively controlled wastes resulted from ER Project remedial activities at MDA-P and far exceeded the projections of 100 cubic meters per year. However, this material was non-hazardous wastes, soil, concrete rubble, and debris placed in MDA-J as fill in preparation of capping (1999 Annual Report Questionnaire for the Los Alamos National Laboratory, Technical Area 54, Area J Landfill).

Workforce data were above projections. The 12,412 employees at the end of calendar year 1999 represent 1061 more employees than projected by the ROD. Thus, regional socioeconomic consequences, such as salaries and procurements, also should have exceeded projections.

Electricity use during 1999 totaled 369 gigawatt-hours with a peak demand of 68 megawatts, compared to projections of 782 gigawatt-hours and 113 megawatts. Water usage was 453 million gallons (compared to 759 million gallons projected), and natural gas consumption totaled 1.43 million decatherms (compared to 1.84 projected).

The collective TEDE for the LANL workforce during 1999 was 131 person-rem, considerably lower than the projected workforce dose of 704 person-rem.

Parameters of environmental stewardship were similar to (ecological resources and groundwater) or lower than (cultural resources and land use) ROD projections. For land use, the ROD projects the disturbance of 41 acres of new land at TA-54 because of the need for additional disposal cells for LLW. Through 1999, however, this expansion had not begun. Groundbreaking did occur on 30 acres of land that are being developed along West Jemez Road for the IRP. This project has its own NEPA documentation, and the land is being leased to Los Alamos County for this development.

Cultural resources remained protected, and no excavation of sites at TA-54 or any other part of LANL has occurred. (The ROD projected that 15 prehistoric sites would be affected by the expansion of Area G into Zones 4 and 6 at TA-54.)

As projected by the ROD, water levels in wells penetrating into the regional aquifer continue to decline in response to pumping, typically by several feet each year. In areas where pumping is reduced, water levels show

some recovery. No unexplained changes in patterns have occurred in the 1995–1999 period, and water levels in the regional aquifer have continued a gradual decline that started in about 1977.

Ecological resources continued to be enhanced as a result of protection afforded by DOE ownership of LANL. These resources include biological resources such as protected sensitive species, ecological processes, and biodiversity.

5.2 Conclusions

The data for 1999 reveal effects from LANL operations that are below levels projected by the SWEIS ROD. Site-wide, there are two main reasons for this fact. The ROD was not issued until September 1999; consequently operations were more likely to be at levels consistent with pre-ROD conditions. Moreover, data in the SWEIS were presented for the highest level projected over the ten-year period 1996–2005. Thus, the data from early years in the projection period (1999) would be expected to fall below the maximum.

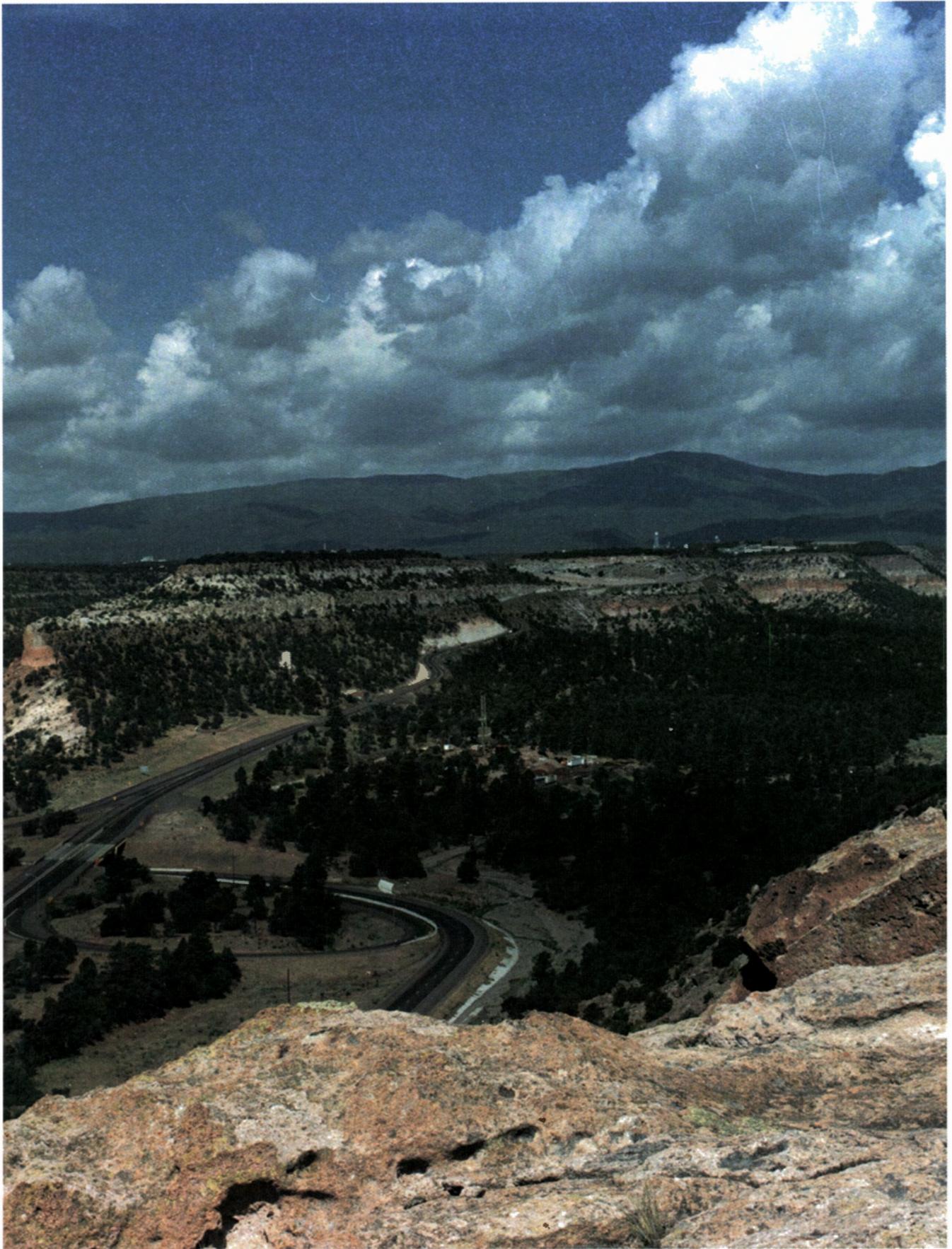
One purpose of the 1999 Yearbook is to compare LANL operations and resultant 1999 data to the SWEIS in order to determine if LANL was still operating within the environmental envelope established by the SWEIS and the ROD. Data for 1999 indicate that positive impacts (such as socioeconomics) were greater than SWEIS projections, while negative impacts, such as radioactive air emissions and land disturbance, were, for the most part, within the SWEIS envelope.

5.3 To the Future

The Yearbook will continue to be prepared on an annual basis, with operations and relevant parameters in a given year compared to SWEIS projections for activity levels chosen by the ROD. The presentation proposed for the 2000 Yearbook will follow that developed for the previous Yearbooks—comparison to the ROD.

The 1999 Yearbook is an important step forward in fulfilling a commitment to make the SWEIS for LANL a living document. Future Yearbooks are planned to continue that role.





6.0 References

- Bertino 2000. Email from Paula Bertino to Chris Del Signore, Los Alamos, NM (10/4/2000).
- DOE 1992a. "Nuclear Safety Analysis Report," DOE Order 5480.23, Washington, D.C. (04/10/92).
- DOE 1992b. "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Report," DOE Standard DOE-STD-1027-92, Washington, D.C. (12/92).
- DOE 1995. "Dual-Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement," DOE/EIS-0228, Albuquerque, NM (08/95).
- DOE 1996a. "Environmental Assessment for Effluent Reduction," DOE/EA-1156, Los Alamos, NM (09/11/96).
- DOE 1996b. "Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management," Appendix K, "Atlas Facility Project-Specific Analysis," DOE/EIS-0236, Washington, D.C. (09/96).
- DOE 1997a. "Relocation of Radiography at TA-16," LAN-97-036, Los Alamos, NM (01/16/97).
- DOE 1997b. "Environmental Assessment for the Lease of Land for the Development of a Research Park at Los Alamos National Laboratory," DOE/EA-1212, Los Alamos, NM (10/07/97).
- DOE 1998a. "DOE List of Los Alamos National Laboratory Nuclear Facilities," DOE Albuquerque Operations Office Memorandum (12/98).
- DOE 1998b. "Environmental Assessment for the Proposed Strategic Computing Complex, Los Alamos National Laboratory, Los Alamos, New Mexico," DOE/EA-1250 (12/18/98).
- DOE 1999a. "Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory," DOE/EIS-0238, Albuquerque, NM (01/99).
- DOE 1999b. "Record of Decision: SWEIS in the State of New Mexico," 64FR50797, Washington, D.C. (09/19/99).
- DOE 1999c. "HE Formulation Relocation from TA-16-340 to TA-9-39 & Bldg. 45," LAN-99-042a, Los Alamos, NM (05/12/99).
- DOE 1999d. "Decontamination and Volume Reduction System for Transuranic Waste at Los Alamos National Laboratory," DOE/EA-1269, Los Alamos, NM.
- DOE 1999e. "Environmental Assessment for Nonproliferation and International Security Center," DOE/EA-1247, Los Alamos, NM (07/21/99).
- Jacobson 2000. Jacobson, Kieth. "US Department of Energy Report 1999 LANL Radionuclide Air Emissions," LA-13732-ENV, Los Alamos, NM.
- LANL 1998a. "NEPA Categorical Exclusion for Facilities Improvement Technical Support (FITS) Building," LAN-97-013A, Los Alamos, NM (2/5/98, amended 1/19/99).
- LANL 1998b. "NEPA Categorical Exclusion for HE Wastewater Collection System Repairs, TA-9-21," LAN-96-012, Los Alamos, NM (10/6/98).

- LANL 1998c. "NEPA Categorical Exclusion for the Applied Research, Optics, and Electronics (AROE) Laboratory," LAN-98-101, Los Alamos, NM (10/3/98).
- LANL 1999a. "Comprehensive Site Plan 2000 (Draft)," Chapter VIII, "Projects," Los Alamos, NM.
- LANL 1999b. "Groundwater Annual Status Report for FY 1998," Los Alamos, NM (03/23/99).
- LANL 2000a. "Emissions Inventory Report Summary, Reporting Requirements for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73 for Calendar Year 1999," LA-13728-PR, Los Alamos, NM.
- LANL 2000b. "Environmental Surveillance at Los Alamos During 1999," LA-13775-ENV, Los Alamos, NM (12/00).
- LANL 2000c. "1999 RCRA Hazardous Waste Biennial Report," Los Alamos, NM.
- Lansford, Robert, Larry Adcock, Shaul Ben-David, and John Temple. 1997. "The Economic Impact of Los Alamos National Laboratory on North-Central New Mexico and the State of New Mexico Fiscal Year 1996," New Mexico State University; prepared for the US Department of Energy (06/97).
- Lansford, Robert, Larry Adcock, Shaul Ben-David, and John Temple. 1998. "The Economic Impact of Los Alamos National Laboratory on North-Central New Mexico and the State of New Mexico Fiscal Year 1997," New Mexico State University; prepared for the US Department of Energy (05/98).
- Lansford, Robert, Larry Adcock, Shaul Ben-David, and John Temple. 1999. "The Economic Impact of Los Alamos National Laboratory on North-Central New Mexico and the State of New Mexico Fiscal Year 1998," New Mexico State University; prepared for the US Department of Energy (08/99).
- Sandoval 2000. Email from Tina M. Sandoval to Chris Del Signore, Los Alamos, NM (04/07/00).
- Shaul, David A., Michael R. Alexander, Robin P. Reynolds, Christopher T. McLean, Ryan P. Romero. 2000. "Surface Water Data at Los Alamos National Laboratory: 1999 Water Year," LA-137076-PR, Los Alamos, NM.

Appendix: Chemical Usage and Estimated Emissions Data

Table A-1. Comparison of Chemicals used in 1995 and 1999

TECHNICAL AREA	NUMBER OF CHEMICALS USED IN 1995 BUT NOT IN 1999	NUMBER OF CHEMICALS USED IN 1999 BUT NOT IN 1995
03	107	8
08	6	3
09	34	11
15	8	2
16	35	9
18	12	4
21	119	3
35	134	8
39	10	0
40	3	3
43	18	19
48	61	22
50	12	13
53	8	0
54	46	0
55	92	1

Table A-2. Chemical and Metallurgy Research Building

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Chemistry and Metallurgy Research Building				
	Acetic Acid	kg/yr	0.2	0.5
	Acetone	kg/yr	2.5	7.1
	Ammonium Chloride (Fume)	kg/yr	0.3	0.8
	Diethylene Triamine	kg/yr	0.3	1.0
	Ethanol	kg/yr	3.1	9.0
	Formic Acid	kg/yr	10.0	28.7
	Hydrogen Bromide	kg/yr	1.6	4.5
	Hydrogen Chloride	kg/yr	43.2	123.4
	Hydrogen Fluoride, as F	kg/yr	0.3	0.7
	Hydrogen Peroxide	kg/yr	24.1	68.9
	Magnesium Oxide Fume	kg/yr	0.4	1.0
	Methyl Alcohol	kg/yr	0.1	0.4
	n-Amyl Acetate	kg/yr	0.2	0.4
	Phosphoric Acid	kg/yr	9.6	27.5
	Potassium Hydroxide	kg/yr	16.9	48.3
	Propane	kg/yr	0.0	219.3
	Sulfuric Acid	kg/yr	70.8	202.4

A total of 17 of the listed chemicals were used at the CMR in 1999. The amount of propane combusted at the facility totaled 484 pounds (219 kg).

Table A-3. High Explosives Processing Facilities

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
High Explosives Processing Facilities				
	Acetic Acid	kg/yr	14.7	42.0
	Acetone	kg/yr	66.4	189.8
	Acetonitrile	kg/yr	16.2	46.3
	Acetylene	kg/yr	7.7	22.0
	Carbon Black	kg/yr	0.4	1.0
	Chlorodifluoromethane	kg/yr	168.3	480.8
	Chloroform	kg/yr	1.0	3.0
	Chromic acids & chromates	kg/yr	0.2	0.5
	Copper	kg/yr	0.0	0.5
	Cyclohexane	kg/yr	0.1	0.4
	Cyclohexanone	kg/yr	0.3	0.9
	Dichlorodifluoromethane	kg/yr	0.1	0.2
	Ethanol	kg/yr	174.6	498.7
	Ethyl Ether	kg/yr	1.5	4.2
	Ethylene Dichloride	kg/yr	8.6	24.7
	Hydrogen Chloride	kg/yr	11.9	34.1
	Hydrogen Fluoride, as F	kg/yr	0.2	0.4
	Hydrogen Peroxide	kg/yr	15.8	45.0
	Isopropyl Alcohol	kg/yr	5.5	15.6
	Mercury numerous forms	kg/yr	0.3	29.0
	Methyl Alcohol	kg/yr	37.3	106.4
	Methyl Cyclohexane	kg/yr	0.3	0.8
	Methyl Ethyl Ketone (MEK)	kg/yr	169.7	484.9
	Methylene Chloride	kg/yr	7.4	21.2
	n,n-Dimethylformamide	kg/yr	4.0	11.4
	Nitric Oxide	kg/yr	2.7	7.6
	Nitrous Oxide	kg/yr	3.9	11.1
	Phenol	kg/yr	0.4	1.0
	Propane	kg/yr	0.0	4396.2
	Propyl Alcohol	kg/yr	1.4	4.0
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.1	6.2
	Sulfur Hexafluoride	kg/yr	1.6	4.6
	Sulfuric Acid	kg/yr	2.6	7.4
	Tetrahydrofuran	kg/yr	21.5	61.4
	Thionyl Chloride	kg/yr	0.2	0.5
	Toluene	kg/yr	5.3	15.1
	Turpentine	kg/yr	1.1	3.2
	Xylene (o-,m-,p-Isomers)	kg/yr	0.3	0.8
	Zinc Oxide Fume	kg/yr	0.8	2.3

A total of 39 of the listed chemicals were used in High Explosives Processing in 1999. The amount of propane combusted at the facility totaled 9692 pounds (4396 kg).

Table A-4. High Explosives Testing Facilities

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
High Explosives Testing Facilities				
	Acetone	kg/yr	0.8	2.4
	Acetylene	kg/yr	2.8	7.9
	Ethanol	kg/yr	2.2	6.3
	Methyl Alcohol	kg/yr	1.1	3.2
	Methyl Ethyl Ketone (MEK)	kg/yr	0.3	0.8
	Methylene Chloride	kg/yr	0.5	1.3
	Nitromethane	kg/yr	0.1	0.2
	Propane	kg/yr	0.0	296.9
	Stoddard Solvent	kg/yr	0.3	0.7

A total of 9 of the listed chemicals were used in High Explosives Testing in 1999. The amount of propane combusted at the facility totaled 655 pounds (297 kg).

Table A-5. HRL

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
HRL				
	1,4-Dioxane	kg/yr	0.4	1.0
	2-Methoxyethanol (EGME)	kg/yr	0.2	0.5
	Acetic Acid	kg/yr	4.0	11.5
	Acetic Anhydride	kg/yr	8.4	24.1
	Acetone	kg/yr	10.6	30.4
	Acetonitrile	kg/yr	231.6	661.6
	Acrylamide	kg/yr	0.6	1.6
	Ammonium Chloride (Fume)	kg/yr	0.6	1.6
	Catechol	kg/yr	0.7	2.0
	Chloroform	kg/yr	2.6	7.6
	Chromic acids & chromates	kg/yr	1.3	3.8
	Cyclohexane	kg/yr	0.1	0.4
	Ethanol	kg/yr	94.2	269.1
	Ethanolamine	kg/yr	0.7	2.0
	Ethyl Ether	kg/yr	2.9	8.4
	Ethylene Diamine	kg/yr	4.2	12.0
	Formamide	kg/yr	5.2	14.9
	Hexane (other isomers)* or n-Hexane	kg/yr	0.3	1.0
	Hexylene Glycol	kg/yr	0.1	0.4
	Hydrogen Chloride	kg/yr	2.1	5.9
	Hydrogen Fluoride, as F	kg/yr	0.2	0.5
	Hydrogen Peroxide	kg/yr	0.5	1.4
	Iso-Amyl Alcohol	kg/yr	0.7	2.0
	Isopropyl Alcohol	kg/yr	21.9	62.4
	Mercury numerous forms	kg/yr	0.0	0.5
	Methyl Alcohol	kg/yr	28.5	81.3
	Methylene Chloride	kg/yr	16.9	48.4
	n,n-Dimethylformamide	kg/yr	0.6	1.6
	n-Butyl Alcohol	kg/yr	0.6	1.6
	Paraffin Wax Fume	kg/yr	0.2	0.5
	Phenol	kg/yr	1.9	5.6
	Phosphoric Acid	kg/yr	1.0	3.0
	Potassium Hydroxide	kg/yr	0.2	0.5
	sec-Butyl Alcohol	kg/yr	0.1	0.4
	Sulfuric Acid	kg/yr	1.7	4.8
	Tetrahydrofuran	kg/yr	17.2	49.2
	Tetrasodium Pyrophosphate	kg/yr	0.2	0.5
	Trichloroacetic Acid	kg/yr	4.9	14.0
	Xylene (o-,m-,p-Isomers)	kg/yr	0.2	0.4
	Zinc Chloride Fume	kg/yr	0.4	1.2

A total of 40 of the listed chemicals were used at the HRL in 1999.

Table A-6. LANSCE

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
LANSCE				
	1,1,1-Trichloroethane	kg/yr	97.8	279.4
	2-Butoxyethanol	kg/yr	0.2	0.5
	Acetone	kg/yr	177.0	505.6
	Acetylene	kg/yr	736.5	2104.4
	Benzene	kg/yr	0.3	0.9
	Carbon Disulfide	kg/yr	0.4	1.3
	Carbon Tetrachloride	kg/yr	3.3	9.6
	Chlorodifluoromethane	kg/yr	8440.3	24115.2
	Cyclohexane	kg/yr	0.3	0.8
	Dichlorodifluoromethane	kg/yr	1.5	4.4
	Diethanolamine	kg/yr	0.2	0.5
	Ethanol	kg/yr	197.9	565.4
	Ethylene Dichloride	kg/yr	0.4	1.1
	Iron Oxide Fume, as Fe	kg/yr	0.2	0.5
	Isobutane	kg/yr	19.2	55.0
	Isopropyl Alcohol	kg/yr	7.3	20.8
	Mercury numerous forms	kg/yr	26.1	2612.7
	Methyl Alcohol	kg/yr	3.6	10.3
	Methylene Chloride	kg/yr	0.5	1.3
	n-Butyl Acetate	kg/yr	0.2	0.4
	Phosphoric Acid	kg/yr	0.3	0.9
	Potassium Hydroxide	kg/yr	0.2	0.5
	Propane	kg/yr	0.0	3797.7
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	0.5
	Sulfur Hexafluoride	kg/yr	0.2	0.7
	Sulfuric Acid	kg/yr	1.9	5.5
	Toluene	kg/yr	0.2	0.4
	Tungsten as W insoluble Compounds	kg/yr	7.3	732.5
	Zinc Chromate, as Cr	kg/yr	0.4	1.1

A total of 29 of the listed chemicals were used at LANSCE in 1999. The amount of propane combusted at the facility totaled 8373 pounds (3798 kg).

Table A-7. Machine Shops

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Machine Shops				
	Isopropyl Alcohol	kg/yr	1.1	3.1
	Propane	kg/yr	0.0	593.8

A total of 2 of the listed chemicals were used at the machine shops in 1999. The amount of propane combusted at the facility totaled 1309 pounds (594 kg).

Table A-8. Material Science Laboratory

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Material Science Laboratory				
	1,1,2,2-Tetrachloroethane	kg/yr	1.1	3.2
	1,1,2-Trichloro-1,2,2-Trifluoroethane	kg/yr	0.5	1.6
	2-Methoxyethanol (EGME)	kg/yr	0.7	1.9
	Acetic Acid	kg/yr	0.2	0.5
	Acetone	kg/yr	3.6	10.3
	Aluminum numerous forms	kg/yr	0.0	2.2
	Ammonia	kg/yr	0.1	0.3
	Benzene	kg/yr	0.3	0.9
	Biphenyl	kg/yr	0.4	1.0
	Chlorobenzene	kg/yr	1.5	4.4
	Chloroform	kg/yr	1.0	3.0
	Copper	kg/yr	0.1	6.8
	Diethylene Triamine	kg/yr	0.2	0.5
	Ethanol	kg/yr	4.0	11.3
	Ethyl Acetate	kg/yr	1.3	3.6
	Ethylene Chlorohydrin	kg/yr	0.1	0.3
	Hydrogen Bromide	kg/yr	0.2	0.5
	Hydrogen Chloride	kg/yr	0.6	1.8
	Hydrogen Fluoride, as F	kg/yr	0.2	0.7
	Hydrogen Peroxide	kg/yr	0.5	1.4
	Isopropyl Alcohol	kg/yr	4.4	12.6
	Methyl Alcohol	kg/yr	3.3	9.5
	Methylene Chloride	kg/yr	0.5	1.3
	Molybdenum	kg/yr	0.0	0.5
	n,n-Dimethylformamide	kg/yr	0.2	0.5
	n-Butyl Acetate	kg/yr	0.2	0.4
	n-Butyl Alcohol	kg/yr	0.3	0.8
	Phenol	kg/yr	0.2	0.5
	Phosphorus Oxychloride	kg/yr	0.1	0.3
	Potassium Hydroxide	kg/yr	3.5	10.0
	Pyridine	kg/yr	0.7	1.9
	Silica, Quartz	kg/yr	1.3	3.6
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	0.8

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Material Science Laboratory				
	Styrene	kg/yr	0.3	0.9
	Sulfuric Acid	kg/yr	2.6	7.4
	tert-Butyl Alcohol	kg/yr	0.3	0.8
	Toluene-2,4-diisocyanate (TDI)	kg/yr	0.6	1.6
	Vanadium, Respirable Dust & Fume	kg/yr	0.0	0.5
	Zinc Chloride Fume	kg/yr	0.4	1.0
	Zirconium Compounds, as Zr	kg/yr	0.0	0.3

A total of 40 of the listed chemicals were used at the in 1999.

Table A-9. Pajarito Site

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Pajarito Site				
	Ethanol	kg/yr	0.1	0.4
	Isopropyl Alcohol	kg/yr	1.6	4.7
	Magnesium Oxide Fume	kg/yr	15.9	45.4
	Phenylphosphine	kg/yr	6.6	18.9
	Propane	kg/yr	0.0	1050.2
	Xylene (o-,m-,p-Isomers)	kg/yr	0.3	0.8

A total of 6 of the listed chemicals were used at Pajarito Site in 1999. The amount of propane combusted at the facility totaled 2315 pounds (1050 kg).

Table A-10. Plutonium Facility Complex

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Plutonium Facility Complex				
	Acetic Acid	kg/yr	14.7	42.0
	Acetylene	kg/yr	2.8	7.9
	Ethanol	kg/yr	59.0	168.6
	Hydrogen Chloride	kg/yr	311.6	890.3
	Hydrogen Peroxide	kg/yr	45.5	130.1
	Iron Oxide Fume, as Fe	kg/yr	0.1	0.3
	Methyl 2-Cyanoacrylate	kg/yr	0.5	1.5
	Methyl Ethyl Ketone (MEK)	kg/yr	5.3	15.2
	n,n-Dimethylformamide	kg/yr	1.3	3.8
	Potassium Hydroxide	kg/yr	245.5	701.5
	Sulfuric Acid	kg/yr	36.7	104.9
	Trichloroethylene	kg/yr	114.9	328.3

A total of 12 of the listed chemicals were used at the Plutonium Facility Complex in 1999

Table A-11. Radiochemistry Laboratory

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Radiochemistry Laboratory				
	1,1,1-Trichloroethane	kg/yr	2.3	6.7
	1,1,2-Trichloro-1,2,2-Trifluoroethane	kg/yr	2.2	6.3
	1,3,5-Trimethylbenzene	kg/yr	0.2	0.5
	1,3-Butadiene	kg/yr	5.3	15.0
	1,4-Dioxane	kg/yr	0.4	1.0
	2-Methoxyethanol (EGME)	kg/yr	0.2	0.5
	Acetic Acid	kg/yr	1.9	5.5
	Acetic Anhydride	kg/yr	0.8	2.2
	Acetone	kg/yr	90.9	259.8
	Ammonium Chloride (Fume)	kg/yr	0.8	2.3
	Arsenic, el.&inorg.,exc. Arsine, as As	kg/yr	0.4	1.1
	Benzene	kg/yr	0.8	2.2
	Benzyl Chloride	kg/yr	0.2	0.5
	Bromine	kg/yr	0.3	0.8
	Carbon Tetrachloride	kg/yr	64.5	184.2
	Chlorine	kg/yr	0.3	0.9
	Chloroform	kg/yr	5.5	15.6
	Chromium, Metal &Cr III Compounds, as Cr	kg/yr	0.3	0.7
	Cobalt, elemental & inorg.comp., as Co	kg/yr	0.3	0.9
	Cyclohexylamine	kg/yr	0.3	0.8
	Diethanolamine	kg/yr	2.3	6.7
	Diethylamine	kg/yr	0.5	1.5
	Ethanol	kg/yr	10.0	28.6
	Ethyl Acetate	kg/yr	8.8	25.2
	Ethyl Chloride	kg/yr	0.4	1.0
	Ethyl Ether	kg/yr	4.4	12.6
	Ethylene Diamine	kg/yr	0.2	0.5
	Ethylene Dichloride	kg/yr	0.9	2.5
	Furfural	kg/yr	0.2	0.6
	Hexafluoroacetone	kg/yr	0.3	0.7
	Hexane (other isomers)* or n-Hexane	kg/yr	11.2	32.0
	Hydrogen Bromide	kg/yr	4.3	12.3
	Hydrogen Chloride	kg/yr	211.8	605.0
	Hydrogen Fluoride, as F	kg/yr	3.2	9.0
	Hydrogen Peroxide	kg/yr	11.6	33.1
	Indene	kg/yr	0.1	0.3
	Iron Oxide Fume, as Fe	kg/yr	0.4	1.0
	Isopropyl Alcohol	kg/yr	8.0	22.8

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
	Isopropyl Ether	kg/yr	0.1	0.3
	Kerosene	kg/yr	0.0	3.0
	Magnesium Oxide Fume	kg/yr	0.4	1.1
	Mercury numerous forms	kg/yr	0.0	0.5
	Methyl Alcohol	kg/yr	11.1	31.7
	Methyl Ethyl Ketone (MEK)	kg/yr	0.3	0.8
	Methyl Formate	kg/yr	0.4	1.0
	Methyl Iodide	kg/yr	0.4	1.0
	Methylene Chloride	kg/yr	13.9	39.8
	Molybdenum	kg/yr	0.0	1.0
	n,n-Dimethylformamide	kg/yr	1.0	2.8
	Nitric Oxide	kg/yr	1.5	4.2
	Nitromethane	kg/yr	0.2	0.6
	Nitrous Oxide	kg/yr	0.1	0.2
	p-Phenylenediamine	kg/yr	0.2	0.5
	Pentane (all isomers)	kg/yr	0.9	2.5
	Phosphoric Acid	kg/yr	2.6	7.3
	Phosphorus Trichloride	kg/yr	0.1	0.3
	Potassium Hydroxide	kg/yr	1.7	4.7
	Propane	kg/yr	0.0	1769.7
	Pyridine	kg/yr	0.8	2.4
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	0.4
	Sulfuric Acid	kg/yr	12.2	35.0
	tert-Butyl Alcohol	kg/yr	0.1	0.4
	Tetrahydrofuran	kg/yr	5.6	16.0
	Thionyl Chloride	kg/yr	0.7	1.9
	Toluene	kg/yr	17.7	50.7
	Trichloroethylene	kg/yr	0.3	0.7
	Triethylamine	kg/yr	0.8	2.3
	Uranium (natural) Sol.&Unsol.Comp. as U	kg/yr	0.7	1.9
	Vinyl Acetate	kg/yr	0.3	0.9

A total of 69 of the listed chemicals were used at the Radiochemistry Laboratory in 1999. The amount of propane combusted at the facility totaled 3902 pounds (1770 kg).

Table A-12. Sigma Complex

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Sigma Complex				
	2-Butoxyethanol	kg/yr	1.3	3.6
	Acetone	kg/yr	8.0	22.9
	Acetylene	kg/yr	11.0	31.6
	Aluminum numerous forms	kg/yr	0.1	11.8
	Ammonia	kg/yr	0.2	0.5
	Cadmium, el.&compounds, as Cd	kg/yr	0.0	0.5
	Chloroform	kg/yr	0.3	0.7
	Chromium, Metal &Cr III Compounds, as Cr	kg/yr	0.0	4.0
	Copper	kg/yr	0.6	56.6
	Diethylene Triamine	kg/yr	0.7	1.9
	Ethanol	kg/yr	15.2	43.5
	Hydrazine	kg/yr	0.1	0.3
	Hydrogen Chloride	kg/yr	5.4	15.4
	Hydrogen Fluoride, as F	kg/yr	64.9	185.4
	Hydrogen Peroxide	kg/yr	1.3	3.7
	Isopropyl Alcohol	kg/yr	9.9	28.3
	Kerosene	kg/yr	0.0	21.4
	Methyl Alcohol	kg/yr	4.6	13.1
	Methyl Ethyl Ketone (MEK)	kg/yr	0.3	0.8
	Methylene Chloride	kg/yr	0.2	0.7
	Molybdenum	kg/yr	3.9	387.1
	Nickel, metal (dust) or Soluble & Inorganic Comp.	kg/yr	0.0	4.0
	Phosphoric Acid	kg/yr	234.3	669.3
	Potassium Hydroxide	kg/yr	0.8	2.3
	Silica, Quartz	kg/yr	0.7	2.0
	Sulfuric Acid	kg/yr	25.5	72.8
	Tantalum Metal	kg/yr	0.3	27.2
	Tin numerous forms	kg/yr	0.0	1.1
	Xylene (o-,m-,p-Isomers)	kg/yr	1.7	4.9
	Zinc Oxide Fume	kg/yr	0.2	0.5
	Zirconium Compounds, as Zr	kg/yr	0.0	1.0

A total of 31 of the listed chemicals were used at the Sigma Complex in 1999.

Table A-13. Target Fabrication Facility

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Target Fabrication Facility				
	1,1,1-Trichloroethane	kg/yr	4.9	14.1
	1,1,2-Trichloroethane	kg/yr	0.5	1.4
	2-Methoxyethanol (EGME)	kg/yr	0.3	1.0
	Acetone	kg/yr	20.0	57.2
	Acrylic Acid	kg/yr	0.2	0.6
	Acrylonitrile	kg/yr	0.3	0.8
	Ammonia	kg/yr	1483.5	4238.6
	Ammonium Chloride (Fume)	kg/yr	0.4	1.0
	Aniline & Homologues	kg/yr	0.2	0.5
	Chlorine	kg/yr	6.9	19.7
	Cyclohexane	kg/yr	0.5	1.6
	Dibutyl Phthalate	kg/yr	0.7	2.1
	Diethanolamine	kg/yr	0.2	0.5
	Diethyl Phthalate	kg/yr	0.1	0.4
	Diethylene Triamine	kg/yr	0.3	1.0
	Ethanol	kg/yr	9.1	25.9
	Ethyl Acetate	kg/yr	1.3	3.6
	Ethylene Diamine	kg/yr	0.2	0.4
	Ethylene Dichloride	kg/yr	2.4	6.8
	Hydrogen Chloride	kg/yr	3.9	11.0
	Hydrogen Fluoride, as F	kg/yr	0.3	1.0
	Hydrogen Peroxide	kg/yr	0.2	0.7
	Isopropyl Alcohol	kg/yr	6.9	19.6
	Methyl Alcohol	kg/yr	12.1	34.7
	Methyl Cyclohexane	kg/yr	0.3	0.8
	Methyl Isobutyl Ketone	kg/yr	0.1	0.4
	Methylene Chloride	kg/yr	1.9	5.3
	n,n-Dimethyl Acetamide or Dimethyl Acetamide	kg/yr	0.3	0.9
	n,n-Dimethylformamide	kg/yr	12.3	35.1
	n-Amyl Acetate	kg/yr	0.3	0.9
	n-Butyl Acetate	kg/yr	0.2	0.4
	n-Heptane	kg/yr	1.0	2.7
	Nitrous Oxide	kg/yr	19.3	55.0
	Osmium Tetroxide, as Os	kg/yr	0.1	0.2
	Phosphoric Acid	kg/yr	0.4	1.0
	Potassium Hydroxide	kg/yr	0.4	1.0
	Propane	kg/yr	0.0	45.4
	Propyl Alcohol	kg/yr	0.3	0.8
	Silicon Tetrahydride	kg/yr	3.1	8.9
	Styrene	kg/yr	1.7	4.9
	Sulfur Hexafluoride	kg/yr	9.7	27.7
	Sulfuric Acid	kg/yr	4.8	13.8
	Tetrahydrofuran	kg/yr	0.3	0.9
	Toluene	kg/yr	1.2	3.5

A total of 44 of the listed chemicals were used at the Target Fabrication Facility in 1999. The amount of propane combusted at the facility totaled 100 pounds (45 kg).

Table A-14. Tritium Facility

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Tritium Facilities				
	Ammonia	kg/yr	0.8	2.4
	Copper	kg/yr	0.0	0.5
	Ethanol	kg/yr	0.3	0.7
	Hydrogen Chloride	kg/yr	0.4	1.2
	Methyl Alcohol	kg/yr	0.3	0.8
	Phenylphosphine	kg/yr	0.3	0.9
	Propane	kg/yr	0.0	73.4
	Sulfur Hexafluoride	kg/yr	14.2	40.6

A total of 8 of the listed chemicals were used at the Tritium Facilities in 1999. The amount of propane combusted at the facility totaled 162 pounds (73 kg).

Table A-15. Waste Management Operations: Radioactive Liquid Waste Treatment Facility

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
Waste Management Operations: Radioactive Liquid Waste Facility				
	1,1,2-Trichloro-1,2,2-Trifluoroethane	kg/yr	1.4	4.0
	Acetic Acid	kg/yr	17.7	50.5
	Acetone	kg/yr	0.8	2.4
	Acetonitrile	kg/yr	0.3	0.8
	Acetylene	kg/yr	6.9	19.7
	Ammonium Chloride (Fume)	kg/yr	0.2	0.7
	Cadmium, el.&compounds, as Cd	kg/yr	0.2	22.7
	Carbon Black	kg/yr	0.6	1.6
	Hexane (other isomers)* or n-Hexane	kg/yr	1.8	5.3
	Hydrogen Chloride	kg/yr	88.0	251.4
	Hydrogen Fluoride, as F	kg/yr	0.7	2.0
	Hydrogen Peroxide	kg/yr	11.8	33.8
	Magnesium Oxide Fume	kg/yr	0.2	0.5
	Methyl 2-Cyanoacrylate	kg/yr	0.1	0.3
	Methyl Alcohol	kg/yr	1.9	5.5
	Oxalic Acid	kg/yr	0.2	0.5
	Phenol	kg/yr	0.7	2.0
	Phosphorus	kg/yr	0.2	0.6
	Potassium Hydroxide	kg/yr	3.3	9.5
	Propane	kg/yr	0.0	12340.9
	Propyl Alcohol	kg/yr	0.1	0.4
	Silica, Quartz	kg/yr	1.1	3.0

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
	Silver (metal dust & soluble comp., as Ag)	kg/yr	0.0	1.1
	Sulfuric Acid	kg/yr	152.6	435.9
	Tin numerous forms	kg/yr	0.0	0.7
	Trichloroacetic Acid	kg/yr	0.2	0.5
	Zinc Chloride Fume	kg/yr	0.2	0.5

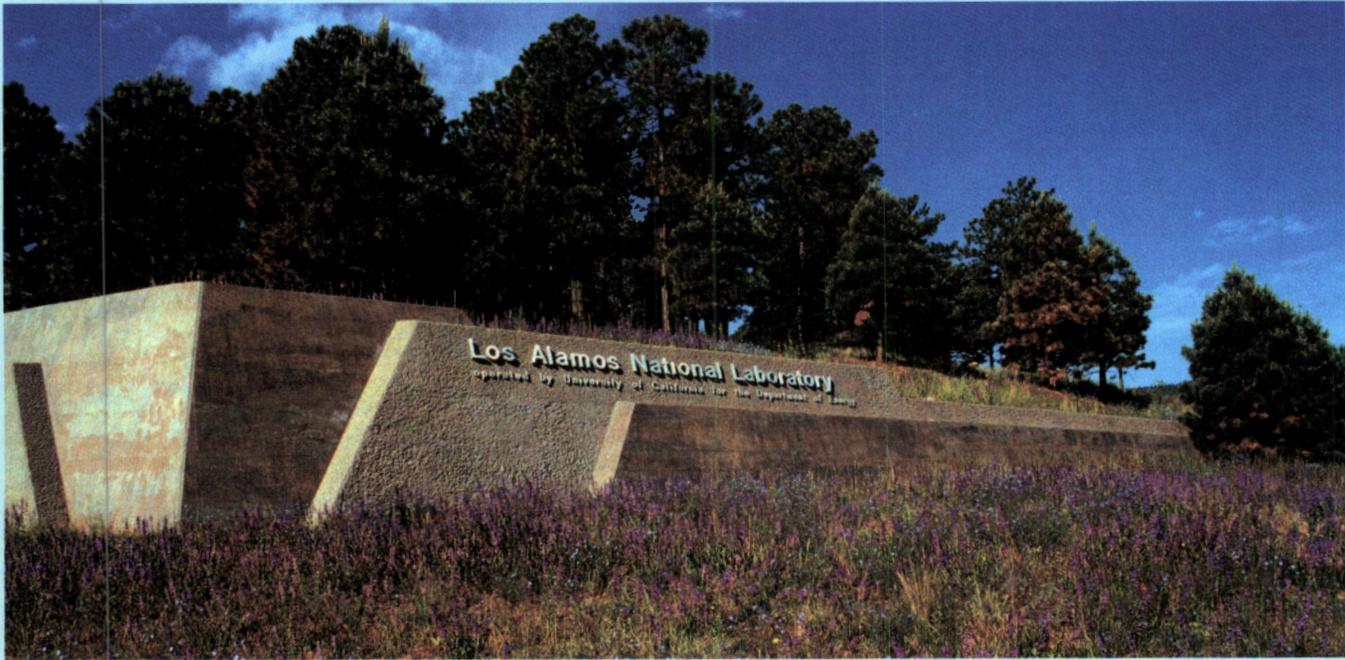
A total of 27 of the listed chemicals were used in Waste Management Operations in 1999. The amount of propane combusted at the facility totaled 27207 pounds (12341 kg).

Table A-16. Waste Management Operations: Solid Radioactive and Chemical Waste Facilities

KEY FACILITY	CHEMICAL NAME	UNIT OF MEASURE	1999 ESTIMATED AIR EMISSIONS	1999 USAGE
WMO: solid rad and chem				
	Diethanolamine	kg/yr	0.2	0.5
	Ethanol	kg/yr	14.9	42.6
	Hydrogen Chloride	kg/yr	6.9	19.6
	Methyl Alcohol	kg/yr	1.4	4.0
	Propane	kg/yr	0.0	1675.0
	Sulfuric Acid	kg/yr	0.6	1.8

A total of 6 of the listed chemicals were used in WMO in 1999. The amount of propane combusted at the facility totaled 3693 pounds (1675 kg).





To obtain a copy of the SWEIS Yearbook —1999, contact Doris Garvey, Project Leader, Site-Wide Issues Office, P.O. Box 1663, MS M889, Los Alamos, New Mexico 87545. This 1999 Yearbook is available on the web at: <http://lib-www.lanl.gov/la-pubs/00393813.pdf>

The Site-Wide Issues Office and the Environmental Publications and Design Team of the Ecology Group (ESH-20) coordinated production of this booklet.

Lead Writers: Doris Garvey and Ken Rea

Editor: Hector Hinojosa, IM-1

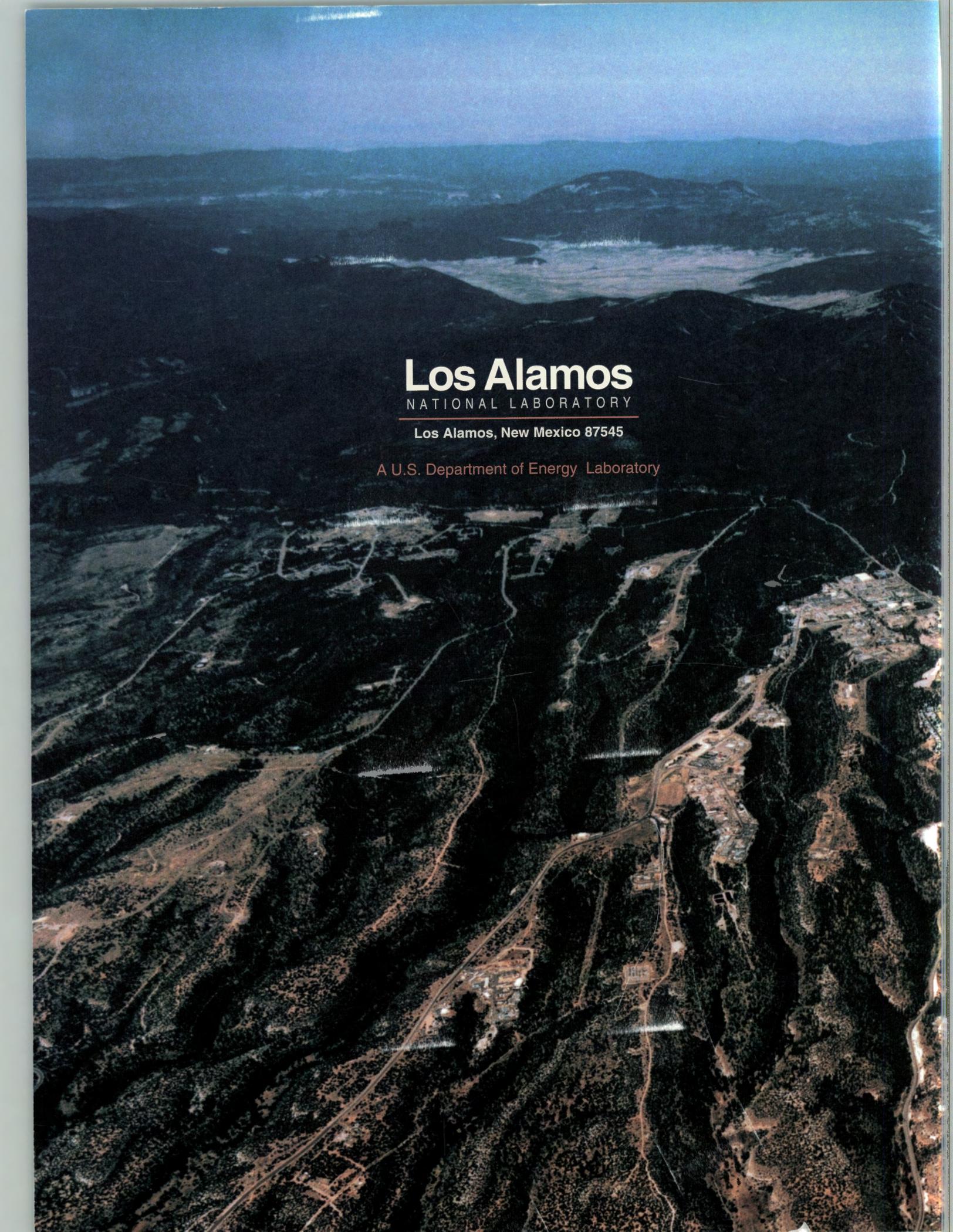
Designer: Randy Summers, IM-1

Printing coordinator: Lupe Archuleta, IM-4

Photos

RN83124001	xii	P6130035	3-19
82039k014	1-2	P6200077	3-19
RN991723	2-6	P6200079	3-19
RN991728	2-11	P8090716	3-20
RN991770	2-11	P6300197	3-20
RN991724	2-17	P8150788	3-20
RN00212007	2-22	P8290958	3-20
di000686001	2-33	P9271313	3-20
di000845	2-49	RN94085001	4-2
RN00134036	2-49	RN94085006	5-4
di990719	3-12	di991637	Above

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the US Department of Energy under contract W-7405-ENG-36. By acceptance of this article, the publisher recognizes that the US Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for US Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the US Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.



Los Alamos

NATIONAL LABORATORY

Los Alamos, New Mexico 87545

A U.S. Department of Energy Laboratory

APPENDIX H

TECHNICAL AREA 55 ACCEPTABLE KNOWLEDGE REPORTS

LA-UR Numbers:

LA-UR-00-5860

LA-UR-00-5861

LA-UR-00-5862

LA-UR-00-5863

LA-UR-00-5864

LA-UR-00-5865

Electronic copies of these reports were provided to the New Mexico Environment Department. Acrobat Reader is required for this electronic database.

APPENDIX I

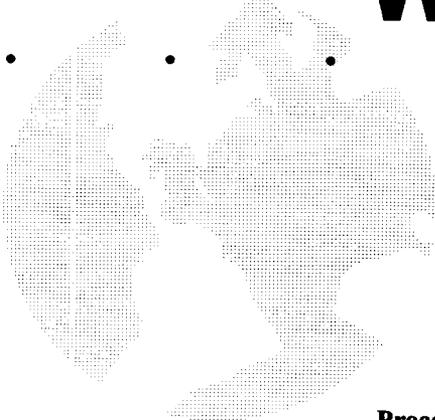
**COPY OF "DISPOSAL OF OFFSITE GENERATED RADIOACTIVE
WASTE" (REPORT-54G-026,R.0)**

Los Alamos

NATIONAL LABORATORY
Environmental Management
Solid Waste Operations
Mail Stop J595, Los Alamos, NM 87545

REPORT-54G-026,R.0

Disposal of Offsite Generated Radioactive Waste



Process Owner	Signature	Date
Julie Minton-Hughes, EM-SWO	SIGNATURES ON FILE	
Nuclear Operations Leader		
Davis Christensen, EM-SWO		
Group Leader/Facility Manager		
Tony Stanford, EM-SWO		

YOU ARE RESPONSIBLE FOR VERIFYING THAT YOU ARE WORKING TO THE MOST CURRENT REVISION OF THIS DOCUMENT.

DISPOSAL OF OFFSITE GENERATED RADIOACTIVE WASTE

Introduction

Since 1957 a radioactive waste disposal facility has been operated at Material Disposal Area G (MDA G) at Technical Area (TA) 54 at Los Alamos National Laboratory (the Laboratory). Currently MDA G is the only authorized disposal area for solid Low-Level radioactive waste (LLW). MDA G also serves as the storage area for transuranic waste destined for the Waste Isolation Pilot Plant (WIPP) and RCRA-permitted storage area for mixed low-level waste.

Scope

This document summarizes the waste received for disposal or storage at MDA G from both Laboratory and non-Laboratory offsite generators. This document does not consider waste that was treated through such technologies as metal melt.

Discussion

Prior to 1971 the origination of waste from offsite facilities was not well documented; however the logbooks from that time do have listings for waste received from offsite generators. These logbooks indicate that approximately 980 m³ was disposed of at MDA G. Since 1971 approximately 200 m³ of radioactive waste generated offsite has been disposed of or stored at MDA G. Some of this waste is generated by Laboratory personnel working at offsite facilities on Laboratory-sponsored projects; the remainder was generated by non-Laboratory-sponsored activities from other Department of Energy's (DOE) sites or projects. The information on this waste is summarized in Table 1. A complete listing of the offsite waste shipments by year is in Attachment A.

The waste generated by Laboratory personnel has included waste from studies performed at the Nevada Test Site (NTS) and Stanford University. This waste includes soils and laboratory equipment. Other waste generated by Laboratory that was transferred from an offsite location includes waste generated in treatment studies of mixed waste.

The majority of the waste received from other DOE facilities has come from the Kansas City Plant (KCP) operated by Bendix (now Allied Signal). The waste received for disposal from Bendix was generally classified parts that were not acceptable for disposal elsewhere in the complex. Other offsite generators of LLW disposed at the Laboratory have included University of Florida, Sandia National Laboratories, and EG&G. Additionally, the Laboratory has taken TRU waste from Lovelace Inhalation Toxicology Research Institute (ITRI), the Pantex Plant, and Sandia National Laboratories for storage until the opening of the WIPP site.

There is continued interest by offsite generators in using MDA G. In 1996, representatives from the KCP contacted MDA G personnel about transferring classified low-level waste to MDA G for disposal. Additionally, there are currently discussion with the DOE concerning the transfer of

transuranic waste from Sandia to the Laboratory and low-level waste from Mound. In addition, the waste stream from Stanford is the result of an on-going project and increased waste volume is anticipated. Because Laboratory personnel perform work at offsite locations such as NTS this waste source will continue

Because the Laboratory is the only DOE LLW disposal site with the authorization to dispose of polychlorinated biphenyl (PCB) waste, it is expected that small amounts of LLW contaminated with PCB will be disposed of at MDA G. The wastes will be the result of various environmental restorations (ER) projects and decontamination and decommissioning (D&D) activities throughout the DOE complex.

Conclusion

Historically the Laboratory has received offsite waste from a number of sources and given the DOE's down-sizing efforts and the anticipated ER projections and D&D activities, the offsite generated radioactive waste received by the Laboratory is likely to increase.

Table 1
Offsite Waste

Number of items or loads*	From	Years
3	University of New Mexico	1959 - 1960
17	Pantex	1960 - 1962, 1997
69	Bendix	1960 - 1965, 1967 -1972, 1974, 1979, 1981, 1984
7	Eberline - Santa Fe	1960, 1962 - 1964
2	Avco	1961
10	Interstate Laundry	1962 - 1963
56	ITRI	1962 - 1963, 1975 -1976, 1981, 1984
1	ACF (Albuquerque)	1964
1	University of Florida	1973
2	EG&G	1975, 1977
3	Sandia	1976
16	NTS**	1991, 1997
2	Stanford**	1996
8	Exxon	1997
2	Catholic University**	1997
3	Pantex	1997

* The number in this column is the number of items if the waste is stored or disposed of after 1997 or the number of loads if the waste was disposed of prior to 1997.

** These wastes were generated by Laboratory projects at offsite facilities.

February 27, 2001

Attachment A: Detail on Offsite Waste

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
1959	UNM		9593			unknown		unknown	3 stainless steel cans & several bottles of liquid (chemicals)
1960	Pantex		9593			55	G	0.208	1 55-G drum
	Bendix		9593			unknown		unknown	96 55-G drums, 66 30-G drums, 25 15-G drums, and 23 boxes
	UNM		9593			unknown		unknown	1 box and source pig
	UNM		9593			unknown		unknown	4 boxes
	Bendix		9593			unknown		unknown	64 containers
	Eberline - Santa Fe		9593			60	G	0.227	1 55-G drum and 1 5-gal drum
	Bendix		9593			unknown		unknown	121 containers
	Bendix		9593			3930	G	14.875	131 30-G containers
	Pantex		9593			unknown		unknown	7 containers
1961	Pantex		9593			60	G	0.227	3 20-G containers
	Avco (Idaho)		9593			unknown		unknown	1 plastic container
	Avco (Idaho)		9593			unknown		unknown	1 plastic container
	Bendix		9593			unknown		unknown	223 drums
	Pantex		11363			110	G	0.416	2 55-G drums
	Pantex		11363			75	G	0.284	5 15-G drums
	Pantex		11363			30	G	0.114	2 15-G drums
	Eberline - Santa Fe		11363			165	G	0.624	3 55-G drums
	Bendix		11363			3080	G	11.64	56 55-G drums
	Pantex		11363			35	G	0.132	7 5-G drums
	Pantex		11363			165	G	0.624	3 55-G drums
1962	Pantex		11363			3135	G	11.856	57 55-G drums

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
	Bendix		11363			3520	G	13.312	64 55-G drums
	Bendix		11363			3465	G	13.104	63 55-G drums
1962	Bendix		11363			4910	G	18.584	10 55-G drums and 218 20-G drums
	Pantex		11363			55	G	0.208	1 55-G drum
	Bendix		11363			105	G	0.397	7 15-G drums
	Eberline - Santa Fe		11363			6345	G	24.016	99 55-G drums and 60 15-G drums
	Eberline - Santa Fe		11363			110	G	0.416	2 55-G drums
	Pantex		11363			70	G	0.265	1 55-G drum and 5 3-G cans
	Bendix		11363			6780	G	25.662	123 55-G drums and 1 15-G drum
	Interstate Laundry - Santa Fe		11363			165	G	0.624	3 55-G drums
	ITRI		11363			220	G	0.832	4 55-G drums
	Bendix		11363			5675	G	21.48	99 55-G drums, 7 20-G drums, and 3 30-G drums
	Eberline - Santa Fe		11363			165	G	0.624	3 55-G drums and 1 plastic bag
	Pantex		11363			30	G	0.114	1 30-G drum
	Interstate Laundry - Santa Fe		11363			110	G	0.416	2 55-G drums
	Bendix		11363			6180	G	23.391	112 55-G drums and 1 20-G drum
	Pantex		11363			55	G	0.208	1 55-G drum
	Interstate Laundry - Santa Fe		11363			145	G	0.549	1 55-G drum and 6 15-G drums
	Pantex		11363			110	G	0.416	2 55-G drums
1963	ITRI		11866			330	G	1.248	6 55-G drums
	Interstate Laundry - Santa Fe		11866			275	G	1.04	5 55-G drums
	Bendix		11866			6985	G	56.416	127 55-G drums
	Interstate Laundry - Santa Fe		11866			220	G	0.832	4 55-G drums

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
	ITRI		11866			110	G	0.416	2 55-G drums
	Interstate Laundry - Santa Fe		11866			220	G	0.832	4 55-G drums
	Bendix		11866			6710	G	2.538	122 55-G drums
	Interstate Laundry - Santa Fe		11866			275	G	1.04	5 55-G drums
1963	Interstate Laundry - Santa Fe		11866			275	G	1.04	5 55-G drums
	Interstate Laundry - Santa Fe		11866			275	G	1.04	5 55-G drums
	Interstate Laundry - Santa Fe		11866			220	G	0.832	4 55-G drums
	Eberline - Santa Fe		11866			55	G	0.208	1 55-G drum
	Bendix		11866			6930	G	26.208	126 55-G drums
	Bendix		11866			351	ft ³	9.94	3 wooden crates
	Eberline - Santa Fe		11866			59.16	ft ³	1.675	7 55-G drums and 1 package
1964	ACF (Albuquerque)		11866			660	G	2.496	12 55-G drums
	Eberline - Santa Fe		11866			110	G	0.416	2 55-G drums
	Bendix		11866			7040	G	26.624	128 55-G drums
	Bendix		11866			162	ft ³	4.588	6 wooden boxes (3'x3'x3')
	Bendix		11866			6545	G	24.752	119 55-G drums
	Bendix		11866			228	ft ³	6.457	8 wooden boxes (3'x3'x4')
	Bendix		11866			6160	G	23.296	112 55-G drums
	Bendix		11866			94.5	ft ³	2.676	3 wooden boxes (3'x3'x3.5')
1965	Bendix		11866			6270	G	23.712	114 55-G drums
	Bendix		11866			72	ft ³	2.039	2 wooden boxes (3'x3'x4')
	Bendix		11866			6105	G	23.088	111 55-G drums
	Bendix		11866			832	ft ³	23.563	13 wooden boxes (4'x4'x4')
1966	Bendix		11866			10980	G	41.559	366 30-G drums

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
	Bendix		11866			9405	G	35.568	171 55-G drums
	Bendix		11866			256	ft ³	7.25	4 wooden boxes (4'x4'x4')
	Bendix		11866			8690	G	32.864	158 55-G drums
	Bendix		11866			16	ft ³	0.453	2 boxes (2'x2'x2')
1967	Bendix		11866			6820	G	25.792	124 55-G drums
	Bendix		11866			3	ft ³	0.085	22 pieces of bulk material
1968	Bendix		11866			3300	G	12.48	60 55-G drums
	Bendix		11866			7040	G	26.624	128 55-G drums
1969	Bendix		11866			2415	G	9.141	43 55-G drums, 1 30-G drum, and 1 20-G drum
	Bendix		11866			42.75	ft ³	1.211	wooden boxes
	Bendix		11866			4145	G	15.689	74 55-G drums, 2 30-G drums, and 3 5-G drums
1969	Bendix		11866			8360	G	31.616	152 55-G drums
	Bendix		11866			4565	G	17.264	83 55-drum
	Bendix		11866			52	ft ³	1.473	19 items (wooden boxes and signs)
1970	Bendix		11866			10010	G	37.856	182 55-G drums
	Bendix		11866			1779	ft ³	50.382	38 plywood boxes and 3 55-G drums
	Bendix		11866			1438.25	ft ³	40.732	29 plywood boxes and 14 55-G drums
	Bendix		11866			2860	G	10.816	52 55-G drums
	Bendix		11866			1472	ft ³	41.688	23 plywood boxes (4'x4'x4'??)

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
	Bendix		11866			4180	G	15.808	76 55-G drums
	Bendix		11866			1216	ft ³	34.438	7 wooden crates and 12 cardboard boxes
	Bendix		11866			8745	G	33.072	159 55-G drums
	Bendix		11866			64	ft ³	1.813	43 wooden crates
1971	Bendix	LLW		S710084	S710084	433.2	ft ³	12.268	108 55-G drums
	Bendix	LLW		S710085	S710085	450	ft ³	12.744	80 55-G drums
	Bendix	LLW		S710259	S710259	4	m ³	4	20 55-G drums
	Bendix	LLW		S710556	S710556	450	ft ³	12.744	80 55-G drums
1971	Bendix	LLW		S710567	S710567	450	ft ³	12.744	80 55-G drums
	Bendix	LLW		S710878	S710878	5.3	ft ³	0.15	plywood box + 40-G container
1972	Bendix	LLW		S721145	S721145	30	G	4.4	No copy of RSWD; database description refers to Logbook 11866
	Bendix	LLW		S721146	S721146	2475	G	15.8	No copy of RSWD; database description refers to Logbook 11866
1973	University of Florida	LLW		S730516	S730516	1	ft ³	0.028	
1974	Bendix	LLW		S001487	S001487	334.9	ft ³	9.485	45 55-G drums
1975	ITRI	TRU		S004058	S004058	55	G	0.208	
	ITRI	TRU		S004059	S004059	55	G	0.208	
	ITRI	TRU		S004060	S004060	55	G	0.208	
	ITRI	TRU		S004061	S004061	55	G	0.208	
	ITRI	TRU		S004062	S004062	55	G	0.208	
	ITRI	TRU		S004063	S004063	55	G	0.208	

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
		ITRI		S004064	S004064	55	G	0.208	
		ITRI		S004065	S004065	55	G	0.208	
		ITRI		S004086	S004086	55	G	0.208	
		EG&G		S004071	S004071	0.1	ft ³	0.003	
1976	Sandia	TRU		S761917	S761917	55	G	0.208	
	Sandia	TRU		S761918	S761918	55	G	0.208	
	Sandia	TRU		S761919	S761919	128	ft ³	3.625	
	Sandia	LLW		S761920	S761920	13.6	ft ³	0.385	1 55-G drums and 1 6.2 ft ³ box
1977	EG&G	LLW		S771975	S771975	8	ft ³	0.227	
1979	Bendix	LLW		S791113	S791113	220	G	0.833	
1981	Bendix	LLW		S813862	S813862	28.4	ft ³	0.804	
	Bendix	LLW		S813863	S813863	22.8	ft ³	0.646	
	Bendix	LLW		S813864	S813864	8.8	ft ³	0.249	
	Bendix	LLW		S813865	S813865	62.8	ft ³	1.779	
	Bendix	LLW		S813866	S813866	12.7	ft ³	0.36	
	Bendix	LLW		S813867	S813867	3.5	ft ³	0.099	
	Bendix	LLW		S813868	S813868	41.1	ft ³	1.164	
	Bendix	LLW		S813869	S813869	40.2	ft ³	1.138	
	ITRI	TRU		S813875	S813875	55	G	0.208	
	ITRI	TRU		S813876	S813876	55	G	0.208	
	ITRI	TRU		S813877	S813877	55	G	0.208	
	ITRI	TRU		S813878	S813878	55	G	0.208	
	ITRI	TRU		S813879	S813879	55	G	0.208	
	ITRI	TRU		S813880	S813880	55	G	0.208	
	ITRI	TRU		S813881	S813881	55	G	0.208	
	ITRI	TRU		S813882	S813882	55	G	0.208	

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
		ITRI		S813883	S813883	55	G	0.208	
		ITRI		S813884	S813884	55	G	0.208	
		ITRI		S813885	S813885	55	G	0.208	
		ITRI		S813886	S813886	55	G	0.208	
		ITRI		S813887	S813887	55	G	0.208	
		ITRI		S813888	S813888	55	G	0.208	
		ITRI		S813889	S813889	55	G	0.208	
		ITRI		S813890	S813890	55	G	0.208	
		ITRI		S813891	S813891	55	G	0.208	
		ITRI		S813892	S813892	55	G	0.208	
		ITRI		S813893	S813893	55	G	0.208	
1981		ITRI		S813894	S813894	55	G	0.208	
		ITRI		S813895	S813895	55	G	0.208	
		ITRI		S813896	S813896	55	G	0.208	
		ITRI		S813897	S813897	55	G	0.208	
		ITRI		S813898	S813898	55	G	0.208	
1984		ITRI		S844103	S844103	55	G	0.208	
		ITRI		S844104	S844104	55	G	0.208	
		ITRI		S844105	S844105	55	G	0.208	
		ITRI		S844106	S844106	55	G	0.208	
		ITRI		S844107	S844107	55	G	0.208	
		ITRI		S844108	S844108	55	G	0.208	
		ITRI		S844109	S844109	55	G	0.208	
		ITRI		S844110	S844110	55	G	0.208	
		ITRI		S844111	S844111	55	G	0.208	
		ITRI		S844112	S844112	55	G	0.208	
		ITRI		S844113	S844113	55	G	0.208	
		ITRI		S844114	S844114	55	G	0.208	
		ITRI		S844115	S844115	55	G	0.208	
		ITRI		S844116	S844116	55	G	0.208	

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
		ITRI		S844117	S844117	55	G	0.208	
		ITRI		S844387	S844387	55	G	0.208	
		ITRI		S844388	S844388	55	G	0.208	
		ITRI		S844389	S844389	55	G	0.208	
		ITRI		S844390	S844390	55	G	0.208	
		Bendix		S843965	S843965	19.1	ft ³	0.542	
		Bendix		S843966	S843966	19.1	ft ³	0.542	
		Bendix		S843967	S843967	19.1	ft ³	0.542	
1991	NTS (LANL)	LLW		S913075	2026725	352	ft ³	9.969	
1992	NTS (LANL)	LLW		L92000040	2000045	160	ft ³	4.531	
	NTS (LANL)	LLW		L92000047	2000086	140	ft ³	3.965	
	NTS (LANL)	LLW		L92000151	2000127	140	ft ³	3.965	
	NTS (LANL)	LLW		L92000435	2000340	140	ft ³	3.965	
	NTS (LANL)	LLW		L92000552	2000397	160	ft ³	4.531	
	NTS (LANL)	LLW		L92000654	2000480	140	ft ³	3.965	
	NTS (LANL)	LLW		L92000726	2028932	144	ft ³	4.078	
	NTS (LANL)	LLW		L92000824	2029026	140	ft ³	3.965	
1993	NTS (LANL)	LLW		L93000035	2029165	160	ft ³	4.531	
	NTS (LANL)	LLW		L93000128	2029244	60	ft ³	1.699	
	NTS (LANL)	LLW		L93000258	2029364	160	ft ³	4.531	
	NTS (LANL)	LLW		L93000313	2029416	140	ft ³	3.965	
	NTS (LANL)	LLW		L93000729	2029794	160	ft ³	4.531	
1994	NTS (LANL)	LLW		L94000264	2030235	160	ft ³	4.531	
	NTS (LANL)	LLW		L94000693	2031033	176	ft ³	4.984	
	NTS (LANL)	LLW		L94000593	2031231	150	ft ³	4.248	
1996	NTS (LANL)	LLW		L96070976	3002978	30	G	0.114	

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
	NTS (LANL)	LLW		L96070978	3002978	55	G	0.208	
	NTS (LANL)	LLW		L96070979	3002978	55	G	0.208	
	NTS (LANL)	LLW		L96070980	3002978	55	G	0.208	
	NTS (LANL)	LLW		L96070981	3002978	55	G	0.208	
	NTS (LANL)	LLW		L96070982	3002978	55	G	0.208	
	NTS (LANL)	LLW		L96070983	3002978	55	G	0.208	
	NTS (LANL)	LLW		L96071984	3002978	85	G	0.322	
1997	Exxon (LANL)	TRU		56511	56511	55	G	0.208	
1997	Exxon (LANL)	TRU		56512	56512	55	G	0.208	
	Exxon (LANL)	TRU		56513	56513	55	G	0.208	
	Exxon (LANL)	TRU		56514	56514	55	G	0.208	
	Exxon (LANL)	TRU		56515	56515	55	G	0.208	
	Exxon (LANL)	TRU		56516	56516	55	G	0.208	
	Exxon (LANL)	TRU		56517	56517	55	G	0.208	
	Exxon (LANL)	TRU		56518	56518	55	G	0.208	
	NTS (LANL)	LLW		L96074132	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074134	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074135	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074136	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074137	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074138	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074139	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074140	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074141	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074142	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074143	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074144	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074145	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074146	3002717	55	G	0.208	
	NTS (LANL)	LLW		L96074147	3002717	55	G	0.208	

February 27, 2001

Year Rcvd	From	Waste Type	Logbook ID	Con_ID	RSWD/CWDR /TWSR No.	Generator Volume	Units	Volume (m ³)	Notes
	Catholic University (LANL)	LLW		L97079027	3004077	55	G	0.208	
	Catholic University (LANL)	LLW		L97079028	3004077	55	G	0.208	
	Pantex	TRU		56503	56503	55	G	0.208	
	Pantex	TRU		56504	56504	55	G	0.208	
	Pantex	TRU		56505	56505	55	G	0.208	

APPENDIX J

**COPY OF LOS ALAMOS NATIONAL LABORATORY
“DISPOSAL AND STORAGE FACILITY INFORMATION
AT AREA G”**

LA-UR-01-1670

Hard copies of this document were provided to
the New Mexico Environment Department as a separate package.

APPENDIX K

**MIXED WASTE STORAGE AREAS AT
LOS ALAMOS NATIONAL LABORATORY
AS OF APRIL 4, 2001**

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
2026	18	250			SAA	ACTIVE	NIS-18
2027	3	30		OUTSIDE	< 90 DAY	REMOVED	E-ER
2032	3	29	2195	Within Taped off Area in floor	SAA	ACTIVE	NMT-13
2033	3	29	7195	Within Taped Off Area On Floor	SAA	ACTIVE	NMT-13
2034	3	29	7295	Within Taped Off Area on Floor	SAA	REMOVED	NMT-13
2036	3	29	S026	On Table	SAA	REMOVED	NMT-13
2022	54	8			< 90 DAY	REMOVED	FWO-SWO
2024	3	29	9160	Bottle and Bag in Marked White Bucket in Cell 16	SAA	ACTIVE	NMT-11
7	3	102	118	EAST END OF SHOP	< 90 DAY	ACTIVE	ESA-WMM
1466	3	29	3123	Entire Glovebox	SAA	ACTIVE	C-ACT
1467	53	1071	N/A	NEAR BULDILNG 1071/NE IMP	SAA	REMOVED	EM-ER
1451	53	1	0	BASEMENT	< 90 DAY	REMOVED	AOT-FM
1377	3	29	7016		SAA	REMOVED	CST-26
1361	43	1	163		SAA	REMOVED	LS-4
1351	54	58	0	INSIDE PERMACON	SAA	REMOVED	EM-SWO
1321	48	1	407		SAA	ACTIVE	C-INC
1259	55	4	115	FLOOR	SAA	REMOVED	NMT-11
1250	48	1	412		SAA	ACTIVE	C-SIC
1251	3	29	S019	IN CABINET	SAA	REMOVED	CST-8
1255	3	29	1007	OUTLINED ON FLOOR	SAA	REMOVED	NMT-1
1244	54	0	N/A	AREA L/MIXED WASTE AREA	INTERIM	REMOVED	CST-5
1240	54	0	N/A	AREA L/MIXED WASTE AREA	INTERIM	ACTIVE	FWO-SWO
1228	55	4	N/A	BASEMENT Area 3 (B05)	INTERIM	ACTIVE	NMT-7
1224	54	283	N/A	AREA G/STORAGE DOME 283	INTERIM	ACTIVE	FWO-SWO
1225	55	4	401	CEMENTING PROCESS	INTERIM	ACTIVE	NMT-7
1226	55	4	401	STORAGE AREA	INTERIM	ACTIVE	NMT-7
1227	55	4	N/A	BASEMENT Area 2 (B38 Annex)	INTERIM	ACTIVE	NMT-7
1212	3	30	N/A	BACK OF BLDG	< 90 DAY	REMOVED	CST-18
1183	55	4	420	GLOVE BOX G49813	< 90 DAY	REMOVED	NMT-3
1178	54	1024	N/A	EAST SIDE OUTSIDE	< 90 DAY	REMOVED	CST-12
1181	15	0	N/A	SEE MAP IN FILE	< 90 DAY	REMOVED	ESA-DE
1175	60	0	0	SIGMA MESA	< 90 DAY	REMOVED	CST-18
1162	50	1	131B		SAA	ACTIVE	C-ACS
1163	43	1	162		SAA	REMOVED	B-N2
1150	18	257	N/A	NEAR BLDG 257 IN TRANSPOR	< 90 DAY	REMOVED	ESA-DE
1145	48	1	415	FLAMMABLE CABINET	SAA	REMOVED	CST-17
1116	21	4	412	D&D PROJECT BLDG SOUTH	SAA	REMOVED	EM-ER

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
1072	55	4	115	GLOVEBOX GB-G103	SAA	ACTIVE	NMT-16
1060	54	0	N/A	AREA L/MIXED WASTE	SAA	REMOVED	EM-SWO
1047	0	0	N/A	TOWNSITE	< 90 DAY	REMOVED	ENG-1
1046	3	40	E28A		< 90 DAY	REMOVED	ESH-4
1033	53	3	N/A	A6	SAA	REMOVED	AOT-7
1019	33	86	N/A	Outside Bldg 86	SAA	REMOVED	ESA-TSE
1018	33	86	2	SW CORNER OF THE ROOM	SAA	REMOVED	ESA-EPE
1011	43	1	151		SAA	REMOVED	LS-2
997	48	45	E105	CABINET BENEATH EACI HOOD	SAA	REMOVED	CST-7
991	50	1	5		SAA	INACTIVE	CST-9
992	50	1	10		SAA	REMOVED	CST-9
993	50	1	1		SAA	REMOVED	CST-9
989	50	1	131		SAA	REMOVED	CST-9
988	50	1	130		SAA	ACTIVE	C-ACS
981	43	1	235B		SAA	REMOVED	LS-2
961	3	29	2074	WING 2 BASEMENT	SAA	ACTIVE	NMT-7
957	3	29	7115	IN HOOD ON WEST SIDE	SAA	REMOVED	CST-4
958	3	29	5127	LEFT HALF OF CABINET SW	SAA	REMOVED	NMT-1
959	3	29	5125	GLOVEBOX AND HOOD IN ROOM	SAA	ACTIVE	C-AAC
960	3	29	2102	CABINET IN HALLWAY - EAST	SAA	ACTIVE	NMT-16
956	3	29	7112	In cabinet under hood	SAA	ACTIVE	C-AAC
952	3	29	5128		SAA	REMOVED	CST-8
953	3	29	7121	IN AND UNDER HOOD + SHELF IN GLOVEBOX LINE 3	SAA	ACTIVE	C-AAC
954	3	29	7127	EAST HOOD	SAA	REMOVED	CST-8
955	3	29	7134	MARKED AREA IN HOOD #3280	SAA	ACTIVE	C-AAC
946	3	29	2074	IN A BASEMENT LAB	SAA	REMOVED	MST-5
947	41	4	250	INSIDE HOOD NW CORNER RM	< 90 DAY	REMOVED	ESA-EPE
924	53	3	N/A	OUTSIDE TEST CHANNEL SE	SAA	REMOVED	AOT-7
888	48	1	606	SE CORNER	SAA	ACTIVE	C-INC
849	3	29	9030	TAPED AREA SOUTHWEST WALL	INTERIM	ACTIVE	NMT-7
835	21	3	326	UPSTAIRS	SAA	REMOVED	CST-3
825	48	1	338	HOTCELL AREA	SAA	REMOVED	CST-11
793	48	1	307	UNDER SINK SAT AREA	SAA	REMOVED	CST-12
794	48	1	423	UNDER CAB	SAA	REMOVED	CST-12
796	46	250	105	UNDER HOOD	SAA	ACTIVE	C-PCS
787	35	213	A107	UNDER HOOD 12290	SAA	ACTIVE	MST-7
788	48	1	305	UNDER SOUTH SINK	SAA	REMOVED	CST-12

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
783	53	4	104	EAST OF BLDG 4 RM104	SAA	REMOVED	LANSCE-2
766	55	4	425	CABINET	SAA	REMOVED	NMT-7
768	3	29	S012	CMR BASEMENT BY ELE	< 90 DAY	REMOVED	CST-26
764	55	4	401	FLO 1	< 90 DAY	REMOVED	NMT-7
756	35	27	104		< 90 DAY	REMOVED	NIS-5
757	35	2	C157		< 90 DAY	REMOVED	NIS-5
758	48	1	414	UNDER SINK W HOOD	SAA	REMOVED	CST-12
755	3	102	118	MAIN SHOP AREA/OUT OFFICE	SAA	REMOVED	ESA-WMM
751	48	1	411	LEFT OF 1ST HOOD	SAA	REMOVED	CST-12
752	2	1	115	CHEM LAB	SAA	REMOVED	CST-25
738	3	141	N/A	NORTH DOCK	SAA	REMOVED	MST-6
739	3	141	136A	PROCESS ROOM	SAA	REMOVED	MST-6
740	3	66	P100	E-CHEM PLATING AREA	SAA	INACTIVE	MST-6
741	3	66	J105		SAA	REMOVED	MST-6
729	21	3	306A	BLDG 3N OUTSIDE	SAA	REMOVED	CST-10
716	21	5	500A	OUTSIDE N OF 500A	SAA	REMOVED	CST-3
715	21	4	4J	STORAGE ROOM	< 90 DAY	REMOVED	CST-3
692	55	3	170	IN CHEMICAL HOOD	SAA	REMOVED	NMT-2
686	35	2	A131	INSIDE ROOM	SAA	REMOVED	CST-1
685	35	2	A129	UNDER SINK IN WET LAB	SAA	REMOVED	CST-1
669	46	59	101		< 90 DAY	REMOVED	CST-2
675	35	27	104A		SAA	REMOVED	NIS-5
664	48	1	N/A	SW DOCK OF RC-1	< 90 DAY	REMOVED	CST-13
665	3	102	118	OUTSIDE UNDER ROOF	SAA	REMOVED	ESA-10
667	3	39	7	SOUTH SIDE/MAINT AREA	SAA	REMOVED	ESA-10
654	54	0	N/A	AREA L/GAS CYLINDER AREA6	INTERIM	ACTIVE	FWO-SWO
655	54	0	N/A	AREA L/SHAFT 36	INTERIM	ACTIVE	FWO-SWO
656	54	0	N/A	AREA L/SHAFT 37	INTERIM	ACTIVE	FWO-SWO
653	54	0	N/A	AREA L/GAS CYLINDER AREA7	PERMITTED	ACTIVE	FWO-SWO
641	3	102	118A	CORNER OF LIH SHOP	INTERIM	CLOSED	ESA-10
634	3	40	E38	IN ROOM	SAA	REMOVED	P-3
635	48	1	416	FUME HOOD	SAA	REMOVED	CST-8
627	53	883	N/A	WHITE SHED	SAA	REMOVED	LANSCE-2
628	53	4	R104		SAA	REMOVED	LANSCE-2
629	53	3	S300	RMA LAMPF SWITCHYARD	SAA	REMOVED	AOT-2
631	35	2	A144		SAA	REMOVED	ESA-DE
621	48	45	N/A	WEST LOADING DOCK	SAA	ACTIVE	C-INC

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
622	35	2	A133	IN CABINET IN WET LAB	SAA	REMOVED	CST-12
623	48	1	311A		SAA	REMOVED	CST-12
605	51	21	1	UNDER TABLE	SAA	REMOVED	EES-15
601	48	1	410	UND SINK NEAR HOOD 4	SAA	REMOVED	CST-15
598	55	4	420	GLOVE BOX (G441)	SAA	REMOVED	NMT-2
591	48	8	1	MARKED CABINET	SAA	REMOVED	CST-7
552	48	1	312	UNDER SINK	SAA	REMOVED	CST-13
547	48	1	413	UNDER CABINET	SAA	REMOVED	CST-12
549	53	3	N/A	TOFI SPEC. NEAR WALL	SAA	REMOVED	CST-13
550	21	155	5501	SOUTH END OF RM 5501	SAA	ACTIVE	ESA-TSE
551	59	1	106	UNDER HOOD	SAA	REMOVED	CST-9
527	54	8	101	54 WEST	< 90 DAY	REMOVED	CST-7
518	50	1	34B		SAA	ACTIVE	FWO-WFM
512	21	209	125		SAA	REMOVED	ESA-3
514	21	209	BASE		SAA	REMOVED	ESA-3
506	21	155	5523	SOUTH SIDE	SAA	ACTIVE	ESA-TSE
507	21	209	129	LAB HOOD	SAA	REMOVED	ESA-3
508	21	152	5208		SAA	REMOVED	NMT-6
509	21	209	143		SAA	REMOVED	ESA-3
505	21	152	5225	SHOP	SAA	REMOVED	ESA-TSE
510	21	209	178		SAA	REMOVED	ESA-3
502	3	29	5110	FLAMMABLE CABINET S WALL	SAA	ACTIVE	C-SIC
491	16	205	114	WEST WALL	SAA	ACTIVE	ESA-TSE
482	53	166	N/A	SOUTH SURFACE IMPOUNDMENT	INTERIM	WITHDRAWN	EMR-FP
483	53	166	N/A	NW SURFACE IMPOUNDMENT	INTERIM	WITHDRAWN	EMR-FP
484	53	166	N/A	NE SURFACE IMPOUNDMENT	INTERIM	WITHDRAWN	EMR-FP
485	50	1	60A	CEMENTING PROCESS	INTERIM	ACTIVE	FWO-RLW
486	50	37	115	TWO WASTE FEED TANKS	INTERIM	UNDER CLOSURE	CST-16
481	55	4	401	13 STORAGE TANKS	INTERIM	ACTIVE	NMT-7
474	54	0	N/A	AREA G/SHAFT 149	INTERIM	REMOVED	CST-14
475	55	4	N/A	BASEMENT/VAULT	INTERIM	ACTIVE	NMT-7
476	55	4	429	GLOVEBOX GB 472A	INTERIM	UNDER CLOSURE	NMT-7
477	55	4	N/A	BASEMENT Area 1 (B40)	INTERIM	ACTIVE	NMT-7
478	55	4	N/A	BASEMENT Area Oversized TRU (B45)	INTERIM	ACTIVE	NMT-7
479	55	4	N/A	BASEMENT/LOW LEVEL MIXED	INTERIM	ACTIVE	NMT-7
480	55	0	N/A	OUTSIDE BLDG 4 STORAGE	INTERIM	ACTIVE	NMT-7
473	54	0	N/A	AREA G/SHAFT 148	INTERIM	REMOVED	CST-14

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
465	54	0	N/A	AREA G/PAD 2	INTERIM	ACTIVE	FWO-SWO
466	54	0	N/A	AREA G/PAD 4	INTERIM	INACTIVE	FWO-SWO
467	54	33	N/A	AREA G/DRUM PREP FACILITY	INTERIM	ACTIVE	FWO-SWO
468	54	153	N/A	AREA G/STORAGE DOME 153	INTERIM	ACTIVE	FWO-SWO
469	54	224	N/A	AREA G/STORAGE DOME 224	INTERIM	ACTIVE	FWO-SWO
470	54	0	N/A	AREA G/SHAFT 145	INTERIM	ACTIVE	FWO-SWO
471	54	0	N/A	AREA G/SHAFT 146	INTERIM	ACTIVE	FWO-SWO
472	54	0	N/A	AREA G/SHAFT 147	INTERIM	REMOVED	CST-14
464	54	0	N/A	AREA G/PAD 1	INTERIM	ACTIVE	FWO-SWO
457	33	92	N/A		INTERIM	REMOVED	ESA-MF
458	50	37	115		INTERIM	ACTIVE	E-ET
459	50	37	118		INTERIM	ACTIVE	E-ET
460	50	1	59		INTERIM	ACTIVE	FWO-RLW
461	50	69	N/A	OUTSIDE WCRRF	PERMITTED	ACTIVE	E-ET
462	50	69	N/A	INSIDE WCRRF	PERMITTED	ACTIVE	E-ET
456	33	90	N/A		INTERIM	REMOVED	ESA-MF
463	54	8	N/A	AREA G/STORAGE SHED 8	INTERIM	ACTIVE	FWO-SWO
451	50	37	112	INCINERATOR ROOM	SAA	REMOVED	CST-7
454	3	29	9010	ENTIRE ROOM	INTERIM	ACTIVE	NMT-11
455	21	61	N/A		INTERIM	UNDER CLOSURE	CST-5
447	16	370	101		< 90 DAY	REMOVED	ESA-MF
448	41	1	101		< 90 DAY	REMOVED	ESA-EPE
412	48	1	343	HOT CELL MACHINE SHP	SAA	REMOVED	CST-15
401	3	29	2000	WING 2 BASEMENT	SAA	REMOVED	MST-5
402	3	29	2048	DARKROOM	SAA	REMOVED	MST-5
403	3	29	2057	WING 2 BASEMENT SHOP	SAA	REMOVED	NMT-7
396	3	30	W113	B/VAC PUMP REPAIR SHOP	SAA	REMOVED	ESA-10
361	3	66	R100	HIGH BAY	SAA	ACTIVE	MST-6
347	50	1	N/A	BREEZE	< 90 DAY	REMOVED	CST-9
348	50	114	N/A	MODULAR BLDG	INTERIM	REMOVED	EM-RLW
351	3	35	103		SAA	REMOVED	MST-6
352	3	66	B104		SAA	REMOVED	MST-6
354	3	66	K104	CENTER OF ROOM	SAA	INACTIVE	MST-6
342	54	49	N/A	AREA G/STORAGE DOME	INTERIM	ACTIVE	FWO-SWO
343	54	48	N/A	AREA G/STORAGE DOME 48	INTERIM	ACTIVE	FWO-SWO
345	50	37	117	MIXED WASTE CSA	INTERIM	ACTIVE	E-ET
341	16	0	N/A	AREA P	INTERIM	UNDER CLOSURE	ESA-WMA

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
337	3	1819	115	HEPA FILTERED HOOD	SAA	REMOVED	MST-STC
338	3	1819	104	HOOD	SAA	REMOVED	MST-STC
339	3	34	B12	HOOD	SAA	REMOVED	MST-STC
321	3	66	P1	NE CORNER	SAA	ACTIVE	MST-6
307	3	141	144	NORTH DOCK	SAA	REMOVED	MST-6
292	3	66	G105	ALSO G105B	SAA	ACTIVE	MST-6
293	3	66	R11	SOUTH SIDE	SAA	INACTIVE	MST-6
274	3	66	R4	BASEMENT SW CORNER	SAA	REMOVED	MST-6
253	3	66	B107	URANIUM MACHINE SHOP	SAA	REMOVED	MST-6
254	3	66	B3	BASEMENT	SAA	REMOVED	MST-6
255	3	66	R108	WEST SIDE OF ROOM	SAA	ACTIVE	MST-6
240	16	88	N/A	NE CORNER OF BLDG	INTERIM	ACTIVE	ESA-EA
193	21	150	607	CHEM LAB AND ADJ LAB	SAA	REMOVED	CST-3
170	21	5	500A	LOCATED OUTSIDE 500A ON	SAA	REMOVED	CST-18
167	21	150	603	UNDER HOOD	SAA	REMOVED	CST-3
162	3	66	H105	LAB	SAA	ACTIVE	MST-6
157	48	1	4	UNDER SINK	SAA	REMOVED	CST-1
132	3	29	7135	INSIDE LAB WING 7	SAA	REMOVED	CST-9
74	15	184	N/A	PERMEX FIRING POINT	INTERIM	REMOVED	DX-4
72	50	37	N/A	CONTROLLED AIR INC.	INTERIM	UNDER CLOSURE	CST-16
27	36	0	N/A	KAPPA 8 FIRING POINT	INTERIM	ACTIVE	DX-4
16	3	30	N/A	OUTSIDE, WEST SIDE	< 90 DAY	REMOVED	ESA-10
2040	3	29	5195	North Side of Filter Tower	SAA	REMOVED	NMT-13
2042	3	334			SAA	ACTIVE	JCNNM-UMAP
2044	48	1	70	Outside controlled area of work	SAA	ACTIVE	C-FM
2045	35	2	C102		SAA	ACTIVE	C-ADI
2050	21	0		MDA B	< 90 DAY	REMOVED	E-ER
2053	55	4	208	Glovebox 223, designated area inside glovebox	< 90 DAY	REMOVED	NMT-7
2054	35	27	104		SAA	REMOVED	NIS-5
2055	3	29	2295	Within Taped Area on Floor	SAA	REMOVED	NMT-13
2056	36	0		R-19 Well Drilling Site	SWA	INACTIVE	E-ER
2071	3	271	0	Outside - In yard	SAA	ACTIVE	E-ER
2072	50	1	2A	1/2 of closed shelf space	SAA	REMOVED	CST-9
2073	3	29	4129	In flammable cabinet and marked area on benchtop and floor	SAA	ACTIVE	NMT-7
2074	3	29	5165	Cabinet below hood 2740	SAA	REMOVED	NMT-1
2078	53	3	140		SAA	REMOVED	LANSCE-FM
2081	50			Outside - Paved area within fenced area of MDA C	< 90 DAY	REMOVED	E-ER

Mixed Waste Storage Areas at Los Alamos National Laboratory as of April 4, 2001

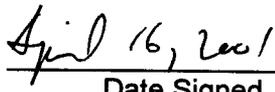
Site ID	TA	BLDG	ROOM	Other Location Information	Facility Type	Status	Group
2083	60	85		Outside	SWA	ACTIVE	JCNNM-HENV
2087	59	1	118		SAA	ACTIVE	C-ACS
2088	3	29	4023	In taped off area in southeast corner of room	SAA	ACTIVE	NMT-13
2089	54	0	0	Pad 4	< 90 DAY	REMOVED	FWO-WFM
2090	54	0	0	Fenced Area West of 54-245	< 90 DAY	REMOVED	FWO-SWO
2093	2	1	124D	Vault	< 90 DAY	REMOVED	FWO-SWO
2094	54	145		Area G	INTERIM	ACTIVE	FWO-SWO
2095	54	146		Area G	INTERIM	ACTIVE	FWO-SWO
2096	54	144		Area G	INTERIM	ACTIVE	FWO-SWO
2098	54	1041		Area G	INTERIM	ACTIVE	FWO-SWO
2099	54	1030		Area G	INTERIM	ACTIVE	FWO-SWO
2100	54	1028		Area G	INTERIM	ACTIVE	FWO-SWO
2101	54	1027		Area G	INTERIM	ACTIVE	FWO-SWO
2103	16	0	0	Outside - Fenced Drum Storage Area	SWA	ACTIVE	E-ER
2116	53	3	A6	Remote Handling Area, Posted Radiological Area	< 90 DAY	REMOVED	LANSCE-FM
2120	54	144			INTERIM	REMOVED	FWO-SWO
2121	54	145			INTERIM	REMOVED	FWO-SWO
2122	54	146			INTERIM	REMOVED	FWO-SWO
2123	54	177			INTERIM	ACTIVE	FWO-SWO
2126	3	0		IT Project Trailer on east end of Bldg. 223	SAA	ACTIVE	E-ER
2127	3	29	5072	Taped off area in corner of room under duct	SAA	ACTIVE	NMT-13
2139	54	426			< 90 DAY	ACTIVE	E-ET
2147	3	29	2195	Taped Off Area on Floor	SAA	REMOVED	NMT-13
2150	3	29	3195	Inside blue box	SAA	REMOVED	NMT-13
2162	51	0		Outside - North of TA-51-11	< 90 DAY	ACTIVE	E-ER
2180	53	404	102		SAA	ACTIVE	LANSCE-5
2181	3	29	2066		NONE	REMOVED	NMT-13
2182	41	4	238		SAA	ACTIVE	ESA-WE
2187	48	1	6	Under Table	SAA	ACTIVE	E-ET
2191	53	8	100	In PSR alcove, Cabinet #2 (Comb. 1973)	SAA	ACTIVE	LANSCE-2
2192	46	25	0	Lab	SAA	ACTIVE	ESA-EPE
2193	53	3		Outside North of P3 East in flammable cabinet	SAA	ACTIVE	LANSCE-FM
2198	50	1	35		NONE	ACTIVE	FWO-WFM
2200	53	3	A6	Area A Remote Handling Area	SAA	ACTIVE	LANSCE-FM
2203	53	809		Transportainer 809 on the north side of the beam line	SAA	ACTIVE	P-25
2208	53	7	1	1L Service Area	SAA	ACTIVE	LANSCE-7

CERTIFICATION

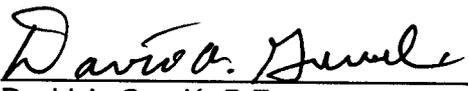
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage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



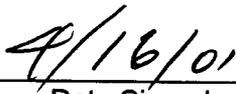
Dennis J. Erickson
Division Director for Environment, Safety, and
Health Division
Los Alamos National Laboratory
Operator



Date Signed



David A. Gurulé, P.E.
Area Manager, Los Alamos Area Office
U.S. Department of Energy
Albuquerque Operations
Owner/Operator



Date Signed

TA-55 PLUTONIUM FACILITY

ACCEPTABLE KNOWLEDGE REPORT

REPORT TITLE: Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55

REPORT NUMBER: TWCP-AK-2.1-002,R.1 (LA-UR-00-5861)

WASTE GENERATED FROM PROCESS/STATUS CODES: CL, CLRD, CLS, CS, CSE, CW, CX, CXL, LD, MB, MS, PB, PRR, PUB, and SE

EFFECTIVE DATE: 12/04/00

NEXT REVIEW DATE: 12/04/02

DOCUMENT PREPARER:

John Musgrave 12/04/00
NAME DATE

APPROVALS:

June Fabryka-Martin 12/04/00
INDEPENDENT TECHNICAL REVIEWER/EDITOR DATE

Pamela Rogers 12/04/00
SITE PROJECT MANAGER DATE

Matt J. Riggs 12/04/00
WASTE CERTIFICATION OFFICIAL DATE

M A Gavett 12/04/00
SITE PROJECT QA OFFICER DATE

Charles L. Foxx 12/04/00
FACILITY REPRESENTATIVE DATE

CONTENTS

Section	Page
ACRONYMS	iv
PROCESS STATUS (P/S) CODE INDEX.....	vi
PROCESS ACCEPTABLE KNOWLEDGE SUMMARY.....	viii
1.0 INTRODUCTION.....	1
2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS	1
3.0 DESCRIPTION OF THE PROCESS WASTE.....	2
3.1 Facility and Mission.....	3
3.2 Waste Physical Form and Content Description.....	3
3.3 Waste Volume and Time Period of Waste Generation	3
3.4 Waste Generation Processes.....	4
3.5 Material Inputs to the Waste Generation Processes	8
4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS.....	13
4.1 F, K, and P Listings.....	13
4.2 Toxicity Listings	14
4.3 Corrosivity, Reactivity, and Ignitability.....	15
5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION.....	15
6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED	15
7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED	16
8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS ..	17
9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM.....	17
10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE	18
11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS.....	18

Table

1 Process Feed Materials for Chloride Operations.....	9
2 Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %)...	11
3 Chemical Inputs to Processes Described in This Report.....	12

Attachments

- 1 Acceptable Knowledge Roadmap (5 pages)
- 2 LANL and TA-55 Site Maps (2 pages)
- 3 Timeline for Chloride Operations (3 pages)
- 4 Process Inputs and Outputs (5 pages)
- 5 Simplified Process Flow Diagram (1 page)

ACRONYMS

AK	acceptable knowledge
CFR	<i>Code of Federal Regulations</i>
CMPO	octylphenyldiisobutylcarbamoymethylphosphine oxide
D	RCRA hazardous waste code for wastes with hazardous characteristics, defined in 40 CFR Subpart C, Sections 261.21 to 261.24
DCHP	dicesium hexachloroplutonate
DOE	U.S. Department of Energy
DOR	direct oxide reduction (process, not P/S code)
DWLS	Discardable Waste Log Sheet
EPA	U.S. Environmental Protection Agency
F	RCRA hazardous waste code for hazardous wastes from non-specific sources, defined in 40 CFR Subpart D, Section 261.31
HCl	hydrochloric acid
HEPA	high-efficiency particulate air
K	RCRA hazardous waste code for hazardous wastes from specific sources, defined in 40 CFR Subpart D, Section 261.32
LANL	Los Alamos National Laboratory
MT	material type
P	RCRA hazardous waste code for acute hazardous waste defined in 40 CFR Subpart D, Section 261.33
P/S [code]	process/status [code]
PCB	polychlorinated biphenyl
PF-4	Plutonium Facility, Building 4
Pu-Be	plutonium-beryllium (radioactive source materials)
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
R&D	research and development
RD&D	research, development, and demonstration
RLWTF	Radioactive Liquid Waste Treatment Facility
RMDC	Records Management/Document Control
Sampling Plan	<i>Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001)</i>
SME	subject matter expert
SOP	safe/standard operating procedure
TA	technical area
TBP	tributyl phosphate
TRU	transuranic
TWCP	Transuranic Waste Characterization/Certification Project
UCNI	Unclassified Controlled Nuclear Information
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant
WIPP WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)</i>
WIPP WAP	<i>Attachment B, Waste Analysis Plan, to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088)</i>

WODF
WPRF

Waste Origination and Disposition Form
Waste Profile Request Form

PROCESS/STATUS (P/S) CODE INDEX

NOTE: This index indicates the main process AK summary report and report section that covers each P/S code mentioned in this report.

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
CC	Calcination	Nitrate Operations	3.4.3, 3.4.6, Att. 4
CD	Hydroxide Cake Dissolution	Nitrate Operations	3.4.2, Att. 4
CF	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
CL	Crucible Processing	Chloride Operations	3.4.2, 3.4.3, Att. 4
CLRD	Aqueous Chloride R&D	Chloride Operations	3.4.2, Att. 4
CLS	Accountable CLS Chloride Solutions	Chloride Operations	3.4.2, 3.4.3, 3.4.4, Att. 4
CR	Crushing and Pulverizing	Nitrate Operations	3.4.1, Att. 4
CS	Chloride Solutions	Chloride Operations	3.4.3, Att. 4
CSE	Chloride Solvent Extraction	Chloride Operations	3.4.3, Att. 4
CW	Caustic Waste	Chloride Operations	3.4.4, Att. 4
CX	Chloride Anion Exchange	Chloride Operations	3.4.2, 3.4.3, 3.4.4, Att. 4
CXL	Experimental Chloride Extraction Line	Chloride Operations	3.4.2, 3.4.3, Att. 4
DS	Ion Exchange	Nitrate Operations	3.4.3, Att. 4
EXT	Extraction RD&D	Miscellaneous Operations	3.4.6, Att. 4
HCD	Hydroxide Cake Dissolution	Nitrate Operations	3.4.2, Att. 4
HP	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
LD	Chloride Leach & Dissolution	Chloride Operations	3.4.2, Att. 4
LR	Ion Exchange	Nitrate Operations	3.4.3, Att. 4
MB	Nitric Dissolution of Molten Salts	Chloride Operations Nitrate Operations	3.4.2, Att. 4 3.4.2, 3.4.6, Att. 4
MS	Molten Salts Purification Dissolution	Chloride Operations	3.4.2, Att. 4
NR	Nitrate Recovery	Nitrate Operations	3.4.2, 3.4.6, Att. 4
OR	Direct Oxide Reduction	Pyrochemical Processes	3.4.2, Att. 4
PB	Pu-Beryllium Source Recovery	Chloride Operations	3.4.1, Att. 4
PK	Pickling and Nitrate Holding	Pyrochemical Processes	3.4.11, Att. 4

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
PRR	Pyrochemical Residue Recovery	Chloride Operations	3.4.3, 3.4.4, Att. 4
PS	Peroxide Precipitation of MSE Salts	Nitrate Operations	3.4.2, 3.4.6, Att. 4
PTP	Plutonium Trichloride Preparation	Pyrochemical Processes	3.4.12, Att. 4
PUB	Pu/Be Source Recovery	Chloride Operations	3.4.1, Att. 4
RB	Roasting and Blending	Nitrate Operations	3.4.3, Att. 4
RM	Reduction to Metal	Special Processing	3.4.4, 3.4.6, 3.4.7, 3.4.8, 3.4.9, Att. 4
SE	Solvent Extraction	Chloride Operations	3.4.3, Att. 4
SP	Scrap Dissolution, G438	Nitrate Operations	3.4.2, Att. 4
SS	Salt Stripping	Pyrochemical Processes	3.4.3, 3.4.4, 3.4.5, 3.4.7, 3.4.8, Att. 4

* Process AK summary reports: Chloride Operations (this report), Miscellaneous Operations (TWCP-AK-2.1-004,R.1), Nitrate Operations (TWCP-AK-2.1-005,R.1), Pyrochemical Processes (TWCP-AK-2.1-006,R.1), and Special Processing (TWCP-AK-2.1-007,R.1)

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY

Waste-generating process: Chloride Operations

P/S codes: CL, CLRD, CLS, CS, CSE, CW, CX, CXL, LD, MB, MS, PB, PRR, PUB, and SE

Type of waste generated:

Retrievably stored and newly generated, mixed and non-mixed, combustible and non-combustible debris; liquid wastes sent to the Radioactive Liquid Waste Treatment Facility at TA-50 or immobilized in cement (as part of nitrate operations)

Site: LANL

Facility Mission (including defense and non-defense programs):

TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites in the defense complex. The recovered plutonium is converted into pure plutonium feedstock. These manufacturing and recovery operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste contaminated scrap, residues, and debris generated at TA-55. The scrap and residues are processed to recover as much plutonium as practicable before disposal. Wastes from chloride operations are generated from plutonium recovery and purification for defense and non-defense programs; these wastes are generated and produced in the same rooms and gloveboxes and so were not segregated until August 27, 1998.

Area(s) or building(s) where the process waste was generated (including operations carried out in those areas):

TA-55 Plutonium Facility (Building PF-4), Room 208 (plutonium-beryllium source recovery) and Room 420 (other chloride operations). Plutonium operations included reclaiming plutonium from scrap and residues produced by numerous feed sources and plutonium-beryllium source recovery.

Description of the process waste (physical form and typical content description):

Primarily debris waste, including cellulosic materials, plastic, rubber, ceramic, metal and glass debris, and waste sent to nitrate operations to be immobilized in cement. Occasionally pieces of hydroxide cake, which contains chloride salts, are discarded in the cement fixation process or as debris waste.

Description of the waste-generating process:

The overall goal of the chloride operations is to recover plutonium from metal, metal alloys, scrap, and residues and produce a purified plutonium oxide product or feedstock for conversion to metal. Processes in chloride operations include pretreatment, dissolution, purification, and hydroxide precipitation.

Process feed:

Plutonium metal or metal alloys and oxides; pyrochemical salts; plutonium-beryllium sources; crucible pieces; ash; analytical laboratory solutions; and residues from other DOE facilities.

Radioisotopic content of the waste:

Variety of plutonium material types with different well-defined isotopic compositions; Am-241, Np-237, and U-234 may be present at detectable concentrations as decay products of their plutonium precursors. Some of the processes separate plutonium and americium or plutonium and uranium. The waste will usually be enriched in americium and uranium, but may also be depleted in some cases.

RCRA Constituents/EPA Hazardous Waste Numbers:

- No D001 (ignitable), D002 (corrosive) or D003 (reactive) listings apply to solid wastes from chloride operations because no ignitable chemicals were used in the processes and because the solid wastes do not contain any free liquids.
- D007 (chromium) and D009 (mercury) apply to solid waste from all P/S codes in chloride operations.
- D008 (lead) applies to all P/S codes from chloride operations except P/S code PRR.
- D011 (silver) applies to waste from P/S codes CW and CX through 1993.
- D019, D021, D022 and D039 apply to cellulosic, ceramic, plastic and rubber waste from P/S codes CLS, CW, and CXL. These D codes do not apply to glass or metal debris waste.
- D039 applies to waste from P/S codes CSE and SE.
- F002 applies to cellulosic, ceramic, plastic and rubber debris waste from P/S codes CLS, CSE, CW, CXL, and SE. F002 also applies to waste absorbed in vermiculite from P/S code CSE through 1993. It does not apply to glass or metal debris waste.
- F003 applies to cellulosic, ceramic, plastic and rubber debris waste from P/S codes CLS, CW, and CXL. It does not apply to glass or metal debris waste.
- No K or P codes apply to any of the P/S codes under chloride operations.

Process waste volume (if known):

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are segregated into waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

Years of generation for the process waste: 1982–present

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY REPORT FOR CHLORIDE OPERATIONS AT TA-55

1.0 INTRODUCTION

All transuranic (TRU) waste must be sufficiently characterized and certified before it is shipped to the Waste Isolation Pilot Plant (WIPP). The U.S. Environmental Protection Agency (EPA) allows use of acceptable knowledge (AK) for waste characterization. EPA uses the term AK in its guidance document, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. Attachment B, Waste Analysis Plan, to the *Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088) (WIPP WAP) defines AK and provides guidelines on how AK should be obtained and documented.

This process AK summary report was prepared in accordance with *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5). The primary purpose of this report is to systematically organize, evaluate, and summarize detailed AK information about individual processes used by one of the TRU-waste generators at Los Alamos National Laboratory (LANL). By doing so, this report provides detailed technical support for one or more waste stream AK summary reports that include these process wastes.

2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS

The AK search for the information related to Technical Area (TA)-55 waste streams resulting from chloride operations covered:

- Review of the *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3) (Sampling Plan) that includes information regarding all TRU waste streams
- Review of documents related to waste generation and waste management activities at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)
- Interviews with personnel involved with waste generation and waste management at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)

NOTE: Much of the AK information related to chloride operations is contained in Transuranic Waste Characterization/Certification Project (TWCP) Record No. TWCP-3547. Individual documents in this record have been assigned a separate identifier, CI-nn, where nn is a sequential 1- or 2-digit number. This referencing nomenclature is used throughout this report and its attachments.

- Analyses of individual processes generating waste, and evaluations of the potential for Resource Conservation and Recovery Act (RCRA)-regulated constituents to be present in the process wastes, based on subject matter expert (SME) interviews and any available data

The TWCP Records Management/Document Control (RMDC) Center contains copies of the documents referenced in this report. Any Unclassified Controlled Nuclear Information (UCNI) will be contained in these records, and will not be included in this report. Such records are identified as UCNI in the Acceptable Knowledge Roadmap (Attachment 1).

This process AK summary report is part of a set of closely related reports about TRU-waste generating activities at TA-55. For convenience in organizing AK for plutonium processing at this facility, the processes were categorized into six arbitrary operational areas. The multiple processes in each area are then described in detail in the following six process AK reports for plutonium:

- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002) (this report)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004)
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005)
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006)
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007)

Each process AK report contains information on multiple individual processes that are assigned unique identifiers called process/status (P/S) codes. For example, chloride operations include 15 individual processes that are each assigned a P/S code, as listed on the cover page of this report. The search and compilation of AK information was based on P/S code because that is the most detailed level of process information generally recorded in waste generation records. The process AK reports frequently cross-reference one another because P/S codes in one operational area often provide the material feed for P/S codes in another area. An index of P/S codes cited in this process AK report follows the list of acronyms; this index lists process descriptions and the primary process AK report in which that P/S code is discussed.

3.0 DESCRIPTION OF THE PROCESS WASTE

The following sections describe processes used in chloride operations, and identify the resulting wastes as well as outputs that are sent to other operations, such as nitrate operations, for further processing.

3.1 Facility and Mission

The TA-55 Plutonium Facility (Building PF-4) recovers plutonium from scrap and residues generated throughout the U.S Department of Energy (DOE) defense complex, and processes it into pure plutonium oxide for conversion to metal and other products. A LANL site map and a detailed map of the buildings at TA-55, including Building PF-4, are shown in Attachment 2.

Most processes in chloride operations were solely defense related (TWCP-614, TWCP-4162). An exception was Pu-Be source recovery activities (P/S codes PB and PUB) that included non-defense as well as defense activities. However, wastes from various processes were not segregated by funding source, waste-generating process, or waste-generating location (e.g., room or glovebox) until recently (August 27, 1998), but rather were segregated and packaged based on waste type (TWCP-887, TWCP-4162, TWCP-4167). Consequently, a single waste container often contains wastes from multiple processes. Some debris waste was also co-mingled with room trash related to these same operations (both defense and non-defense), and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits (TWCP-816).

3.2 Waste Physical Form and Content Description

Wastes generated during chloride operations, primarily debris wastes and wastes entered into the cement fixation process or sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50 are covered by this process AK report. General debris waste categories from chloride operations include

- Cellulose-based waste (for example, paper, cloth)
- Plastic-based waste (for example, gloves, tape, labware)
- Rubber
- Metal debris (for example, wire, hose clamps, tools, labware)
- Glass debris

These debris items are contaminated with small amounts of radioactive and chemical substances from chloride operations.

3.3 Waste Volume and Time Period of Waste Generation

This report covers waste streams generated from 1982, when chloride operations first began, to the present. Process wastes from chloride operations have different associated RCRA codes depending on the time period during which they were generated. The P/S codes, their time period of generation, and corresponding RCRA codes are shown graphically in Attachment 3, Timelines.

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are assigned to waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

3.4 Waste Generation Processes

The following subsections describe the generation of waste by chloride operations, as well as product and waste outputs to the nitrate operations, covered in TWCP-AK-2.1-005,R.1.

Manufacturing and research operations performed at TA-55 in the production of plutonium also generate plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as is practical. TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites. These recovery and manufacturing operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste generated at TA-55.

Detailed information about the TA-55 plutonium recovery processes can be found in *Waste from Plutonium Conversion and Scrap Recovery Operations* (TWCP-352). A full-block flow diagram for plutonium processing and waste management at TA-55 is given in reference TWCP-886. In general, TA-55 plutonium recovery processes can be divided into six major processes:

- Head-end operations
- Aqueous nitrate-based processes
- Aqueous chloride-based processes
- Separation and purification by precipitation
- Metal preparation and purification (pyrochemical processes)
- Aqueous waste treatment

This report addresses the aqueous chloride-based processes.

The primary feed materials for chloride operations are plutonium metal or metal alloys, oxides and hydroxide cakes; pyrochemical salts; plutonium-beryllium sources; crucible pieces; anode heels; ash; analytical laboratory solutions; and residues from other DOE facilities. The overall goal of the chloride operations is to recover plutonium from scrap and residues and produce a purified plutonium oxide for conversion to metal and other products.

Analytical laboratory operations feed into chloride operations because samples from various stages of plutonium production are sent for radiochemical and chemical analyses. After analysis, excess samples that are either an intermediate or direct product having considerable value, and sample residues rich in plutonium, are returned to TA-55 as feedstock for the production of plutonium

metals and oxides. The solvents used in some of the analytical analyses do not carry a RCRA F listing designation in the analytical processes because the sample residues are not a waste at that time but are considered feedstock for other processes.

Chloride operations can be broken down into the following general process categories:

- Pretreatment
- Dissolution
- Purification
- Hydroxide precipitation

Each of these process categories is described below. A complete listing of P/S codes for chloride operations, their descriptions, feed materials, and inputs and outputs is found in Attachment 4. A simplified process flow diagram for chloride operations is found in Attachment 5.

3.4.1 Pretreatment (P/S codes PB, PUB)

Pretreatment includes primarily physical processes used to prepare scrap and residues for dissolution. Pretreatment may include sorting, crushing, and/or pulverizing (P/S code CR; discussed in TWCP-AK-2.1-005,R.1). As materials are received from various areas in TA-55, they are sorted and sent to various pretreatment processes or directly to dissolution, depending on the physical nature of the scrap or residue, and the amount and type of plutonium associated with the material.

A separate pretreatment procedure is the decladding of Pu-Be sources (P/S codes PB, PUB; Cl-14, Cl-20, Cl-21, all in TWCP-3547). The metal cladding is removed from the sources, and is placed into containers with metal debris from other PF-4 activities. The Pu-Be sources, after the cladding has been removed, are entered into the chloride line for plutonium recovery. The P/S code for the decladding and processing of the Pu-Be sources in the chloride line was PB prior to 1988, and PUB from 1988 to the present.

The EPA hazardous waste number P015 (beryllium powder) does not apply to waste resulting from recovery of this plutonium, for the following reasons (TWCP-4168):

- The beryllium is never in the powdered form.
- The beryllium in the metal alloy used in the source is not in a form supplied by a commercial manufacturer.

- The beryllium is extracted from the source by dissolution in a low pH solution. The beryllium forms a soluble chloride or hydroxide salt, and is not present in the pure metal state.

This solution is disposed in the caustic waste line to RLWTF at TA-50.

3.4.2 Dissolution (P/S codes CL, CLRD, CLS, CX, CXL, LD, MB, MS)

In general, the dissolution step can be described as the use of hydrochloric acid (HCl) to leach and dissolve plutonium from scrap, crucibles, and residues. The feed materials also include various solutions, including solutions from the analytical chemistry laboratory known at different times as CHM-1, CLS-1, CST-1, and NMT-1 and presently known as C-ACC. The scrap and residues may include lead and mercury from feed materials (Section 3.5), as well as chromium leached from stainless steel in equipment and lead leached from shielding used in chloride operations activities (CI-27/TWCP-3547).

The chloride operations line was developed in 1982, and operated under P/S code CLRD until 1984, P/S code CX (along with other more feed-specific codes described below) until 1994, and P/S code CXL from 1994 to the present.

NOTE: After dissolution, if a plutonium-containing solution contained so much iron that it interfered with the solvent extraction process (Section 3.4.3), it went to +3 ion exchange (not to be confused with the +4 ion exchange as a part of purification) as an intermediate step prior to entering the purification phases of chloride operations.

Some P/S codes were used for dissolution of specific feed materials. P/S code CL, used from 1985 to 1990, applied to crucible leaching in HCl. P/S code LD, used from 1988 to 1992, applied to the dissolution step for most materials but specifically excluded solutions from the analytical laboratory (CLS-1, etc.). P/S codes MB and MS, 1985–1990, were used only for dissolution of molten salts or pyrochemical salts. P/S code MB is also part of nitrate operations and is discussed in more detail in process AK report TWCP-AK-2.1-005,R.1. P/S code CLS was used specifically for feed solutions from the analytical laboratory.

Waste solids from chloride dissolution activities generally were sent to cement fixation (P/S codes CF or HP), but on occasions were discarded as debris waste (CI-26/TWCP-3547).

3.4.3 Purification (P/S codes CL, CLS, CS, CSE, CX, CXL, PRR, SE)

The purification steps in the chloride operations line may include solvent extraction, ion exchange, and oxalate precipitation, depending on the chemical nature of the solutions to be purified.

Solvent extraction (P/S codes CSE and SE) has been used in the chloride line since 1985 (CI-26, CI-27, both in TWCP-3547). The RCRA-regulated solvent tetrachloroethylene was used in the solvent extraction process until 1992. Cellulosic, ceramic, plastic, and rubber debris wastes from the solvent extraction process therefore carry the RCRA code F002 and D039, as do liquid wastes absorbed in vermiculite. In order to be conservative, the applicability of the RCRA listing is extended by one year after cessation of the chemical's use. The F listing does not apply to glass or metal debris, even if the items were in contact with the F-listed chemical, because their non-porous surfaces do not absorb liquids or gases. Pieces left after filtration in the hydrochloric acid dissolution step are removed from the line prior to solvent extraction, and so also do not carry the F002 designation (see Attachment 5, Simplified Process Flow Diagram).

Silver nitrate titration was used to determine chloride concentrations, with potassium dichromate as an end-point indicator, in the solvent extraction and ion exchange processes (P/S codes CSE, CX and SE) up until the end of 1993, so RCRA codes D011 (silver) and D007 (chromium) are applied to these process wastes during this time period (TWCP-4164).

The chloride line was halted from 1992 until 1994. When it resumed operation, non-RCRA-regulated solvents replaced the tetrachloroethylene used in solvent extraction, and silver nitrate titration was replaced by use of a silver electrode (CI-24/TWCP-3547, TWCP-4164). P/S code CXL was initiated to denote the newly operational chloride line.

During operation of the chloride line, some leaching of chromium from stainless steel equipment and glovebox walls and lead from shielding always occurs. Lead and mercury from feed materials are present as well (CI-27/TWCP-3547). These heavy metals concentrate in the waste that is eventually sent to P/S codes CF or HP to be immobilized in cement, after first being mixed with waste from nitrate operations. Analyses on these cemented wastes showed them to exceed RCRA limits (CI-27/TWCP-3547). Because RCRA metals have not been analyzed in debris waste from chloride operations, these wastes are also required to carry RCRA codes D007, D008 (except P/S code PRR) and D009.

Ion exchange columns (+3 and +4) are used to collect plutonium and separate out impurities such as americium and uranium (P/S codes CX, CXL, and PRR). Heavy metals are not associated with the resin because these metals tend not to sorb onto the resin used, and because the resins are chemically stripped before and after use. Prior to May 1987 and resuming recently, ion exchange resins have not been immobilized in cement. Instead, they are canned and discarded as solid waste under the originating P/S codes. Previously, they had been immobilized in cement due to a concern about the need to stabilize particulates (TWCP-4164).

The enriched plutonium solutions from solvent extraction or ion exchange are treated with oxalic acid (oxalate precipitation) (P/S codes CS, CSE, CX, CXL, and SE), and the resulting plutonium precipitate is sent to nitrate operations to be calcined (P/S code CC; discussed in TWCP-AK-2.1-005,R.1) and eventually to the vault. The liquid solution (filtrate) goes to hydroxide precipitation.

3.4.4 Hydroxide Precipitation (P/S codes CLS, CW, CX, PRR)

In this step, potassium, magnesium, or sodium hydroxide is added to the solutions from purification steps in order to precipitate Pu-rich hydroxide salts. The resulting enriched cakes (Pu concentrations greater than the discard level) go to nitrate operations for further processing (see Timelines in Attachment 3 for P/S codes and corresponding RCRA codes). If Pu concentrations are less than the discard level, the hydroxide cake is discarded. Hydroxide cake fines were cemented until 1995, and large chunks of hydroxide filtrate cakes (with Pu concentrations less than the discard level) were placed into containers for disposal. Based on a revision to the *Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (DOE/WIPP-069) (WIPP WAC) in 1995, all cake material with Pu less than a revised discard level is containerized for disposal as debris waste. Caustic liquid waste meeting the waste acceptance criteria (WAC) for the RLWTF at TA-50 is disposed through the caustic waste line. P/S code CW was used from 1985 to 1992 for feed materials specifically containing analytical laboratory (CLS-1, etc.) solutions as feed material. Occasionally, solutions from hydroxide precipitation are returned to HCl dissolution for reprocessing (see Attachment 5); RCRA code assignments would then be carried into other P/S codes.

3.5 Material Inputs to the Waste Generation Processes

Attachment 4 lists P/S codes for chloride operations at TA-55, including process descriptions, feed material, other process inputs, process outputs, and type of waste. The feed materials for chloride operations consist of the general types of materials listed in Table 1 that are obtained either from the storage vault, as process output from other P/S codes, or from sources outside TA-55, including other DOE sites.

Table 1. Process Feed Materials for Chloride Operations

Feed Material	RCRA-Regulated Substances	P/S Codes in Chloride Operations
Analytical laboratory solutions	Potentially contaminated with RCRA-regulated constituents <ul style="list-style-type: none"> • All analytical laboratory solutions are potentially contaminated with chromium (D007), lead (D008), and mercury (D009) • CLS-1 solutions potentially contaminated with mercury (D009) and lead (D008), as well as RCRA-listed organic substances used as solvents, including acetone (F003), butyl alcohol (F003), carbon tetrachloride (D019), chlorobenzene (F002, D021), chloroform (D022), methanol (F003), methylene chloride (F002), tetrachloroethylene (F002, D039), xylene (F003) (CI-25/TWCP-3547). 	CLS, CW, CXL (analytical laboratory solutions from CLS-1) CSE, SE (other solutions)
Crucible pieces (tantalum, magnesium oxide)	Typically fairly pure, no RCRA substances present	CL
MSE salts	Typically fairly pure, suspect contaminated with barium (D005) but no other RCRA substances present	MB, MS
Pu oxalates	Typically fairly pure, no RCRA substances present	PB, PUB
Pu-Be sources	High purity constituents, no RCRA-regulated substances (see Section 3.4.1)	PB, PUB
Pyrochemical salts	Typically fairly pure, no RCRA substances other than barium (D005) are present	MB, MS, PRR
Stainless steel and/or tantalum residues from decladding of Pu-Be sources	High purity metals, potential leaching of chromium (D007) from stainless steel if subjected to strong acid	PB, PUB

The remainder of this section summarizes the nature of the process waste in terms of its physical, chemical and radioisotopic characteristics.

3.5.1 Physical Waste Form Identification

Solid waste from chloride operations primarily consists of debris waste, and cemented waste discarded under P/S codes CF or HP. Debris waste contains glassware, plastics, ceramic materials, paper, rags, high-efficiency particulate air (HEPA) filters, metal containers, brushes, and small tools. Leaded gloves may also be generated as process waste. Prior to May 1992, leaded gloves were discarded as metal debris and were not

segregated from other metal wastes. Since that time, they have been routinely segregated from other metal debris waste and assigned RCRA code D008. Occasionally pieces of hydroxide cake—which commonly contain entrained salts such as potassium chloride, sodium chloride, and calcium chloride—are entered into the cement fixation (P/S code CF) process or discarded with the debris waste (CI-26/TWCP-3547). In addition, caustic solutions from hydroxide precipitation are discarded through the waste line to the RLWTF at TA-50.

Because items from several different processes are usually combined into individual waste drums, the physical waste form of each drum must be determined independently. This information is documented on a Waste Origination and Disposition Form (WODF) by the waste generator according to controlled procedures. The P/S code for each waste item is also documented on this form. In the packaging process, a standard form, the Discardable Waste Log Sheet (DWLS), was used to list each item ID number and record its matrix material. This form was signed by the waste packager, reviewed, and approved by quality assurance (QA) personnel.

3.5.2 Radionuclide Content Identification

The primary plutonium material type inputs for chloride operations at TA-55 are listed in Table 2. The designation *material type* (MT) (e.g., MT 52) is used within the DOE Complex to describe the isotopic composition of common blends of radioactive materials used within the Complex. The material type notation was developed because it is a convenient way to describe material types that have very consistent isotopic compositions. Table 2 indicates the isotopic composition of the material types at the time the waste was characterized.

The material type provides the basis for estimating an upper bound for U-234, U-235, and Am-241 contents based on the rate of decay of their precursors, Pu-238, Pu-239 and Pu-241, respectively. The results of these calculations are also tabulated in Table 2, assuming (a) none of these isotopes were initially present in the material, (b) the oldest Pu material in inventory dates back to 1 January 1960, and (c) the waste was packaged on 1 January 1996, making it 36 years old (TWCP-698).

The material type used in the process generating each waste item was documented on the WODF and DWLS. However, some of the plutonium recovery processes separate plutonium and americium, or plutonium and uranium, so that their relative ratios may be altered in the process outputs and wastes. Waste items may be either depleted or enriched in americium depending on whether the source of contamination is the process product or the process residues (TWCP-882).

**Table 2. Average Isotopic Content of Plutonium Material Types and Enrichments
(Weight %)**

Material Type (MT)	Plutonium isotope and half-life						Upper limits for weight ratios		
	Pu-238 (87.74 yr)	Pu-239 (24120 yr)	Pu-240 (6564 yr)	Pu-241 (14.35 yr)	Pu-242 (376,300 yr)	Pu-244 (8.26 x 10 ⁷ yr)	U-234/ Total Pu	U-235/ Total Pu	Am-241/ Total Pu
MT 51	0.006	96.77	3.13	0.076	0.018	—	1 x 10 ⁻⁵	0.001	0.0006
MT 52	0.01	93.78	6	0.2	0.02	—	2 x 10 ⁻⁵	0.001	0.002
MT 53	0.03	91.08	8.45	0.366	0.071	—	7 x 10 ⁻⁵	0.0009	0.003
MT 54	0.046	87.42	11.5	0.81	0.22	—	0.0001	0.0009	0.007
MT 55	0.06	83.88	14.73	1.03	0.304	—	0.0002	0.0009	0.009
MT 56	0.061	81.9	16.51	1.18	0.355	—	0.0002	0.0009	0.01
MT 57	0.433	74.63	20.7	2.55	1.69	—	0.001	0.0008	0.02
MT 42									
84%	1.02	1.37	10.32	3.13	84.14	0.02	0.003	1 x 10 ⁻⁵	0.03
90%	0.72	1.26	6.4	1.86	89.77	—	0.002	1 x 10 ⁻⁵	0.02
95%	0.45	0.56	2.47	0.906	95.58	0.029	0.001	6 x 10 ⁻⁶	0.008
MT 83									
83%	83.89	13.8	1.9	0.32	0.09	—	0.26	0.0002	0.003
89%	89.26	10.07	0.633	0.021	0.015	—	0.28	0.0001	0.0002

Source: TWCP-698

Residues submitted for reprocessing often contain Np-237, the decay product of Am-241 (half-life, 458 yr). This radioisotope is expected to be present in minor amounts in nearly all debris waste from chloride operations at TA-55.

In general, uranium and its isotopes are expected to be present only at trace levels, if at all. U-238 would only be present if purposefully added to the feed material. U-235 in growth from the decay of Pu-239 (half-life, 24,120 years) would be negligible due to the long half-life of Pu-239. U-234 would be present in MT 83 as a decay product of Pu-238 (half-life, 87.74 years). After 20 years, 14.6 percent of the initial Pu-238 would have decayed to U-234. For MT 83 with an initial content of 83.89 percent Pu-238, the atomic ratio U-234 to total Pu would be about 0.14. No U-236 is present.

During TWCP characterization, the contents of each waste package undergo non-destructive analysis to provide detailed radioisotopic data. These data will be used to evaluate the accuracy of AK information in accordance with *Waste Characterization Data Reconciliation with Acceptable Knowledge* (TWCP-DTP-1.2-064). If warranted, this AK report will be updated to incorporate the results of these comparisons.

3.5.3 Chemical Content Identification

Chemical inputs to chloride operation processes are listed in Table 3.

Table 3. Chemical Inputs to Processes Described in This Report

Chemical Input	P/S Codes in which RCRA-Listed Chemicals Are Used	Comments on Applicability of RCRA Listing
Gases		
Argon gas		
Acids		
Hydrochloric acid Hydrofluoric acid Nitric acid Oxalic acid		D002 does not apply to the solid debris waste because there are no free liquids in this waste. D001 (oxidizer) does not apply to the use of nitric acid for the same reason.
Bases		
Calcium hydroxide Magnesium hydroxide Potassium hydroxide Sodium hydroxide		D002 does not apply to the solid debris waste because there are no free liquids in this waste.
Inorganic Chemicals		
Aluminum chloride Calcium carbonate Calcium fluoride Cesium chloride Ferrous chloride Hydroxylamine hydrochloride Potassium dichromate	CS, CSE, PB, PUB, SE	D007 applies to P/S codes CW and CX until end of 1993. Used in P/S codes CS, CSE, PB, PUB and SE as a titration endpoint indicator. The chromium-bearing solution is sent to P/S code CW or CX (Hydroxide precipitation), and chromium is incorporated as a contaminant in the hydroxide cake (TWCP-4166, TWCP-4167)
Potassium fluoride Silver nitrate	CS, CSE, PB, PUB, SE	D011 applies to P/S codes CW and CX until end of 1993. Used for chloride titration in P/S codes CS, CSE, PB, PUB and SE (C1-23/TWCP-3547). The silver-bearing solution is sent to P/S code CW or CX (Hydroxide precipitation), and silver is incorporated as a contaminant in the hydroxide cake.
Sodium bicarbonate Sodium nitrite Stannous chloride		
Organic Chemicals		
Bromocresol purple DCHP Octylphenyldiisobutylcarbamoyl methylphosphine oxide (CMPO) Tetrachloroethylene	CSE, SE	D039, F002 (used as solvent). Used until 1992 in P/S codes CSE and SE
Tributyl phosphate (TBP)		

4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS

The assignment of EPA hazardous waste numbers, or RCRA codes, to process wastes from chloride operations is summarized below, as well as on the process timelines in Attachment 3, and in the table of process inputs and outputs in Attachment 4. These assignments take into account the possible presence of RCRA chemicals in process waste as a result of their suspected or known presence in feed materials, chemical inputs, equipment, and glovebox surfaces.

4.1 F, K, and P Listings

The following F listings only apply to cellulosic, ceramic, plastic, and rubber items, and only through 1993. These F-listed chemicals were not used in chloride operations after the end of 1992, but in order to be conservative, the applicability of the codes is extended by one year after cessation of use. The F listings do not apply to glass or metal debris, even if these items were in contact with the F-listed chemicals, because their non-porous surfaces do not absorb liquids or gases.

F002 applies to waste from P/S codes CLS, CSE, CW, CXL, and SE for the following reasons:

- Tetrachloroethylene was used as a solvent in these codes until the end of 1992.
- Chlorobenzene, methylene chloride, and tetrachloroethylene were solvents that were present in analytical laboratory solutions obtained from CLS-1, that were feed materials to the P/S codes CLS, CW, and CXL.

F003 applies to waste from P/S codes CLS, CW, and CXL for the following reason:

- Acetone, butyl alcohol (butanol), methanol and xylene were solvents that were present in analytical laboratory solutions obtained from CLS-1, that were feed materials to the above P/S codes.

No F listings apply to solid wastes generated from the following processes in chloride operations because no F-listed chemicals were present in the feed materials, chemicals, or equipment used in these processes: P/S codes CL, CLRD, CS, CX, LD, MB, MS, PB, PRR, and PUB.

No K or P listings apply to solid wastes generated from any of the chloride operations because no K-listed or P-listed chemicals were present in the feed materials, chemicals or equipment used in these processes.

4.2 Toxicity Listings

D007 (chromium) applies to waste generated under P/S codes from chloride operations for the following reasons:

- Potassium dichromate may have been present in solid waste from P/S codes CW and CX until the end of 1992.
- Chromium was leached from stainless steel equipment, including gloveboxes, in which chloride operations were conducted.

D008 (lead) applies to waste from all P/S codes in chloride operations except PRR, for the following reasons:

- Lead had the potential to be leached from lead shielding used inside the gloveboxes for P/S codes PB and PUB.
- Lead may have been present in analytical laboratory solutions that were feed materials to P/S codes CLS, CSE, CXL, CW, and SE.
- Before 1992, leaded gloves were segregated and discarded as metal debris. Thus, metal debris containing these gloves from chloride operations before 1992 is assigned D008. Since May 1992, however, these gloves have been routinely segregated from other metal debris although they are still discarded under the originating P/S code (TWCP-4166).

D009 (mercury) applies to waste from chloride operations because:

- mercury thermometers may have been present in the gloveboxes, and
- mercury may have been present in analytical laboratory solutions that were feed materials to P/S codes CLS, CSE, CW, CXL, and SE.

D011 (silver) applies to waste from P/S codes CW and CX through 1993 due to the use of silver nitrate in these processes until the end of 1992.

D019, D021, D022 and D039 apply to cellulosic, ceramic, plastic, and rubber debris waste items from the following P/S codes:

- D019 (carbon tetrachloride) applies to waste from P/S codes CLS, CW, and CXL due to the presence of carbon tetrachloride in the analytical laboratory solutions obtained from CLS-1, that were feed materials to these processes.
- D021 (chlorobenzene) applies to waste from P/S codes CLS, CW, and CXL due to the presence of carbon tetrachloride in the analytical laboratory solutions obtained from CLS-1, that were feed materials to these processes.

- D022 (chloroform) applies to waste from P/S codes CLS, CW, and CXL due to the presence of chloroform in the analytical laboratory solutions obtained from CLS-1, that were feed materials to these processes.
- D039 (tetrachloroethylene) applies to waste from P/S codes CLS, CSE, CW, CXL, and SE. This chemical was present in the analytical laboratory solutions obtained from CLS-1, that were feed materials to P/S codes CLS, CW and CXL, and it was used as a solvent in P/S codes CSE and SE until 1992.

D019, D022 and D039 do not apply to glass or metal debris waste items, even if the items were in contact with these chemicals, because the non-porous surfaces of these materials do not absorb liquids or gases. Use of these D-listed chemicals was discontinued in chloride operations by the end of 1992 but the codes are applied to the waste (excluding glass and metal) up to the present day because of the lack of AK information about discontinuance of their use in analytical laboratory operations.

No D001 (ignitable), D002 (corrosive) or D003 (reactive) listings apply to the solid wastes from chloride operations because no ignitable chemicals were used in these processes and because the solid wastes do not contain any free liquids (see Section 6.0).

4.3 Corrosivity, Reactivity, and Ignitability

See Section 6.0.

5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION

See Section 3.5.2.

6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED

According to the WIPP WAP, “The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes.” Administrative controls on waste packaging were in place at various times to ensure the absence of such items from the waste stream.

- Liquids were prohibited from solid waste streams at TA-55 when the facility opened in January 1978. A waste management procedure written to cover operations at the new facility, *TA-55 Standard Operating Procedure (SOP) 406-GEN-R00*, stated that “Liquids are not permitted in any container of solid waste materials” (TWCP-3943).
- Chemical Waste Disposal Requests introduced in June 1980 included checkboxes which the waste generator was required to check if the waste contained corrosive

- acids or bases, or pyrophoric, flammable, corrosive, explosive, toxic, carcinogenic or highly reactive materials.
- The Certification Plan (TWCP-697) and related Generator Attachments (TWCP-701) were implemented in 1987. Waste generators were required to sign a statement on the WODF documenting that the waste contained “no free liquids, pyrophorics, explosives, compressed gases, powders or materials other than the indicated matrix.” Checkboxes were also present for indicating the presence or absence of corrosive chemicals. Full implementation of this generator statement occurred in May 1987.
 - Waste management inspectors perform visual examination of the waste prior to its initial packaging, thus allowing the inspectors to verify the generator’s WODF statement (TWCP-701, Sections 3.8.5 to 3.8.6).
 - Explosives were prohibited from TA-55 until installation of the Impact Test Facility in the early 1990s. Explosives continue to be banned in the solid waste streams up to the present time. If a misfire should occur, the requirement is to destroy the unspent powder by burning.
 - The Waste Profile Request Form (WPRF), which has been in use at LANL since 1991, includes a statement which must be authenticated by the waste generator, that the waste is not ignitable (flash point >200°F), reactive, or corrosive.
 - The TA-55 Generator Attachments to the Certification Plan were updated in 1995 (TWCP-700) but the prohibition on liquids in the waste, and the waste management inspection, remained in effect.

Hence, since the inception of operations at TA-55, corrosive and reactive wastes have been excluded from TA-55 solid wastes through the prohibition of liquids.

The absence of these prohibited items is verified through radiography of each waste container and visual examination of selected containers during TWCP characterization activities. These data will be used to assess the accuracy of AK information in accordance with *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028). Any free liquids are remediated, or the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007).

7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED

Section 6.0 summarizes administrative controls in place at TA-55 that prohibit incompatible chemicals in the waste, and measures taken to verify their absence. In addition, all waste containers shipped from TA-55 to TA-54 for storage were evaluated for potentially incompatible chemicals in accordance with 49 *Code of Federal Regulations* (CFR) Subpart C—Segregation and separation chart of hazardous materials;

Section 177.848, Segregation of hazardous materials, and were determined to be in compliance with this requirement.

8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS

Most gases used at the TA-55 Plutonium Facility are stored outside the building and the gas is plumbed into the glovebox from outside the building (TWCP-4164). Occasionally, a lecture bottle may have been used for a process inside the building, but these bottles were kept outside of the glovebox with the gas plumbed into the glovebox. Consequently, compressed gas cylinders or containers are not expected to be in any of the TRU wastes generated by TA-55 operations.

Spray cans, especially WD-40, were in common use in TA-55 gloveboxes until May 1992 (TWCP-4166). These were routinely discarded as metal debris waste. From 1988 until May 1992, the protocol was to vent or puncture the spray cans inside the glovebox; venting was indicated by inserting a metal wire into the valve. After May 1992, spray cans were no longer used in gloveboxes.

For items of pyrochemical salt waste, the procedures of oxygen sparging and/or carbonate oxidation have been used since May 1987 to ensure that pyrophorics were oxidized. In addition, screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501) have shown (1) no autoignition, (2) no spontaneous combustion, and (3) no sparking. Experimental results on the reactivity of LANL Direct Oxide Reduction (DOR) salt with water and the reactivity in air of heated calcium metal nodules from DOR salts indicate the absence of "dangerous when wet materials" and pyrophoricity in these salts (TWCP-3730, TWCP-3731, TWCP-3732).

Verification that individual waste drums do not contain compressed gases, free liquids, or sealed containers greater than 4 L in volume is obtained from radiography of each waste container and visual examination of selected containers during TWCP characterization activities. Any free liquids are remediated, and any sealed containers greater than 4 L in volume, or unpunctured or unvented gas containers, are removed; or else the waste container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007). For administrative controls on the prohibition of pyrophorics, see Sections 6.0 and 7.0.

9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM

No PCBs were introduced into the chloride operations, based on documentation in TA-55 procedures reviewed during the AK investigation and summarized in the process inputs listed in Table 1, Table 3, and Attachment 4. Oils used in the reviewed processes include

vacuum pump oils and cutting fluids used for cooling purposes; none of these oils are known to contain PCBs. All transformers known to contain PCBs have been tracked from the time of startup of TA-55 in 1978. Whenever any transformer oil is drained, it is handled by a subcontractor who is wholly responsible for its disposal (TWCP-AK-2.1-005,R.1, Section 9.0). This oil does not enter the LANL disposal operations.

10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE

Asbestos heating mantles were never used at TA-55. Asbestos gloves were used in glovebox operations in P/S codes OR and RM (TWCP-4162, TWCP-4166), which are discussed in *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006,R.1) and *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007,R.1), respectively. Asbestos-bearing transite was widely used until recently for thermal insulation, including as a coverplate over the furnace in glovebox wells, and as part of end plates on Lindberg furnaces (TWCP-4162, TWCP-4166). Although many Lindberg furnaces have been replaced with newer asbestos-free furnaces, some are still in use at TA-55. The transite would have been disposed either as metal or as ceramic and glass debris waste.

11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS

- 40 CFR Part 261, Subpart C—Characteristics of hazardous waste, Sections 261.21 (*Characteristic of ignitability*), 261.22 (*Characteristic of corrosivity*), 261.23 (*Characteristic of reactivity*), and 261.24 (*Toxicity characteristic*)
- 40 CFR Part 261, Subpart D—Lists of hazardous waste, Sections 261.31 (*Hazardous wastes from non-specific sources*), 261.32 (*Hazardous wastes from specific sources*), and 261.33 (*Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof*)
- 49 CFR Subpart C—Segregation and separation chart of hazardous materials. Section 177.848, *Segregation of hazardous materials*
- *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021)
- *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3)
- *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003,R.1)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004,R.1)

- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55 (TWCP-AK-2.1-005,R.1)*
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55 (TWCP-AK-2.1-006,R.1)*
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55 (TWCP-AK-2.1-007,R.1)*
- *Reconciliation of Visual Examination and Radiography Information (TWCP-QP-1.1-028)*
- *Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)*
- *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste (EPA/OSWER 9938.4-03)*
- *Waste Analysis Plan, Attachment B to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088)*
- *Waste Characterization Data Reconciliation with Acceptable Knowledge (TWCP-DTP-1.2-064)*

ACCEPTABLE KNOWLEDGE ROADMAP

P/S Codes: CL, CLRD, CLS, CS, CSE, CW, CX, CXL, LD, MB, MS, PRR, PB, PUB, and SE

Copies of these documents are in the TWCP RMDC Center.

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-352	B	Description of plutonium recovery processes	Wastes from Plutonium Conversion and Scrap Recovery Operations, LA-11069, March 1988	Document describes the Pu residues and the various treatment approaches used in recovering plutonium from scrap	Document does not give information about RCRA constituents introduced or present in the processes
TWCP-614	D	All TA-55 waste is defense related	Memo from Doug Sankey.	All TA-55 waste is defense related	None
TWCP-697	C	Waste management requirements to meet WIPP WAC requirements were formalized in 1984.	<i>Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , WCP-HSE7-CPL-01, R.2 (November 1984)	Waste management requirements to meet WIPP WAC requirements. Generator Attachments were used to describe and reference specific generator procedures.	Overview document - Generator Attachments provide more detailed information.
TWCP-698	B	Gives Material Type compositions	NMT Memo, NMT-7 WM/EC-96-032 Benchmark Environmental Corp. Memo, AL-7193 BEC	Gives Material Type compositions	Does not give information on how material may fractionate in TA-55 waste processes.
TWCP-700	C	<i>Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , R05	<i>NMT-7 Attachment</i> , January 1995, TRUWM-TA55-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.
TWCP-701	C	<i>TA-55 Generator Attachment to the TRU Waste Certification Plan for Newly Generated TRU Waste</i>	<i>TA-55 Attachment</i> , 1987, TRU-MST12-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-816	D	Jim Foxx Interview on Number of Layers of Packaging	C.L. Foxx, Los Alamos National Laboratory	Waste was co-mingled with room trash, and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits.	None
TWCP-882 (UCNI)	D	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste	Memo from Jim Foxx	Lists additional radionuclides and metals potentially in waste, subdivided by process status code. Covers time period from 1978 to the present.	Best information available, but it is based on worker recollection because other records are not available.
TWCP-887	D	Co-mingling of Defense and Non-Defense TRU Waste	Memo from Jim Foxx	Wastes generated from defense and non-defense activities were not segregated at TA-55 through 1997	None
TWCP-2501	B	“Backlog Waste Reassessment Baseline Book, Waste Form 34”	Rocky Flats Environmental Technology Site Report 1995	Page WF34-10 contains results of tests for corrosivity	Tests were conducted on residues rather than on waste.
CI-6/TWCP-3547 (UCNI)	C	Developmental Chloride Solvent Extraction Process	Procedure 462-REC, all revisions	Describes development of chloride line processes	Limited information on wastes
CI-7/TWCP-3547 (UCNI)	C	Recovery and Purification of Pu from Direct Oxide Reduction (DOR) Salts by Chloride Anion Exchange	Procedure 463-REC, all revisions	Process descriptions	Describes only one portion of chloride line; does not address use of RCRA-regulated solvents
CI-8/TWCP-3547 (UCNI)	C	Hydroxide Precipitation of Chloride Solutions Containing Organic Chemicals	Procedure 467-REC, all revisions	Process descriptions	Describes only one portion of chloride line; does not address use of RCRA-regulated solvents
CI-9/TWCP-3547 (UCNI)	C	Dissolution and/or Leaching of Various Materials in HCl	Procedure 470-CLO, all revisions	Process description	Describes only one portion of chloride line

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
CI-10/TWCP-3547 (UCNI)	C	Oxalate Precipitation of Plutonium from Chloride Solutions	Procedure 471-CLO, all revisions	Process description	Describes only one portion of chloride line
CI-11/TWCP-3547 (UCNI)	C	Chloride Solvent Extraction	Procedure 472-CLO	Process description	Describes only one portion of chloride line; does not address use of RCRA-regulated solvents
CI-12/TWCP-3547 (UCNI)	C	Purification and Recovery of Plutonium by Chloride Anion Exchange	Procedure 473-CLO, all revisions	Process description	Describes only one portion of chloride line
CI-13/TWCP-3547 (UCNI)	C	Hydroxide Precipitation of Chloride Waste Streams	Procedure 474-CLO, all revisions	Process description	Describes only one portion of chloride line
CI-14/TWCP-3547 (UCNI)	C	Recovery of Plutonium from Plutonium-Beryllium Neutron Sources	Procedure 476-CLO, all revisions	Process description	Detail only in decladding operation
CI-15/TWCP-3547 (UCNI)	C	Calcination Operation for Aqueous Chloride Processes	Procedure 477-CLO, all revisions	Process description	Describes only one portion of chloride line
CI-16/TWCP-3547 (UCNI)	C	Dicesium Hexachloro Plutonate	Procedure 478-CLO, all revisions	Process description	Additional step of DCHP precipitation used for certain feed material only
CI-17/TWCP-3547 (UCNI)	C	Head End Processing of Aqueous Chloride Plutonium	Procedure 479-CLO, all revisions	Process description	Does not describe where silver nitrate and potassium dichromate are disposed of
CI-18/TWCP-3547 (UCNI)	C	Hydroxide Precipitation of the Plutonium in Chloride Waste	Procedure 481-REC, all revisions	Process description	Describes only one portion of chloride line
CI-19/TWCP-3547 (UCNI)	C	Recovery of Plutonium from Hydrochloric CLS-1 Solutions	Procedure 482-REC, all revisions	Process description	Does not address RCRA-regulated solvents
CI-20/TWCP-3547 (UCNI)	C	Decladding of PuBe Neutron Sources	Procedure 482-CLO, all revisions	Process description	Decladding only
CI-21/TWCP-3547 (UCNI)	C	Purification and Recovery of Pu by Chloride Anion Exchange	Procedure 483-CLO, all revisions	Process description	Describes only one portion of chloride line

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
CI-22/TWCP-3547 (UCNI)	C	Radiochemical Analysis at TA-55	Procedure 029-CST-1, R02	Process description	Feed material only; does not address further processing
CI-23/TWCP-3547 (UCNI)	D	Answers to questions about chloride processes	Interview with Jim Foxx 8/31/99	Answers to questions on Chloride processes	None
CI-24/TWCP-3547 (UCNI)	D	Answers to questions about chloride processes	Interview with Jim Foxx, 9/15/99	Answers to questions on Chloride processes. Chloride operations line shut down from 1992 to 1994.	None
CI-25/TWCP-3547 (UCNI)	D	Answers to questions about chloride processes	Interview with Jim Foxx, 9/23/99	Answers to questions on Chloride processes; CLS-1 solvent list	None
CI-26/TWCP-3547 (UCNI)	D	Answers to questions about chloride processes	Interview with Tim Hayes, 1/12/00	Answers to questions on Chloride processes	None
CI-27/TWCP-3547 (UCNI)	D	Answers to questions about chloride processes	Interview with Tim Hayes, 6/1/00	Answers to questions on Chloride processes	None
TWCP-3730 (UCNI)	B	Pyrophoricity characterization	Characterization of Direct Oxide Salts (LA-CP-95-0098)	Hydrogen generation and pyrophoricity of DOR salts. Also gives reference for MSE, ER, and Cr-containing salts.	None
TWCP-3731	D	Sodium pyrophoricity in pyrochemical salts	Memo (MST-12-ARO-88-052)	Treatment of sodium in salts is effective	Sodium only
TWCP-3732	C	Experimental data on calcium pyrophoricity in salts	Memo (MST-12-ARO-88-077)	Treatment of calcium in salts is effective	Calcium only
TWCP-3943	B	Procedure for Waste Management at TA-55	TA-55 Document, 406-GEN-R00	Contains information on waste management procedures in 1978	None, but doesn't address today's waste management concerns
TWCP-4162	D	Answers to questions about P/S codes PB, PuBe, CC, MB, MS, FF, BF, and other issues	Interview with Jim Foxx, 10/12/00	Answers to questions on use of asbestos at TA-55, non-defense activities, and specific P/S codes in chloride operations.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

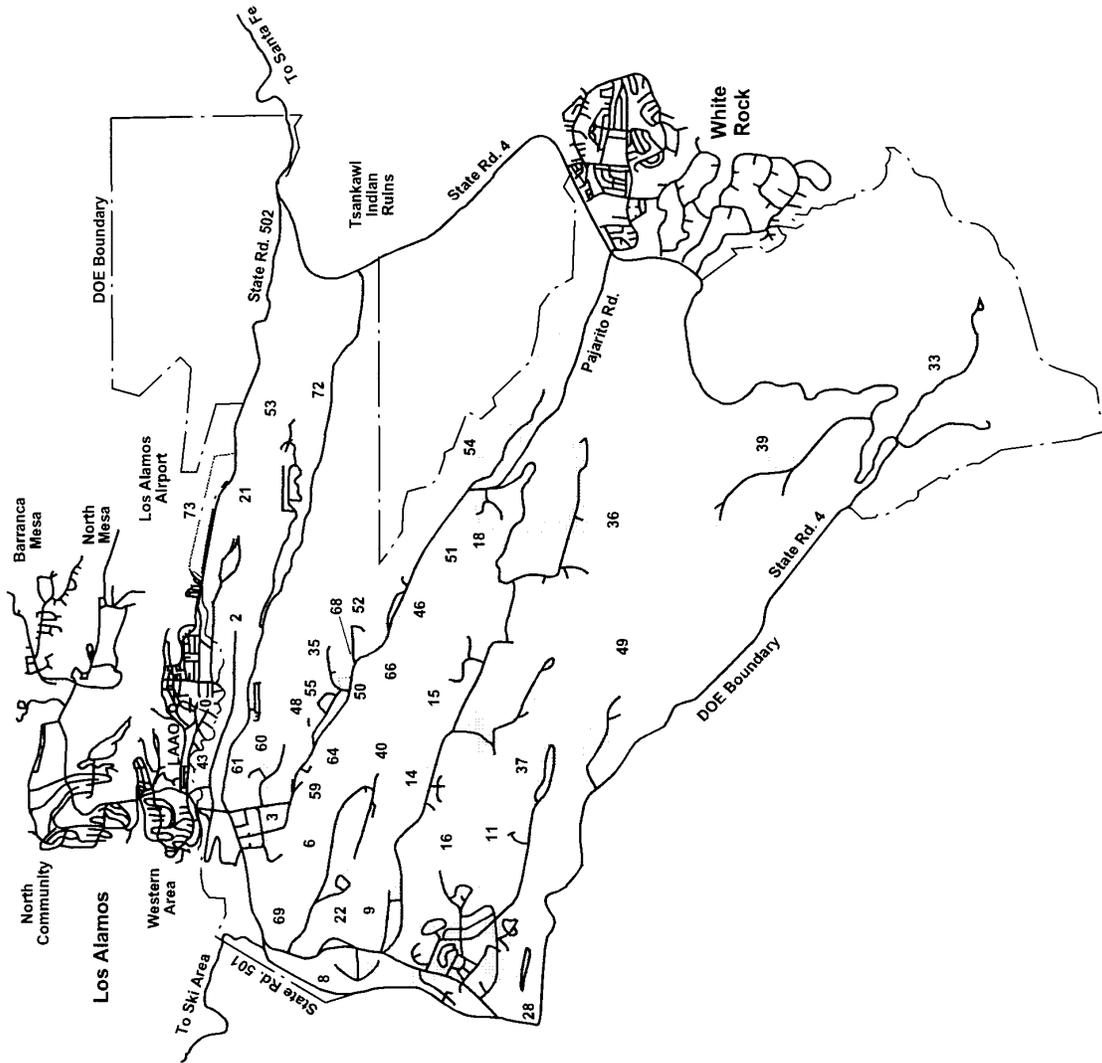
TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-4164	D	Answers to questions about various P/S codes	Interview with Jim Foxx, 10/16/00	Answers to questions on use of silver, disposal of ash and resins, and use of gases.	None
TWCP-4166	D	Answers to questions about P/S codes DO, EV, HP, CF, OR, RM, PY	Interview with Jim Foxx, 10/17/00	Answers to questions on use of chromium and silver, RCRA metals in cement, asbestos in furnaces and gloves, and disposal of spray cans used in gloveboxes.	None
TWCP-4167	D	Answers to questions about segregation of non-defense wastes; leachability of silver from ash; use of potassium dichromate in chloride operations	Interview with Jim Foxx, 10/18/00	Segregation of non-defense wastes began on 27 August 1998; analytical data show that silver in ash is below limits of regulatory concern; potassium dichromate—and not potassium chromate—was used in chloride titrations	None
TWCP-4168	D	Discussion of applicability of P-listing to beryllium in Pu-Be sources	Interview with Jim Foxx, 10/20/00	P015 is not applicable for the PuBe sources for several reasons	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

MAP OF LANL

Technical Area Locations

TA-0	Unassigned Land Reserve
TA-2	Omega Site
TA-3	South Mesa Site
TA-5	Beta Site
TA-6	Two Mile Mesa Site
TA-8	Anchor Site West
TA-9	Anchor Site East
TA-11	K-Site
TA-14	Q-Site
TA-15	R-Site
TA-16	S-Site
TA-18	Pajarito Laboratory
TA-21	DP-Site
TA-22	TD-Site
TA-28	Magazine Area A
TA-33	HP-Site
TA-35	Ten Site
TA-36	Kappa Site
TA-37	Magazine Area C
TA-39	Ancho Canyon Site
TA-40	DF-Site
TA-41	W-Site
TA-43	Health Research Lab & DOE Headquarters
TA-46	WA-Site
TA-48	Radiochemistry Site
TA-49	Frijoles Mesa Site
TA-50	Waste Management Site
TA-51	Radiation Exposure Facility
TA-52	Reactor Development Site
TA-53	Meson Physics Facility
TA-54	Waste Disposal Site
TA-55	Plutonium Facility Site
TA-57	Fenton Hill Site
TA-58	Two Mile North Site
TA-59	OH-Site

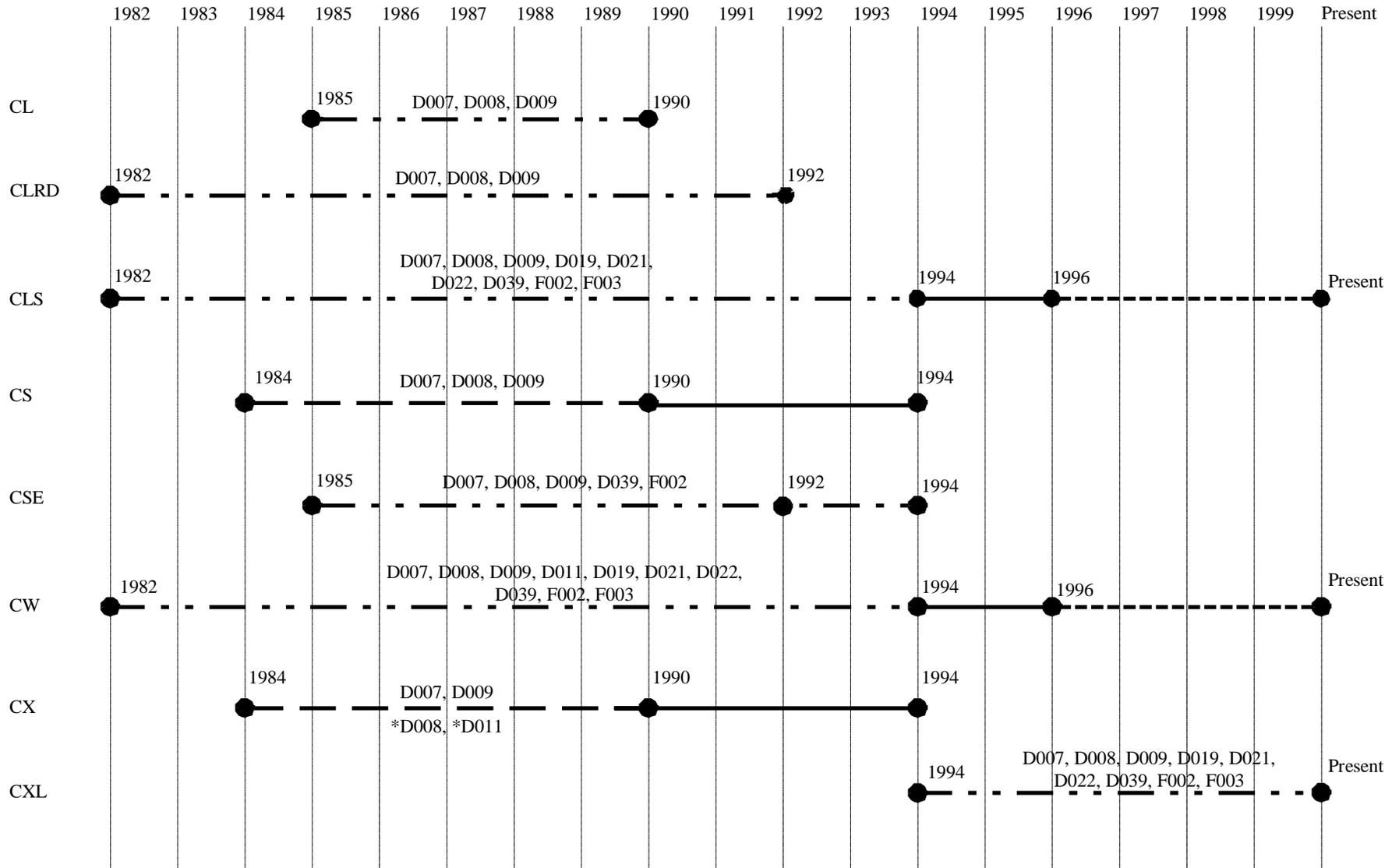


MAP OF TA-55

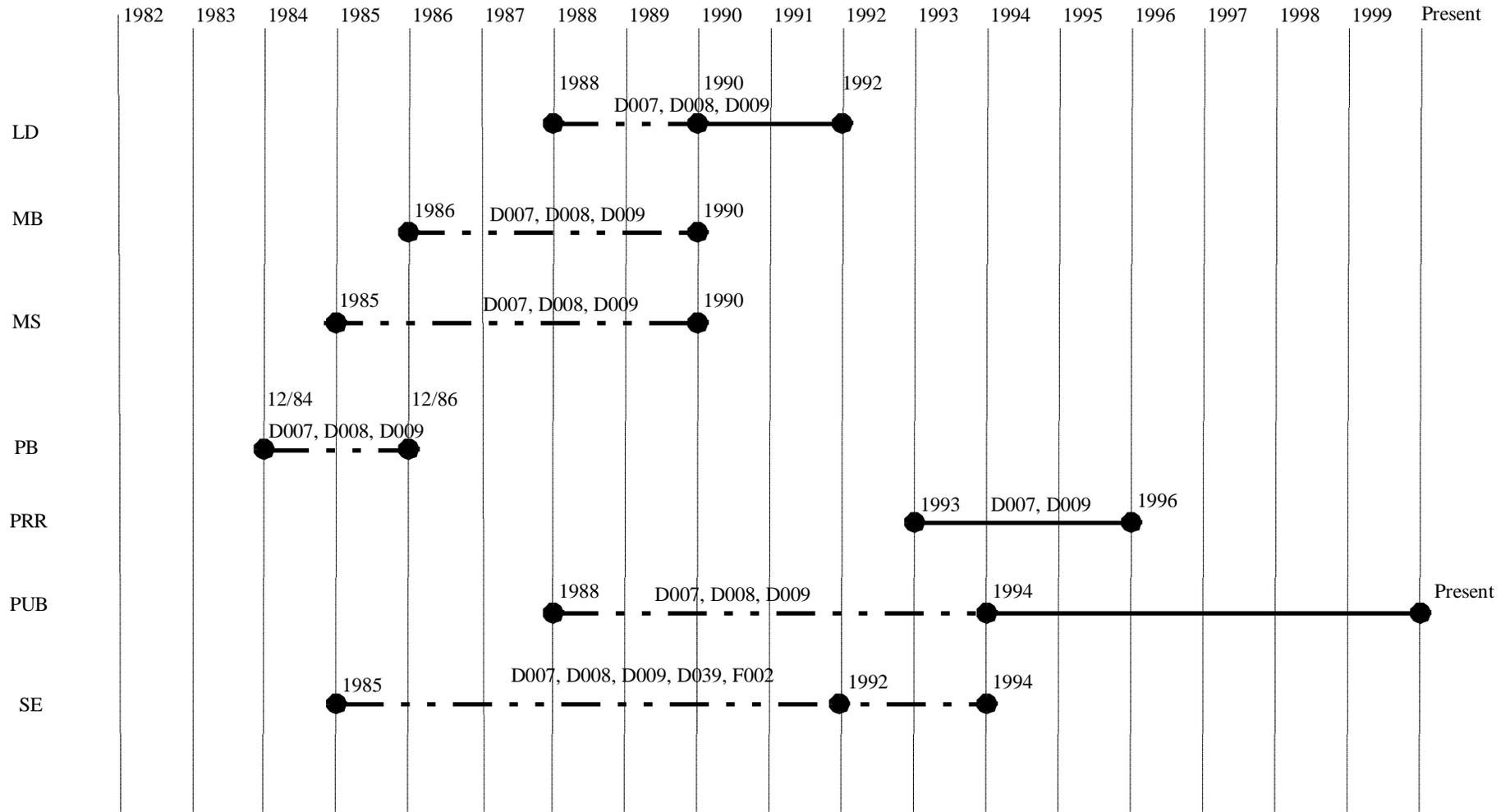
Note: The Plutonium Facility, Building PF-4, is labeled PF-4 on this map.



TIMELINE FOR CHLORIDE OPERATIONS



TIMELINE FOR CHLORIDE OPERATIONS (continued)



NOTE: See Section 4 for details of RCRA code applicability to waste types generated under each P/S code.

* Silver (D011) was not used in chloride operations after 1992. However, to be conservative, the applicability of this code is extended through 1993, a year after cessation of its use. Leaded gloves (D008) were discarded in a separate waste stream after 1992, still under the originating P/S code.

TIMELINE EXPLANATION



The P/S code is established in either the P/S diagrams or in both (or all) revisions of the procedures designating the start and end dates (e.g., Rev. 0 to Rev. 1; or Rev. 0 to Rev. 5)



The P/S code is not identified in the procedure, but the process description matches the P/S code and the description in previous or later revisions of the same procedure.



Extrapolate out two(2) years beyond the last procedure to next possible review date.



Time period based on subject matter expert comments.

PROCESS INPUTS AND OUTPUTS

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CL	Crucible Processing	Crucibles	Hydrochloric acid	Pu-enriched solutions to P/S codes SE or CX (chloride line) (hydroxide cake) for further processing; P/S code SP (nitrate line); vault	1) Crucible pieces to cement fixation (or on occasion, debris waste) 2) Debris waste	D007, D008, D009	CI-26/ TWCP-3547
CLRD	Aqueous Chloride R&D	See Table 1	Hydrochloric acid, other chemicals depending on R&D projects	Pu-enriched solutions to vault; hydroxide cake	Debris waste	D007, D008, D009	CI-6/ TWCP-3547
CLS	Accountable CLS Chloride Solutions	Analytical laboratory sample residues	Magnesium hydroxide, potassium hydroxide, sodium hydroxide	hydroxide cake to vault or to P/S code CXL	Debris waste; solutions to cement fixation	F002, F003, D007, D008, D009, D019, D021, D022, D039	CI-15, CI-20, CI-22, CI-25, CI-27 (all in TWCP-3547)
CS	Chloride Solutions	P/S codes CX and SE, various other feed materials (see Table 1)	Oxalic acid, hydroxylamine hydrochloride, potassium fluoride, sodium hydroxide, sodium bicarbonate, bromocresol purple, silver nitrate, potassium dichromate, argon gas, aluminum chloride	Pu oxide to vault, hydroxide cake to vault or to P/S code CW	Debris waste	D007, D008, D009	CI-26/ TWCP-3547, TWCP-4166, TWCP-4167

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CSE	Chloride Solvent Extraction	P/S codes CX, CSE, various other feed materials (see Table 1)	Hydrochloric acid, oxalic acid, hydroxylamine hydrochloride, potassium fluoride, calcium carbonate, sodium hydroxide, sodium bicarbonate, bromocresol purple, silver nitrate, potassium dichromate, argon gas, aluminum chloride, Tetrachloroethylene, TBP	Pu oxide to vault; hydroxide cake to vault	1) Debris waste 2) Liquids absorbed in vermiculite 3) Hydroxide cake after filtration to cement fixation or to vault	F002, D007, D008, D009, D039	C1-8, C-11, CI-26, CI-27 (all in TWCP-3547), TWCP-4166, TWCP-4167
CW	Caustic Waste	P/S codes CLS, CSE, other chloride solutions	Calcium or sodium or potassium hydroxide	P/S code HCD (nitrate line) (hydroxide cake) or vault	Debris waste	F002, F003, D007, D008, D009, D011, D019, D021, D022, D039	CI-25, CI-26, CI-27 (all in TWCP-3547)
CX	Chloride Anion Exchange	P/S codes PTP, PK, PRR, OR, EXT, SS	Hydrochloric acid, oxalic acid, hydroxylamine hydrochloride, potassium fluoride, calcium carbonate, sodium hydroxide, sodium bicarbonate, bromocresol purple, silver nitrate, potassium dichromate, argon gas, aluminum chloride, sodium nitrite	P/S codes SP or HCD (nitrate line) (hydroxide cake); Pu oxide to vault	1) Pieces left after filtration to cement fixation or debris waste 2) Ion exchange resins to cement fixation 3) Debris waste	D007, D008, D009, D011	C1-7, C1-8, CI-10, CI-12, CI-17, C1-18, CI-21, CI-27 (all in TWCP-3547), TWCP-4166, TWCP-4167

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CXL	Experimental Chloride Extraction Line	See Table 1; note no RCRA-regulated solvents used after 1992.	Hydrochloric acid, oxalic acid, calcium carbonate, magnesium hydroxide, potassium hydroxide, sodium hydroxide, bromocresol purple, ferrous chloride, stannous chloride, calcium fluoride, sodium nitrite, cesium chloride, argon gas, aluminum chloride	P/S codes RB, SP, CR, LR, DS, or NR (all nitrate line) (hydroxide cake); recycle back or continue through chloride process; vault	1) Pieces left after filtration to cement fixation or to debris waste 2) Ion exchange resins to cement fixation or to debris 3) Debris waste	F002, F003, D007, D008, D009, D019, D021, D022, D039	CI-7, CI-10, CI-12, CI-13, CI-15, CI-16, CI-18, CI-19, CI-21, CXL-25 (all in TWCP-3547)
LD	Chloride Leach & Dissolution	P/S code SS; also see Table 1	Hydrochloric acid	P/S code CX (chloride line); SP (nitrate line) (hydroxide cake); Pu oxide to vault	1) Pieces left after filtration to cement fixation (or occasionally, debris waste) 2) Debris waste	D007, D008, D009	CI-9, CI-26 (both in TWCP-3547)
MB	Nitric Dissolution of Molten Salts	Molten salts	Hydrochloric acid, nitric acid	P/S codes CS, CW, CX, or SE (chloride line), or as hydroxide cake to P/S codes LR or PS (nitrate line)	Debris waste	D007, D008, D009	CI-26/ TWCP-3547
MS	Molten Salts Purification Dissolution	Molten salts	Hydrochloric acid	P/S code SE (chloride line); Pu oxide to vault; hydroxide cake to vault or to P/S code SE	Debris waste	D007, D008, D009	CI-26/ TWCP-3547

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
PB	Pu-Beryllium Source Recovery	Pu-Be sources	Hydrochloric acid, sodium nitrite, DCHP, oxalic acid, potassium hydroxide, silver nitrate, hydroxylamine hydrochloride, bromocresol purple, sodium bicarbonate, potassium dichromate, hydrofluoric acid, calcium carbonate, stannous chloride, aluminum chloride	P/S codes CXL (recycle back through chloride line); P/S codes HCD, CD (nitrate line) (hydroxide cake)	1) Metal cladding to metals waste stream 2) Pieces left after filtration to cement fixation 3) Debris waste	D007, D008, D009	CI-20, CI-21 (both in TWCP-3547)
PRR	Pyrochemical Residue Recovery	See Table 1	Hydrochloric acid, oxalic acid, calcium carbonate, magnesium hydroxide, potassium hydroxide, sodium hydroxide, bromocresol purple, argon gas, aluminum chloride	P/S codes CX, CXL (chloride line); P/S code SP (nitrate line) (hydroxide cake), vault	1) Pieces left after filtration to cement fixation 2) Ion exchange resins to cement fixation 3) Debris waste	D007, D009	CI-7, CI-15, CI-19, CI-21 (all in TWCP-3547)
PUB	Pu/Be Source Recovery	Pu-Be sources	Hydrochloric acid, sodium nitrite, DCHP, oxalic acid, potassium hydroxide, silver nitrate, hydroxylamine hydrochloride, bromocresol purple, sodium bicarbonate, potassium dichromate, hydrofluoric acid, calcium carbonate, stannous chloride, aluminum chloride	P/S codes CXL (chloride line); P/S codes HCD, CD (nitrate line) (hydroxide cake); vault	1) Metal cladding to metals waste stream 2) Pieces left after filtration to cement fixation 3) Debris waste	D007, D008, D009	CI-14, CI-20, CI-21(all in TWCP-3547)

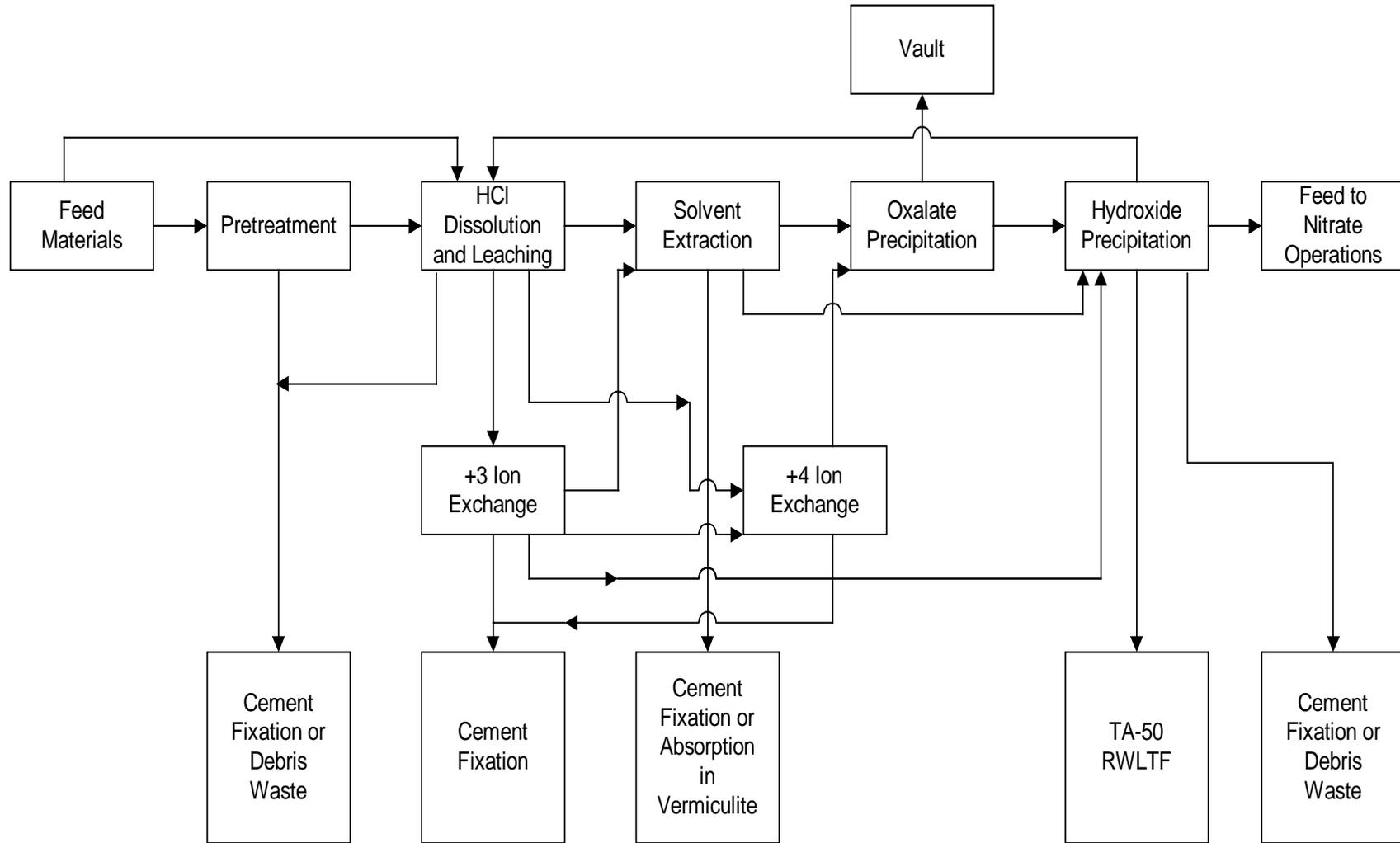
P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
SE	Solvent Extraction	P/S codes PK, LD, CS, PTP	Hydrochloric acid, oxalic acid, hydroxylamine hydrochloride, potassium fluoride, calcium carbonate, sodium hydroxide, sodium bicarbonate, bromocresol purple, silver nitrate, potassium dichromate, argon gas, aluminum chloride, Tetrachloroethylene, TBP, CMPO	P/S code CS (chloride line) or vault	1) Debris waste 2) Liquids absorbed in vermiculite	F002, D007, D008, D009, D039	C1-8, C1-11, C1-26, C1-27 (all in TWCP-3547), TWCP-4166, TWCP-4167

¹ All P/S codes generate routine laboratory debris waste consisting of glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Leaded gloves may also be generated and are segregated.

² See discussion in Section 4.0 for details on the applicability of the RCRA codes listed in this column. The RCRA hazardous waste codes listed apply to the solid TRU waste only and not to any other waste forms that may undergo further treatment or processing (e.g., evaporation or cement fixation). The resulting treated waste stream is evaluated for hazardous waste constituents and assigned the applicable EPA hazardous waste codes. All P/S codes have the potential to generate leaded gloves. The gloves are segregated from other metal debris waste and are assigned EPA hazardous waste code D008 under the originating P/S code.

³ Refer to the Acceptable Knowledge Roadmap in Attachment 1. References listed as C1-*nn* (where *nn* is a 1- or 2-digit number) are in TWCP-3547.

Simplified Process Flow Diagram



TA-55 PLUTONIUM FACILITY ACCEPTABLE KNOWLEDGE REPORT

REPORT TITLE: Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55

REPORT NUMBER: TWCP-AK-2.1-003,R.1 (LA-UR-00-5860)

WASTE GENERATED FROM PROCESS/STATUS CODES: AO, ARI, BA, BC, BT, CA, CN, CO, CT, DA, DOP, DT, EL, ELW, EM, EVAC, FF, FSPF, GI, HG, ID, IN, ITF, ITF4, JA, KBTF, MA, MBC, MOX, MW, OB, OM, PCH, PD, PE, PF, PH, FIG, RAP, RAP2, RL, RS, SRL, TIGR, UA, VD, WE, WLT

EFFECTIVE DATE: 12/04/00

NEXT REVIEW DATE: 12/04/02

DOCUMENT PREPARER:

John Musgrave 12/04/00
NAME DATE

APPROVALS:

June Fabryka-Martin 12/04/00
INDEPENDENT TECHNICAL REVIEWER/EDITOR DATE

Pamela Rogers 12/04/00
SITE PROJECT MANAGER DATE

Matt J. Riggs 12/04/00
WASTE CERTIFICATION OFFICIAL DATE

M A Gavett 12/04/00
SITE PROJECT QA OFFICER DATE

Charles L. Foxx 12/04/00
FACILITY REPRESENTATIVE DATE

CONTENTS

Section	Page
ACRONYMS	v
PROCESS/STATUS (P/S) CODE INDEX.....	vii
PROCESS ACCEPTABLE KNOWLEDGE SUMMARY.....	ix
1.0 INTRODUCTION	1
2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS.....	1
3.0 DESCRIPTION OF THE PROCESS WASTE	3
3.1 Facility and Mission.....	3
3.2 Waste Physical Form and Content Description	3
3.3 Waste Volume and Time Period of Generation.....	4
3.4 Waste Generation Processes	4
3.5 Material Inputs to the Waste Generation Processes.....	20
4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS	25
4.1 F, K, and P Listings	25
4.2 Toxicity Listings	25
4.3 Corrosivity, Reactivity, and Ignitability.....	28
5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION	28
6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED	28
7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED.....	30
8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS ...	30
9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM	31
10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE	31
11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS	31
Tables	
1 Process Feed Materials for Metal Operation Processes.....	21
2 Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %).	23
3 Average Isotopic Content of Uranium Material Types and Enrichments (Weight %)	23
4 Chemical Inputs to Processes Described in This Report	26

Attachments

- 1 Acceptable Knowledge Roadmap (11 pages)
- 2 LANL and TA-55 Sites Maps (2 pages)
- 3 Timeline for Metal Operations (5 pages)
- 4 Process Inputs and Outputs (9 pages)
- 5 Simplified Process Flow Diagram for Metal Operations (3 pages)

ACRONYMS

AK	acceptable knowledge
ARIES	Advanced Recovery and Integrated Extraction System
CFR	<i>Code of Federal Regulations</i>
C-N-O	carbon-nitrogen-oxygen
D	RCRA hazardous waste code for wastes with hazardous characteristics, defined in 40 CFR Subpart C, Sections 261.21 to 261.24
DL	discard limit
DOE	U.S. Department of Energy
DOR	Direct Oxide Reduction (process conducted under P/S code OR)
DWLS	Discardable Waste Log Sheet
EB	electron beam
EPA	U.S. Environmental Protection Agency
F	RCRA hazardous waste code for hazardous wastes from non-specific sources, defined in 40 CFR Subpart D, Section 261.31
GB	glovebox
GTAW	gas tungsten arc welder
HEPA	high-efficiency particulate air
HIP	Hot Isostatic Press
K	RCRA hazardous waste code for hazardous wastes from specific sources, defined in 40 CFR Subpart D, Section 261.32
LANL	Los Alamos National Laboratory
LLW	low-level waste
MEK	methyl ethyl ketone
MOX	mixed oxide
MT	material type
NMT	Nuclear Material Technology
P	RCRA hazardous waste code for acute hazardous waste defined in 40 CFR Subpart D, Section 261.33
P/S [code]	process/status [code]
PCB	polychlorinated biphenyl
PF-4	Plutonium Facility, Building 4
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RLWTF	Radioactive Liquid Waste Treatment Facility
RMDC	Records Management/Document Control
Sampling Plan	<i>Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001,R.2)</i>
SME	subject matter expert
SNM	special nuclear material
SOP	safe/standard operating procedure
TA	technical area
TIG	tungsten inert gas
TRU	transuranic

TWCP	Transuranic Waste Characterization/Certification Program
UCNI	Unclassified Controlled Nuclear Information
WIPP	Waste Isolation Pilot Plant
WIPP WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant</i> (DOE/WIPP-069)
WIPP WAP	Attachment B, Waste Analysis Plan, to the <i>Hazardous Waste Facility</i> <i>Permit Issued to the Waste Isolation Pilot Plant</i> (EPA No. NM4890139088)
WODF	Waste Origination and Disposition Form
WPRF	Waste Profile Request form

PROCESS/STATUS (P/S) CODE INDEX

Note: This index indicates the main process AK summary report and report section that covers each P/S code mentioned in this report.

P/S Code	P/S Name	Process AK Summary Report and Report Section*
ACL	Analytical Chemistry Laboratory	Miscellaneous Operations 3.4.4, Att. 4
AO	Assembly Operation	Metal Operation Processes 3.4.3, Att. 4
ARI	ARIES	Metal Operation Processes 3.4.3, Att. 4
BA	Basement Isopress	Metal Operation Processes 3.4.2, Att. 4
BC	Physical Properties	Metal Operation Processes 3.4.2, Att. 4
BT	Burst Testing	Metal Operation Processes 3.4.3, Att. 4
CA	Casting	Metal Operation Processes 3.4.2, Att. 4
CF	Cement Fixation	Nitrate Operations 3.4.5, Att. 4
CN	C-N-O Analysis	Metal Operation Processes 3.4.1, Att. 4
CO	Comminution	Metal Operation Processes 3.4.1, Att. 4
CT	Compatibility Testing	Metal Operation Processes 3.4.1, Att. 4
DA	Alloy Development	Metal Operation Processes 3.4.2, Att. 4
DOP	Detector Oxide Preparation	Metal Operation Processes 3.4.2, Att. 4
DT	John Ward R&D	Metal Operation Processes 3.4.2, Att. 4
EL	Element Loading	Metal Operation Processes 3.4.1, Att. 4
ELW	Experimental Laser Welding	Metal Operation Processes 3.4.3, Att. 4
EM	Electron Microscopy	Metal Operation Processes 3.4.2, Att. 4
ER	Electrorefining	Pyrochemical Processes 3.4.4, Att. 4
EVAC	Evacuation and Bake Out	Metal Operation Processes 3.4.3, Att. 4
FF	Fuel Fabrication	Metal Operation Processes 3.4.1, Att. 4
FSPF	Special Furnace Operation	Metal Operation Processes 3.4.3, Att. 4
GI	Pellet Grinding & Inspection	Metal Operation Processes 3.4.1, Att. 4
HG	Pu Removal by Mercury	Metal Operation Processes 3.4.2, Att. 4
HP	Cement Fixation	Nitrate Operations 3.4.5, Att. 4
ID	Immersion Density	Metal Operation Processes 3.4.1, Att. 4
IN	Inspection	Metal Operation Processes 3.4.2, Att. 4
ITF	Impact Test Facility	Metal Operation Processes 3.4.2, Att. 4
ITF4	Impact Test Facility	Metal Operation Processes 3.4.2, Att. 4
JA	Gas Isostatic Press	Metal Operation Processes 3.4.2, Att. 4
KBTF	Kolsky Bar Test Facility	Metal Operation Processes 3.4.3, Att. 4
MA	Machining	Metal Operation Processes 3.4.2, Att. 4
MBC	Crystal	Metal Operation Processes 3.4.3, Att. 4

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
ME	Metallography	Miscellaneous Operations	3.4.10, Att. 4
MOX	Mixed Oxide Fuel Production	Metal Operation Processes	3.4.1, Att. 4
MW	Metal Working	Metal Operation Processes	3.4.2, Att. 4
OB	Oxide Blending	Metal Operation Processes	3.4.1, Att. 4
OM	Oxygen To Metal Ratio Determination	Metal Operation Processes	3.4.1, Att. 4
OR	Direct Oxide Reduction	Pyrochemical Processes	3.4.2, Att. 4
PAF	Passivation Furnaces	Nitrate Operations	3.4.1, Att. 4
PCH	Plasma Chemistry	Metal Operation Processes	3.4.2, Att. 4
PD	Pit Disassembly	Metal Operation Processes	3.4.2, Att. 4
PE	Sputtering Process	Metal Operation Processes	3.4.2, Att. 4
PF	Plutonium Surfaces	Metal Operation Processes	3.4.2, Att. 4
PH	Thermal Hydride/Dehydride	Metal Operation Processes	3.4.2, Att. 4
PIG	Welding	Metal Operation Processes	3.4.3, Att. 4
RAP	Research Alloy Preparation	Metal Operation Processes	3.4.3, Att. 4
RAP2	Research Alloy Preparation	Metal Operation Processes	3.4.3, Att. 4
RL	Radiochemical Coating	Metal Operation Processes	3.4.2, Att. 4
RM	Reduction to Metal	Special Processing	3.4.4, 3.4.6, 3.4.7, 3.4.8, 3.4.9, Att. 4
RS	Pellet Sintering	Metal Operation Processes	3.4.1, Att. 4
SP	Scrap Dissolution, G438	Nitrate Operations	3.4.2, Att. 4
SRL	Special Recovery Line	Metal Operation Processes	3.4.2, Att. 4
SS	Salt Stripping	Pyrochemical Processes	3.4.3, 3.4.4, 3.4.5, 3.4.7, 3.4.8, Att. 4
TIGR	Thermally-Induced Gallium Removal	Metal Operation Processes	3.4.3, Att. 4
UA	Uranium Fabrication	Metal Operation Processes	3.4.2, Att. 4
VD	Vapor Degreaser and Sand Blasting	Metal Operation Processes	3.4.2, Att. 4
WE	Welding	Metal Operation Processes	3.4.2, Att. 4
WLT	Welding Leak Test	Metal Operation Processes	3.4.3, Att. 4
WM	Waste Management	Miscellaneous Operations	3.4.9, Att. 4

* Process AK summary reports: Metal Operation Processes (this report), Miscellaneous Operations (TWCP-AK-2.1-004,R.1), Pyrochemical Processes (TWCP-AK-2.1-006,R.1), and Special Processing (TWCP-AK-2.1-007,R.1)

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY

Waste Generating Process: Metal Operations

P/S codes: AO, ARI, BA, BC, BT, CA, CN, CO, CT, DA, DOP, DT, EL, ELW, EM, EVAC, FF, FSPF, GI, HG, ID, IN, ITF, ITF4, JA, KBTF, MA, MBC, MOX, MW, OB, OM, PCH, PD, PE, PF, PH, PIG, RAP, RAP2, RL, RS, SRL, TIGR, UA, VD, WE, WLT

Type of waste generated:

Retrievably stored and newly generated, mixed and non-mixed debris.

Site: LANL

Facility Mission (including defense and non-defense programs):

TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites in the defense complex. The recovered plutonium is converted into pure plutonium feedstock. These manufacturing and recovery operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste contaminated scrap, residues, and debris generated at TA-55. The scrap and residues are processed to recover as much plutonium as practicable before disposal. Wastes from metal operations are generated from plutonium recovery and purification for defense and non-defense programs; these wastes are generated and produced in the same rooms and gloveboxes and so were not segregated until August 27, 1998.

Area(s) or building(s) where the process waste was generated (including operations carried out in those areas):

TA-55 Plutonium Facility, Building PF-4, rooms 115, 124, 125 and 126 (reactor fuel development activities) and rooms 38 East, 113, 114, 201E, 305, 306, 308, 309, 319 and 327 (other metal operation processes). Plutonium operations included preparing ultra-pure plutonium metal, alloys, and compounds; preparing specific alloys on a large scale; determining high temperature thermodynamic properties of plutonium; and disassembling compounds for inspection and analysis.

Description of the process waste (physical form and typical content description):

Solid TRU waste from metal operation processes consists primarily of graphite and debris waste, including cellulosic, ceramic, plastic, rubber, metal, and glass debris. Typical debris items are rags, gloves (leaded and non-leaded), small tools, steel storage containers, magnesium oxide crucibles, HEPA filters, paper, cardboard, strain gauges, plastic items, and scrap stainless steel.

Solid TRU waste from reactor fuel development processes: tungsten carbide and hardened steel press dies, diamond or aluminum oxide grinding wheels, HEPA filters, rubber, wood, paper, rags, cardboard, glass vials, balances, steel and brass storage containers, ceramic, graphite, magnesium oxide crucibles, vacuum pumps, graphite trays, tungsten trays, molybdenum trays, thermocouples, heating elements, non-leaded gloves, and stainless and hardened steel balls.

Description of the waste-generating process:

The overall defense-related goal of the metal operation processes is to cast and machine plutonium metal. Reactor fuel development is also part of metal operation processes.

Process feed:

Plutonium metal or metal alloys and oxides, disassembled weapons components (pits), other actinide metals or metal alloys and oxides, reactor fuel pellets.

Radioisotopic content of the waste:

Variety of uranium and plutonium material types with different well-defined isotopic compositions; various radionuclides used as sources, including Am-241, Am-243, Ce-144, Cm-44, Pa-231, Np-237, Th-232, Th-232 enriched in Th-230, U-233, and depleted uranium. Am-41, Np-237, and U-234 may be present at detectable concentrations as decay products of their plutonium precursors.

RCRA Constituents/EPA Hazardous Waste Numbers:

- D004 (arsenic): P/S code PE (1984–1985 only)
- D007 (chromium): P/S code PCH
- D008 (lead materials): P/S codes BT and KBTF
- D008 (leaded gloves until May 1992): P/S codes BA, BC, CA, DA, DOP, IN, JA, MA, MW, PCH, PE, PF, PH, RL, UA, VD, WE
- D022 (chloroform): P/S code FF
- D035 (methyl ethyl ketone): P/S code MA
- D040 (trichloroethylene): P/S codes EL, FF, and MA (for MA, applies from 1979–1992 and from February 2000–present)
- F002: P/S code DA due to use of Freon TF
- F002: P/S code MA due to use of Freon TF and trichloroethylene
- F005: P/S code MA due to use of methyl ethyl ketone
- No K or P codes apply

Process waste volume (if known):

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are segregated into waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

Years of generation for the process waste: 1979–present

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY REPORT FOR METAL OPERATION PROCESSES AT TA-55

1.0 INTRODUCTION

All transuranic (TRU) waste must be sufficiently characterized and certified before it is shipped to the Waste Isolation Pilot Plant (WIPP). The U.S. Environmental Protection Agency (EPA) allows use of acceptable knowledge (AK) for waste characterization. EPA uses the term AK in its guidance document, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. Attachment B, Waste Analysis Plan, to the *Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088) (WIPP WAP) defines AK and provides guidelines on how AK should be obtained and documented.

This process AK summary report was prepared in accordance with *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5). The primary purpose of this report is to systematically organize, evaluate, and summarize detailed AK information about individual processes used by one of the TRU-waste generators at Los Alamos National Laboratory (LANL). By doing so, this report provides detailed technical support for one or more waste stream AK summary reports that include these process wastes.

2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS

The AK search for the information related to Technical Area (TA)-55 waste streams resulting from metal operation processes covered:

- Review of the *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3) (Sampling Plan) that includes information regarding all TRU waste streams
- Review of documents related to waste generation and waste management activities at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)
- Interviews with personnel involved with waste generation and waste management at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)

NOTE: Much of the AK information related to metal operations is contained in Transuranic Waste Characterization/Certification Project (TWCP) Record No. TWCP-3541. Individual documents in this record have been assigned a separate identifier, MET-nn, where nn is a sequential 1- or 2-digit number. This referencing nomenclature is used throughout this report and its attachments.

- Analyses of individual processes generating waste, and evaluations of the potential for Resource Conservation and Recovery Act (RCRA)-regulated constituents to be

present in the process wastes, based on subject matter expert (SME) interviews and any available data

The TWCP Records Management/Document Control (RMDC) Center contains copies of the documents referenced in this report. Any Unclassified Controlled Nuclear Information (UCNI) will be contained in these records, and will not be included in this report. Such records are identified as UCNI in the Acceptable Knowledge Roadmap (Attachment 1).

This process AK summary report is part of a set of closely related reports about TRU-waste generating activities at TA-55. For convenience in organizing AK for plutonium processing at this facility, the processes were categorized into six arbitrary operational areas. The multiple processes in each area are then described in detail in the following six process AK reports for plutonium:

- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003) [this report]
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004)
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005)
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006)
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007)

Each process AK report contains information on multiple individual processes that are assigned unique identifiers called process/status (P/S) codes. For example, metal operation processes include 48 individual processes that are each assigned a P/S code, as listed on the cover page of this report. The search and compilation of AK information was based on P/S code because that is the most detailed level of process information generally recorded in waste generation records. The process AK reports frequently cross-reference one another because P/S codes in one operational area often provide the material feed for P/S codes in another area. An index of P/S codes cited in this process AK report follows the list of acronyms; this index lists process descriptions and the primary process AK report in which that P/S code is discussed.

3.0 DESCRIPTION OF THE PROCESS WASTE

The following sections describe processes used in metal operation processing, and identify the resulting wastes as well as outputs that are sent to other operations, such as nitrate operations, for further processing.

3.1 Facility and Mission

The TA-55 Plutonium Facility (Building PF-4) recovers Pu from scrap and residues generated throughout the U.S. Department of Energy (DOE) defense complex, and processes it into pure plutonium oxide for conversion to metal and other products. A LANL site map and a detailed map of the buildings at TA-55, including Building PF-4, are shown in Attachment 2.

Most processes in metal operations were solely defense-related (TWCP-614, TWCP-4162). Exceptions are the majority of activities in the reactor-fuel fabrication program that was active from 1979 to 1997, and ongoing non-defense research and development (R&D) activities. However, wastes from various processes were not segregated by funding source, waste-generating process, or waste-generating location (e.g., room or glovebox) until recently (August 27, 1998), but rather were segregated and packaged based on waste type (TWCP-887, TWCP-4162, TWCP-4167). Consequently, a single waste container often contains wastes from multiple processes. Some debris waste was also co-mingled with room trash related to these same operations (both defense and non-defense), and was initially boxed as low-level waste (LLW). Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits (DLs) (TWCP-816).

3.2 Waste Physical Form and Waste Content Description

Wastes generated during metal operation processes consist primarily of debris wastes, and wastes entered into the cement fixation process or sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50, are covered by this process AK report. General debris waste consists of cellulosic materials (for example, paper, cloth), plastics, (for example, gloves, tape, labware), rubber, metal, and glass debris.

- Process waste from the reactor fuel development operations: tungsten carbide and hardened steel press dies; diamond or aluminum oxide grinding wheels; high-efficiency particulate air (HEPA) filters; rubber; wood; paper; rags; cardboard; glass vials; balances; steel and brass storage containers; ceramic, graphite, and magnesium oxide crucibles (crucible waste out of P/S code CN), vacuum pumps; graphite and molybdenum trays; thermocouples; non-lead gloves; and stainless and hardened steel balls.

- Process waste from on-going metal operations include rags, graphite, gloves (lead and non-lead), steel storage containers, graphite and tantalum crucibles, HEPA filters, paper, cardboard, plastic items, and scrap aluminum and stainless steel.
- Process waste from developmental metal operations include rags, gloves (lead and non-lead), HEPA filters, paper, cardboard, strain gauges, plastic items, and scrap stainless steel.

These debris items are contaminated with small amounts of radioactive and chemical substances from metal operation processes.

3.3 Waste Volume and Time Period of Waste Generation

This report covers waste streams generated from 1979, when metal operation processes first began, to the present. Wastes from the metal operation processes have different associated RCRA codes depending on the time period during which they were generated. The P/S codes, their time period of generation, and corresponding RCRA codes are shown graphically in Attachment 3, Time Lines.

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are assigned to waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

3.4 Waste Generation Processes

The following subsections describe the generation of waste by metal operation processes.

Manufacturing and research operations performed at TA-55 in the production of plutonium also generate plutonium-contaminated scrap and residues. The metal operation processes contribute to these scrap and residue wastes. These residues are processed to recover as much plutonium as is practical (TWCP-352). TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites. These recovery and manufacturing operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste generated at TA-55.

Detailed information about the TA-55 plutonium recovery processes can be found in *Waste from Plutonium Conversion and Scrap Recovery Operations* (TWCP-352). A full-block flow diagram for plutonium processing and waste management at TA-55 is given in reference TWCP-886.

Metal operation processes can be divided into three categories:

- Reactor fuel development processes (Section 3.4.1)
- On-going metal operation processes conducted since TA-55 began operations (Section 3.4.2)
- Developmental metal operations that were developed recently (Section 3.4.3)

Processes included in each of these three categories are described below.

Timelines for these processes are shown Attachment 3. A complete listing of P/S codes for metal operation processes, their descriptions, feed materials, and inputs and outputs is found in Attachment 4. A simplified process flow diagram for metal operations is found in Attachment 5.

3.4.1 Reactor Fuel Development (P/S codes CN, CO, CT, EL, FF, GI, ID, MOX, OB, OM, RS)

Procedures for reactor fuel development activities reviewed during the AK search did not have P/S codes assigned to them. However, SME input provided assignment of P/S codes to these procedures (references MET-1 through MET-38 and MET-59 [all in TWCP-3541]). The descriptions below are based on SME input, as indicated in the text and in Attachment 4.

Enriched uranium oxide, depleted uranium oxide, and/or Pu oxide feeds were blended and mixed with graphite and stearic acid. Stearic acid was used to keep the material from sticking during milling. The blended oxide was then pressed into briquettes. This operation was performed under P/S code OB. Small pieces of briquette and powder left after pressing were sent to the vault or to recovery.

The briquettes produced under P/S code OB were transferred to P/S code RS for carbothermic reduction. In this process the Pu or uranium oxide were reduced to the carbide form, resulting in the removal of most carbon and nearly all oxygen from the material, and in the decomposition of the stearic acid. The carbide briquettes were then transferred to P/S code CO.

A jaw crusher was used to reduce the size of the carbide briquettes in preparation for pulverizing in P/S code CO. The crushed material was mixed with 0.2 wt. % stearic acid and polyethylene glycol. A vibratory mill pulverized the crushed material to 325 mesh. Nickel powder at a concentration of 2000 ppm was added to the pulverized carbide as a sintering aid. This material was sent back to P/S code RS.

The carbide powder was pressed into pellets under P/S code RS. These pellets were then loaded into molybdenum trays. The trays were placed in a furnace at 450°C to burn off the stearic acid and polyethylene glycol. Small amounts of MolyKote were used for hand pressing of pellets. The pellets were sintered in an argon-hydrogen atmosphere at 1600°C. Sintered pellets were transferred to P/S code GI.

Pellets were inspected to meet specification (P/S code GI). Out-of-specification material was ground to specification with either diamond or aluminum oxide grinding wheels. A final inspection was performed on these pellets with a hand micrometer, which was later replaced by a laser micrometer. Those pellets that met final inspection specifications were transferred to P/S code EL. Those that did not were sent to the vault for recovery. Sample pellets were collected for chemical analysis (P/S code ACL), carbon-nitrogen-oxygen (C-N-O) analysis (P/S code CN), compatibility testing (P/S code CT), immersion density measurements (P/S code ID), metallographic inspection (P/S code ME), and/or determination of the oxygen to metal ratio (P/S code OM). (P/S codes ACL and ME are discussed in TWCP-AK-2.1-004,R.1.)

Fuel pellets were loaded into fuel elements under P/S code EL. Pellets were placed into "V" troughs made of 1-inch x 1-inch V-shaped stainless steel and aluminum for measurement of fuel pellet dimensions. After the dimensional analysis, the pellets were transferred into another glovebox through a one-inch port. Maintenance of a differential pressure between gloveboxes, with lower pressure in the glovebox where dimensional analysis was done, ensured the cleanliness of the glovebox in which the fuel cladding was added. The fuel pellets were transferred into the cladding glovebox through the port. Cladding tube was held in a lathe while the pellets were pushed into the cladding with a pushrod. A stainless steel shroud tube was placed in the cladding tube prior to insertion of the pellets. A spring and end cap were placed in the open end of the cladding tube, and a tungsten inert gas (TIG) weld was made at the joint between the end cap and the cladding. Cladding, spring, and end cap were stainless steel. Bonding of the fuel was done with either helium or sodium. Scrap sodium was dissolved in Dowanol 80.

A cleaning machine was used outside the glovebox for cleaning the different tubing prior to loading. The cleaning solution was ethanol, water, and a mild caustic or acid. Any waste generated from this operation would not be TRU waste. These operations took place in Room 124 from 1979 until 1994.

In February 1988, P/S codes CN, CO, CT, EL, GI, ID, OB, OM, and RS for reactor fuel development became P/S code FF, marking the change

from carbide fuels to nitride fuels. All processes under the old P/S codes should have remained the same under P/S code FF. Molybdenum equipment was replaced with tungsten equipment. No changes occurred in the chemicals used in the processes except for removal of the nickel sintering aid. Defense-related SP100 reactor fuel wastes were segregated from all other wastes.

From 1988 to 1989, P/S code MOX was set up to fabricate mixed oxide (MOX) fuel. Researchers from Hanford were the principal personnel involved in the work. Only a small amount of LANL waste was generated under this P/S code; the remainder was segregated as Hanford-generated waste. Zinc stearate was used as an anti-sticking agent during blending.

Starting in 1996 and continuing to the present time, LANL began work on MOX fuel under P/S code FF. As a result of the current effort in MOX fuel development, the issue of gallium removal became important. Early thermal gallium removal was the precursor to Thermally Induced Gallium Removal under P/S code TIGR (see section 3.4.3.11).

Some R&D efforts took place under P/S code FF. Microspherical fuel R&D was conducted mostly in a fumehood, not in a glovebox, and the waste generated from this operation would be low level. The microspherical fuels work involved the use of graphite, depleted uranium, sugar, surfactants, and ethylene glycol, which were mixed with water to form a slurry. This slurry was sprayed or injected into supercooled hexane or chloroform in order to form frozen microspheres. The microspheres were then freeze-dried before being introduced into a glovebox where they were sintered. Some of the depleted uranium microspheres were discarded in cemented waste.

Uranium residues and scrap from the reactor fuel development program had several disposal paths (MET-75/TWCP-3541). Most of the highly-enriched uranium nitride fuel went to the Y-12 Plant at Oak Ridge National Laboratory in Tennessee, and some remaining material in the TA-55 vault will also be sent there in the near future. However, the Y-12 Plant will not accept this material in the form of scrap or excess because of its Pu contamination, nor will the Y-12 Plant take depleted nitride pellets due to the low uranium enrichment. Consequently, those items have been oxidized and blended as necessary, canned, and stored in the vault. Depleted nitride material used for development was burned and discarded in a cement matrix. Earlier carbide fuels were sent to Savannah River Site for recovery. MOX material is being consolidated and packaged for shipment and recovery at the Savannah River Site.

Acetone was used outside the glovebox, and ethanol was used inside the glovebox. Trichloroethylene was used as a lubricant for an Isomet cut-off saw.

Waste materials generated from the reactor fuel development program included: tungsten carbide and hardened steel press dies; diamond or aluminum oxide grinding wheels; HEPA filters; rubber; wood; paper; rags; cardboard; glass vials; balances; steel and brass storage containers; ceramic, graphite, and magnesium oxide crucibles (crucible waste out of P/S code CN), vacuum pumps; graphite, tungsten and molybdenum trays; thermocouples; heating elements; non-lead gloves; and stainless and hardened steel balls.

3.4.2 On-Going Metal Operation Processes

3.4.2.1 P/S Code BA: Basement Isopress

The Autoclave Hot Isostatic Press (HIP) uses high pressure and high temperature (up to 1500°C) to increase the densities of parts (MET-48/TWCP-3541). R&D projects to bond materials and consolidate powders are also mentioned in the written procedure. In addition to Pu, other isotopes that may be used in the HIP include Am-241, Cm-244, Np-237, U-233, and Pu-242 as long as the material is placed in coupons. The process takes place in Room 38 East. Wastes include rags and paper from cleaning; tools; spent hydraulic fluid, silicone lubricant and isopropyl alcohol; and miscellaneous materials consisting of stainless steel, aluminum, titanium and firebrick.

3.4.2.2 P/S Code BC: Physical Properties

Measuring Physical Properties (MET-41, MET-64 [both in TWCP-3541]) is a procedure that describes techniques for the study of physical properties of alloys, including the structural, magnetic, electronic and metallurgical properties of actinide metals, alloys and compounds. A muffle furnace with an argon atmosphere is used for testing sample homogeneity or compatibility, and for temporary storage. Measurements include dilatometry (thermal expansion) and electrical resistivity. A Carver press is used to produce sample wires and pellets. The process takes place in Room 113, glovebox G187. Wastes include rags and paper from cleaning; glass, plastic, and metal labware; and discarded dies from the press.

3.4.2.3 P/S Code CA: Casting

The casting process receives Pu metal from pyrochemical operations under P/S codes RM or SS (described in TWCP-AK-2.1-006,R.1 and TWCP-AK-2.1-007 R.1, respectively) depending on material type, or from other sources such as P/S code SRL. The metal is combined with other metal from different sources to produce a product metal that meets purity specifications. Specification metal is then cast as a prealloyed feed aliquot at which time gallium metal is added, it is analyzed chemically in-line to determine the proper gallium content, and the metal is placed into in-line storage. Metal is pulled from in-line storage to cast into shapes. Casting is done by an induction furnace using tantalum crucibles and tantalum puller plugs. Molten Pu is poured into the graphite mold through a tantalum funnel. Casting is done under vacuum so that the Pu does not oxidize. The mold is allowed to cool at which time the cast shape is unmolded and sent to heat treatment to homogenize the Pu. After heat treatment, the parts undergo density determination using bromobenzene. Bromobenzene is volatile, and hence evaporates and is removed by the ventilation system. The cast shape undergoes a final heat treatment and density measurement. The finished cast parts are sent to machining (P/S code MA), or are placed in temporary in-line storage. Other parts produced by casting are transferred to P/S codes such as ITF and KBTF.

Chemical analysis is performed on rejected parts. If the rejected parts meet the chemical requirements, the parts are added to other metal in the metal blending step described above. Those parts that do not meet the chemical specifications are cast into ingots. These ingots are sent to P/S code RM or SS, depending on the material type, to be electrorefined.

Casting skulls, which are small amounts of Pu left on the furnace and crucible surfaces, are oxidized to plutonium oxide. The plutonium oxide easily brushes from the metal surfaces with a paintbrush, thus allowing the tantalum crucibles and funnels to be reused many times. In addition, scrap from the cast pre-alloyed feed aliquot and the casting step are roasted to oxide. This plutonium oxide is sent to aqueous recovery.

Graphite molds have always constituted the largest volume of waste from casting operations because these molds are used only once. R&D efforts are exploring the use of metal molds because they would be reusable, thereby reducing the amount of waste generated by casting operations. The used graphite molds sometimes undergo a scabbling process in which the graphite mold surfaces are removed so that residual plutonium can be dissolved from these fines. The graphite molds are discarded as waste under P/S code CA.

Other wastes generated by casting include the occasional discard of tantalum crucibles and funnels, tools, rags, gloves (leaded), gaskets, and small amounts of plastics and glass. All these items would be discarded under P/S code CA.

Bromobenzene and Freon TF are the only chemicals used in casting. Freon TF is used infrequently to clean the furnace and tantalum parts. The Freon-cleaned parts are air-dried.

Roadmap references for casting are MET-45, MET-62, and MET-66 (all in TWCP-3541).

3.4.2.4 P/S Code MA: Machining

Machining involves a variety of operations on cast parts obtained from P/S code CA. Machining operations include turning, milling, grinding, and boring. The objective of the machining operations is to bring the parts to their final dimensional specifications.

Chemicals used in the past as coolants during machining include Tap Magic (which contains 1,1,1 trichloroethane) and Freon TF. Tap Magic use was discontinued in 1992, and Freon TF use was discontinued in 1995 because it was an inferior coolant for Pu due to the nature of machining this metal. Processes within machining have used dry machining techniques since 1992. When cooling is required, SF-2I is used. This coolant is quite volatile and simply evaporates during use. Texaco Regal 32 is used as a cutting oil for the final cut on a part because of the superior finish it gives to the final cut. Although Tap Magic contains 1,1,1 trichloroethane, the RCRA F002 listing does not apply in this case because the chemical was used as a coolant, and not as a solvent.

Cleaning solvents were used in machining operations in the past, and still are occasionally used, although with less-

hazardous substitutes. Methyl ethyl ketone (MEK) (RCRA-listed as D035 and F005) was used. Metalprep 79 was a phosphoric acid-based metal cleaner used until about 1992 when it was replaced by a metal cleaner derived from citrus fruit. This cleaner met with only limited success and is no longer used. Freon TF is used to remove oil from turnings before they are sent to recovery. For final cleaning, trichloroethylene was used from 1979 until 1992, when it was replaced by the use of ethanol or isopropanol until February 2000. Since February 2000, trichloroethylene has been used to clean parts at the assembly stage. Cellulosic wastes generated as a result of assembly operations under P/S code MA would carry F002 from 1979 to 1992 and again during March 2000, as well as D035 throughout its period of operation (in the absence of information about the extent of use of MEK).

Ultrasonic Pit Inspection is a physical inspection process performed during machining and uses no chemicals. The process takes place in Room 319. The written procedure did not include a process flow diagram.

Roadmap references for machining are MET-42, MET-62, MET-67, MET-68, and MET-76 (all in TWCP-3541).

Wastes generated from machining operations include rags, gloves, small amounts of plastics and other metals, routine glovebox maintenance items, tools, grinding wheels, and cutters. Cellulosic, plastic and rubber wastes generated under P/S code MA would be conservatively assigned the F002 and F005 hazardous waste codes because of the historical and continuing use of F-listed solvents. This code would not apply to glass or metal debris because the non-porous surfaces of these materials would not absorb any fluid.

3.4.2.5 P/S Codes MW: Metal Working, PD: Pit Disassembly, and SRL: Special Recovery Line

Pit disassembly is conducted under P/S codes MA, MW, PD, and SRL, depending on whether the pit is contaminated with tritium (MET-42, MET-51, MET-52, MET-53, MET-62 [all in TWCP-3541]). The procedures describe separation and sampling of pit assemblies using milling, turning and grinding techniques. The process takes place in Rooms 305, 308, 309 and 319.

Pits are received and monitored for tritium. If no tritium is detected or is below a specified activity, the pit is placed in GB 386 where it is cut in half, and its components are separated and decontaminated of slight tritium contamination. Care is taken not to mix non-special nuclear material metals with the special nuclear material (SNM) metals. The non-SNM metals are discarded as waste. Uranium and Pu shells are decontaminated of minor surface contamination. Uranium shells are sent to the vault. Pu shells are sent to the vault or to P/S codes CA, MA, or SS. P/S code SS is discussed in TWCP-AK-2.1-006,R.1.

Tritium is recovered in the Special Recovery Line (P/S code SRL) if tritium is above a specified activity. Separation of pit components is done using a special abrasive cut-off wheel. The pit is cut in half, and the shells are cleaned with copper wool and Freon TF. Scrap is sent to recovery or to waste management depending on whether the material is SNM or not. After the shells are cleaned with the copper wool and Freon TF, they are placed in an ultrasonic bath for cleaning using product SF-2I. Tritium-contaminated water is collected and poured over zeolites for disposal.

Small-scale decontamination of tritium-contaminated Pu and other SNM is done in the SRL furnace. The SRL furnace area consists of different sections, including metal handling, tritium removal furnace, equipment for collecting tritium liberated in furnace, and effluent treatment system. The procedure that describes the operation of the furnace and furnace gas treatment system contains no details on disposition of output materials, or post-run cleaning operations.

Wastes generated from pit disassembly operations include rags and paper from cleaning, glass and rubber labware, hand tools and aluminum foil, cutting wheels, milling machine cutters, and lathe cutting tools. Tritium-contaminated trash is generated in the form of copper wool and rags.

3.4.2.6 P/S Code PCH: Plasma Chemical Reactor

Plasma etching of samples is conducted in a 20-liter vacuum chamber into which up to four process gases are dynamically pumped (MET-40/TWCP-3541). The gases are tetrafluoromethane, hexafluoroethane, perfluoropropane, oxygen, argon and carbon dioxide. Two electrodes are in the

chamber: (1) an upper power electrode through which reactant gas enters, and (2) a lower substrate electrode where the sample is placed. A plasma of the gases is formed through ionization and disassociation of the gases. The process takes place in Room 114, glovebox GB111, and in Room 319, in hood XB305. Wastes include rags and paper from cleaning; glass, plastic and metal labware; used pump oil (Fomblin brand, contains perfluoropolyether); discarded test samples such as tantalum foil, tungsten foil, tungsten-coated silicon, silicon dioxide; and various actinide surfaces. No RCRA-regulated materials are used. Gases are consumed in the plasma. RCRA code D007 (chromium) is assigned to solid wastes generated under P/S code PCH.

3.4.2.7 P/S Code PH: Thermal Hydride/Dehydride

a. Pu Hydriding System

The Pu hydriding process studies the reactions of Pu alloys and other actinides with hydrogen and other gases (MET-43/TWCP-3541). The process takes place in Room 114, glovebox 110, and uses no chemicals other than the gases. Wastes include debris wastes, not RCRA-regulated, but the types of wastes are not mentioned in the procedure.

b. Operating the Hydride-Dehydride Systems

The hydride-dehydride operating procedure describes how to safely form Pu hydride, and then to decompose it to Pu metal (MET-44/TWCP-3541). Three phases are involved: (1) phase one uses hydrogen gas in large amounts and dehydriding is done in a separate reactor, and (2) phases two and three use a closed loop, minimal hydrogen gas, and a single reactor. The process takes place in Room 114, GB 116, GB 119 and GB 154. No chemicals are used besides the gases. Wastes produced are debris wastes, not RCRA-regulated, including rags and paper from cleaning, used Fromblin pump oil and tools.

3.4.2.8 P/S Code WE: Welding

Welding operations under P/S code WE fall into two categories: encapsulation of radioactive isotopes (MET-39/TWCP-3541) and other welding operations

(MET-69/TWCP-3541). Two methods of welding are employed: a gas tungsten arc welder (GTAW) and an electron beam (EB) welder. Encapsulation of radioactive isotopes involves placing the isotope to be sealed into a stainless steel capsule and subsequently welding the capsule closed. The exterior of the capsule is cleaned with Freon TF. The Freon TF is allowed to evaporate, hence no wiping of the capsule surface with rags is required. Other welding operations include welding of Pu samples on vanadium in an argon atmosphere, brazing gold to repair platinum frits, welding titanium to repair titanium boats, and welding of aluminum. No welding of lead occurs. Welding outside of the glovebox line is also done under this P/S code. Waste generated under P/S code WE includes hand tools, spent welding rods, stainless steel capsules, rags, and glovebox maintenance items.

Other P/S codes included in the Ongoing Metal Operations are covered below; however, no written procedures were found for them, and descriptions are based solely on SME information.

3.4.2.9 P/S Code DA: Alloy Development

This process was for the development of Pu alloys (MET-55/TWCP-3541). Pu metal was placed in metal cups onto which the alloying metal was coated on the cup walls. The alloys were melted in the metal cups. The melt was allowed to cool. Observations were made on the success of the alloying process. If the alloy reacted with the cup, it was sent to aqueous recovery. If not, it could either be sent back to casting (P/S code CA) or possibly to electrorefining (P/S code ER or SS), depending on the circumstances. Bromobenzene was used for density measurements. Freon was used to clean parts prior to 1992, making cellulosic, rubber, and plastic debris from this process F002-listed waste during that time period. No RCRA-listed metals were used to produce the alloys. Outputs of P/S code DA would go to P/S codes CA, SS (ER, prior to SS), or aqueous recovery. Waste would include rags, gloves, metal cups, and other general glovebox maintenance items.

3.4.2.10 P/S Code DOP: Detector Oxide Preparation

This operation involved preparation of radionuclide detector packages. No RCRA-listed chemicals were used in this

operation, although leaded gloves were probably discarded under this P/S code (MET-71, MET-72/TWCP-3541).

3.4.2.11 P/S Code DT: John Ward R&D

This P/S code was used in a nonprocessing area, and only generated routine TRU glovebox waste.

3.4.2.12 P/S Code EM: Electron Microscopy.

No written procedures were found for this process, and the SMEs associated with the process have either retired or left the laboratory.

3.4.2.13 P/S Code HG: Pu Removal by Mercury

Only “cold” work was done under this P/S code so no TRU waste would be generated from it (MET-62/TWCP-3541).

3.4.2.14 P/S Code IN: Inspection

This code applies to the physical inspection of parts for dimensionality (MET-69/TWCP-3541), which only generates routine glove box maintenance waste items.

3.4.2.15 P/S Code ITF and ITF4: Impact Test Facility

ITF4 is an old designation for this process. There is a 7-inch gas gun and a 40-mm powder gun used in this test facility (MET-58/TWCP-3541). The 7-inch gun is used for Pu-238 experiments, such as heat source impact testing and impact testing of Pu-238 capsules in graphite blocks. The entire test is conducted in a tube so that the material is contained. The entire tube with contents is transferred back to Nuclear Material Technology (NMT)-9 for recovery. No TRU waste is generated from the 7-inch gun experiments.

The 40-mm gun enables the experimenter to generate data on materials in high stress environments. During the test, a projectile propelled to hyper-velocity by a charge of smokeless powder, strikes an instrumented target contained within a glovebox. The target is shattered into macro and microscopic pieces during the impact and the projectile is arrested by a series of stopping plates. Target materials can range from surrogate materials to actinides. Post test, the remains of the target material, projectile, instrumentation,

and stopping plates are removed as waste or reused. Materials are segregated to minimize generation of mixed wastes and to recover actinides for reuse. The barrel, breech and other operating parts are cleaned using rags and GoJo cleaner. Since the launcher is contained within a glovebox, materials removed are possibly contaminated with actinides. MET-70/TWCP-3541 has a more complete description of the process and of the wastes generated.

Wastes generated from this operation include rags, metals, wire, HEPA filters, and gloves. GoJo cleaner is a high-purity kerosene derivative.

3.4.2.16 P/S Code JA: Gas Isostatic Press

This process is similar to P/S code BA except that it takes place in a glovebox, samples are not heated, and air is the medium used to pressurize the press instead of hydraulic oil (MET-64, MET-69 [both in TWCP-3541]). No RCRA-listed chemicals were used in this process. Only rags and glovebox maintenance items were generated. This process was active from 1979 to 1997 or 1998.

3.4.2.17 P/S Code PE: Sputtering Process

From 1982 to 1990, this process sputtered various metals onto Pu and vice versa (MET-54/TWCP-3541). The only RCRA-listed metal used was arsenic (D004) for a short duration in 1984 to 1985. Other metals recalled by the SME were gold and lutetium. No solvents were used in this process.

3.4.2.18 P/S Code PF: Pu Surfaces

Starting in 1983 and continuing to the present, various physical and spectroscopic methods are used to characterize Pu surfaces (MET-64/TWCP-3541). Freon TF and SF2I are used outside the glovebox line as cutting fluids. An alcohol is used, but the SME could not recall which type.

3.4.2.19 P/S Code RL: Radiochemical Coating

Based on SME input, this process is similar to P/S code PE (MET-65/TWCP-3541). Metals were coated onto Pu. Metals used by this SME were gold and lutetium. No solvents were used.

3.4.2.20 P/S Code UA: Uranium Fabrication

Two activities are covered by this P/S code—pit disassembly and detector fabrication (MET-69/ TWCP-3541). Uranium shells removed during pit disassembly are accounted for under P/S code UA. Pu operations that are identical during pit disassembly to the uranium operation are covered under P/S codes IN, MW and SRL. Detector packages using uranium-233 were fabricated under P/S code UA, generating the same types of wastes as were generated by detector package fabrication under P/S code WE. This P/S code may contain leaded gloves; however, no lead chemicals were used. P/S code UA generates the same wastes as do P/S codes IN, MW and SRL.

3.4.2.21 P/S Code VD: Vapor Degreaser & Sand Blasting

Sand blasting is a “cold” operation. The vapor degreaser operation cleans parts in an ultrasonic bath using Freon (MET-69/TWCP-3541). The operation accepts parts from P/S codes CA, PE and PF. The parts are placed in the ultrasonic bath, cleaned, and allowed to air dry. Over time, the Freon evaporates from the bath. Wastes include rags and general glovebox maintenance items.

3.4.3 Developmental Metal Operations

3.4.3.1 P/S Code ARI: ARIES

The Advanced Recovery and Integrated Extraction System (ARIES) is a demonstration process which receives and disassembles pits, Pu hydrides and metallic Pu, from which it produces Pu metal or oxide powder (MET-49/TWCP-3541). The product is canned for long term storage. Wastes include Pu-contaminated debris waste. Wastes also come from the electrolytic decontamination module. No RCRA-regulated waste is produced.

Operation of the ARIES Electrolytic Can Decontamination System (MET-50/TWCP-3541) decontaminates the external surfaces of canned Pu using an electrolytic decontamination system. An electrolyte (initially sodium nitrate, now sodium sulfate) and water are used in the system in a recycle mode. Sodium hydroxide is used for pH control. Wastes include electrolyte and water solutions contaminated with Pu. There is the potential for chromium to be present in the electrolyte

solution waste when this solution has been used to decontaminate stainless steel. No disposal path is mentioned.

Other P/S codes included in the Developmental Metal Operations group but for which no procedures were found during this AK search are listed below. SME input provided information on these P/S codes.

3.4.3.2 P/S Code AO: Assembly Operations

Operations in P/S code AO involve bringing nuclear material out of the glovebox and encapsulating it in a cold container (MET-69, MET-74/TWCP-3541). This outer container can be a bolted assembly or a welded assembly using electron beam, PIGMA, TIG or laser welding techniques. No solvents are used. Wastes include aluminum foil, plastic bags, and gloves. This waste is nearly always LLW.

3.4.3.3 P/S Code BT: Burst Testing

Hemi-shells are placed on a test stand and a buffered test solution is pumped into the shell and pressurized until it bursts (MET-58/TWCP-3541). Strain gauges monitor the deformation of the shell. The test solution is sodium tetraborate and sodium hydroxide and is filtered and reused. The solution is eventually discarded in the caustic waste line to the RLWTF at TA-50.

Wastes include rags, HEPA filters, gloves, electric lead wires, and strain gauges. Strain gauges have electrical contact points that are tin-lead solder. Metal waste from this P/S code would, therefore, carry the D008 code. No solvents are used.

3.4.3.4 P/S Code ELW: Experimental Laser Welding

Laser welding and brazing is performed at TA-55 on a variety of materials, ranging from stainless steel to SNM materials (MET-60/TWCP-3541). It is performed in one of three high-purity argon gloveboxes located in PF-4. A 1-kW, pulsed Nd:YAG laser energy beam is delivered into the glovebox environment through an optical fiber. Computerized numerical control motion systems and rotary motion systems manipulate the relative position of the laser with respect to a weld joint. Laser melting and subsequent solidification is used to join the components being fabricated. No RCRA constituents are used in this process.

3.4.3.5 P/S Code EVAC: Evacuation and Bake Out

Only LLW is generated under this P/S code (MET-69, MET-74/TWCP-3541).

3.4.3.6 P/S Code FSPF: Special Furnace Operations

This process involves heating samples in a controlled environment (MET-57, MET-64/TWCP-3541). The furnace is controlled by a computer, and is capable of being evacuated by a cryo-pump during the heating. There is a neutron detector that can be used during heating. The furnace is large enough to do full-size tests, and can also be used to heat-treat samples. Although no chemicals are used, waste is created by compatibility and weld testing, mostly in the form of contaminated scrap metals, ceramics, glass, and plastic.

3.4.3.7 P/S Code KBTF: Kolsky Bar Test Facility

The KBTF is a gas gun operation for physical property testing (MET-58/TWCP-3541). A stainless steel bar with plastic seals at each end is fired by gas pressure down a stainless steel barrel that strikes a target, usually Pu. Behind the target is another stainless steel bar instrumented with sensors. This bar is butted against a plastic wrapped lead brick at the back of the chamber. The facility started operation in December 1997 and has had 40 shots fired thus far.

Wastes include rags, HEPA filters, and gloves. The rags may contain some lead/lead oxide from cleaning operations; hence, wastes from this operation are assigned the RCRA code D008. The barrel is cleaned with a cotton swab. No solvents are used.

3.4.3.8 P/S Code MBC: Crystal

This process studied the work hardening of Pu (MET-63/TWCP-3541). Pu metal samples were placed in a Carver press and subjected to high pressure. The Carver press developed a leak and was discarded. No RCRA-listed constituents were used in this operation. Rags and routine glovebox maintenance items are typical wastes generated under this P/S code.

3.4.3.9 P/S Code PIG: Welding

This operation uses aluminum to weld beryllium (MET-61/TWCP-3541). No other metals have been used. Ethanol is the only chemical used in this operation.

3.4.3.10 P/S Code RAP and RAP2: Research Alloy Preparation

No activity has occurred in these P/S codes (MET-64/TWCP-3541).

3.4.3.11 P/S Code TIGR: Thermally Induced Gallium Removal

The process involves passing argon—6 percent hydrogen gas over PuO_2 — Ga_2O_3 powder at 600°C to 1200°C to produce Ga_2O and H_2O . Ga_2O is evolved from the powder and condenses on a cold spiral condenser downstream. The Ga_2O is eventually converted to Ga_2O_3 upon exposure to glovebox atmosphere (MET-56/TWCP-3541). No RCRA constituents are used in this process.

3.4.3.12 P/S Code WLT: Welding Leak Test

This operation performs the leak detection of containers back-filled with gas to allow storage of Pu metal in gloveboxes without reaction with atmospheric contaminants (MET-74/TWCP-3541). No solvents are used. Because items under P/S code WLT are in the glovebox line, they become TRU waste when discarded. These items consist of plastic rags and bags, cotton gloves, and a minimal quantity of metal including Swagelok fittings.

3.5 Material Inputs to the Waste Generation Processes

Attachment 4 lists P/S codes for metal operation processes at TA-55, including process descriptions, feed material, other process inputs, process outputs, and type of waste. The feed materials for metal operation processes consist of the general types of materials listed in Table 1 that are obtained from the storage vault, as process output from other P/S codes, or from sources outside TA-55, including other DOE sites:

The remainder of this section summarizes the nature of the process waste in terms of its physical, chemical and radioisotopic characteristics.

Table 1. Process Feed Materials for Metal Operation Processes

Feed Material	RCRA-Regulated Substances	P/S Codes in Metal Operation Processes
Disassembled weapons components (pit disassembly)	High-purity Pu and U material types	ARI, CA, PH, SRL
Pu metal or metal alloys	High purity, no RCRA-regulated substances, unless noted otherwise	AO, ARI, BC, BT, CA, DA, ELW, EVAC, FSPF, ITF, ITF4, JA, KBTF, MA, MBC, MW, PCH (variable purity), PD, PE, PF, PH, RL, SRL, VD, WE, WLT
Pu and other radionuclides, as oxides	High purity, no RCRA-regulated substances	DOP
Reactor fuel pellets	High purity Pu and U material types, no RCRA-regulated substances	FF, MOX, OB

3.5.1 Physical Waste Form Identification

Waste from metal operation processes primarily consists of debris waste, including cellulosic materials, plastics, rubber, metal debris, glass debris, and graphite. Some waste is immobilized in cement and discarded under P/S codes CF or HP (discussed in TWCP-AK-2.1-005,R.1). Process waste from reactor fuel development processes include tungsten carbide and hardened steel press dies, diamond or aluminum oxide grinding wheels, HEPA filters, rubber, wood, paper, rags, cardboard, glass vials, balances, steel and brass storage containers, ceramic, graphite, and magnesium oxide crucibles, vacuum pumps, graphite and molybdenum trays, thermocouples, non-leaded gloves, and stainless and hardened steel balls. Process waste from other metal operations include rags, graphite, gloves (leaded and non-leaded), steel storage containers, graphite and tantalum crucibles, HEPA filters, paper, cardboard, strain gauges, plastic items, and scrap stainless steel.

Leaded gloves are also a standard waste item generated by metal operation processes. Prior to May 1992, leaded gloves were disposed as metal debris but were not otherwise segregated from other metal wastes. Since that time, they have been routinely segregated from other metal debris waste and assigned the RCRA code D008.

Because items from several different processes are usually combined into individual waste drums, the physical waste form of each drum must be determined independently. This information is documented on a

Waste Origination and Disposition Form (WODF) by the waste generator according to controlled procedures. The P/S code for each waste item is also documented on this form. In the packaging process, a standard form, the Discardable Waste Log Sheet (DWLS), was used to list each item ID number and record its matrix material. This form was signed by the waste packager, reviewed, and approved by quality assurance (QA) personnel.

3.5.2 Radionuclide Content Identification

The primary Pu material type inputs for metal operation processes at TA-55 are listed in Table 2. The designation *material type* (MT) (e.g., MT 52) is used within the DOE Complex to describe the isotopic composition of common blends of radioactive materials used within the Complex. The material type notation was developed because it is a convenient way to describe material types that have very consistent isotopic compositions. Table 2 indicates the isotopic composition of the material types at the time the waste was characterized.

The material type provides the basis for estimating an upper bound for U-234, U-235, and Am-241 contents based on the rate of decay of their precursors, Pu-238, Pu-239 and Pu-241, respectively. The results of these calculations are also tabulated in Table 2, assuming (a) none of these isotopes were initially present in the material, (b) the oldest Pu material in inventory dates back to 1 January 1960, and (c) the waste was packaged on 1 January 1996, making it 36 years old (TWCP-698).

The primary uranium material type inputs for reactor fuel development activities and for pit disassembly at TA-55 are listed in Table 3.

Metal operation processes primarily receive feed material from other P/S codes, particularly P/S code SS (TWCP-AK-2.1-006,R.1) and RM (TWCP-AK-2.1-007,R.1), and are not expected to alter the isotopic ratios of the feed material. The material type used in the process generating each waste item was documented on the WODF and DWLS. Many P/S codes processed feed material in which radionuclides other than Pu were present in significant levels (Attachment 4):

- Depleted or enriched uranium metal or oxides were the process feed materials for P/S codes CN, FF, GI, MW, OB, PD, RS, SRL, and UA. Of these codes, FF, PD, and SRL are still active.
- P/S code WE worked with radionuclides used as sources from 1978 to the present (Am-241, Am-243, Ce-144, Cm-244, depleted uranium, Pa-231, Np-237, Th-232, Th-232 enriched in Th-230) (TWCP-882).

Table 2. Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %)

Material Type (MT)	Pu isotope and half-life						Upper limits for weight ratios		
	Pu-238 (87.74 yr)	Pu-239 (24120 yr)	Pu-240 (6564 yr)	Pu-241 (14.35 yr)	Pu-242 (376,300 yr)	Pu-244 (8.26 x 10 ⁷ yr)	U-234/ Total Pu	U-235/ Total Pu	Am-241/ Total Pu
MT 51	0.006	96.77	3.13	0.076	0.018	—	1 x 10 ⁻⁵	0.001	0.0006
MT 52	0.01	93.78	6	0.2	0.02	—	2 x 10 ⁻⁵	0.001	0.002
MT 53	0.03	91.08	8.45	0.366	0.071	—	7 x 10 ⁻⁵	0.0009	0.003
MT 54	0.046	87.42	11.5	0.81	0.22	—	0.0001	0.0009	0.007
MT 55	0.06	83.88	14.73	1.03	0.304	—	0.0002	0.0009	0.009
MT 56	0.061	81.9	16.51	1.18	0.355	—	0.0002	0.0009	0.01
MT 57	0.433	74.63	20.7	2.55	1.69	—	0.001	0.0008	0.02
MT 42									
84%	1.02	1.37	10.32	3.13	84.14	0.02	0.003	1 x 10 ⁻⁵	0.03
90%	0.72	1.26	6.4	1.86	89.77	—	0.002	1 x 10 ⁻⁵	0.02
95%	0.45	0.56	2.47	0.906	95.58	0.029	0.001	6 x 10 ⁻⁶	0.008
MT 83									
83%	83.89	13.8	1.9	0.32	0.09	—	0.26	0.0002	0.003
89%	89.26	10.07	0.633	0.021	0.015	—	0.28	0.0001	0.0002

Source: TWCP-698

Table 3. Average Isotopic Content of Uranium Material Types and Enrichments (Weight %)

Material Type	U-234	U-235	U-236	U-238
MT 12	0.0015	0.23	0.008	99.77
MT 35	0.36	37.6	0.14	61.9
MT 36	0.63	62.44	0.18	36.75
MT 38	1.03	93.04	0.41	5.53
MT 39	1.32	97.52	0.17	0.99

Source: TWCP-698

- P/S codes BC and JA worked with Am-243 (1992 to present), depleted uranium (1990 to present), Np-237 (1983 to present), Pa-231 (1989), and Th-232 enriched in Th-230 (1994 to present). (P/S code JA ended in 1997 or 1998; BC is still active.)
- P/S code DOP worked with Am, Ce-144, Cm-244, Np-237, Th-232, U-233.
- P/S code BA worked with various radionuclides (unspecified).

In some cases, SME information has identified several P/S codes in which secondary radionuclides are expected to be present in process wastes, in addition to the cases listed above (TWCP-698):

- Some of the process wastes from P/S codes CA and MA contain Am-241, Am-243 and Np-237 during the period 1984 to 1990.
- Some of the process wastes from P/S code PH contains Am-243 (1993 to present).

Np-237, the decay product of Am-241 (half-life, 458 yr), is expected to be present mostly in minor amounts in nearly all debris waste from metal operation processes at TA-55, with the exceptions as noted above.

In general, uranium and its isotopes are expected to be present only at trace levels, if at all, if the feed material did not purposefully contain uranium. If the waste generator indicates that only Pu is present in the feed material, then U-236 and U-238 are not expected to be present in measurable concentrations. U-235 ingrowth from the decay of Pu-239 (half-life, 24,120 years) would be negligible due to the long half-life of Pu-239. On the other hand, U-234 would be present in MT 83 (and to a lesser extent in other Pu material types) as a decay product of Pu-238 (half-life, 87.74 years) (Table 2). After 20 years, 14.6 percent of the initial Pu-238 would have decayed to uranium-234. For MT 83 with an initial content of 83.89 percent Pu-238, the atomic ratio U-234 to total Pu would be about 0.14. After 36 years, this ratio would increase to 0.26.

During TWCP characterization, the contents of each waste package undergo non-destructive analysis to provide detailed radioisotopic data. These data will be used to evaluate the accuracy of AK information in accordance with *Waste Characterization Data Reconciliation with Acceptable Knowledge* (TWCP-DTP-1.2-064). If warranted, this AK report will be updated to incorporate the results of these comparisons.

3.5.3 Chemical Content Identification

Chemical inputs to metal operation processes are listed in Table 4.

4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS

The assignment of EPA hazardous waste numbers, or RCRA codes, to process wastes from metal operations is summarized below, as well as on the process timelines in Attachment 3, and the table of process inputs and outputs in Attachment 4. These assignments take into account the possible presence of RCRA chemicals in process waste as a result of their suspected or known presence in feed materials, chemical inputs, equipment, and glovebox surfaces.

4.1 F, K, and P Listings

The following F listings only apply to cellulosic, ceramic, plastic, and rubber items. The F listings do not apply to glass or metal debris, even if these items were in contact with the F-listed chemicals, because their non-porous surfaces do not absorb liquids or gases.

- F002 applies to wastes generated under P/S code DA because Freon TF was occasionally used in this process.
- F002 applies to wastes generated under P/S Code MA due to the use of trichloroethylene and Freon TF. Trichloroethylene was used as a cleaning solvent until 1992, resuming again in March 2000. Freon TF has been used as a cleaning solvent since 1979 and is still used.
- F005 applies to waste generated under P/S code MA due to the use of methyl ethyl ketone.

No K or P listings apply to solid wastes generated from any of the metal operation processes because no K-listed or P-listed chemicals were present in the feed materials, chemicals or equipment used in these processes.

4.2 Toxicity Listings

No D001 (ignitable), D002 (corrosive), or D003 (reactive listings apply to the solid wastes from metal operation processes because no ignitable chemicals were used in these processes and because the solid wastes do not contain any free liquids (see Section 6.0).

D004 applies to P/S code PE, in which arsenic was used in 1984 and perhaps into 1985 (MET-54/TWCP-3541).

Table 4. Chemical Inputs to Processes Described in This Report

Chemical Input	P/S Codes in which RCRA-Listed Chemical Is Used	Comments on Applicability of RCRA Listings
Gases		
Carbon dioxide gas		
Hexafluoroethane gas	PCH	F-listing does not apply. These fluorinated hydrocarbons are not used as solvents or degreasers and are totally consumed in P/S code PCH. Also, gas cylinders are outside gloveboxes.
Perfluoropropane gas	PCH	
Tetrafluoromethane gas	PCH	
Bases		
Potassium hydroxide	NA	D002 (strong base) does not apply because there are no free liquids in the solid wastes from these processes.
Sodium hydroxide		
Inorganic Chemicals		
Graphite Magnesium perchlorate Silicone lubricant Sodium nitrate Sodium sulfate Sodium tetraborate Uranium nitride, depleted	FF	D003 does not apply in this case. Although uranium nitride is pyrophoric, its disposal in an oxic environment eliminates this characteristic because it is converted to uranium oxide
Uranium oxide, depleted Zinc stearate Zirconium carbide		
Metals		
Arsenic metal	PE	D004 applies to P/S code PE; used between 1984 to 1985
Copper wool		
Gold metal		D008 applies to P/S codes WE and KBTF
Lead metal	WE, KBTF	
Lutetium metal		
Nickel powder, Nickel ribbles		D003 does not apply because excess Na is dissolved in Dowanol 80 D006 does not apply. No potential to leach chromium because stainless steel is not exposed to strong acids in P/S code WE D008 applies to P/S codes BT and WE
Niobium + 1% zirconium metal (as sheet)		
Sodium metal	EL	
Stainless steel	WE	
Tin-lead solder	BT, WE	
Titanium		
Uranium metal powder, depleted		
Vanadium metal		
Organic Chemicals		
3-in-1 Household Oil	FF, MOX	F003 does not apply because acetone was only used outside the glovebox and hence is not in the TRU process waste D001 does not apply because there are no free liquids in solid waste
Acetone		
Bromobenzene		

Chemical Input	P/S Codes in which RCRA-Listed Chemical Is Used	Comments on Applicability of RCRA Listings
<p>Chloroform</p> <p>Dow Corning 2000 Oil Dowanol 80 (long-chain alcohol)</p> <p>Ethanol Ethylene glycol Fantastic Freon TF</p> <p>Fomblin pump oil (contains perfluoropolyether)</p> <p>GoJo cleaner (kerosene derivative)</p> <p>Hexane Isopropanol Metalprep 79 (phosphoric acid-based metal cleaner)</p> <p>Methanol Methyl ethyl ketone MolyKote Nuetracleaner #1 Nuetracleaner #2 Polyethylene glycol SF-2I (as coolant) Stearic acid Sugar Surfactants</p> <p>Tap Magic (contains 1,1,1 trichloroethane)</p> <p>Tetrachloroethane</p> <p>Texaco Regal 32 oil (cutting oil)</p> <p>Trichloroethylene</p> <p>Vactra Oil Windex</p>	<p>FF</p> <p>CA, DA, MA, MW, PD, PF, SRL, UA, VD, WE</p> <p>MA</p> <p>MA</p> <p>EL, FF, MA</p>	<p>D022 applies to P/S code FF although concentrations are expected to be below RCRA threshold because freeze-drying should have removed most, if not all, of the residual chloroform before the microspheres were taken into the glovebox for sintering.</p> <p>D001 does not apply to ethanol; no free liquids in this waste</p> <p>F002 applies to P/S codes DA and MA. In P/S code PF, F002 does not apply because Freon TF is used as a coolant for a cutting saw. In other P/S codes, Freon TF is used as a solvent to clean metal parts, but the parts are routinely air-dried to avoid the need for cellulosic wipes, and F002 does not apply.</p> <p>D001 does not apply; no free liquids in this waste D001 does not apply; no free liquids in this waste</p> <p>F003 does not apply because methanol is only used outside glovebox. F005 and D035 apply to P/S code MA</p> <p>F002 does not apply because Tap Magic is used as a metal cutting fluid or coolant, not as a solvent. Its use was discontinued in 1992. No codes apply. Although tetrachloroethane is listed on the chemical inventory for metal operations, it was never used in glovebox operations</p> <p>D040 applies to P/S codes EL, FF, and MA. F002 applies to P/S code MA, in which trichloroethylene was used during final cleaning of metal parts from 1979 to 1992, resuming again in February 2000. F002 does not apply to EL or FF, in which trichloroethylene was used as a lubricant for a cutting saw, not as a solvent.</p>

D008 applies to metal debris from P/S codes codes BA, BC, CA, DA, DOP, IN, JA, MA, MW, PCH, PE, PF, PH, RL, UA, VD, WE until May 1992, when leaded gloves began to be routinely segregated from other metal debris waste (TWCP-4166). Prior to May 1992, leaded gloves were disposed as metal debris waste (not otherwise segregated) under the originating P/S code. However, if leaded gloves were not present in a waste container of metal debris during this period of time, then D008 would not need to be assigned to it because no other source of lead would be present. After May 1992, D008 applies only to the leaded-glove waste stream rather than to each P/S code process in which such gloves were used.

D008 applies to metal waste generated under P/S code BT due to the use of tin-lead solder connections on the strain gauges used in this series of experiments (MET-58/TWCP-3541).

D008 applies to P/S code KBTF, in which a plastic-wrapped lead brick is used as a damper at the rear end of the test chamber (MET-58/TWCP-3541). Waste could potentially be contaminated with lead or lead oxide during clean-up operations in the test chamber.

D022 applies to P/S code FF because of the use of chloroform in the microsphere fuel R&D project (MET-59/TWCP-3541).

D035 applies to P/S code MA due to the use of methyl ethyl ketone.

D040 applies to P/S codes EL and FF due to the use of trichloroethylene as a lubricant in an Isomet cut-off saw (MET-59/TWCP-3541).

D040 applies to P/S code MA due to the use of trichloroethylene in the final cleaning of metal parts from 1979 to 1992, resuming again in February 2000.

4.3 Corrosivity, Reactivity, and Ignitability

See Section 6.0.

5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION

See Section 3.5.2.

6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED

According to the WIPP WAP, "The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes." Administrative controls on waste packaging were in place at various times to ensure the absence of such items from the waste stream.

- Liquids were prohibited from solid waste streams at TA-55 when the facility opened in January 1978. A waste management procedure written to cover operations at the new facility, *TA-55 Standard Operating Procedure (SOP) 406-GEN-R00*, stated that “Liquids are not permitted in any container of solid waste materials” (TWCP-3943).
- Chemical Waste Disposal Requests introduced in June 1980 included checkboxes which the waste generator was required to check if the waste contained corrosive acids or bases, or pyrophoric, flammable, corrosive, explosive, toxic, carcinogenic or highly reactive materials.
- The Certification Plan (TWCP-697) and related Generator Attachments (TWCP-701) were implemented in 1987. Waste generators were required to sign a statement on the WODF documenting that the waste contained “no free liquids, pyrophorics, explosives, compressed gases, powders or materials other than the indicated matrix.” Checkboxes were also present for indicating the presence or absence of corrosive chemicals. Full implementation of this generator statement occurred in May 1987.
- Waste management inspectors perform visual examination of the waste prior to its initial packaging, thus allowing the inspectors to verify the generator’s WODF statement (TWCP-701, sections 3.8.5 to 3.8.6).
- Explosives were prohibited from TA-55 until installation of the Impact Test Facility in the early 1990s. Explosives continue to be banned in the solid waste streams up to the present time. If a misfire should occur, the requirement is to destroy the unspent powder by burning.
- The Waste Profile Request Form (WPRF), which has been in use at LANL since 1991, includes a statement which must be authenticated by the waste generator, that the waste is not ignitable (flash point >200°F), reactive, or corrosive.
- The TA-55 Generator Attachments to the Certification Plan were updated in 1995 (TWCP-700) but the prohibition on liquids in the waste, and the waste management inspection, remained in effect.

Hence, since the inception of operations at TA-55, corrosive and reactive wastes have been excluded from TA-55 solid wastes through the prohibition of liquids.

The absence of these prohibited items is verified through radiography of each waste container and visual examination of selected containers during TWCP characterization activities. These data will be used to assess the accuracy of AK information in accordance with *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028). Any free liquids are remediated, or the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007).

7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED

Section 6.0 summarizes administrative controls in place at TA-55 that prohibit incompatible chemicals in the waste, and measures taken to verify their absence. In addition, all waste containers shipped from TA-55 to TA-54 for storage were evaluated for potentially incompatible chemicals in accordance with 49 *Code of Federal Regulations* (CFR) Subpart C—Segregation and separation chart of hazardous materials; Section 177.848, Segregation of hazardous materials, and were determined to be in compliance with this requirement.

8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS

Most gases used at the TA-55 Plutonium Facility are stored outside the building and the gas is plumbed into the glovebox from outside the building (TWCP-4164). Occasionally, a lecture bottle may have been used for a process inside the building, but these bottles were kept outside of the glovebox with the gas plumbed into the glovebox. Consequently, compressed gas cylinders or containers are not expected to be in any of the TRU wastes generated by TA-55 operations.

Spray cans, especially WD-40, were in common use in TA-55 gloveboxes until May 1992 (TWCP-4166). These were routinely discarded as metal debris waste. From 1988 until May 1992, the protocol was to vent or puncture the spray cans inside the glovebox; venting was indicated by inserting a metal wire into the valve. After May 1992, spray cans were no longer used in gloveboxes.

For items of pyrochemical salt waste, the procedures of oxygen sparging and/or carbonate oxidation have been used since May 1987 to ensure that pyrophorics were oxidized. In addition, screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501) have shown (1) no autoignition, (2) no spontaneous combustion, and (3) no sparking. Experimental results on the reactivity of LANL Direct Oxide Reduction (DOR) salt with water and the reactivity in air of heated calcium metal nodules from DOR salts indicate the absence of “dangerous when wet materials” and pyrophoricity in these salts (TWCP-3730, TWCP-3731, TWCP-3732).

Verification that individual waste drums do not contain compressed gases, free liquids, or sealed containers greater than 4 L in volume is obtained from radiography of each waste container and visual examination of selected containers during TWCP characterization activities. Any free liquids are remediated, and any sealed containers greater than 4 L in volume, or unpunctured or unvented gas containers, are removed; or else the waste container is tagged as non-compliant by filing a Prohibited Waste Report in accordance

with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007). For administrative controls on the prohibition of pyrophorics, see Sections 6.0 and 7.0.

9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM

No PCBs were introduced into the metal operation processes, based on documentation in TA-55 procedures reviewed during the AK investigation and summarized in the process inputs listed in Table 1, Table 4, and Attachment 4. Oils used in the reviewed processes include vacuum pump oils, and cutting fluids used for cooling purposes; none of these oils are known to contain PCBs. All transformers known to contain PCBs have been tracked from the time of startup of TA-55 in 1978. Whenever any transformer oil is drained, it is handled by a subcontractor who is wholly responsible for its disposal (TWCP-AK-2.1-005,R.1, section 9.0). This oil does not enter the LANL disposal operations.

10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE

Asbestos heating mantles were never used at TA-55. Asbestos gloves were used in glovebox operations in P/S codes OR and RM (TWCP-4162, TWCP-4166), which are discussed in *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006,R.1) and *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007,R.1), respectively. Asbestos-bearing transite was widely used until recently for thermal insulation, including as a coverplate over the furnace in glovebox wells, and as part of end plates on Lindberg furnaces (TWCP-4162, TWCP-4166). Although many Lindberg furnaces have been replaced with newer asbestos-free furnaces, some are still in use at TA-55. The transite would have been disposed either as metal or as ceramic and glass debris waste.

11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS

- 40 CFR Part 261, Subpart C—Characteristics of hazardous waste, Sections 261.21 (*Characteristic of ignitability*), 261.22 (*Characteristic of corrosivity*), 261.23 (*Characteristic of reactivity*), and 261.24 (*Toxicity characteristic*)
- 40 CFR Part 261, Subpart D—Lists of hazardous waste, Sections 261.31 (*Hazardous wastes from non-specific sources*), 261.32 (*Hazardous wastes from specific sources*), and 261.33 (*Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof*)
- 49 CFR Subpart C—Segregation and separation chart of hazardous materials. Section 177.848, *Segregation of hazardous materials*
- *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021)

- *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001,R.3)*
- *Nonconformance Reporting and Tracking (TWCP-QP-1.1-007)*
- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55 (TWCP-AK-2.1-002,R.1)*
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55 (TWCP-AK-2.1-004,R.1)*
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55 (TWCP-AK-2.1-005,R.1)*
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55 (TWCP-AK-2.1-006,R.1)*
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55 (TWCP-AK-2.1-007,R.1)*
- *Reconciliation of Visual Examination and Radiography Information (TWCP-QP-1.1-028)*
- *Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)*
- *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste (EPA/OSWER 9938.4-03)*
- *Waste Analysis Plan, to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088, Attachment B)*
- *Waste Characterization Data Reconciliation with Acceptable Knowledge (TWCP-DTP-1.2-064)*

ACCEPTABLE KNOWLEDGE ROADMAP

Waste Stream: Waste from Process Status Codes ARI, BA, BC, BT, CA, CN, CO, CT, DA, DOP, DT, EL, ELW, EM, FF, FSPF, GI, HG, ID, IN, ITF/4, JA, KBTF, MA, MBC, MOX, MW, OB, OM, PCH, PD, PE, PF, PH, PIG, RAP, RAP2, RL, RS, SRL, TIGR, UA, VD, WE, WLT

Copies of these documents are in the TWCP RMDC Center.

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-352	B	Description of Pu recovery processes	<i>Wastes from Plutonium Conversion and Scrap Recovery Operations</i> , LA-11069-MS, March 1988.	Document describes the Pu residues and the various treatment approaches used in recovering Pu from scrap	Document does not give information about RCRA constituents introduced or present in the processes
TWCP-614	D	All TA-55 waste is Defense related.	Memo from Doug Sankey.	All TA-55 waste is Defense related.	None
TWCP-697	C	Waste management requirements to meet WIPP WAC requirements were formalized in 1984.	<i>Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , WCP-HSE7-CPL-01, R.2 (November 1984)	Waste management requirements to meet WIPP WAC requirements. Generator Attachments were used to describe and reference specific generator procedures.	Overview document—Generator Attachments provide more detailed information.
TWCP-698	B	Gives Material Type compositions	NMT Memo, NMT-7 WM/EC-96-032 Benchmark Environmental Corp. Memo, AL-7193 BEC	Gives Material Type compositions	Does not give information on how material may fractionate in TA-55 waste processes.
TWCP-700	C	<i>Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , R05	<i>NMT-7 Attachment, January 1995</i> , TRUWM-TA55-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.
TWCP-701	C	<i>TA-55 Generator Attachment to the TRU Waste Certification Plan for Newly Generated TRU Waste</i>	<i>TA-55 Attachment, 1987</i> , TRU-MST12-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-816	D	Jim Foxx Interview on Number of Layers of Packaging	C.L. Foxx, Los Alamos National Laboratory	Waste was co-mingled with room trash, and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits.	None
TWCP-882 (UCNI)	D	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste	Memo from Jim Foxx	Lists additional radionuclides and metals potentially in waste, subdivided by process status code. Covers time period from 1978 to present.	Best information available, but it is based on worker recollection because other records are not available.
TWCP-886	C	Color Flow Diagram of Pu-processes at TA-55.	N/A	Indicates that process inputs are thermally treated and that heavy metals from process inputs end up in the nitric acid evaporator bottoms.	Does not indicate solvent input to processes.
TWCP-887	D	Segregation of Defense and Non-Defense TRU Waste	Memo from Jim Foxx	Wastes generated from defense and non-defense activities were not segregated at TA-55 through 1997.	None.
TWCP-2501	B	“Backlog Waste Reassessment Baseline Book, Waste Form 34”	Rocky Flats Environmental Technology Site Report 1995	Page WF34-10 contains results of tests for corrosivity	Tests were conducted on residues rather than on waste.
MET-1/TWCP-3541 (UCNI)	C	Reactor Fuels Development	MAS-NF-DE-11-13—Potential hazards associated with metallography in Room 115	Describes metallography process involved in reactor fuel development.	None
MET-2/TWCP-3541 (UCNI)	C	Reactor Fuels Development	MAS-NF-DE-11-18—Metallographic procedure for making alpha autoradiographs	Describes procedure for making alpha autoradiographs.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-3/TWCP-3541 (UCNI)	C	Reactor Fuels Development	MAS-NF-DE-11-8— Metallurgical examination of Pu-contaminated materials	Describes procedure for metallurgical examination of Pu-contaminated materials.	None
MET-4/TWCP-3541 (UCNI)	C	Reactor Fuels Development	MAS-NF-DE-11-14— Identification of potential hazards associated with metallography in Rooms G104 and G107	Describes procedure for identifying hazards associated with metallography at TA-55.	None
MET-5/TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3401—Cleaning of SP-100 fuel pin components (P/S EL)	Describes procedure for cleaning of SP-100 fuel pin components.	None
MET-6/TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3402—Heat treatment of SP-100 components (P/S EL)	Describes process for heat treatment of SP-100 components.	None
MET-7/TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3530—Shroud tube fuel and insulator pellet loading (P/S EL)	Describes process for shroud tube fuel and insulator pellet loading.	None
MET-8/TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3540—Fuel element component assembly (P/S EL)	Describes process for fuel element component assembly.	None
MET-9/TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3570—Fuel element and component examination (P/S EL)	Describes process for fuel element and component examination.	None
MET-10/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3590—Wire wrap (P/S EL)	Describes process for wire wrap.	None
MET-11/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3620—Fuel and insulator pellet archive (P/S EL)	Describes process for fuel and insulator pellet archives.	None
MET-12/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3630—Sampling of EBRI-II type fuel elements and wrap wires for residual chloride and fluoride (P/S EL)	Describes process for sampling of EBRI-II type fuel elements and wrap wires for residual chloride and fluoride.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-13/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3820—Cleaning requirements for large components (P/S EL)	Describes process for cleaning and requirements for large components.	None
MET-14/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3830—Cleaning for small components (P/S EL)	Describes process for cleaning of small components.	None
MET-15/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3340—Sodium melting using cassette (P/S EL)	Describes process for sodium melting using cassette.	None
MET-16/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-FI-3002—Fabrication and inspection of He-bonded fuel elements (P/S EL)	Describes process for fabrication and inspection of He-bonded fuel elements.	None
MET-17/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-FI-3004—Fabrication and inspection of Na-bonded WSA-60 fuel pin capsules (P/S EL)	Describes process for fabrication and inspection of Na-bonded WSA-60 fuel pin capsules.	None
MET-18/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-MS-2006—Material specification for 235-U	Describes process for material specification for 235-U.	QA Requirement documents
MET-19/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-MS-2004—Carbothermic process material specification for U oxide powder	Describes process for carbothermic process material specification for U oxide powder.	QA Requirement documents
MET-20/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-MS-2001—Carbothermic process material specification for Pu oxide powder	Describes process for carbothermic process material specification for Pu oxide powder.	QA Requirement documents
MET-21/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-MS-2000—Material specification for U oxide powder, depleted	Describes process for material specification for depleted U oxide powder.	QA Requirement documents
MET-22/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2011—Master blend preparation for Pu oxide powder (P/S OB and FF)	Describes process for master blend preparation for Pu oxide powder.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-23/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2040—Vacuum reduction procedure for U carbide or U-Pu carbide preparation (P/S RS and FF)	Describes process for vacuum reduction for U carbide or U-Pu carbide preparation.	None
MET-24/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2050—Comminution and Ni addition for U carbide or U-Pu carbide (P/S CO and FF)	Describes process for comminution and Ni addition for U carbide or U-Pu carbide.	None
MET-25/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2060—Automatic pellet pressing (P/S MOX and FF)	Describes process for automatic pellet pressing.	None
MET-26/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2070—Sintering for U or U-Pu carbide pellets (P/S MOX, RS, and FF)	Describes process for sintering for U or U-Pu carbide pellets.	None
MET-27/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2080—Manual pellet pressing (P/S MOX and FF)	Describes process for manual pellet pressing.	None
MET-28/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2090—Sampling sintered fuel and insulator pellets (P/S MOX, GI, and FF)	Describes process for sampling sintered fuel and insulator pellets.	None
MET-29/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2100—Measuring density of sintered fuel or insulator pellets (P/S MOX, ID, GI, and FF)	Describes process for measuring density of sintered fuel or insulator pellets.	None
MET-30/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2110—Physical inspection and size sorting (P/S MOX, GI, and FF)	Describes process for physical inspection and size sorting.	None
MET-31/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2130—Centerless grinding (P/S MOX, GI, and FF)	Describes process for centerless grinding.	None
MET-32/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-2160—Binder burnout (P/S RS, MOX, and FF)	Describes process for binder burnout.	None
MET-33/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3000—Cleaning requirements (P/S EL)	Describes process for cleaning requirements.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-34/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3300—Sodium canister startup and casting (P/S EL)	Describes process for sodium canister startup and casting.	None
MET-35/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3310—Sodium extrusion (P/S EL)	Describes process for sodium extrusion.	None
MET-36/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3330—Sodium loading into fuel elements (P/S EL)	Describes process for sodium loading into fuel elements.	None
MET-37/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3350—Sodium bonding (P/S EL)	Describes process for sodium bonding.	None
MET-38/ TWCP-3541 (UCNI)	C	Reactor Fuels Development	FAB-PP-3360—WSA capsule loading and sodium melting (P/S EL)	Describes process for WSA capsule loading and sodium melting.	None
MET-39/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	353-WEL—Encapsulation of Radioactive Isotopes (P/S WE)	Describes process for encapsulation of radioactive isotopes	Vague description of process; therefore vague on chemical use
MET-40/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	118-MRD—Plasma Chemical Reactor (P/S PCH)	Describes process for plasma chemical reactor operation	None
MET-41/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	116-MRD -Measuring Physical Properties (P/S BC)	Describes process for measuring physical properties	Poor description of chemical use
MET-42/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	397-SEC—Safe Operating Procedure for Pit Disassembly (P/S MW, MA, PD, SRL)	Describes process for safe operating procedure for pit disassembly	None
MET-43/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	NMT5-SOP-3026-MRD—Plutonium Hydriding System (formerly 3026-MRD-R01) (P/S PH)	Describes process for Pu hydriding system	None
MET-44/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	119-MRD—Operating the Hydride-Dehydride Systems (P/S PH)	Describes process for operating the hydride-dehydride systems	None
MET-45/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	317-CAS—Button Breaking Press (P/S CA)	Describes process for button breaking press	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-46/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	321-MET—Ultrasonic Degreaser (P/S MA)	Describes process for operation of the ultrasonic degreaser	None
MET-47/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	ESA-2 SOP-20.6.4—Ultrasonic Pit Inspection at TA-55 (P/S MA)	Describes process for ultrasonic pit inspection at TA-55	None, physical inspection—no chemical use
MET-48/ TWCP-3541 (UCNI)	C	On-Going Metal Operations	399-MET—Operating the Autoclave Hot Isostatic Press (P/S BA)	Describes process for operating the autoclave hot isostatic press	None
MET-49/ TWCP-3541 (UCNI)	C	Developmental Metal Operations	NMT6-AP-AR-142—ARIES Integration System (P/S ARI)	Describes process for ARIES integration system	Weak on describing chemical use
MET-50/ TWCP-3541 (UCNI)	C	Developmental Metal Operations	NMT6-SOP-AR-127—Operation of the ARIES Electrolytic Can Decontamination System (P/S ARI)	Describes process for operation of the ARIES electrolytic can decontamination system	None
MET-51/ TWCP-3541 (UCNI)	C	Developmental Metal Operations	ATP/SRL-104—Pit Disassembly (formerly 397-SRL-R04) (P/S SRL)	Describes process for pit disassembly	None
MET-52/ TWCP-3541 (UCNI)	C	Developmental Metal Operations	ATP/SRL-105—Processing Material in the Special Recovery Line Furnace (P/S SRL)	Describes process for processing material in the special recovery line furnace	None
MET-53/ TWCP-3541 (UCNI)	C	Developmental Metal Operations	397-SRL—Pit Disassembly (Special Recovery Line) (P/S SRL)	Describes process for pit disassembly (Special Recovery Line)	None
MET-54/ TWCP-3541 (UCNI)	D	Information regarding P/S code PE	Rueben Gutierrez, SME, 2/17/2000	Sputtering operations deposited Pu onto other surfaces. Other sputtering operations deposited other metals as thin films onto Pu.	No procedure existed for this process. SME recall of information about a process that occurred over a decade ago.
MET-55/ TWCP-3541 (UCNI)	D	Information regarding P/S code DA	Dale Soderquist, SME. 2/28/2000	P/S code DA was a process to study Pu alloys.	No procedure existed for this process.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-56/ TWCP-3541 (UCNI)	D	Information regarding P/S code TIGR	David Kolman, SME, 3/2/2000	Process is a dry process to remove gallium from Pu. Very little waste generated from this process.	No procedure existed for this process.
MET-57/ TWCP-3541 (UCNI)	D	Information regarding P/S code FSPF	Janice Aasen, SME, 3/7/2000	FSPF replaced P/S code DA and was set up to be like DA. Process involves heating samples in a furnace under a controlled environment.	As with P/S code DA, no procedure existed for FSPF.
MET-58/ TWCP-3541 (UCNI)	D	Information regarding P/S codes KBTF, ITF/ITF4, and BT	Jim Foxx, SME, 3/15/2000	Jim Foxx interviewed Ben Lopez, SME for KBTF and ITF/ITF4. Both processes are impact tests for determining physical properties of materials.	No procedures existed for these processes.
MET-59/ TWCP-3541 (UCNI)	D	Information regarding the reactor fuels program.	Ken Chidster, Roberta Simpson, and Rudy Fernandez, SMEs, 3/7/2000, 3./13/200	Provided detailed information on reactor fuels development work. Provided information on P/S codes CN, CO, CT, EL, FF, ID, OB, OM, MOX, and RS.	Very thorough source of information
MET-60/ TWCP-3541 (UCNI)	D	Information regarding P/S code ELW	John Milewski, SME, 2/29/2000	Laser welding operation for Pu and other metals. Minimal amounts of waste generated, no RCRA-listed constituents	No procedure existed for this process
MET-61/ TWCP-3541 (UCNI)	D	Information regarding P/S code PIG	Richard Oleary, SME, 2/29/2000	Welding operation in which ethanol is the only chemical use.	No procedure existed for this process
MET-62/ TWCP-3541 (UCNI)	D	Information regarding P/S code CA, MA, PD, SRL, and HG	David Olivas, Charles Rense, SMEs, 3/2/2000	Information provided clarified issues for these P/S codes that were unclear from the limited procedures available.	Limited number of procedures available for these P/S codes, hence it was difficult to generate a clear understanding of these processes.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-63/ TWCP-3541 (UCNI)	D	Information on P/S code MBC	Mike Blau, Dane Spearing, SMEs, 3/6/2000, 3/8/2000	Information on potential RCRA-listed constituents. This operation uses none.	No process description available
MET-64/ TWCP-3541 (UCNI)	D	Information on P/S codes RAP, RAP2, FSPF, PF, and JA	Barbara Cort Martinez, SME, 2/29/2000	Reasonable information on P/S code PF obtained, but limited information on other codes. Time information good. RCRA information good.	No procedures existed for these processes. Sketchy information on P/S code JA process. Limited information on P/S code FSPF.
MET-65/ TWCP-3541 (UCNI)	D	Information on P/S code RL	Jack Simpson, SME, 2/28/2000	Process is similar to P/S code PE in that Pu metal was coated with thin film of other metals.	No procedures existed for this process. SME couldn't recall a lot of detail.
MET-66/ TWCP-3541 (UCNI)	D	Information on P/S code CA	Dale Soderquist, SME, 3/29/2000	Detailed information on casting operations.	Procedures available for casting operations provided little useful information. SME input provided the detail.
MET-67/ TWCP-3541 (UCNI)	D	Information on chemicals used in machining operations, P/S code MA.	George Zakar, SME, 3/15/2000	SME provided a list of chemicals used in machining operations.	Procedures available for machining operations were sketchy and provided little information about chemical use in machining. SME input provided a detailed list.
MET-68/ TWCP-3541 (UCNI)	D	Information regarding P/S code MA	George Zakar, SME, 3/29/2000	SME provided detailed information on machining operations that was not available from the procedures.	Procedures provided little information on process descriptions or chemicals used in machining. SME input provided required information.
MET-69/ TWCP-3541 (UCNI)	D	Information regarding P/S codes AO, EVAC, IN, JA, UA, VD, and WE	Jim Foxx, SME, 4/12/2000	SME provided information on process and wastes generated from these various P/S codes.	No procedures existed for these P/S codes.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
MET-70/ TWCP-3541 (UCNI)		Waste Management Plan, October 14, 1999 Rev. 1, 40-MM Powder Breech Project, TA-55 Bldg. PF-4, Los Alamos National Laboratory	Jim Foxx, 3/9/2000	Information regarding P/S code ITF. Includes process description, some of the materials used.	Details on materials used is sketchy, hence input from SME was required.
MET-71/ TWCP-3541 (UCNI)	C	Procedure for Curium-244 Detector Fabrication, P/S code DOP	TA-55 Document, 308-FAB-R03	Contains materials used in the process	No RCRA analyses documents
MET-72/ TWCP-3541 (UCNI)	C	Procedure for Robotic Isotope Detector Fabrication	TA-55 Document, 3029-DET-R00	Contains materials used in the process	No RCRA analyses documents
MET-73/ TWCP-3541 (UCNI)	D	Information regarding P/S codes PPD, UA, VD, IN, WE and type of Dowanol used in P/S codes EL and FF	Jim Foxx, SME, 5/2/2000	SME provided additional information about processes, time periods, and chemical use and type	Answers to specific questions
MET-74/ TWCP-3541 (UCNI)	D	Information regarding P/S codes AO, EVAC, MA, and WLT	Jim Foxx, SME, 6/26/2000	SME provided additional information on P/S codes AO, EVAC, and WLT than was contained in MET69	Answers to specific questions
MET-75/ TWCP-3541 (UCNI)	D	Information regarding deposition of uranium used in reactor fuel development	Jim Foxx, SME, 6/27/2000	SME provided information on uranium deposition	Answers to specific questions
MET-76/ TWCP-3541 (UCNI)	D	Information on TCE use in P/S code MA	Jim Foxx, SME, 6/29/2000	SME provided information on trichloroethylene use in P/S code MA	Answers to specific questions
TWCP-3730 (UCNI)	B	Pyrophoricity characterization	Characterization of Direct Oxide Salts (LA-CP-95-0098)	Hydrogen generation and pyrophoricity of DOR salts. Also gives reference for MSE, ER, and Cr-containing salts.	None
TWCP-3731	D	Sodium pyrophoricity in pyrochemical salts	Memo (MST-12-ARO-88-052)	Treatment of sodium in salts is effective	Sodium only
TWCP-3732	C	Experimental data on calcium pyrophoricity in salts	Memo (MST-12-ARO-88-077)	Treatment of calcium in salts is effective	Calcium only

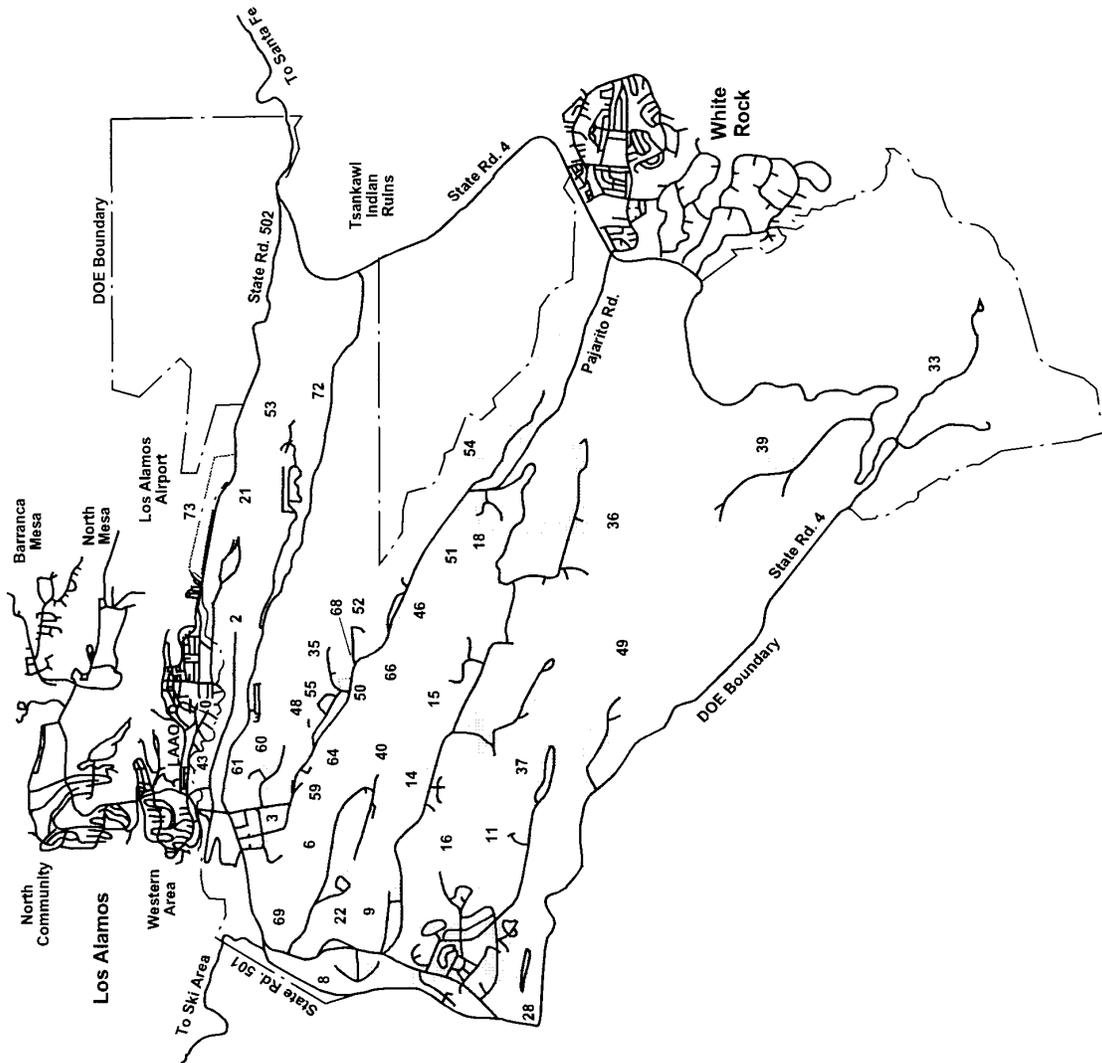
* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-3943	B	Procedure for Waste Management at TA-55	TA-55 Document, 406-GEN-R00	Contains information on waste management procedures in 1978	None, but doesn't address today's waste management concerns
TWCP-4162	D	Answers to questions about P/S codes PB, PuBe, CC, MB, MS, FF, BF, and other issues	Interview with Jim Foxx, 10/12/00	Answers to questions on use of asbestos at TA-55, non-defense activities, and specific P/S codes in chloride operations.	None
TWCP-4164	D	Answers to questions about various P/S codes	Interview with Jim Foxx, 10/16/00	Answers to questions on use of Ag, disposal of ash and resins, and use of gases.	None
TWCP-4166	D	Answers to questions about P/S codes DO, EV, HP, CF, OR, RM, PY	Interview with Jim Foxx, 10/17/00	Answers to questions on use of Cr and Ag, RCRA metals in cement, asbestos in furnaces and gloves, and disposal of spray cans used in gloveboxes.	None
TWCP-4167	D	Answers to questions about segregation of non-defense wastes; leachability of Ag from ash	Interview with Jim Foxx, 10/18/00	Segregation of non-defense wastes began on 27 August 1998; analytical data show that Ag in ash is below limits of regulatory concern	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

MAP OF LANL

Technical Area Locations	
TA-0	Unassigned Land Reserve
TA-2	Omega Site
TA-3	South Mesa Site
TA-5	Beta Site
TA-6	Two Mile Mesa Site
TA-8	Anchor Site West
TA-9	Anchor Site East
TA-11	K-Site
TA-14	Q-Site
TA-15	R-Site
TA-16	S-Site
TA-18	Pajarito Laboratory
TA-21	DP-Site
TA-22	TD-Site
TA-28	Magazine Area A
TA-33	HP-Site
TA-35	Ten Site
TA-36	Kappa Site
TA-37	Magazine Area C
TA-39	Ancho Canyon Site
TA-40	DF-Site
TA-41	W-Site
TA-43	Health Research Lab & DOE Headquarters
TA-46	WA-Site
TA-48	Radiochemistry Site
TA-49	Frijoles Mesa Site
TA-50	Waste Management Site
TA-51	Radiation Exposure Facility
TA-52	Reactor Development Site
TA-53	Meson Physics Facility
TA-54	Waste Disposal Site
TA-55	Plutonium Facility Site
TA-57	Fenton Hill Site
TA-58	Two Mile North Site
TA-59	OH-Site



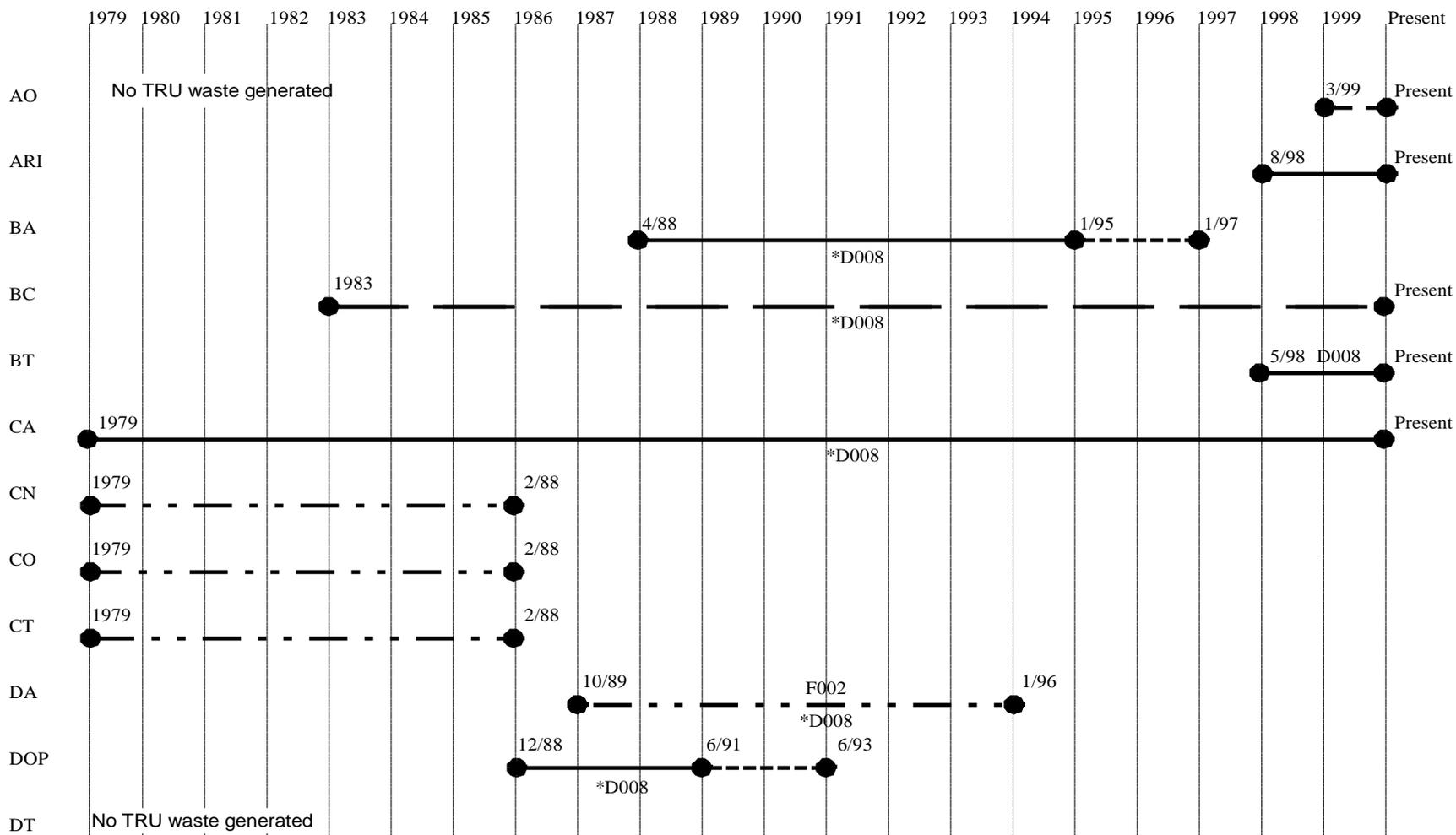
MAP OF TA-55

Note: The Plutonium Facility, Building PF-4, is labeled PF-4 on this map.

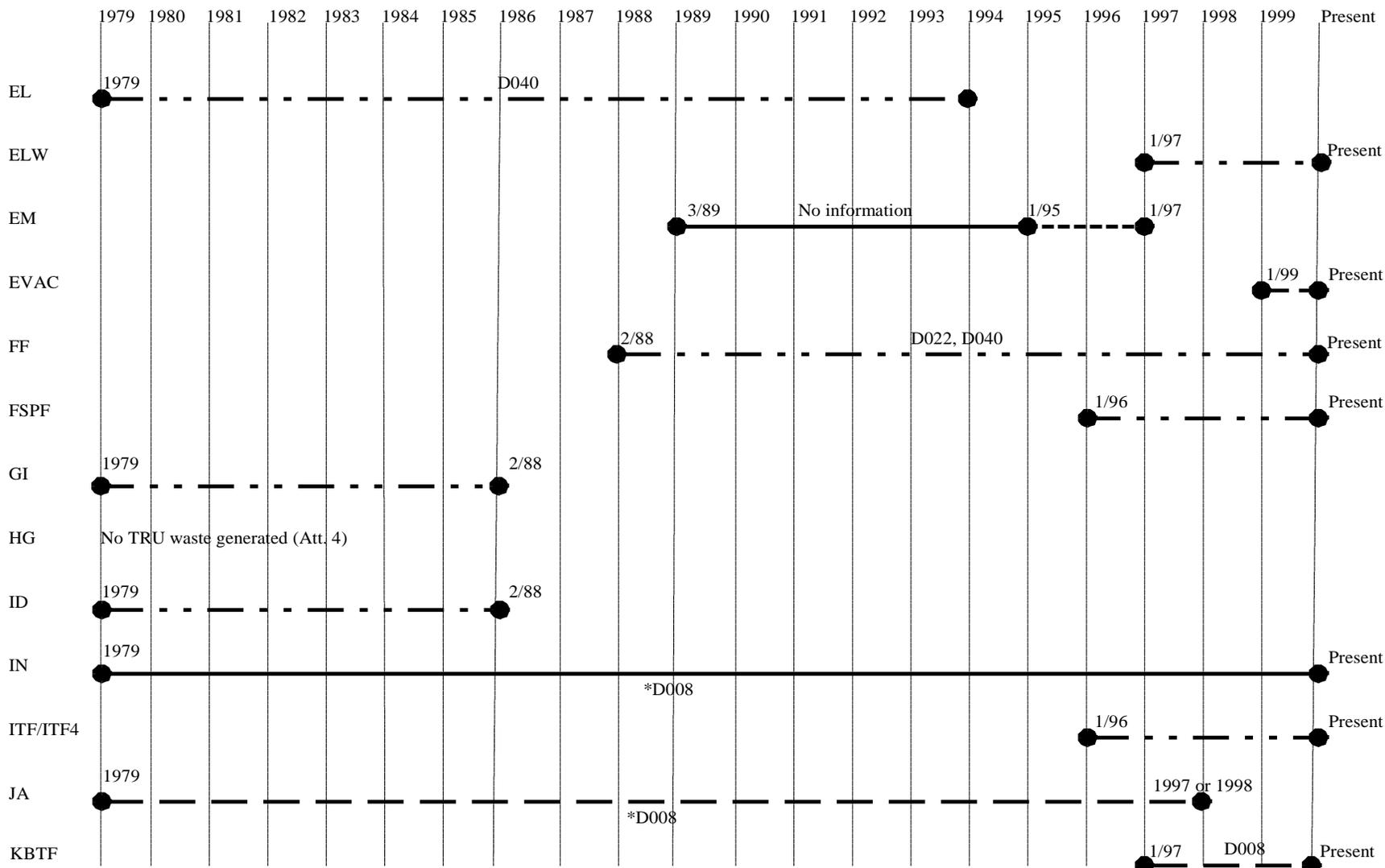


TIMELINE FOR METAL OPERATIONS

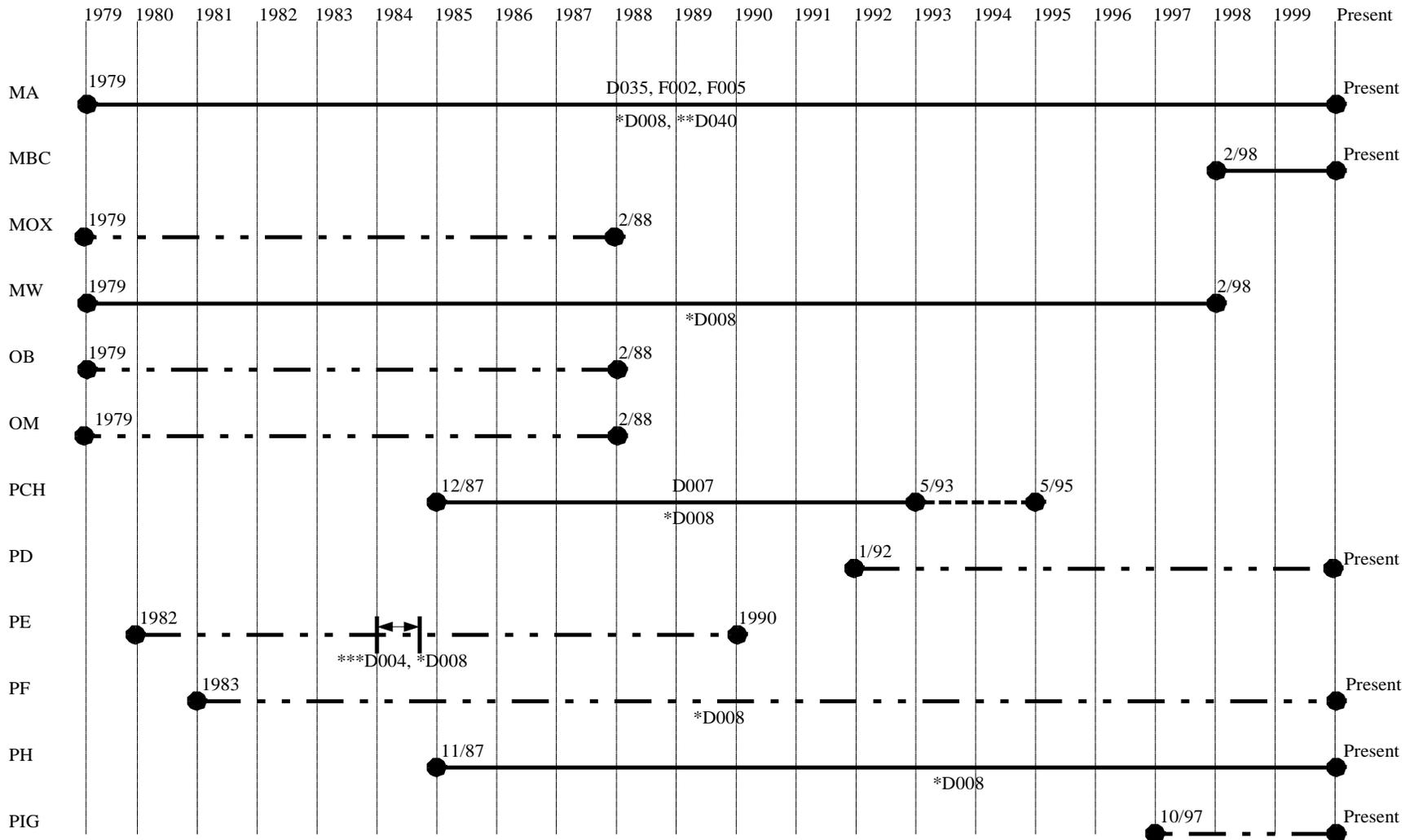
See Section 4.0 for details of RCRA code applicability to waste types generated under each P/S Code.



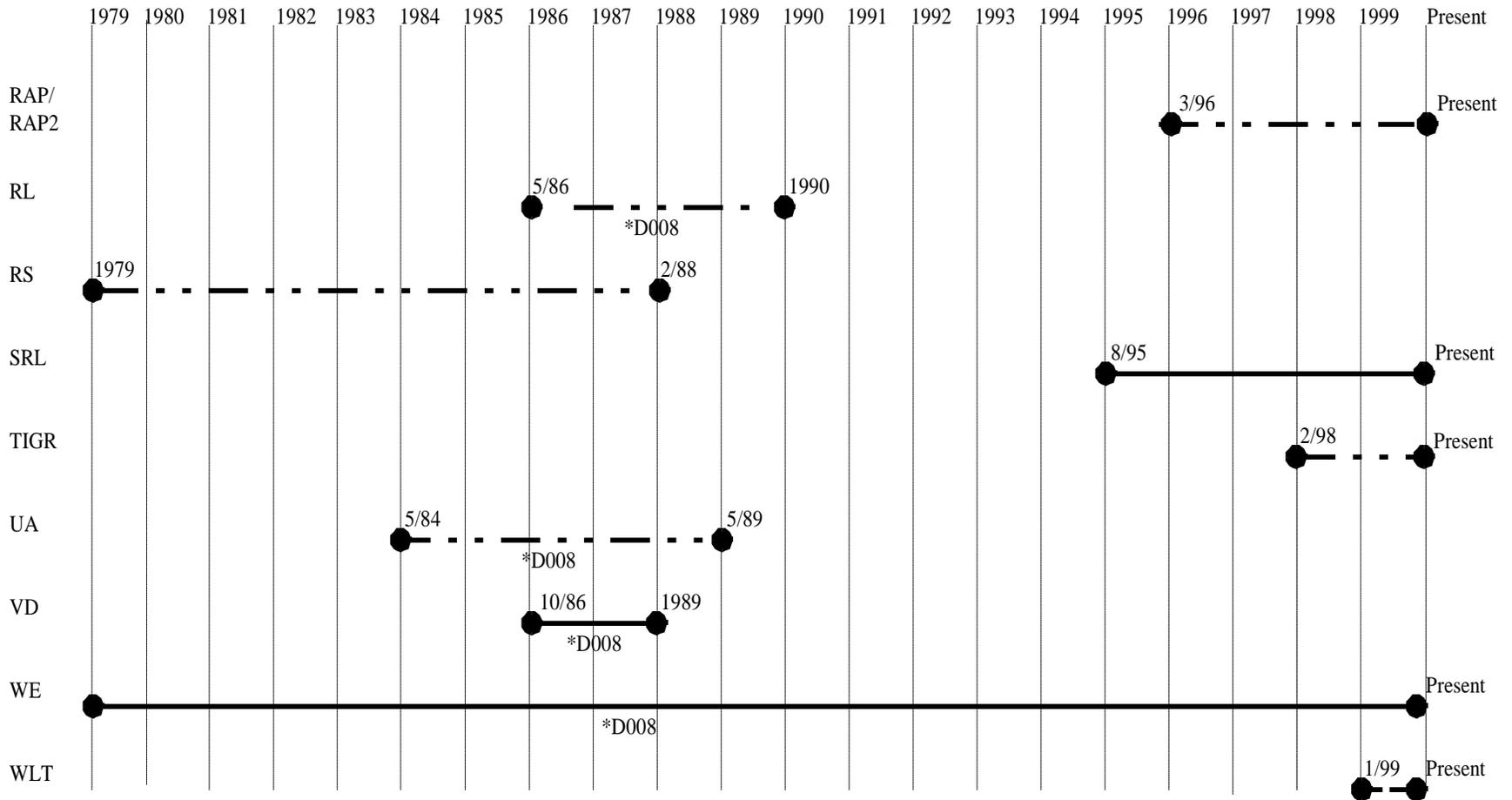
TIMELINE FOR METAL OPERATIONS (continued)



TIMELINE FOR METAL OPERATIONS (continued)



TIMELINE FOR METAL OPERATIONS (continued)



TIMELINE EXPLANATION



The P/S code is established either in the P/S diagrams and/or in the procedures designating the start and end dates.



Extrapolate out two (2) years beyond the last revision date for the procedure to next possible review date.



Dates for which a process is known to have been in operation based on Subject Matter Expert input, but no procedures exist nor is there a P/S code for this time period.

* Until 1992 leaded gloves were disposed as metal debris waste under the originating P/S code. Thereafter, they were segregated into a leaded-glove waste stream.

** Trichloroethylene was used in the final cleaning of metal parts from 1979-1992, resuming in March 2000.

*** Arsenic was only used in 1984 and perhaps into 1985.

PROCESS INPUTS AND OUTPUTS

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
AO	Assembly Operation	Pu metal (high purity)	No chemicals used	Pu metal parts	Waste is LLW		MET-69, MET-74/ TWCP-3541
ARI	ARIES	Pu metal (high purity)	Sodium hydroxide, sodium nitrate, sodium sulfate	Pu metal and plutonium oxide to vault	rags, tools, labware, gloves, spent electrolyte solution		MET-49, MET-50/ TWCP-3541
BA	Basement Isopress	Pu and isotopes of other radionuclides sealed in coupons	No chemicals used	Pu and isotopes of other radionuclides sealed in coupons	Rags, paper, tools, gloves, spent hydraulic fluid, spent hydraulic fluid, silicone lubricant, isopropyl alcohol, miscellaneous materials consisting of stainless steel, aluminum, titanium and firebrick	D008	MET-48/ TWCP-3541
BC	Physical Properties	Actinide metals, alloys, and compounds	No chemicals used	Actinide metals, alloys, and compounds	rags, paper, tools, gloves, glass, plastic and metal labware, press dies	D008	MET-41, MET-64/ TWCP-3541
BT	Burst Testing	Pu metal (high purity)	sodium hydroxide, sodium tetraborate, tin- lead solder	Material to vault.	rags, tools, gloves, HEPA filters, wire, strain gauges	D008	MET-58/ TWCP-3541
CA	Casting	High purity metal from P/S code RM and SS or other P/S codes, e.g. SRL	Freon TF, bromobenzene	Cast metal parts	Rags, tools, gaskets, graphite crucibles, rags, tools, tantalum parts, plastic and glass, leaded gloves	D008	MET-45, MET-62, MET-66/ TWCP-3541

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CN	Carbon-Nitrogen-Oxygen (C-N-O) Analysis	Sample reactor fuel pellet for analysis	No chemicals used	No Product. Samples not analyzed returned to P/S code GI. Analyzed samples to vault	Labware, rags, non-leaded gloves, HEPA filters, rubber, wood, paper, cardboard, glass vials, balances, steel and brass storage containers, graphite, molybdenum trays, magnesium oxide crucibles		MET-59/ TWCP-3541
CO	Comminution	Crushed briquettes from P/S code RS	Stearic acid, nickel powder, polyethylene glycol	Product to P/S code RS, scrap to vault.	Tools, labware, rags, non-leaded gloves, HEPA filters, rubber, wood, paper, cardboard, glass vials, balances, steel and brass storage containers, graphite, molybdenum trays, stainless and hardened steel balls		MET-59/ TWCP-3541
CT	Compatibility Testing	Encapsulated material, P/S code is a status only, hence no TRU waste was probably generated.	No chemicals used	N/A	N/A		MET-59/ TWCP-3541
DA	Alloy Development	Pu metal, alloying metals.	Bromobenzene, Freon TF	Pu alloys to P/S CA, SS or aqueous recovery	Labware, gloves, rags, metal cups	D008 F002	MET-55/ TWCP-3541
DOP	Detector Oxide Preparation	Oxides of various radionuclides	No chemicals used	Encapsulated oxide	Labware, gloves, rags	D008	MET-71, MET-72/ TWCP-3541
DT	John Ward R&D	Nonprocessing	Nonprocessing	N/A	N/A		

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
EL	Element Loading	Reactor fuel pellets from P/S code GI	Ethanol, mild acids and caustics, helium, sodium metal, Dowanol 80, trichloroethylene	Fuel pin	Tools, labware, rags, non-leaded gloves, spent welding rods, Dowanol 80 containing sodium metal	D040	MET-59/ TWCP-3541
ELW	Experimental Laser Welding	Pu metal	Ethanol	Welded part	Gloves, rags		MET-60/ TWCP-3541
EM	Electron Microscopy	No AK information available					
EVAC	Evacuation and Bake-out	Pu metal parts	No chemicals used	Pu metal parts	Waste is LLW		MET-69, MET-74/ TWCP-3541
FF	Fuel Fabrication	Uranium oxide, uranium carbide, uranium nitride	Graphite, sugar, stearic acid, ethylene glycol, helium, argon, hydrogen gas, sodium metal, Dowanol 80, bromobenzene, MolyKote, microspheres, ethylene glycol, surfactants, hexane, chloroform, ethanol, trichloroethylene, chloroform	Fuel pin	Tools, labware, rags, non-leaded gloves, tungsten carbide and hardened steel press dies; diamond or aluminum oxide grinding wheels; HEPA filters; rubber; wood; paper; cardboard; glass vials; balances; steel and brass storage containers; ceramic, graphite, and magnesium oxide crucibles, vacuum pumps; graphite and molybdenum trays; thermocouples; stainless and hardened steel balls	D022 D040	MET-59/ TWCP-3541

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
FSPF	Special Furnace Operation	Pu metal (high purity)	No chemicals used	Pu metal to vault, Pu contaminated metals to recovery if > DL.	Pu contaminated metals to discard if < DL. Rags, gloves, ceramics, glass, plastics		MET-57, MET-64/ TWCP-3541
GI	Pellet Grinding and Inspection	Uranium or Pu pellets from P/S code RS	No chemicals used	Pellets to P/S EL or to vault	Rags, tools, non-leaded gloves, HEPA filters, rubber, wood, paper, cardboard, glass vials, balances, steel and brass storage containers, graphite, molybdenum trays, diamond and aluminum oxide grinding wheels		MET-59/ TWCP-3541
HG	Pu Removal by Mercury	"Cold" Experiments only	N/A	N/A	No TRU waste generated		MET-62/ TWCP-3541
ID	Immersion Density	Uranium or Pu pellets from P/S code GI	Bromobenzene	Pellets to P/S code EL, FF or ME	Status code, so no TRU waste generated; non-leaded gloves; LLW		MET-59/ TWCP-3541
IN	Inspection	Status only, Physical inspection of parts	No chemicals used	Inspected Parts	Gloves, rags, tools	D008	MET-69/ TWCP-3541
ITF	Impact Test Facility	Pu metal	GoJo cleaner	7" gas gun tube to NMT-9 for recovery; data from 40-mm gun; materials reused if possible	Rags, metals, wire, HEPA filters, gloves from 40-mm gun; no TRU waste generated from 7" gas gun		MET-58/ TWCP-3541
ITF4	Impact Test Facility	Pu metal	GoJo cleaner	7" gas gun tube to NMT-9 for recovery; data from 40-mm gun; materials reused if possible	Rags, metals, wire, HEPA filters, gloves from 40-mm gun; no TRU waste generated from 7" gas gun		MET-58/ TWCP-3541

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
JA	Gas Isostatic Press	Pu and isotopes of other radionuclides	No chemicals used	Material returned to P/S code BC	Gloves, rags, tools	D008	MET-64, MET-69/ TWCP-3541
KBTF	Kolsky Bar Test Facility	Pu metal	No chemicals used; plastic-wrapped lead bricks used as damper	Pu metal returned to sending P/S code	Gloves, rags, tools	D008	MET-58/ TWCP-3541
MA	Machining	High purity Pu metal	Tap Magic, Freon TF, Metalprep 79, Texaco Regal 32 oil, methyl ethyl ketone, trichloroethylene, ethanol, isopropanol	Machined part, scrap and trunings to recovery	Gloves, rags, tools, plastics, grinding wheels, lathe cutting tools, milling machining cutters	F002 F005 D008 D035 D040	MET-42, MET-46, MET-47, MET-62, MET-67, MET-68, MET-76/ TWCP-3541
MBC	Crystal	Pu metal	No chemicals used	Pu metal to recovery	Gloves and rags		MET-63/ TWCP-3541
MOX	Mixed Oxide Fuel Production	Uranium/Pu oxide	Zinc stearate	Fuel pellets	Tools, labware, rags, non-lead gloves, HEPA filters, rubber, wood, paper, cardboard, glass vials, balances, steel and brass storage containers, graphite, molybdenum trays		MET-63/ TWCP-3541
MW	Metal Working	Pu metal, uranium metal	Freon TF	Pu metal to recovery, uranium metal to vault	Gloves, rags, paper, copper wool, tools, plastic bottles, glass and rubber labware, aluminum foil, cutting wheels, milling machine cutters, and lathe cutting tools. Tritium-contaminated copper wool and rags	D008	MET-42/ TWCP-3541

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
OB	Oxide Blending	Enriched uranium oxide, depleted uranium oxide, Pu oxide	Graphite, stearic acid	Blended oxides to P/S code RS	Rags, tools, non-leaded gloves, HEPA filters, rubber, wood, paper, cardboard, glass vials, balances, steel and brass storage containers, graphite, molybdenum trays, ceramic and graphite crucibles		MET-59/ TWCP-3541
OM	Oxygen to Metal Ratio Determination	Reactor fuel pellets	No chemicals used	Reactor fuel pellets	Status code, no TRU waste generated; LLW		MET-59/ TWCP-3541
PCH	Plasma Chemistry	Pu metal (varying purity)	Various gases used for plasma: tetrafluoroethane, hexafluoroethane, perfluoropropane, oxygen, argon, carbon dioxide, Fomblin pump oil (contains perfluoropolyether)	Pu metal to recovery	Gloves, rags, tools, glass, plastic and metal labware; used pump oil (Fomblin brand); discarded test samples such as tantalum foil, tungsten foil, tungsten-coated silicon, silicon dioxide; and various actinide surfaces	D007 D008	MET-40/ TWCP-3541
PD	Pit Disassembly	Pu metal, uranium metal	Freon TF SF-2I	Pu metal to recovery, uranium metal to vault	Gloves, rags, copper wool, tools, plastic bottles, glass and rubber labware, aluminum foil, cutting wheels, milling machine cutters, and lathe cutting tools. Tritium-contaminated copper wool and rags		MET-42, MET-50/ TWCP-3541

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
PE	Sputtering Process	Pu metal (high purity), arsenic, gold, lutetium	No other chemicals used	Part with sputtered metal coating	Gloves, rags, tools, metals used in coating process	D004 D008	MET-54/ TWCP-3541
PF	Plutonium Surfaces	Pu metal	Ethanol and possibly methanol	Pu metal to recovery	Tools, labware, rags, gloves, plastics	D008	MET-64/ TWCP-3541
PH	Thermal Hydride/Dehydride	Pu metal, Pu alloys and other actinides	hydrogen gas	Pu metal and alloys to recovery, other actinides to vault	Tools, labware, rags, paper, gloves, used Fromblin pump oil	D008	MET-43, MET-44/ TWCP-3541
PIG	Welding	Beryllium, aluminum	Ethanol	Beryllium welded part	Gloves and rags		MET-61/ TWCP-3541
RAP/ RAP2	Research Alloy Preparation	No activity in these P/S codes	None				MET-64/ TWCP-3541
RL	Radiochemical Coating	Pu metal (high purity), other metals	Gold metal and lutecium metal	Pu metal part with metal coating	Gloves and rags, metals used in coating process	D008	MET-65/ TWCP-3541
RS	Pellet Sintering	Enriched uranium oxide, depleted uranium oxide, Pu oxide from P/S code OB; also returned from P/S code CO	Argon, hydrogen gas, MolyKote	Sintered fuel pellets to P/S code GI	Tools, labware, rags, non-leaded gloves, HEPA filters, rubber, wood, paper, cardboard, glass vials, balances, steel and brass storage containers, graphite, molybdenum trays, ceramic and graphite crucibles, thermocouples, heating elements, vacuum pumps		MET-59/ TWCP-3541

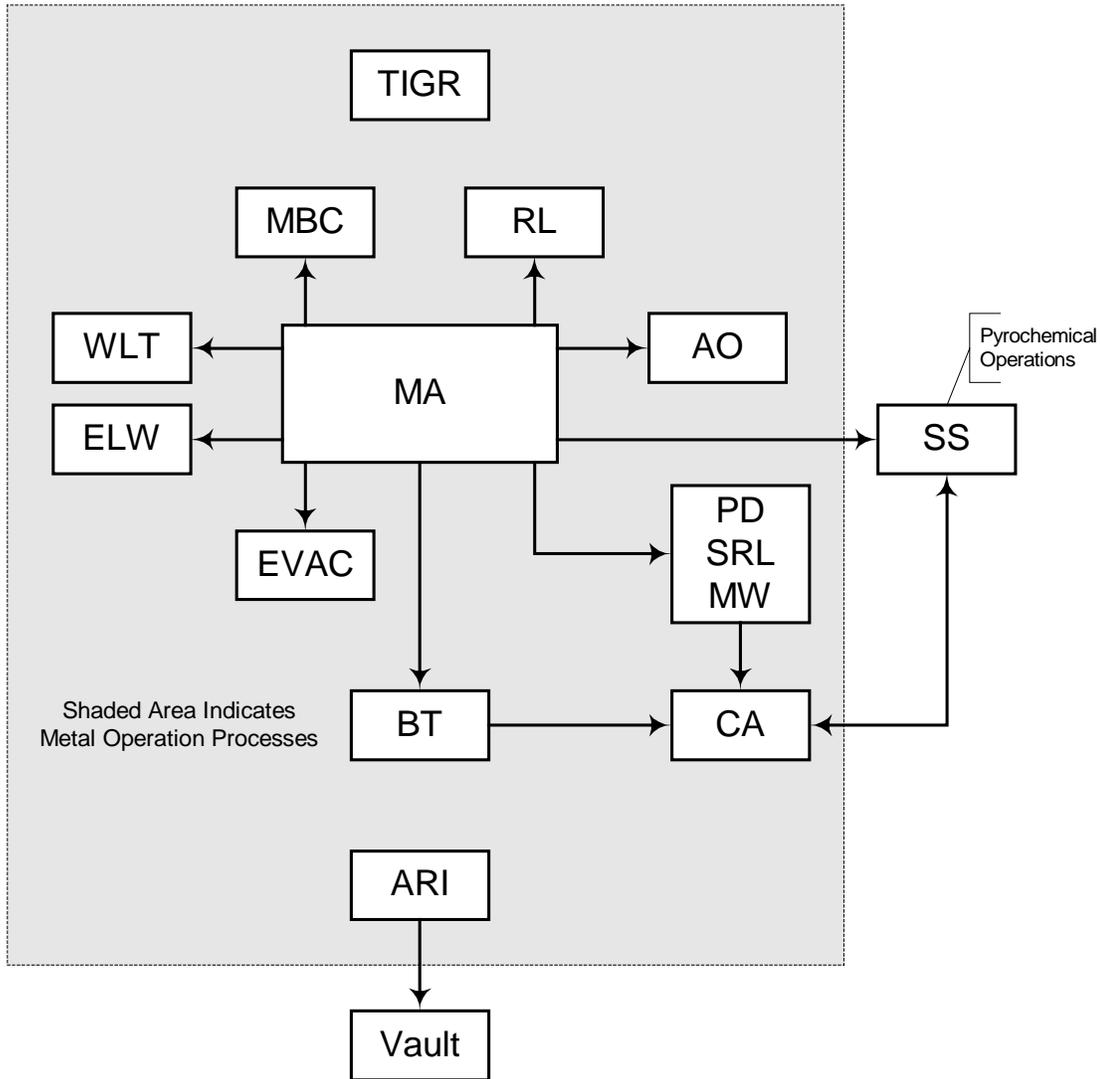
P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
SRL	Special Recovery Line	Pu metal, uranium metal	Freon TF SF-2I copper wool	Pu metal to recovery, uranium metal to vault	Gloves, rags, copper wool, tools, plastic bottles, glass and rubber labware, aluminum foil, cutting wheels, milling machine cutters, and lathe cutting tools, tritium-contaminated copper wool and rags		MET-42, MET-51, MET-52 MET-53, MET-62/ TWCP-3541
TIGR	Thermally Induced Gallium Removal	Pu-gallium oxide	argon and hydrogen gas	Separated Pu oxide and gallium oxide	Tools, labware, rags, gloves		MET-56/ TWCP-3541
UA	Uranium Fabrication	Uranium metal and oxide	Freon TF	Uranium to vault	Gloves, rags, copper wool, tools, glass and rubber labware, aluminum foil, cutting wheels, milling machine cutters, and lathe cutting tools.	D008	MET-69, MET-73/ TWCP-3541
VD	Vapor Degreaser and Sand Blasting	Pu metal parts	Freon TF	Cleaned parts	Gloves, rags, tools	D008	MET-69/ TWCP-3541
WE	Welding	Pu metal, other metals including aluminum, titanium, gold	Freon TF	Welded parts	Gloves, rags, tools, spent welding rods, stainless steel capsules		MET-39, MET-69/ TWCP-3541
WLT	Welding Leak Test	Pu metal parts	No chemicals used	Pu metal parts	Plastic gloves, bags and rags, cotton gloves, minimal amount of metal items		MET-74/ TWCP-3541

¹ All P/S codes generate routine laboratory debris waste. The debris waste may consist of glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Leaded gloves may also be generated and are segregated.

² See discussion in Section 4.0 for details on the applicability of the RCRA codes listed in this column. The RCRA hazardous waste codes listed apply to the solid TRU waste only and not to any other waste forms that may undergo further treatment or processing (e.g., evaporation or cement fixation). The resulting treated waste stream is evaluated for hazardous waste constituents and assigned the applicable EPA hazardous waste codes. All P/S codes have the potential to generate leaded gloves. The gloves are segregated from other metal debris waste and are assigned EPA hazardous waste code D008 under the originating P/S code.

³ Refer to the Acceptable Knowledge Roadmap in Attachment 3.

SIMPLIFIED PROCESS FLOW DIAGRAM FOR METAL OPERATIONS
 (continued)

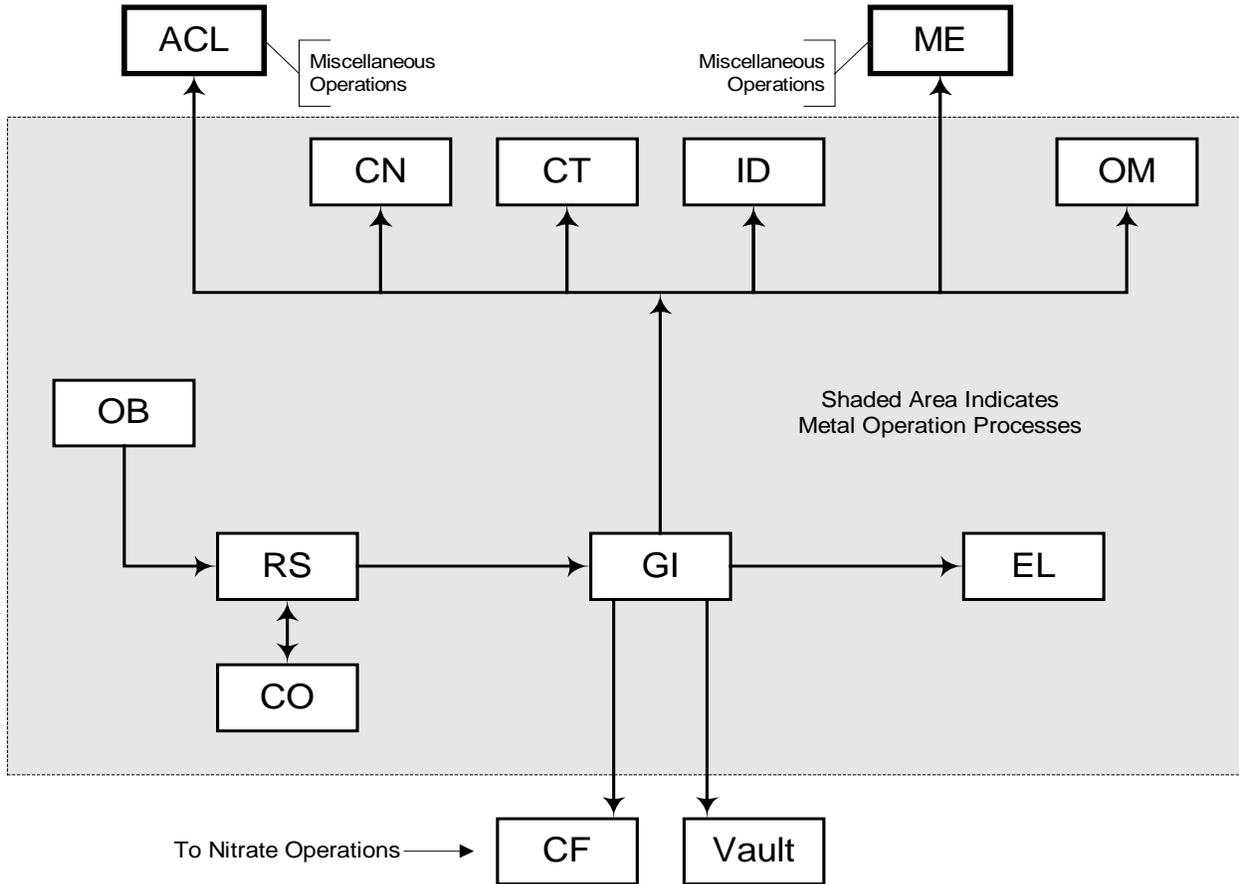


NOTE: All of these P/S codes may obtain feed material from or send product output to the vault.

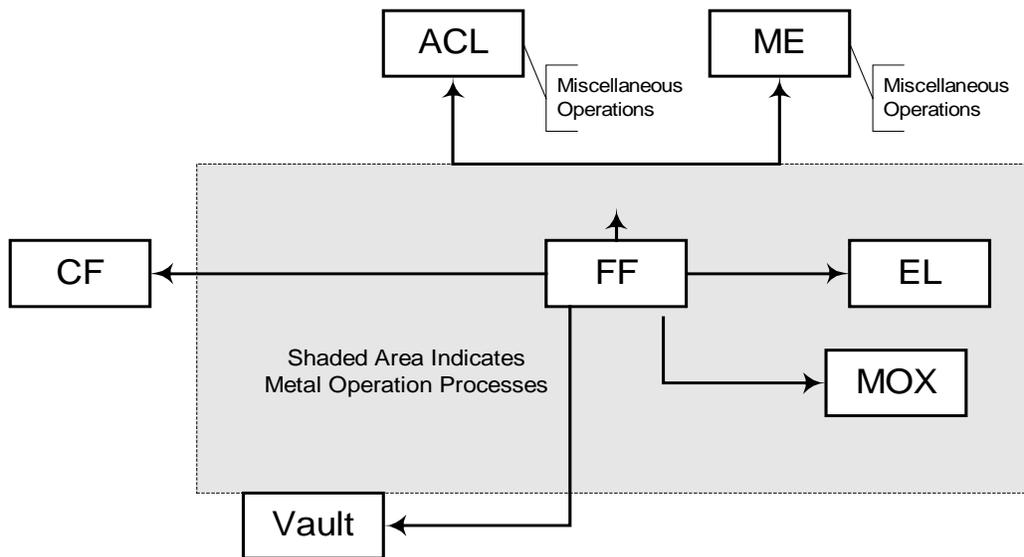
LEGEND

AO	Assembly Operations	MW	Metal Working
ARI	ARIES	PD	Pit Disassembly
BM	Burning Metal	RB	Roasting and Blending
BT	Burst Testing	RL	Radiochemical Coating
CA	Casting	SRL	Special Recovery Line
ELW	Experimental Laser Welding	SS	Salt Stripping
EVAC	Evacuation and Bake Out	TIGR	Thermally Induced Gallium Removal
MA	Machining	WLT	Welding Leak Test
MBC	Crystal		

**SIMPLIFIED PROCESS FLOW DIAGRAM:
 REACTOR FUEL DEVELOPMENT**



In 1988, P/S codes CO, GI, ID, OB, and RS were combined into P/S code FF. P/S codes CT, ID, and OM are statuses only, and will not generate TRU waste.



NOTE: All of these P/S codes may obtain feed material from or send product output to the vault.

TA-55 PLUTONIUM FACILITY

ACCEPTABLE KNOWLEDGE REPORT

REPORT TITLE: Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55

REPORT NUMBER: TWCP-AK-2.1-004,R.1 (LA-UR-00-5865)

WASTE GENERATED FROM PROCESS/STATUS CODES: AC, AC1, AC2, AC3, ACL, AD, APD, AX, CK, CV, EDC, EOC, EXT, FDL, FLU, HRS, IB, ICP, IE, LI, LIBS, ME, NCD, RASS/RSS, RD, SA, SMP, SO, STF, VS, WM, X0, XES, XO, XP

EFFECTIVE DATE: 12/04/00

NEXT REVIEW DATE: 12/04/00

DOCUMENT PREPARER:

John Musgrave
NAME

12/04/00
DATE

APPROVALS:

June Fabryka-Martin
INDEPENDENT TECHNICAL REVIEWER/EDITOR

12/04/00
DATE

Pamela Rogers
SITE PROJECT MANAGER

12/04/00
DATE

Matt J. Riggs
WASTE CERTIFICATION OFFICIAL

12/04/00
DATE

M A Gavett
SITE PROJECT QA OFFICER

12/04/00
DATE

Charles L. Foxx
FACILITY REPRESENTATIVE

12/04/00
DATE

CONTENTS

Section	Page
ACRONYMS	v
PROCESS/STATUS (P/S) CODE INDEX.....	vii
PROCESS ACCEPTABLE KNOWLEDGE SUMMARY.....	ix
1.0 INTRODUCTION.....	1
2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS	1
3.0 DESCRIPTION OF THE PROCESS WASTE.....	3
3.1 Facility and Mission.....	3
3.2 Waste Physical Form and Content Description.....	3
3.3 Waste Volume and Time Period of Waste Generation	4
3.4 Waste Generation Processes.....	4
3.5 Material Inputs to the Waste Generation Process	22
4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS.....	26
4.1 F, K, and P Listings.....	26
4.2 Toxicity Listings	32
4.3 Corrosivity, Reactivity, and Ignitability.....	33
5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION.....	34
6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED	34
7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED	35
8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS ..	35
9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM.....	36
10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE	36
11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS.....	36

Tables

1 Process Feed Materials for Miscellaneous Operations	23
2 Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %)...	25
3 Average Isotopic Content of Uranium Material Types and Enrichments (Weight %)	25
4 Chemical Inputs to Processes Described in This Report.....	27
5 Evaluation of the Applicability of EPA Hazardous Waste Numbers to Processes Discussed in This Report.....	30

CONTENTS (concluded)

Attachments	Page
1 Acceptable Knowledge Roadmap (14 pages)	
2 LANL and TA-55 Site Maps (2 pages)	
3 Timeline for TA-55 Miscellaneous Processes (5 pages)	
4 Process Inputs and Outputs (10 pages)	
5 Simplified Process Flow Diagram (1 page)	

ACRONYMS

AK	acceptable knowledge
CMPO	octylphenyldiisobutylcarbamoymethylphosphine oxide
D	RCRA hazardous waste code for wastes with hazardous characteristics, defined in 40 CFR Subpart C, Sections 261.21 to 261.24
DBBP	dibutyl butylphosphonate
DHDCMP	dihexyl N,N-diethylcarbamoymethyl phosphonate
DL	discard limit
DOE	U.S. Department of Energy
DWLS	Discardable Waste Log Sheet
EPA	U.S. Environmental Protection Agency
F	RCRA hazardous waste code for hazardous wastes from non-specific sources, defined in 40 CFR Subpart D, Section 261.31
FOOF	oxygen fluoride
GB	glovebox
HEPA	high-efficiency particulate air
HWN	[EPA] hazardous waste number
K	RCRA hazardous waste code for hazardous wastes from specific sources, defined in 40 CFR Subpart D, Section 261.32
LANL	Los Alamos National Laboratory
MEGAS	Multiple Energy Gamma Assay System
MSE	molten salt extract
MT	material type
NDA	non-destructive assay
P	RCRA hazardous waste code for acute hazardous waste defined in 40 CFR Subpart D, Section 261.33
PF-4	Plutonium Facility, Building 4
P/S [code]	process/status [code]
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RD&D	research, development, and demonstration
RFETS	Rocky Flats Environmental Technology Site
RLWTF	Radioactive Liquid Waste Treatment Facility
RMDC	Records Management/Document Control
Sampling Plan	<i>Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001,R.3)</i>
SME	subject matter expert
TA	technical area
TBP	tributyl phosphate
TCLP	Toxicity Characteristic Leaching Procedure
TRU	transuranic
TWCP	Transuranic Waste Characterization Program
UCNI	Unclassified Controlled Nuclear Information
WIPP	Waste Isolation Pilot Plant

WIPP WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)</i>
WIPP WAP	<i>Attachment B, Waste Analysis Plan, to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088)</i>
WODF	Waste Origination and Disposition Form
WPRF	Waste Profile Request Form

PROCESS/STATUS (P/S) CODE INDEX

Note: This index indicates the main process AK summary report and report section that covers each P/S code mentioned in this report.

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
AC	Actinide Chemistry, R&D	Miscellaneous Operations	3.4.3, Att. 4
AC1	Actinide Chemistry, R&D	Miscellaneous Operations	3.4.3, Att. 4
AC2	Actinide Chemistry, R&D	Miscellaneous Operations	3.4.3, Att. 4
AC3	Actinide Chemistry, R&D	Miscellaneous Operations	3.4.3, Att. 4
ACL	Analytical Chemistry Laboratory	Miscellaneous Operations	3.4.4, Att. 4
AD	Actinide Processing Demonstration	Miscellaneous Operations	3.4.1, Att. 4
APD	Actinide Processing Demonstration	Miscellaneous Operations	3.4.7, Att. 4
AX	Solution Assay	Miscellaneous Operations	3.4.3, Att. 4
CF	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
CK	RD&D Volatile Fluoride Pu Recovery	Miscellaneous Operations	3.4.2, Att. 4
CV	R&D Experimental Chlorination Processes	Miscellaneous Operations	3.4.2, Att. 4
CX	Chloride Anion Exchange	Chloride Operations	3.4.2, 3.4.3, Att. 4
EDC	Electrolytic Decontamination	Miscellaneous Operations	3.4.8, Att. 4
EOC	Experimental Oxide Characterization	Miscellaneous Operations	3.4.5, Att. 4
EV	Evaporator	Nitrate Operations	3.4.4, Att. 4
EXT	Extraction RD&D	Miscellaneous Operations	3.4.6, Att. 4
FDL	FOOF Demonstration Loop	Miscellaneous Operations	3.4.2, Att. 4
FLU	Fluorination RD&D	Miscellaneous Operations	3.4.2, Att. 4
HP	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
HRS	High Resolution Spectroscopy	Miscellaneous Operations	3.4.5, Att. 4
IB	Matrix Study of Pyrochemical Salts	Miscellaneous Operations	3.4.6, Att. 4
ICP	ICP–AES Analysis	Miscellaneous Operations	3.4.4, Att. 4
IE	Isotope Enrichment	Miscellaneous Operations	3.4.2, Att. 4
IS	Incinerator	Nitrate Operations	3.4.1, Att. 4
LI	XF6 Experimental Measurements	Miscellaneous Operations	3.4.2, Att. 4
LIBS	Laser-Induced Breakdown Spectroscopy System	Miscellaneous Operations	3.4.5, Att. 4

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
ME	Metallography	Miscellaneous Operations	3.4.10, Att. 4
NCD	Nonconfirming Drums	Miscellaneous Operations	3.4.9, Att. 4
OR	Direct Oxide Reduction	Pyrochemical Processes	3.4.2, Att. 4
PTS	RD&D Pretreatment Study	Nitrate Operations	3.4.1, 3.4.6, Att. 4
PX	Multiple DOR with In-Situ Regeneration and Electrowinning	Special Processing	3.4.6, 3.4.7, 3.4.8, 3.4.9, 3.4.10, Att. 4
RASS/RSS	Raman Spectroscopy System	Miscellaneous Operations	3.4.5, Att. 4
RB	Roasting and Blending	Nitrate Operations	3.4.3, Att. 4
RBJ	Roasting and Blending Jr.	Nitrate Operations	3.4.3, Att. 4
RC	Rotary Calciner	Nitrate Operations	3.4.1, 3.4.6, Att. 4
RD	Repackaging into Retrievable Drums	Miscellaneous Operations	3.4.9, Att. 4
RR	Ion Exchange	Nitrate Operations	3.4.3, Att. 4
SA	Super Acid RD&D	Miscellaneous Operations	3.4.3, Att. 4
SMP	SP Mounting Preparation	Miscellaneous Operations	3.4.5, Att. 4
SO	Super Oxidizer, FOOF Program	Miscellaneous Operations	3.4.2, Att. 4
SS	Salt Stripping	Pyrochemical Processing	3.4.3, 3.4.4, 3.4.5, 3.4.7, 3.4.8, Att. 4
STF	Standard Fabrication	Miscellaneous Operations	3.4.6, Att. 4
VS	Confirmation, Inspection & Sampling	Miscellaneous Operations	3.4.5, Att. 4
WM	Waste Management	Miscellaneous Operations	3.4.9, Att. 4
X0	Inactive or Unspecified P/S Material	Miscellaneous Operations	3.4.9, Att. 4
XES	X-Ray Energy Spectroscopy	Miscellaneous Operations	3.4.5, Att. 4
XO	Inactive or Unspecified P/S Material	Miscellaneous Operations	3.4.9, Att. 4
XP	RD&D Experimental Processes	Miscellaneous Operations	3.4.4, Att. 4

* Process AK summary reports: Chloride Operations (TWCP-AK-2.1-002,R.1), Miscellaneous Operations (this report), Nitrate Operations (TWCP-AK-2.1-005,R.1), Pyrochemical Processes (TWCP-AK-2.1-006,R.1), and Special Processing (TWCP-AK-2.1-007,R.1)

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY

Waste-generating process: Miscellaneous Operations

P/S codes:

AC, AC1, AC2, AC3, ACL, AD, APD, AX, CK, CV, EDC, EOC, EXT, FDL, FLU, HRS, IB, ICP, IE, LI, LIBS, ME, NCD, RASS/RSS, RD, SA, SMP, SO, STF, VS, WM, X0, XES, XO, XP

Type of waste generated:

Retrievably stored and newly generated, mixed and non-mixed, combustible and non-combustible debris; liquid wastes sent to the Radioactive Liquid Waste Treatment Facility at TA-50 or immobilized in cement (as part of nitrate operations)

Site: LANL

Facility Mission (including defense and non-defense programs):

TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites in the defense complex. The recovered plutonium is converted into pure plutonium feedstock. These manufacturing and recovery operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste contaminated scrap, residues, and debris generated at TA-55. The scrap and residues are processed to recover as much plutonium as practicable before disposal. Wastes from miscellaneous operations are generated from plutonium recovery and purification for defense and non-defense programs; these wastes are generated and produced in the same rooms and gloveboxes and so were not segregated until August 27, 1998.

Area(s) or building(s) where the process waste was generated (including operations carried out in those areas):

TA-55 Plutonium Facility (Building PF-4), Rooms 105, 106, 112, 113, 115, 120, 124, 126, 208, 209, 210, 401, 409, 420, and 432

Description of the process waste (physical form and typical content description):

Primarily debris waste, including cellulosic materials, plastic, rubber, ceramic, metal and glass debris, and waste sent to nitrate operations to be immobilized in cement.

Description of the waste-generating process:

The overall goal of the miscellaneous operations is to recover plutonium from metal, metal alloys, scrap, and residues and produce a purified plutonium oxide product or feedstock for conversion to metal. Processes in miscellaneous operations include pretreatment, dissolution, purification, and hydroxide precipitation.

Process feed:

Plutonium metal or metal alloy, oxides and hydroxide cakes; pyrochemical salts; crucible pieces; anode heels; ash; analytical laboratory solutions; and residues from other DOE facilities.

Radioisotopic content of the waste:

Variety of plutonium material types with different well-defined isotopic compositions; americium-241, neptunium-237, and uranium-234 may be present at detectable concentrations as decay products of their plutonium precursors. Some of the processes separate plutonium and americium or plutonium and uranium. The waste will usually be enriched in americium and uranium, but may also be depleted in some cases.

RCRA Constituents/EPA Hazardous Waste Numbers:

- No K or P codes
- F001: P/S codes WM, XO, X0 (trichloroethylene and 1,1,2-trichloro-1,2,2-trifluoroethane (freon))
- F002: P/S codes AC/AC1/AC2, AD, APD, SA, WM, X0, XO (chlorobenzene, methylene chloride, tetrachloroethylene, trichloroethylene)
- F003: AD, APD, ME, SA (acetone, diethyl ether, methanol, xylene)
- F005: P/S codes AC/AC1/AC2, SA, WM, X0, XO (benzene, methyl ethyl ketone, toluene, pyridine)
- D004 (arsenic) and D010 (selenium): P/S codes AD, RASS/RSS, SO, XES, SP
- D005 (barium) and D006 (cadmium): P/S codes AD, CK, CV, EXT, FDL, FLU, IB, IE, LI, RASS/RSS, SO, XES, XP, SO
- D007 (chromium) and D009 (mercury): P/S codes AC, AC1, AC2, ACL, AD, APD, AX, CK, CV, EDC (D007 only), EOC, EXT, FDL, FLU, HRS, IB, ICP, IE, LI, ME (D007 only), RASS/RSS, RD, SA, SO, STF (D007 only), VS, WM, X0, XES, XO, XP
- D008 (lead, excluding leaded gloves): P/S codes AD, APD, CK, CV, EXT, FDL, FLU, IB, IE, LI, RASS/RSS, SO, WM, X0, XES, XO, XP
- D008 (leaded gloves only): P/S codes AC, AC1, AC2, ACL, AD, APD, AX, CK, CV, EDC, EOC, EXT, FDL, FLU, HRS, IB, ICP, IE, LI, ME, RASS/RSS, RD, SA, SO, STF, VS, WM, X0, XES, XO, XP
- D011 (silver): P/S codes AD, APD, CK, CV, EXT, FDL, FLU, IB, IE, LI, RASS/RSS, SO, XES, XP
- D018 (benzene): P/S codes AC, AC1, AC2, SA
- D019 (carbon tetrachloride): P/S codes AD, APD, CV, RASS/RSS
- D021 (chlorobenzene): P/S code APD
- D022 (chloroform): P/S codes AC, AC1, AC2, APD, WM, X0, XO

- D035 (methyl ethyl ketone): P/S codes WM, X0, XO
- D038 (pyridine): P/S code SA
- D039 (tetrachloroethylene): P/S codes AD, APD, CV
- D040 (trichloroethylene): P/S codes ME, WM, X0, XO
- No HWN: P/S codes LIBS, NCD, SMP

Process waste volume (if known):

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are segregated into waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

Years of generation for the process waste: 1979–present

PROCESS AK SUMMARY REPORT FOR MISCELLANEOUS OPERATIONS AT TA-55

1.0 INTRODUCTION

All transuranic (TRU) waste must be sufficiently characterized and certified before it is shipped to the Waste Isolation Pilot Plant (WIPP). The U.S. Environmental Protection Agency (EPA) allows use of acceptable knowledge (AK) for waste characterization. EPA uses the term AK in its guidance document, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. Attachment B, Waste Analysis Plan, to the *Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088) (WIPP WAP) defines AK and provides guidelines on how AK should be obtained and documented.

This process AK summary report was prepared in accordance with *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5). The primary purpose of this report is to systematically organize, evaluate, and summarize detailed AK information about individual processes used by one of the TRU-waste generators at Los Alamos National Laboratory (LANL). By doing so, this report provides detailed technical support for one or more waste stream AK summary reports that include these process wastes.

2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS

The AK search for the information related to Technical Area (TA)-55 waste streams resulting from miscellaneous (i.e., mixed oxide, uranium, analytical, and research and development) processes covered:

- Review of the *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3) (Sampling Plan) that includes information regarding all TRU waste streams
- Review of documents related to waste generation and waste management activities at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)
- Interviews with personnel involved with waste generation and waste management at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)

NOTE: Much of the AK information related to miscellaneous operations is contained in Transuranic Waste Characterization/Certification Project (TWCP) Record No. TWCP-3546. Individual documents in this record have been assigned a separate identifier, M-*nnn*, where *nnn* is a sequential 3-digit number. This referencing nomenclature is used throughout this report and its attachments.

- Analyses of individual processes generating waste, and evaluations of the potential for Resource Conservation and Recovery Act (RCRA)-regulated constituents to be

present in the process wastes, based on subject matter expert (SME) interviews and any available data

The TWCP Records Management/Document Control (RMDC) Center contains copies of the documents referenced in this report. Any Unclassified Controlled Nuclear Information (UCNI) will be contained in these records, and will not be included in this report. Such records are identified as UCNI in the Acceptable Knowledge Roadmap (Attachment 1).

This process AK summary report is part of a set of closely related reports about TRU-waste generating activities at TA-55. For convenience in organizing AK for plutonium processing at this facility, the processes were categorized into six arbitrary operational areas. The multiple processes in each area are then described in detail in the following six process AK reports for plutonium:

- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004) (this report)
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005)
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006)
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007)

Each process AK report contains information on multiple individual processes that are assigned unique identifiers called process/status (P/S) codes. For example, miscellaneous processes include 36 individual processes that are each assigned a P/S code, as listed on the cover page of this report. The search and compilation of AK information was based on P/S code because that is the most detailed level of process information generally recorded in waste generation records. The process AK reports frequently cross-reference one another because P/S codes in one operational area often provide the material feed for P/S codes in another area. An index of P/S codes cited in this process AK report follows the list of acronyms; this index lists process descriptions and the primary process AK report in which that P/S code is discussed.

3.0 DESCRIPTION OF THE PROCESS WASTE

The following sections describe processes used in miscellaneous operations, and identify the resulting wastes as well as outputs that are sent to other operations, such as nitrate operations, for further processing.

3.1 Facility and Mission

The TA-55 Plutonium Facility (Building PF-4) recovers plutonium from scrap and residues generated throughout the U.S. Department of Energy (DOE) defense complex, and processes it into pure plutonium oxide for conversion to metal and other products. A LANL site map and a detailed map of the buildings at TA-55, including Building PF-4, are shown in Attachment 2.

Processes in miscellaneous operation were solely defense related (TWCP-614, TWCP-4162). However, wastes from various processes were not segregated by funding source, waste-generating process, or waste-generating location (e.g., room or glovebox) until recently (August 27, 1998), but rather were segregated and packaged based on waste type (TWCP-887, TWCP-4162, TWCP-4167). Consequently, a single waste container often contains wastes from multiple processes, including those for non-defense activities. Some debris waste was also co-mingled with room trash related to these same operations (both defense and non-defense), and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits (TWCP-816).

3.2 Waste Physical Form and Content Description

Wastes generated during miscellaneous operations, primarily debris wastes and wastes entered into the cement fixation process or sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50 are covered by this process AK report. General debris waste categories from miscellaneous operations include

- Cellulose-based waste (for example, paper, cloth)
- Plastic-based waste (for example, gloves, tape, labware)
- Rubber
- Metal debris (for example, wire, hose clamps, tools, labware)
- Glass debris

These debris waste items are contaminated with small amounts of radioactive and chemical substances. In addition to these general debris categories, miscellaneous processes also generated waste consisting of organometallic and inorganic solids of various compositions, sand and slag, ash, and crucibles.

3.3 Waste Volume and Time Period of Waste Generation

This report covers waste streams generated from 1979, when miscellaneous processes first began at TA-55, to the present. Process wastes from miscellaneous operations have different associated EPA hazardous waste numbers (HWNs) depending on the time period during which they were generated. The P/S codes, their time period of generation, and corresponding HWNs are shown graphically in Attachment 3, Time Lines. These timelines are based on a review of procedures that guided the experimental and demonstration studies and miscellaneous research and development (R&D) operations at TA-55 and information from SMEs familiar with the operations. Many of the operations were short duration and/or changed frequently. Initiation or continuation of a process was surmised based on the date of approval for a given procedure. In some cases, a series of procedures or related documents for one process could be located to establish the timeline. In many other cases, discontinuities between procedure titles and numbers made it difficult to determine how long the process may have continued before it was modified or ended. For purposes of this report, the time period for the process is assumed to continue two years beyond the date of the last approved procedure unless otherwise indicated. Some processes have continued to the present. In cases where a given procedure did not identify the associated P/S code for the operation, a P/S code assignment was applied when the process description matched or was similar to a description in a previous or later revision of the same or a related procedure. Procedures were not available for some P/S codes (see Attachment 4). For these P/S codes, interviews with SMEs were used to develop process descriptions and timelines.

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are assigned to waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

3.4 Waste Generation Processes

The following subsections describe the generation and disposal of waste by miscellaneous operations.

Manufacturing and research operations performed at TA-55 in the production of plutonium also generate plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as is practical. TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites. These recovery and manufacturing operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste generated at TA-55. Detailed information about the TA-55 plutonium recovery processes can be found in *Waste from Plutonium Conversion and Scrap Recovery Operations* (TWCP-352). A full-block flow diagram for plutonium processing and waste management at TA-55 is given in reference TWCP-886.

Research, development, and demonstration (RD&D) projects at TA-55 comprise an array of activities involving applied techniques and methods designed to study and improve processes associated with the purification, separation, extraction, recovery, and characterization of actinides (primarily plutonium) from various matrices. The nature of many of the investigations and experimental activities was such that no one detailed procedure could describe the variety of activities carried out. In many cases a definitive list of chemicals and reagents used in the investigations was not available. The process descriptions that follow are categorized by process group and are arranged within each group in approximate chronological order. A complete listing of P/S codes for miscellaneous operations, their descriptions, feed materials, and inputs and outputs is found in Attachment 4. A simplified process flow diagram for miscellaneous operations is found in Attachment 5.

3.4.1 Extraction, Separation, and Characterization Studies (P/S Code AD)

From July 1979 until September 1994 or later, a series of similar actinide extraction, separation, and characterization R&D studies occurred in Room 208. These studies were conducted under various revisions of three series of procedures: processing of actinide hydroxide cakes from chloride and nitrate operations, development of sensors and instrumentation for online chemical analysis, and purification process development. A P/S code was not assigned to some of the earlier revisions, but is identified as P/S code AD in the latest revision of each series.

In this subsection, each revision of the hydroxide cake processing procedure is described separately because the chemical list and waste produced in the procedure differed in each revision.

- Beginning in July 1979, gloveboxes (GB) 231 and 233 in Room 208 were designated for americium R&D (M-018/TWCP-3546). These wet chemical experiments involved the use of evaporator hydroxide cake samples as the process feedstock. The process accountability flow diagram and procedures for P/S code AD do not identify the P/S codes that feed this operation; however, according to an SME (M-053/TWCP-3546) familiar with this operation, evaporator hydroxide cake samples came from P/S codes EV and HP (part of TA-55 nitrate operations). The hydroxide cake samples were dissolved in concentrated nitric acid, sampled to determine hydrogen, americium, and other principal cations, and subjected to extraction and separation phases to strip off the organics. The reagent list includes concentrated and dilute acids and caustics. Dibutyl butylphosphonate (DBBP) and kerosene were used in the extraction process.

- Presumably, americium activities occurred as indicated above until August 1983 when the procedure was revised. The modified procedure indicates that GB 231 and 233 were no longer limited to americium R&D but were assigned for use in general process R&D studies (M-019/TWCP-3546). Experimental investigations associated with the revised procedure involved chloride anion-exchange separations of plutonium, americium, thorium, neptunium, uranium, magnesium, and calcium. The process feedstock for these experiments is assumed to have been evaporator hydroxide cake samples from P/S codes EV and HP (M-053/TWCP-3546). The reagent list includes concentrated and dilute caustic and acid solutions, DBBP/Isopar (an isoparaffinic hydrocarbon solvent) and tributyl phosphate (TBP)/Isopar for solvent extraction, as well as platinum and platinum-rhodium alloys. Lead hydroxide, oxide and nitrate are indicated as being used “less frequently.” An SME familiar with this P/S code had “not come across any lead compounds” during his tenure beginning June 1989 (M-034/TWCP-3546). However, because the SME’s tenure began after the presumed end date of this activity, no definitive determination can be made about the presence or absence of lead in the process waste stream. The SME further stated that mercury was present in the 1984/85 time frame. Other chemical reagents listed in this procedure consist of acids, bases, and other extraction solvents that are not RCRA-listed constituents with associated HWNs.
- It is assumed that operations of a similar nature continued in Room 208, GB 231 and 233 until December 1986. At this time, in addition to GB 231 and 233, a third glovebox (GB 289) was assigned for general chemical and electrochemical research with actinide solutions (M-020/TWCP-3546). Experimental investigations conducted under the revised procedure appear to be similar to the two previously described procedures. The chemical list is also similar except that lead-containing compounds are no longer indicated. (However, see the discussion below about lead as a possible constituent in the feedstock material.) Additional materials used in these studies included gallium and tantalum metals, oxides, or salts as solids or in solution; tetraethylamine hydrochloride, tetraethylamine hydroxide, hydrazine dihydrochloride, and perchloric acid.
- It is presumed that various chemical and electrochemical experimental research with actinide solutions continued in the same room and gloveboxes as indicated above until February 1989, at which time the procedure was revised again. The additional investigations described in the revised procedure involved studies of plutonium (III), plutonium (IV), and plutonium (VI) complexed by

nitrate and fluoride (M-021/TWCP-3546). The chemical list is similar to the previously described operations with the exception of dihexyl N, N-diethylcarbamoylmethyl phosphonate (DHDCMP) and octylphenyl-diisobutylcarbamoylmethylphosphine oxide (CMPO) used in extraction experiments. None of the chemical inputs to the process are RCRA-regulated constituents with associated HWNs.

In February 1989, various research studies involving sensors and instrumentation suitable for online chemical analysis took place in Room 208, G261 and 262 (M-022/TWCP-3546). The list of frequently used chemicals includes concentrated and dilute acids and bases, actinide salts or oxides, and reducing agents.

Purification process development investigations occurred in Room 208, GB 230, 238, and 274 from May 1988 through September 1994. Processes carried out were of a non-routine developmental nature involving research, process development, small scale “trouble-shooting,” and occasionally preparation of various isotopes and isotopic mixtures of plutonium, uranium, americium, and neptunium (M-006/TWCP-3546). Frequently used chemicals included concentrated and dilute acids and bases, analytical standards, and reducing and oxidizing agents. Tetrachloroethylene and diisopropyl benzene are listed as solvent diluents, and methanol and ethanol are listed as “infrequently used chemicals.” Waste streams containing or contaminated with tetrachloroethylene would result in the assignment of the F002 hazardous waste code for spent halogenated solvents. Carbon tetrachloride is indicated as being used as a solvent diluent from July 1991 to March 1992. Because carbon tetrachloride was not used as a degreaser, the F001 hazardous waste code for carbon tetrachloride does not apply; however, the D code for carbon tetrachloride (D019) would be applied unless analytical data indicate that the concentration of the D-listed hazardous constituent does not exceed the applicable regulatory threshold limit. The procedure did not clarify how methanol was used in the process; however, an SME (M-034/TWCP-3546) familiar with the process stated that methanol and ethanol slushes were used in cooling baths outside the glovebox. Methanol used outside the glovebox would not become part of the TRU waste stream and the hazardous waste code would not apply. However, methanol and/or ethanol may also have been used for cleaning inside the glovebox (M-034/TWCP-3546).

Wastes that may be generated under P/S code AD include typical laboratory debris such as labware (e.g., glass, plastic, rubber, or metal materials and supplies), rags from general cleanup, spent solutions, and typical glovebox operations waste, including drybox gloves, windows, gaskets, and high-efficiency particulate air (HEPA) filters. Other wastes include the strip solutions and raffinate, spent organics, and unused

hydroxide cake samples. The procedure indicates strip solutions and spent organics were stored but does not address ultimate disposal of these spent solutions. The process accountability flow diagram for P/S code AD indicates outputs from this operation may be sent to the vault, returned to the originating P/S code, or directed to aqueous recovery or cement fixation based on the discard limit (DL). Materials may also be sent for chemical analysis or transferred to P/S code APD for further experimental development. Assuming that evaporator hydroxide cakes comprised the primary feed material for this code, the hazardous constituents associated with the feedstock material may be concentrated in the actinide-containing matrices and solutions that are discarded as waste. Based on information presented in TWCP-AK-2.1-002,R.1 (chloride operations) and TWCP-AK-2.1-005,R.1 (nitrate operations), hydroxide cakes may contain the D-listed heavy metals cadmium (D006), chromium (D007), lead (D008), mercury (D009), and silver (D011).

3.4.2 Halogenation Studies (P/S Codes CK, CV, FDL, FLU, IE, LI, SO)

A variety of halogenation (chlorination and fluorination) studies were conducted in various rooms and gloveboxes in Building PF-4, Rooms 105, 106, 113 and 208, from March 1988 to October 1992. Brief descriptions of these related operations are provided below. Standard debris waste items that were generated from these operations included rags from general clean-up, miscellaneous tools, labware (glass, plastic, or metal), typical glovebox operations waste; additional types of wastes are listed with each process description.

R&D efforts utilizing fluorinating agents to fluorinate ash samples containing plutonium residues were conducted in Room 105, GB-177, beginning in March 1988 under P/S code SO. A gas flow loop was used to pass a fluorinating agent through a gas-solid reactor where plutonium in the solid residue reacted chemically to form solid PuF_4 or gaseous PuF_6 (M-007, M-008/TWCP-3546). Gaseous PuF_6 was trapped in a cold trap, distilled, and reduced to PuF_4 . This process was similar to that used in P/S codes FLU and CK (described later in this section) insofar as they all involved related functions (i.e., extraction of plutonium from various matrices), but each process used a slightly different approach (M-035/TWCP-3546). Chemicals used in this process included fluorine and various halogen fluorides, aluminum oxide, and sodium bicarbonate. The feed material was ash generated in the incinerator (P/S code IS) and that had passed through the rotary calciner (P/S code RC) (M-053/TWCP-3546). Raw ash from the incinerator contains the RCRA-listed heavy metals barium (D005), cadmium (D006), chromium (D007), lead (D008), and silver (D011) in concentrations exceeding the Toxicity Characteristic Leaching Procedure (TCLP) limits. Calcined ash also

contains these metals (except silver) above the TCLP limits. The process accountability flow diagram for P/S code SO indicated that process outputs (i.e., unreacted ash and solid PuF_4) were sent to the vault. Some fluorinated items may have been sent to CLS-1 for analysis. In addition to the standard debris waste items, process waste also included spent aluminum oxide and sodium bicarbonate.

Fluorination of plutonium-containing residues was also carried out in Room 106, GB-185, beginning in October 1990 (M-009/TWCP-3546). Fluorination operations at this location may have occurred prior to 1990 because the procedure reviewed was a revised document and the process was not indicated as being new. The process end date was approximately October 1992 (M-035/TWCP-3546). This process appears to be identical to the fluorination operation (P/S code FDL) described below; however, the procedure indicates that methanol is used in the cold trap outside the glovebox. In addition to the standard debris waste items, process waste also included spent aluminum oxide and sodium bicarbonate. The process accountability flow diagram for P/S code FDL indicated that process outputs (i.e., solid residues and PuF_4 product) were sent to the vault.

P/S code FDL was conducted in Room 105, GB-192, from August 1991 through March 1995, when it was dismantled. This process was part of the oxygen fluoride (FOOF) program and consisted of a gas flow loop to conduct experiments that demonstrated the feasibility of fluorination at room temperature (M-011, M-036/TWCP-3546). The procedure does not identify the precise nature of the plutonium-bearing matrices. P/S code FDL used FOOF as an oxidizing agent and methane as a reduction agent. Carbon tetrafluoride was a reaction byproduct. Aluminum oxide and sodium bicarbonate were used as "getter" beds for excess fluorine. Liquid nitrogen was used in a cooling bath outside the glovebox and was not contaminated by materials inside the glovebox. Cooling was also accomplished by circulating refrigerant mixtures of freons. Upon dismantling the gas loop, the freon was captured. P/S code FDL did not involve the use of any chlorinated compounds. In addition to the standard debris waste items, process waste also included spent aluminum oxide and sodium bicarbonate. The process accountability flow diagram for P/S code FDL indicated that process outputs (i.e., solid residues and PuF_4 product) were sent to the vault.

P/S code CK was a fluorination operation carried out in Room 105, GB-193, beginning in May 1991 (M-010, M-035/TWCP-3546). The procedure does not identify the precise nature of the plutonium-bearing matrices. If ash was a process input (as in P/S codes SO and FDL), the same RCRA-listed heavy metals may be important for subsequent processes that use feedstock from P/S code CK. The organic chemicals

1-propanol and trichloroethylene were used in cold traps and cooling baths in the standard TA-55 configuration located outside the glovebox (M-035/TWCP-3546). The process accountability flow diagram for P/S code CK indicated that outputs from this operation were sent to the countroom or vault or transferred to P/S code PTS (RD&D Pretreatment Studies, covered in TWCP-AK-2.1-005,R.1, nitrate operations).

P/S code IE (the Phoenix Project) ran from about 1984/85 until 1990 (M-035/TWCP-3546). It involved the use of PuF_6 and refluorinating agents. No RCRA constituents of concern were involved in the operation.

P/S code LI was a fairly pure operation in Rooms 105, 106, and 113 that converted small quantities of PuO_2 to PuF_6 (M-035/TWCP-3546). The converted material was given to whomever needed it for further R&D. The timeline is likely similar to that for P/S code IE. No RCRA constituents of concern were involved in the operation.

Separation operations involving experimental chlorination processes similar to the previously described fluorination procedures were initiated in Room 106, GB-165, in March 1991 under P/S code CV (M-026/TWCP-3546). A gas loop was used to flow carbon tetrachloride and perchlorocarbons (M-035/TWCP-3546) through a gas-solid reactor to chlorinate plutonium oxides to form recoverable plutonium compounds. Once produced, the plutonium compounds and/or plutonium-bearing matrices were subjected to further treatment to achieve complete plutonium recovery. Process chemicals included dilute acids and bases and chlorinated hydrocarbons. Carbon tetrachloride and tetrachloroethylene were used in the cold traps, which were of the standard TA-55 configuration located outside the glovebox (M-035/TWCP-3546); therefore, the coolant chemicals would not have been part of the TRU waste stream. Process outputs from this operation may have been sent to the vault via the countroom, returned to the originating P/S code, or transferred to aqueous recovery or cement fixation (based on the discard limit). Sub-accountable samples may have been sent to chemical analysis.

Plutonium chlorination operations were used to recover or purify plutonium compounds and/or plutonium-bearing matrices in Room 208, GB-223, beginning in October 1992. During November 1994 the operation shifted to Room 106, GB-160 (M-027/TWCP-3546). The P/S code for this operation is identified as CV. This operation involves the use of various reagents, which are passed through a gas-solid reaction loop to produce recoverable plutonium compounds. Chemical reagents include dilute acids and bases, carbon tetrachloride, reducing agents, and ammonium chloride. In addition to the standard debris waste, process

waste included trace carbon tetrachloride from reagent bottles. Carbon tetrachloride was used as a chlorinating compound in the reaction loop and would have been completely reacted in the chlorination process (M-035/TWCP-3546). Because carbon tetrachloride was not used as a solvent or degreaser, the F-listing for carbon tetrachloride is not applicable. Process outputs from this operation may have been sent to the vault via the countroom, returned to the originating P/S code, or transferred to aqueous recovery or cement fixation (based on the DL). Sub-accountable samples may have been sent to chemical analysis.

A small-scale research operation involving gas-solid and solid-solid fluorination and chlorination chemistry began in March 1992 in Room 113, GB-117 and 179, under P/S code FLU (M-012/TWCP-3546). The process, materials, and chemicals used in this operation were similar to those used in P/S codes SO and CK because they all involved related functions (i.e., extraction of plutonium from various matrices) although each process used a slightly different approach (M-035/TWCP-3546). The process feedstock (ash) was generated in P/S code IS and also passed through the rotary calciner (P/S code RC) (M-053/TWCP-3546). Raw ash from the incinerator contains the RCRA-listed heavy metals barium (D005), cadmium (D006), chromium (D007), lead (D008), and silver (D011) in concentrations exceeding the TCLP limits. Calcined ash also contains these metals (except silver) above the TCLP limits. The process accountability flow diagram indicates that process outputs are sent to the vault or the originating P/S code. Some items were sent to CLS-1 for analysis. No organic chemicals are listed in the procedure. In addition to standard debris waste, other process wastes included used vacuum pump oil, and heating mantles. Hazardous constituents are not expected to be present in these waste items.

3.4.3 Non-Aqueous Dissolution/Extraction Operations (P/S Codes AC, AC1, AC2, AC3, AX, SA)

Several non-aqueous dissolution/extraction operations occurred in Building PF-4 beginning in 1989 and continuing at least until 1994. These operations are described below.

In January 1989, research operations in Room 208, GB-203, involved the dissolution of actinide compounds and actinide-containing matrices in superacid media. (M-004/TWCP-3546). The superacid solutions were evaporated to leave solid products that were analyzed by a variety of methods. Chemical use included anhydrous hydrofluoric acid, antimony pentafluoride, HSO₃F, hydrofluoric acid, and “other superacid solvents” (which are not specified in the procedure). The P/S code for this operation is not identified in the procedure but the process description is

consistent with P/S code SA (M-024, M-037/TWCP-3546). This P/S code covered two separate activities that did not overlap in time. P/S code SA began in 1989 with superacid work, but the process changed approximately in 1991 to organometallic studies. According to the SME, organic compounds (i.e., solvents) were never used with superacid media. Aluminum oxide and magnesium oxide were used to absorb superacid components. These spent oxides were discarded along with contaminated glass. Hazardous constituents are not expected to be present in any of the waste streams.

The study of the organometallic chemistry of uranium and thorium in non-aqueous solvents (as part of P/S code SA) was conducted in Room 208, GB-216 and 230, in 1989 (M-024/TWCP-3546). Chemical reagents and solvents are not specified but the procedure indicates that materials used in the process may include "hydrocarbon, ethereal, and aromatic solvents, organic reagents, and inorganic salts." The procedure was revised in 1991, at which time the operation was conducted in Room 105 (GB-166 and -177) and Room 208 (GB-230 and -240). The process consisted of a variety of small-scale organoactinide operations involving fundamental research of the synthesis in non-aqueous media of new actinide compounds, their characterization and reaction chemistry, and application to existing actinide processing technology. Due to the range of experimental studies conducted under this P/S code, a definitive list of chemical reagents does not exist; however, previous studies involved the use of a wide range of hydrocarbon solvents, including the D-listed and F-listed constituents: methylene chloride (F002), diethyl ether (F003), benzene (D018, F005), toluene (F005), and pyridine (D038, F005). Tetrahydrofuran and toluene were also used in the organometallic process. Neptunium and plutonium metal were put into tetrahydrofuran and dried. Bromine and/or iodine were added to create plutonium iodide, the starting material for other studies. In addition to standard debris wastes, process wastes may have included reaction by-products and residues, various pieces of laboratory equipment, spent organic solvents, and filtration media. Process outputs from this operation may be sent to the vault, returned to the originating P/S code, or transferred to aqueous recovery or cement fixation (based on the discard limit).

The procedure associated with the previous operation was revised once again in March 1994. The P/S codes for these operations are indicated as AC, AC1, AC2 and AC3. SMEs (M-038/TWCP-3546) familiar with these activities indicated that the process began as P/S code AC in February 1989 and transformed to P/S code AC2 in February 1994. P/S codes AC2 probably ran concurrently with AC1. This revised procedure indicates that operations occurred in the same rooms and gloveboxes identified in the previous revision. The distinguishing features between

AC1 and AC2 were that AC1 was an analytical process using aqueous compounds, predominantly dilute nitric, hydrochloric, and perchloric acid solutions. These acidic solutions would have been neutralized and precipitated to recover the plutonium. Solids were sent to recovery, and solutions were sent to cementation. P/S code AC2 involved synthesis of (air-sensitive) new compounds in an inert glovebox. This was a non-aqueous process. P/S code AC3 is not related to P/S codes AC1 or AC2, but is predominantly a metal operation (M-038/TWCP-3545). This code had not yet become active by the time this report was prepared, and no other information was available for it.

The procedure describes operations that comprise a broad range of laboratory activities in support of fundamental and applied actinide chemistry research (M-025/TWCP-3546). These activities include, but are not limited to, preparation of solvents and reagents, synthesis of new chemical compounds, and characterization and analysis of new chemical compounds using wet chemistry methods and analytical instrumentation. The chemical list indicates the use of a variety of materials, including organic solvents (e.g., toluene and benzene), alkaline earth metals, and transition metals. The SMEs (M-038/TWCP-3546) familiar with these activities indicated that a “variety of aromatic, alkaline, and chlorinated solvents” (e.g., tetrahydrofuran, toluene, benzene, dimethyl chloride (also known as methylene chloride), and chloroform) were used in these activities. These organic chemicals have the following HWNs: benzene (D018, F005), chloroform (D022), methylene chloride (F002), toluene (F005). The SME stated that waste byproducts from the operations that contain these constituents were not discarded but were held in the glovebox for reprocessing or recovery. Because the SME was not involved with these activities after 1994, he was unable to definitively state how the waste materials were ultimately dispositioned. In a later discussion, other SMEs (M-038/TWCP-3546) indicated that use of the chlorinated solvents associated with P/S code AC1 was discontinued in 1994 and that items contaminated with these constituents mentioned are still in the glovebox and have yet to be discarded as of the date of this report. Transition metals used as reagents in the synthesis of new materials in this process included sodium salts, potassium salts, and silver salts. The precipitated salt byproducts also were not discarded but were held in the glovebox for reprocessing and recovery. In a later discussion, other SMEs confirmed that silver salts associated with P/S code AC1 are still in the glovebox awaiting determination for a path forward for disposition. Other than silver (D011), no RCRA metals were used in the processes (M-038/TWCP-3546). In addition to the standard debris wastes, process wastes may have included reaction by-products and residues, heating mantles, vacuum pump apparatus, various pieces of laboratory equipment, spent organic solvents, and filtration media. Process outputs for both P/S codes may be sent to the vault, returned to

the originating P/S code, or transferred to aqueous recovery or cement fixation (based on the discard limit).

P/S code AX was related to the dissolution of actinide compounds in superacid media but involved the assay of plutonium in nitric or hydrochloric acid solutions. This operation occurred in Rooms 401, 409, and 420. The procedure was initiated in 1988 and revised in 1989 (M-005/TWCP-3546). Assay solutions were accumulated for transfer to P/S code CX (in chloride operations) or P/S code RR (in nitrate operations). The use of RCRA solvents is not indicated in the procedure.

3.4.4 Analytical Operations (P/S Codes ACL, ICP, XP)

P/S code ACL is an umbrella operation that covers all analytical techniques performed in Room 124 (M-042/TWCP-3546). This P/S code began in the 1980s and continues to the present. Processes under this P/S code involve analysis of plutonium and americium, RCRA metals, and trace metals. Originators provide samples, which are prepared for further analyses (e.g., ICP and XES). Analytical preparation may involve the use of nitric acid solutions. Unused liquid samples are returned to the originator, sent to radiochemistry for counting, or sent to recovery operations if established discard limits are exceeded. Discardable wastes (based on discard limits) are disposed to the acid waste line. Some solid wastes (i.e., residues from chromatography) are collected, counted, and sent to recovery operations if the plutonium concentration exceeds the discard limit.

P/S code ICP is one of the plutonium analytical techniques associated with P/S code ACL (M-042/TWCP-3546). This process takes place in Room 106, GB-188 and began in 1987/88. Although still active, this P/S code will eventually be replaced by P/S code ACL.

P/S code XP involved several small-scale R&D efforts primarily focused on plutonium recovery (M-049/TWCP-3546). Operations were conducted in Room 208, GB-227, 228, and 229. This P/S code began in March 1986 and ended in May 1990. It included the following activities:

- Fluoride sintering of PuO₂ took advantage of the presence of fluoride to aid the formation of a sintered mass of PuO₂ powder at temperatures above 700°C. Process inputs did not involve constituents that would result in the generation of RCRA hazardous waste (M-049/TWCP-3546).
- Chlorination of Pu oxides involved oxides with tantalum chips from Rocky Flats Environmental Technology Site (RFETS). Chlorination was used to recover plutonium from potassium chloride and sodium chloride matrices. Process inputs did not involve constituents that

would result in the generation of RCRA hazardous waste (M-049/TWCP-3546).

- Processing of molten salt extract (MSE) salts generated at LANL and RFETS did not involve constituents that would result in the generation of RCRA hazardous waste (M-049/TWCP-3546).
- Recovery of plutonium from ash involving plutonium/thorium oxide mixtures generated ash residues that are likely to contain a variety of contaminants, including RCRA heavy metals such as cadmium, chromium, and lead (M-049/TWCP-3546). The ash was sent to recovery and ultimately cemented. The feed material was ash generated in the incinerator (P/S code IS) and that had passed through the rotary calciner (P/S code RC) (M-053/TWCP-3546). Raw ash from the incinerator contains the RCRA-listed heavy metals barium (D005), cadmium (D006), chromium (D007), lead (D008), and silver (D011) in concentrations exceeding the TCLP limits. Calcined ash also contains these metals (except silver) above the TCLP limits.
- Processing of neptunium oxide and metal was performed to remove the protactinium daughter in order to use the neptunium for non-destructive assay (NDA) standards (M-049/TWCP-3546).

Waste from P/S code XP included standard debris items associated with laboratory operations and glovebox maintenance, as well as lead shielding. Phosphine oxide was used as the extracting/complexing agent and diisopropyl benzene, CMPO, and DHDCMP mixtures were used as diluents for processes involving solvent extraction of plutonium leached from a candidate matrix.

3.4.5 Measurement/Detection Operations and Studies (P/S Codes EOC, HRS, LIBS, RASS/RSS, SMP, VS, XES)

P/S code VS took place in Room 209, GB-210, and involved the inspection of high-purity oxides and metals to verify the inventory in the vault (M-045/TWCP-3546). Materials were retrieved from the vault, brought to the glovebox, inspected, assayed by a non-destructive method, sampled if necessary for chemical analysis (under different P/S codes), then repackaged if necessary, and returned to the vault. Waste from this activity would include vials if the inspected material were sampled, and plastic (from the bagout process). No other materials or chemicals were introduced. This P/S code ran only a few months, from August 1987 to early 1988.

P/S code XES is a plutonium assay technique in which samples containing plutonium are excited with X-rays, and the resulting emission

spectra are measured to determine plutonium concentrations (M-042/TWCP-3546). Sample preparation may occasionally require the use of acid/base solutions to suspend solids. Unused sample material is returned to the originator. The time period for P/S code XES is 1988 to present. The process occurs in Room 106.

P/S code RASS/RSS involves interrogating small samples (solids or solutions containing less than 1 gram of nuclear material from other P/S codes) using laser-based spectroscopy (M-043/TWCP-3546). This P/S code was created February 1993 and is still active although the process has not been used in two to three years. The operation takes place in Room 105, GB-165. Sample preparation is not conducted under this P/S code. If samples require preparation prior to spectroscopy (e.g., if the sample must be diluted with an acid solution because plutonium concentrations are too high), the preparation steps are performed by the originating P/S code. Once analyzed, samples are returned to the originating P/S code, sent on to other P/S codes, or sent for recovery/reprocessing. No waste is generated from this P/S code except standard glovebox trash, including gloves that may be leaded or unleaded.

P/S code LIBS used a laser for isotopic analyses of samples of high purity metals and oxides (M-047/TWCP-3546). The process was initiated January 1998 and is still operational. Some developmental work commenced prior to 1998; however, this was before the process went "hot." Process activities are conducted in Room 105, GB 158 and 180. Waste forms include standard glovebox maintenance items. There is no sample preparation involved, and no organic or RCRA metal constituents are introduced or generated during the process.

P/S code SMP has "never gone hot" (M-044/TWCP-3546) but may start up in the first six months of 2000. The process will take place in Room 120 and will involve mounting samples of plutonium metal and stainless steel using a low-melting bismuth-tin alloy in preparation for electron microscopy. No organic solvents or RCRA metals will be introduced or generated as wastes during the process. No other sample preparation will be done under this P/S code. Any required surface preparation will be done at the originating P/S code, and samples will be returned to the originating P/S code. Waste will consist of standard glovebox maintenance items.

P/S code EOC began in March 1992 in Room 208 as an experiment designed to calculate the surface area and pore size distribution of a sample and to analyze its surface characteristics (M-015/TWCP-3546). Mixtures of helium and nitrogen are passed through a U-shaped cell containing a sample to be analyzed. Solvents or chemicals other than

nitrogen and helium are not indicated in the reagent list or mentioned in the text of the procedure. The operation might still be active (M-040/TWCP-3546). Process outputs from this operation may be sent to the vault, returned to the originating P/S code, or transferred to aqueous recovery or cement fixation (based on the discard limit).

P/S code HRS involved spectroscopic studies in Room 105, GB-189 and 190, from January 1987 through March 1995 (M-036/TWCP-3546). Fluorinated actinide compounds were introduced with compressed gases into a long-path, variable temperature cell for spectroscopic measurement and in preparation for physical chemistry (M-023, M-036/TWCP-3546). RCRA-regulated constituents were not indicated as being used. Process outputs, which were the experimental items used for analysis, are expected to have been the same as the process inputs; therefore, no RCRA or other waste constituents of concern were involved.

3.4.6 Pyrochemical Matrix Studies (P/S Codes IB, EXT, STF)

A pyrochemical matrix study was conducted from May 1986 through February 1995 in Room 208, GB-264. The process was initiated under P/S code IB (Incoming Oxide Blending) in May 1986 (M-039/TWCP-3546). From 1986-1992, the process involved rod milling prior to screening (M-030/TWCP-3546). This process had two objectives: (1) blending large batches of homogeneous plutonium metal oxides (up to 85 percent purity) for pyrochemical operations, and (2) dissolution of 78 percent pure (or greater) plutonium metal oxides for nitrate operations (M-039/TWCP-3546). The materials or impurities in oxides destined for dissolution consisted of high iron, chromium, and halide salts; therefore, this accounted for the sources of chromium in the evaporator bottoms.

The process changed in August 1992 to become the Matrix Study of Pyrochemical Salts when a need developed to blend oxides to provide feed material for P/S codes RB and RBJ to make NDA standards. This activity continued until February 1995 when the process became P/S code STF, which is still an active code conducted in Room 126, GB-138 and 139. The objective of this activity was to determine the effect of pyrochemical salt matrices on the accuracy of NDA measurements (M-029/TWCP-3546). Process activities involved crushing, pulverizing, blending, roasting, and sieving pyrochemical salts. The results were used to determine handling and processing of the salts and for correction of bias measurements. The feed material consisted of high-purity oxides to use in the fabrication of standards to be used at LANL and throughout the DOE complex (M-039/TWCP-3546). Waste forms included a stainless steel capsule used to contain the standard, and stainless steel

cans (similar in size to a paint can) used to contain the oxides. The process did not use or generate wastes containing liquids, solvents, organics or metals (except the stainless steel). Waste included typical glovebox maintenance items (e.g., cheesecloth, rags, HEPA filters, glovebox windows, gloves). Process outputs from this operation were sent to the vault.

P/S code EXT was a small basic research operation that began in March 1992 in Room 106, GB-180. This research effort explored aqueous extraction of plutonium from various waste streams, particularly used pyrochemical salts (M-013/TWCP-3546), using acids and bases. The procedure does not indicate the use of any RCRA-listed chemicals. Wastes from this operation would include rags and paper products from general clean-up; labware that may include glass, plastic, or metal; heating mantles, and spent pyrochemical salts. The process accountability flow diagram and procedures for this process do not identify the P/S codes that fed this operation. Spent pyrochemical salts contain barium (D005), cadmium (D006), chromium (D007), lead (D008), and silver (D011) at concentrations that depend upon the process that generated the salt. Concentrations of RCRA heavy metals are below regulatory limits for pyrochemical salts from direct oxide reduction (P/S code OR) (TWCP-2540), but concentrations are not known for pyrochemical salts from salt stripping (P/S code SS) or special processes (P/S code PX). Residues from the solution extraction process were sent to the vault via the countroom, returned to the originating P/S code, or transferred to chloride (P/S code CX) or nitrate (P/S code CF) operations. The D-listed constituents would carry through to subsequent treatment processes. Solutions were transferred to chloride (P/S code CX) or nitrate (P/S code CF) operations, or were disposed to the acid waste line if the solutions met the waste acceptance criteria for the RLWTF at TA-50.

3.4.7 Hydrothermal Processing (P/S Code APD)

P/S code APD was a hydrothermal processing procedure initiated in March 1996 in Room 208, GB-230 (M-001/TWCP-3546). The operation involves the reaction of aqueous/organic mixtures, pure organic liquids, or contaminated combustible solids (e.g., ion exchange resins, plastic filters, and cellulose rags) under supercritical conditions (i.e., high temperature and pressure). Feed streams include, but are not limited to, analytical laboratory solutions that may contain carbon tetrachloride, tributyl phosphate, and organic solvents (unspecified in the procedure), as well as lead and mercury (CI-25/TWCP-3547). Process effluents are gases, liquids and salts. Organic components are oxidized to carbon dioxide. Nitrate contaminants are converted to nitrogen gas and some nitrous oxide. Components such as chlorine, sulfur, and phosphorus are

oxidized and converted to acids or salts. Gases are liberated; solids and liquids are collected for recovery or disposal.

The types of chemical wastes generated by hydrothermal processing experiments are predominantly effluents and rags. Hazardous organic constituents, including carbon tetrachloride, are probably destroyed by the hydrothermal process (M-034/TWCP-3546); therefore, organic RCRA-listed constituents in the feed streams would not be expected to be present in the resulting debris waste. Rags contaminated with carbon tetrachloride that were not processed through the hydrothermal reactor would be assigned the hazardous waste code D019. Hazardous inorganic constituents (i.e., RCRA metals) would not be present in the waste (M-034/TWCP-3546) other than any heavy metals present in the feed solutions (e.g., D008 and D009). Process outputs from this operation may be sent to the vault, returned to the originating P/S code, or transferred to aqueous recovery or cement fixation (based on the discard limit). Materials may also be sent to Actinide Chemistry R&D (P/S codes AC1 or AC2) or Raman Spectroscopy (P/S code RASS/RSS) for quantification.

3.4.8 Electrochemistry Experiments (P/S Code EDC)

Under P/S code EDC, various electrochemistry R&D experiments were conducted in Rooms 105, 106, 112, 208, 209, and 210 in December 1995. Electrochemistry methodologies were designed to decontaminate items, replace processes that produce large amounts of waste, or enhance chemical reactions (M-014 and M-031/TWCP-3546). Electrolytes were typically inert nonhazardous salts. Process inputs were from the vault or metallurgy operations. The process involved uranium decontamination of disassembled weapon components from various sites with various levels of surface contamination with plutonium (M-041/TWCP-3546). The operation was strictly an aqueous process in which an alkaline solution was reacted with the components to precipitate uranium. A stainless steel cathode was used; therefore, corrosion was not an issue and the electrolyte was not degraded. Significant amounts of metal could be stripped in a short period of time. The precipitated solution comprised either uranyl hydroxide or uranyl sulfate, which was then dried for mass balance. The distillate contained small amounts of uranium. Rinse water was discarded to the industrial caustic waste line. RCRA metals would be present in the waste stream but the SME stated that there are "reams of analytical data" to support that RCRA metals are below regulatory threshold limits. However, to be conservative, it is assumed that chromium (D007) could be present in the sand and slag removed during this process (M-031/TWCP-3546). Outputs from the process are directed to the vault or nitrate recovery operations (P/S code CF).

3.4.9 Waste Management Operations (P/S Codes NCD, RD, WM, X0, XO)

P/S code RD was used only in 1984–1986 in Room 432 (M-046/TWCP-3546). This P/S code allowed for tracking of demonstration drums (one drum each year) that were packaged and prepared in accordance with the TA-55 Attachments to the *Certification Plan* (TWCP-701) to meet the WIPP requirements at that time. Packaging of these drums did not of itself result in the generation of TRU waste. The SME stated that the waste drums that were packaged contained non-mixed TRU waste.

Operations under P/S code NCD occurred during the period from April 1989 – April 1991 in Room 432 (M-046/TWCP-3546). This P/S code was established to provide a mechanism for dealing with TRU drums that did not confirm specifications (e.g., recorded weight or nuclear material content). Non-confirming drums were temporarily set aside under this P/S code until such time as personnel could reprocess them under P/S code WM to correct the nonconfirming condition. After April 1991, nonconfirming drums were dealt with immediately, and P/S code NCD was no longer needed.

According to an SME (M-046 and M-050/TWCP-3546) who researched the assignment of waste to P/S codes WM, XO, and X0, P/S code WM is currently limited to waste that arises from the TRU solid waste management operation in Room 432. This situation has been the case since the beginning of 1993. Room trash boxes from Building PF-4 have always been handled as low-level waste; however, the boxes were assayed to verify contamination levels and any that were determined to be TRU waste were diverted to Room 432 for repackaging as such. From May 1987 through 1992, these boxes were created as P/S code XO or X0. These codes were changed to P/S code WM after 1992. Additional controls were placed on room trash after 1992. Trash was assayed with the Multiple Energy Gamma Assay System (MEGAS). When a container was rejected on the basis of MEGAS data, the rejected container was returned to the originator for removal of any “hot” item(s). This process also allowed for greater control to prevent discarding regulated materials (e.g., RCRA constituents) in room trash.

The designations for P/S codes XO and X0 are based on the following distinctions:

- P/S code X0 was designated for waste materials that could not be associated with a specific room, such as a hallway, mezzanine offices, rest rooms and change rooms, basement, pump rooms, and trolleys. The waste from all these areas, except the pump rooms and trolleys, would be low-level waste and no RCRA constituents would be associated with the waste items.

- P/S code XO indicated waste materials that were generated within specific rooms but could not be associated with an individual P/S code in that room. The room trash boxes assigned this P/S code, when determined by assay to qualify as TRU waste instead of low-level waste, could contain rags that had contacted ignitable constituents (e.g., ethanol, isopropyl alcohol, and hexane); however, because the waste items were not packaged as free liquids, the EPA HWN D001 for ignitability would not be applicable. Other constituents that may have been present on rags in debris waste from P/S code XO included the degreasing solvents methyl ethyl ketone (D035, F005), trichloroethylene (D040, F001), and 1,1,2-trichloro-1,2,2-trifluoroethane [freon] (F001); methylene chloride (F002) used as a paint stripper; and chloroform (D022) used in a cryogenic bath.

Two other specific situations could also result in the generation of additional waste items under P/S code WM.

- During maintenance of the in-line glove box, changeout of the leaded gloves and windows would be covered under P/S code WM. No solvents or other chemicals were introduced during this routine maintenance activity.
- A spill in Room 432 in 1989 involved the release of a Pu-239-contaminated solution (consisting primarily of water with a minor amount of nitric acid) from a ventilation line. The spill was wiped up with rags and discarded under P/S code WM. Rags with excessive amounts of nitric acid would have been neutralized by dipping them in a calcium hydroxide solution inside a glovebox. No EPA HWN would be applicable to waste from this incident.

3.4.10 Metallography (P/S Code ME)

P/S code ME takes place in Room 115 and involves a standard metallography process that was initiated at TA-55 in 1979 and continues to the present (M-048/TWCP-3546). The purpose of the metallography operation is to characterize the microstructure of metallic or ceramic pieces to verify and establish the quality and effectiveness of welds. Materials examined under this P/S code consist of plutonium and uranium carbides, nitrides, and oxides, as well as zirconium and tantalum alloys, and stainless steel. Metal pieces (pellets) are cut with a diamond saw. Ceramic pieces are subjected to grinding with standard metal grinding media (e.g., papers impregnated with silicon carbides and diamond). The materials are polished with several different chemical compounds. Prior to May 1992, a mixture of 1–10 percent trichloroethylene and kerosene were used. Ethanol and acetone may also have been used. After May 1992, these materials were replaced with a

mineral oil and a derivative from orange peels. The polishing compounds were not used for their solvent properties, but rather for their cooling and lubricating properties. Little liquid waste is generated from the process. The trichloroethylene/kerosene mixture and the alcohols largely evaporated during the polishing process. Waste trichloroethylene and kerosene was accumulated, absorbed onto vermiculite, and discarded in 55-gallon drum.

Metal or ceramic pieces are cleaned with alcohol and etched with various kinds of acid or caustic etchants, which are reused as much as possible. Waste etchants are neutralized; however, their disposal path is uncertain. Analytical data for some of the etchant residues indicated that these residues did not contain excessive concentrations of RCRA constituents; consequently, waste from this process is documented on Chemical Waste Disposal Records as “non-RCRA.”

Beryllium and chromium (from the stainless steel) would be present in the grindings. However, the beryllium is not in a form that is RCRA regulated. Other waste includes standard glovebox maintenance items (e.g., rags, glovebox gloves, and HEPA filters), and a large volume of grinding paper. Although generally the gloves were not leaded, leaded gloves are used at the grinding station and for the last 3-4 years only at one glovebox.

3.5 Material Inputs to the Waste Generation Process

Attachment 4 lists P/S codes for miscellaneous operations at TA-55, including process descriptions, feed material, other process inputs, process outputs, and type of waste. The feed materials for miscellaneous operations consist of the general types of materials listed in Table 1 that are obtained from the storage vault, as process output from other P/S codes, or from sources outside TA-55, including other DOE sites:

The remainder of this section summarizes the nature of the process waste in terms of its physical, chemical and radioisotopic characteristics.

3.5.1 Physical Waste Form Identification

Solid waste from miscellaneous operations primarily consists of debris waste, as well as cemented waste discarded under P/S codes CF or HP. Debris waste contains glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Leaded gloves are also generated as process waste. Prior to May 1992, leaded gloves were disposed as metal debris and were not segregated from other metal wastes. Since that time, they have been routinely segregated from other metal debris waste and assigned the EPA HWN D008. In addition, caustic solutions from hydroxide precipitation are discarded through the waste line to the RLWTF at TA-50.

Table 1. Process Feed Materials for Miscellaneous Operations

Feed Material	RCRA-Regulated Substances and Associated Hazardous Waste Number	P/S Codes in Miscellaneous Operations
Analytical laboratory solutions	Solutions from other TA-55 operations: no RCRA constituents Solutions from CLS-1: Potentially contaminated with RCRA-regulated heavy metals, mercury (D009) and lead (D008), as well as RCRA-listed organic substances used as solvents, including acetone (F003), butyl alcohol (F003), carbon tetrachloride (D019), chlorobenzene (F002, D021), chloroform (D022), methanol (F003), methylene chloride (F002), tetrachloroethylene (F002, D039), xylene (F003) (reference CI-25 in TWCP-3547).	ACL and ICP (TA-55 solutions) APD (CLS-1 solutions)
Ash from P/S codes IS, SB, and TDC, or from other DOE sites	Usually suspect contaminated with barium (D005), cadmium (D006), chromium (D007), and lead (D008). Silver (D011), arsenic (D004), mercury (D009), and selenium (D010) may also be present; although volatile at high temperatures if present in the oxide form, these heavy metals may be alloyed to Pu if present in the metal form.	SO, XP
Disassembled weapons components	High-purity Pu and U material types	EDC
Experimental R&D feed materials; various isotopes and isotopic mixtures of actinides in various matrices	Variable purity	AD, CV, EXT, HRS, ME, RASS/RSS, SA, XES, XP
Hydroxide cakes	Typically contaminated with RCRA-regulated heavy metals cadmium (D006), chromium (D007), mercury (D009), lead (D008), and silver (D011)	AD
MSE salts	Typically fairly pure, suspect contaminated with barium but no other RCRA substances present	XP
Pu chlorides and fluorides (from various P/S codes)	Variable purity	FDL, SO
Pu metal or metal alloy	High purity, no RCRA-regulated substances, unless noted otherwise	AC, AC1, AC2, EXT, LIBS, SA, SMP, VS
Pu oxides	High-purity oxides used for P/S codes EOC, LIBS and STF. Variable purity for other codes, may be contaminated with RCRA-regulated heavy metals barium (D005), cadmium (D006), chromium (D007), and lead (D008), and silver (D011)	CK, CV, EOC, EXT, FDL, FLU, IB, IE, LI, LIBS, SO, STF, VS, XP
Pyrochemical salts	Typically fairly pure, no RCRA-regulated substances other than barium (D005) present	EXT, IB

Because items from several different processes are usually combined into individual waste drums, the physical waste form of each drum must be determined independently. This information is documented on a Waste Origination and Disposition Form (WODF) by the waste generator according to controlled procedures. The P/S code for each waste item is also documented on this form. In the packaging process, a standard form, the Discardable Waste Log Sheet (DWLS), was used to list each item ID number and record its matrix material. This form was signed by the waste packager, reviewed, and approved by quality assurance (QA) personnel.

3.5.2 Radionuclide Content Identification

The primary plutonium material type inputs for miscellaneous operations at TA-55 are listed in Table 2, and uranium material types are listed in Table 3. The designation *material type* (MT) (e.g., MT 52) is used within the DOE Complex to describe the isotopic composition of common blends of radioactive materials used within the Complex. The material type notation was developed because it is a convenient way to describe material types that have very consistent isotopic compositions. Tables 2 and 3 indicate the isotopic composition of the material types at the time the waste was characterized.

The plutonium material type provides the basis for estimating an upper bound for U-234, U-235, and Am-241 contents based on the rate of decay of their precursors, Pu-238, Pu-239 and Pu-241, respectively. The results of these calculations are also tabulated in Table 2, assuming (a) none of these isotopes were initially present in the material, (b) the oldest Pu material in inventory dates back to 1 January 1960, and (c) the waste was packaged on 1 January 1996, making it 36 years old (TWCP-698).

The material type used in the process generating each waste item was documented on the WODF and DWLS. However, some of the plutonium recovery processes separate plutonium and americium, or plutonium and uranium, so that their relative ratios may be altered in the process outputs and wastes. Waste items may be either depleted or enriched in americium depending on whether the source of contamination is the process product or the process residues (TWCP-882).

Residues submitted for reprocessing often contain Np-237, the decay product of Am-241 (half-life, 458 yr). This radioisotope is expected to be present in minor amounts in nearly all debris waste from miscellaneous operations at TA-55.

Table 2. Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %)

Material Type (MT)	Plutonium isotope and half-life						Upper limits for weight ratios		
	Pu-238 (87.74 yr)	Pu-239 (24120 yr)	Pu-240 (6564 yr)	Pu-241 (14.35 yr)	Pu-242 (376,300 yr)	Pu-244 (8.26 x 10 ⁷ yr)	U-234/ Total Pu	U-235/ Total Pu	Am-241/ Total Pu
MT 51	0.006	96.77	3.13	0.076	0.018	—	1 x 10 ⁻⁵	0.001	0.0006
MT 52	0.01	93.78	6	0.2	0.02	—	2 x 10 ⁻⁵	0.001	0.002
MT 53	0.03	91.08	8.45	0.366	0.071	—	7 x 10 ⁻⁵	0.0009	0.003
MT 54	0.046	87.42	11.5	0.81	0.22	—	0.0001	0.0009	0.007
MT 55	0.06	83.88	14.73	1.03	0.304	—	0.0002	0.0009	0.009
MT 56	0.061	81.9	16.51	1.18	0.355	—	0.0002	0.0009	0.01
MT 57	0.433	74.63	20.7	2.55	1.69	—	0.001	0.0008	0.02
MT 42									
84%	1.02	1.37	10.32	3.13	84.14	0.02	0.003	1 x 10 ⁻⁵	0.03
90%	0.72	1.26	6.4	1.86	89.77	—	0.002	1 x 10 ⁻⁵	0.02
95%	0.45	0.56	2.47	0.906	95.58	0.029	0.001	6 x 10 ⁻⁶	0.008
MT 83									
83%	83.89	13.8	1.9	0.32	0.09	—	0.26	0.0002	0.003
89%	89.26	10.07	0.633	0.021	0.015	—	0.28	0.0001	0.0002

Source: TWCP-698

Table 3. Average Isotopic Content of Uranium Material Types and Enrichments (Weight %)

Material Type	U-234	U-235	U-236	U-238
MT 12	0.0015	0.23	0.008	99.77
MT 35	0.36	37.6	0.14	61.9
MT 36	0.63	62.44	0.18	36.75
MT 38	1.03	93.04	0.41	5.53
MT 39	1.32	97.52	0.17	0.99

Source: TWCP-698

In general, uranium and its isotopes are expected to be present only at trace levels, if at all, unless the feed material is uranium. For plutonium feed materials, U-235 in growth from the decay of Pu-239 (half-life, 24,120 years) would be negligible due to the long half-life of Pu-239. U-234 would be present in MT 83 as a decay product of Pu-238 (half-life, 87.74 years). After 20 years, 14.6 percent of the initial Pu-238 would have decayed to U-234. For MT 83 with an initial content of 83.89 percent Pu-238, the atomic ratio U-234 to total Pu would be about 0.14. No U-236 is present.

During TWCP characterization, the contents of each waste package undergo non-destructive analysis to provide detailed radioisotopic data. These data will be used to evaluate the accuracy of AK information in accordance with *Waste Characterization Data Reconciliation with Acceptable Knowledge* (TWCP-DTP-1.2-064). If warranted, this AK report will be updated to incorporate the results of these comparisons.

3.5.3 Chemical Content Identification

Chemical inputs to miscellaneous operation processes are listed in Table 4. In section 4, these inputs are evaluated along with constituents present in the feed materials and equipment in order to determine to applicability of EOA HWNs to process waste for each P/S code.

4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS

The assignment of EPA HWNs to process wastes from miscellaneous operations is summarized in the text below, as well as in Table 5, on the process timelines in Attachment 3, and in the table of process inputs and outputs in Attachment 4. These assignments take into account the possible presence of RCRA chemicals in process waste as a result of their suspected or known presence in feed materials, chemical inputs, equipment, and glovebox surfaces.

4.1 F, K, and P Listings

The following F listings only apply to cellulosic, ceramic, plastic and rubber items. The F listings do not apply to glass or metal debris, even if these items were in contact with the F-listed chemicals, because their non-porous surfaces do not absorb liquids or gases.

AC/AC1/AC2	F002 (methylene chloride), F005 (benzene, toluene)
AD	F002 (tetrachloroethylene), F003 (methanol)
APD	F002 (chlorobenzene, methylene chloride, tetrachloroethylene); F003 (acetone, methanol, xylene)

Chemical input	P/S Codes in which RCRA-Listed Chemicals Are Used	Comments on Applicability of EPA HWN
Potassium permanganate Potassium salt (not specified) Silver salt Sodium bicarbonate Sodium carbonate Sodium chloride Sodium chlorite Sodium nitrate Sodium salt (not specified) Sodium sulfate Thorium oxide	AC1	D011
Metals		
Alkaline earth metals Bismuth-tin alloy Gallium metal, oxide or salt Lanthanide metals Platinum and platinum-rhodium alloys Stainless steel Tantalum metal, oxide or salt Zirconium and tantalum alloys		D007 (chromium)
Organic Chemicals		
1-propanol Acetone Alkylating agents (unspecified) Benzene Carbon tetrachloride Carbon tetrafluoride Chloroform DBBP (dibutyl butyl-phosphonate) DBBP (dibutyl butyl-phosphonate) / Isopar (isoparaffinic hydrocarbon solvent) Diethyl ether Dihexyl N,N-diethylcarbamoylmethyl phosphonate (DHDCMP) Diisopropyl benzene Ethanol Hexane Hydrazine dihydrochloride Hydrazine hydrochloride Hydroxylamine chloride Hydroxylamine nitrate Isopropanol Kerosene Methanol	ME AC/AC1/AC2, SA AD, CV AC/AC1/AC2, APD, XO SA AD, SO	F003 D018 and F005: solvent use D019 applies to AD and CV. F001 does not apply because this chemical was not used for degreasing. D022 F003 applies to AD because methanol may have been used for cleaning inside the glovebox. F003 does not

Table 5. Evaluation of the Applicability of EPA Hazardous Waste Numbers to Processes Discussed in This Report

P/S Code	Description	Potential EPA Hazardous Waste Numbers (HWNs)			Applicable HWNs
		Due to Feed (from Table 1 and text)	Due to Chemical Use (from Table 4)	Due to Process*	
AC	Actinide Chemistry, R&D	None	D011, D018, D022, F002, F005	D007, D008, D009	D007, D008, D009, D011, D018, D022, F002, F005
AC1	Actinide Chemistry, R&D	None	D011, D018, D022, F002, F005	D007, D008, D009	D007, D008, D009, D011, D018, D022, F002, F005
AC2	Actinide Chemistry, R&D	None	D011, D018, D022, F002, F005	D007, D008, D009	D007, D008, D009, D011, D018, D022, F002, F005
AC3	Actinide Chemistry, R&D	None	None	None	None
ACL	Analytical Chemistry Laboratory	None	None	D007, D008, D009	D007, D008, D009
AD	Actinide Processing Demonstration	D004, D005, D006, D007, D008, D009, D010, D011, D019	D008, D019, D039, F002, F003	D007, D008, D009	D004, D005, D006, D007, D008, D009, D010, D011, D019, D039, F002, F003
APD	Actinide Processing Demonstration	D008, D009, D019, D021, D022, D039, F002, F003	None	D007, D008, D009	D007, D008, D009, D019, D021, D022, D039, F002, F003
AX	Solution Assay	None	None	D007, D008, D009	D007, D008, D009
CK	RD&D Volatile Fluoride Pu Recovery	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
CV	R&D Experimental Chlorination Processes	D005, D006, D007, D008, D011	D019, D039	D007, D008, D009	D005, D006, D007, D008, D009, D011, D019, D039
EDC	Electrolytic Decontamination	D007	None	D007, D008	D007, D008
EOC	Experimental Oxide Characterization	None	None	D007, D008, D009	D007, D008, D009
EXT	Extraction RD&D	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
FDL	FOOF Demonstration Loop	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
FLU	Fluorination RD&D	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
HRS	High Resolution Spectroscopy	None	None	D008	D008
IB	Matrix Study Of Pyrochemical Salts	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
ICP	ICP-AES Analysis	None	None	D007, D008, D009	D007, D008, D009

P/S Code	Description	Potential EPA Hazardous Waste Numbers (HWNs)			Applicable HWNs
		Due to Feed (from Table 1 and text)	Due to Chemical Use (from Table 4)	Due to Process*	
IE	Isotope Enrichment	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
LI	XF6 Experimental Measurements	D005, D006, D007, D008, D011	None	D007, D008, D009	D005, D006, D007, D008, D009, D011
LIBS	Laser-Induced Breakdown Spectroscopy System	None	None	None	None
ME	Metallography	None	D040, F003	D007, D008	D007, D008, D040, F003
NCD	Nonconfirming Drums	None	None	None	None
RASS/RSS	Raman Spectroscopy System	D004, D005, D006, D007, D008, D009, D010, D011, D019	None	D007, D008, D009	D004, D005, D006, D007, D008, D009, D010, D011, D019
RD	Repackaging into Retrievable Drums	None	None	D008	D008
SA	Super Acid RD&D	None	D018, D038, F002, F003, F005	D007, D008, D009	D007, D008, D009, D018, D038, F002, F003, F005
SMP	SP Mounting Preparation	None	None	None	None
SO	Super Oxidizer, FOOF Program	D004, D005, D006, D007, D008, D009, D010, D011	None	D007, D008, D009	D004, D005, D006, D007, D008, D009, D010, D011
STF	Standard Fabrication	None	None	D007, D008	D007, D008
VS	Confirmation, Inspection & Sampling	None	None	D008	D008
WM	Waste Management	Must be determined on case-by-case basis			**D007, D008, D009, D022, D035, D040, F001, F002, F005
X0	Inactive or Unspecified P/S Material	Must be determined on case-by-case basis			**D007, D008, D009, D022, D035, D040, F001, F002, F005
XES	X-Ray Energy Spectroscopy	D004, D005, D006, D007, D008, D009, D010, D011	None	D007, D008, D009	D004, D005, D006, D007, D008, D009, D010, D011
XO	Inactive or Unspecified P/S Material	Must be determined on case-by-case basis. However, HWNs known to be applicable include those for chloroform (D022), trichloroethylene (D040, F001, F002), 1,1,2-trichloro-1,2,2-trifluoroethane (F002), methylene chloride (F002), and methyl ethyl ketone (D035, F005) because cleaning rags may be contaminated with these RCRA chemicals; also D007, D008, D009			**D007, D008, D009, D022, D035, D040, F001, F002, F005

P/S Code	Description	Potential EPA Hazardous Waste Numbers (HWNs)			Applicable HWNs
		Due to Feed (from Table 1 and text)	Due to Chemical Use (from Table 4)	Due to Process*	
XP	RD&D Experimental Processes	D004, D005, D006, D007, D008, D009, D010, D011	None	D007, D008 (gloves and shielding), D009	D004, D005, D006, D007, D008, D009, D010, D011

* EPA HWNs assigned due to the process itself include chromium (D007) when there is the potential for this metal to be leached from stainless steel equipment or items in the process, lead (D008) when leaded gloves are used in the process, and mercury (D009) when there is a potential for a glass mercury thermometer to have been used in the same glovebox.

** P/S codes WM, XO, and XO have conservatively been assigned the same cumulative list of EPA HWNs, regardless of information indicating that specific hazardous constituents are not expected in one or more of these P/S codes, because application of these P/S codes to specific waste containers has been inconsistent at TA-55 (M-050/TWCP-3546).

ME	F003 (acetone)
SA	F002 (methylene chloride), F003 (diethyl ether); F005 (benzene, toluene, pyridine)
WM, XO, XO	F001 (trichloroethylene, 1,1,2-trichloro-1,2,2-trifluoroethane (freon)); F002 (methylene chloride, trichloroethylene); F005 (methyl ethyl ketone)

No K or P listings apply to solid wastes generated from any of the miscellaneous operations because no K-listed or P-listed chemicals were present in the feed materials, chemicals, or equipment used in these processes.

4.2 Toxicity Listings

The list below is summarized from Table 5 and lists the EPA HWNs applicable to waste from processes described in this report. P/S codes marked with an asterisk (*) in the list do not contain RCRA-listed constituents in the feed material or in the chemicals used in the process, but have been assigned HWNs due to the potential for chromium (D007) to be leached from stainless steel equipment or items in the process, lead (D008) due to the use of leaded gloves in the process, and mercury (D009) if there is a potential for a glass mercury thermometer to have been used in the same glovebox. Prior to May 1992, leaded gloves were disposed with other metal waste under the originating P/S code. Since May 1992, the gloves have been routinely segregated from other metal debris (TWCP-4166).

No D001 (ignitable), D002 (corrosive), or D003 (reactive) listings apply to the solid wastes from miscellaneous operations because no ignitable chemicals were used in these processes and because the solid wastes do not contain any free liquids (see Section 6.0).

AC, AC1, AC2	D007, D008, D009, D011, D018, D022
ACL	* D007, D008, D009
AD	D004, D005, D006, D007, D008, D009, D010, D011, D019, D039
APD	D007, D008, D009, D019, D021, D022, D039
AX	* D007, D008, D009
CK	D005, D006, D007, D008, D009, D011
CV	D005, D006, D007, D008, D009, D011, D019, D039
EDC	* D007, D008
EOC	* D007, D008, D009
EXT	D005, D006, D007, D008, D009, D011
FDL	D005, D006, D007, D008, D009, D011
FLU	D005, D006, D007, D008, D009, D011
HRS	* D008
IB	D005, D006, D007, D008, D009, D011
ICP	* D007, D008, D009
IE	D005, D006, D007, D008, D009, D011
LI	D005, D006, D007, D008, D009, D011
ME	D007, D008, D040
RASS/RSS	D004, D005, D006, D007, D008, D009, D010, D011, D019
RD	D008
SA	D007, D008, D009, D018, D038
SO	D004, D005, D006, D007, D008, D009, D010, D011
STF	D007, D008
WM	D007, D008, D009, D022, D035, D040
X0	D007, D008, D009, D022, D035, D040
XES	D004, D005, D006, D007, D008, D009, D010, D011
XO	D007, D008, D009, D022, D035, D040
XP	D004, D005, D006, D007, D008, D009, D010, D011

Activities under P/S codes LIBS, NCD, and SMP do not generate solid waste to which any HWN would be applicable.

4.3 Corrosivity, Reactivity, and Ignitability

See Section 6.0.

5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION

See Section 3.5.2.

6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED

According to the WIPP WAP, "The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes." Administrative controls on waste packaging were in place at various times to ensure the absence of such items from the waste stream.

- Liquids were prohibited from solid waste streams at TA-55 when the facility opened in January 1978. A waste management procedure written to cover operations at the new facility, *TA-55 Standard Operating Procedure (SOP) 406-GEN-R00*, stated that "Liquids are not permitted in any container of solid waste materials" (TWCP-3943).
- Chemical Waste Disposal Requests introduced in June 1980 included checkboxes which the waste generator was required to check if the waste contained corrosive acids or bases, or pyrophoric, flammable, corrosive, explosive, toxic, carcinogenic or highly reactive materials.
- The Certification Plan (TWCP-697) and related Generator Attachments (TWCP-701) were implemented in 1987. Waste generators were required to sign a statement on the WODF documenting that the waste contained "no free liquids, pyrophorics, explosives, compressed gases, powders or materials other than the indicated matrix." Checkboxes were also present for indicating the presence or absence of corrosive chemicals. Full implementation of this generator statement occurred in May 1987.
- Waste management inspectors perform visual examination of the waste prior to its initial packaging, thus allowing the inspectors to verify the generator's WODF statement (TWCP-701, Sections 3.8.5 to 3.8.6).
- Explosives were prohibited from TA-55 until installation of the Impact Test Facility in the early 1990s. Explosives continue to be banned in the solid waste streams up to the present time. If a misfire should occur, the requirement is to destroy the unspent powder by burning.
- The Waste Profile Request Form (WPRF), which has been in use at LANL since 1991, includes a statement which must be authenticated by the waste generator, that the waste is not ignitable (flash point >200°F), reactive, or corrosive.
- The TA055 Generator Attachments to the Certification Plan were updated in 1995 (TWCP-700) but the prohibition on liquids in the waste, and the waste management inspection, remained in effect.

Hence, since the inception of operations at TA-55, corrosive and reactive wastes have been excluded from TA-55 solid wastes through the prohibition of liquids.

The absence of these prohibited items is verified through radiography of each waste container and visual examination of selected containers during TWCP characterization activities. These data will be used to assess the accuracy of AK information in accordance with *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028). Any free liquids are remediated, or the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007).

7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED

Section 6.0 summarizes administrative controls in place at TA-55 that prohibit incompatible chemicals in the waste, and measures taken to verify their absence. In addition, all waste containers shipped from TA-55 to TA-54 for storage were evaluated for potentially incompatible chemicals in accordance with 49 *Code of Federal Regulations* (CFR) Subpart C—Segregation and separation chart of hazardous materials; Section 177.848, Segregation of hazardous materials, and were determined to be in compliance with this requirement.

8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS

Most gases used at the TA-55 Plutonium Facility are stored outside the building and the gas is plumbed into the glovebox from outside the building (TWCP-4164). Occasionally, a lecture bottle may have been used for a process inside the building, but these bottles were kept outside of the glovebox with the gas plumbed into the glovebox. Consequently, compressed gas cylinders or containers are not expected to be in any of the TRU wastes generated by TA-55 operations.

Spray cans, especially WD-40, were in common use in TA-55 gloveboxes until May 1992 (TWCP-4166). These were routinely discarded as metal debris waste. From 1988 until May 1992, the protocol was to vent or puncture the spray cans inside the glovebox; venting was indicated by inserting a metal wire into the valve. After May 1992, spray cans were no longer used in gloveboxes.

For items of pyrochemical salt waste, the procedures of oxygen sparging and/or carbonate oxidation have been used since May 1987 to ensure that pyrophorics were oxidized. In addition, screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501) have shown (1) no autoignition, (2) no spontaneous combustion, and (3) no sparking. Experimental results on the reactivity of LANL Direct Oxide Reduction (DOR) salt with water and the reactivity in air of heated calcium metal nodules from

DOR salts indicate the absence of “dangerous when wet materials” and pyrophoricity in these salts (TWCP-3730, TWCP-3731, TWCP-3732).

Verification that individual waste drums do not contain compressed gases, free liquids, or sealed containers greater than 4 L in volume is obtained from radiography of each waste containers and visual examination of selected containers during TWCP characterization activities. Any free liquids are remediated, and any sealed containers greater than 4 L in volume, or unpunctured or unvented gas containers, are removed; or else the waste container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007). For administrative controls on the prohibition of pyrophorics, see Sections 6.0 and 7.0.

9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM

No PCBs were introduced into the miscellaneous operations, based on documentation in TA-55 procedures reviewed during the AK investigation and summarized in the process inputs listed in Table 1, Table 4, and Attachment 4. Oils used in the reviewed processes include vacuum pump oils, and cutting fluids used for cooling purposes; none of these oils are known to contain PCBs. All transformers known to contain PCBs have been tracked from the time of startup of TA-55 in 1978. Whenever any transformer oil is drained, it is handled by a subcontractor who is wholly responsible for its disposal disposal (TWCP-AK-2.1-005,R.1, Section 9.0). This oil does not enter the LANL disposal operations.

10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE

Asbestos heating mantles were never used at TA-55. Asbestos gloves were used in glovebox operations in P/S codes OR and RM (TWCP-4162, TWCP-4166), which are discussed in *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006,R.1) and *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007,R.1), respectively. Asbestos-bearing transite was widely used until recently for thermal insulation, including as a coverplate over the furnace in glovebox wells, and as part of end plates on Lindberg furnaces (TWCP-4162, TWCP-4166). Although many Lindberg furnaces have been replaced with newer asbestos-free furnaces, some are still in use at TA-55. The transite would have been disposed either as metal or as ceramic and glass debris waste.

11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS

- 40 CFR Part 261, Subpart C—Characteristics of hazardous waste, Sections 261.21 (*Characteristic of ignitability*), 261.22 (*Characteristic of corrosivity*), 261.23 (*Characteristic of reactivity*), and 261.24 (*Toxicity characteristic*)
- 40 CFR Part 261, Subpart D—Lists of hazardous waste, Sections 261.31 (*Hazardous wastes from non-specific sources*), 261.32 (*Hazardous wastes from specific sources*),

- and 261.33 (*Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof*)
- 49 CFR Subpart C—Segregation and separation chart of hazardous materials. Section 177.848, *Segregation of hazardous materials*
 - *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5)
 - *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3)
 - *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007)
 - *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002,R.1)
 - *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003,R.1)
 - *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005,R.1)
 - *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006,R.1)
 - *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007,R.1)
 - *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028)
 - *Waste Acceptance Criteria for the Waste Isolation Pilot Plant* (DOE/WIPP-069)
 - *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste* (EPA/OSWER 9938.4-03)
 - *Waste Analysis Plan, Attachment B to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088)
 - *Waste Characterization Data Reconciliation with Acceptable Knowledge* (TWCP-DTP-1.2-064)

ACCEPTABLE KNOWLEDGE ROADMAP

Waste from P/S Codes: AC, AC1, AC2, AC3, ACL, AD, APD, AX, CK, CV, EDC, EOC, EXT, FDL, FLU, HRS, IB, ICP, IE, LI, LIBS, ME, NCD, RASS/RSS, RD, SA, SMP, SO, STF, VS, WM, XES, XP, XO, X0

Copies of these documents are in the TWCP RMDC Center.

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-352	B	Description of plutonium recovery processes	<i>Wastes from Plutonium Conversion and Scrap Recovery Operations</i> , LA-11069-MS, March 1988.	Document describes the Pu residues and the various treatment approaches used in recovering plutonium from scrap	Document does not give information about RCRA constituents introduced or present in the processes
TWCP-614	D	All TA-55 waste is Defense related.	Memo from Doug Sankey.	All TA-55 waste is Defense related.	Budget information may not be acceptable.
TWCP-697	C	Waste was controlled to meet WIPP WAC requirements as early as 1983.	<i>Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , WCP-HSE7-CPL-01, R.2 (November 1984)	Waste was controlled to meet WIPP WAC requirements as early as 1983. Generator Attachments were used to describe and reference specific generator procedures.	Overview document - Generator Attachments provide more detailed information.
TWCP-698	B	Gives Material Type compositions	NMT Memo, NMT-7 WM/EC-96-032 Benchmark Environmental Corp. Memo, AL-7193 BEC	Gives Material Type compositions	Does not give information on how material may fractionate in TA-55 waste processes
TWCP-700	C	<i>Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , R05	<i>NMT-7 Attachment</i> , January 1995, TRUWM-TA55-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-701	B	<i>TA-55 Generator Attachment to the TRU Waste Certification Plan for Newly Generated TRU Waste</i>	<i>TA-55 Attachment, 1987, TRU-MST12-CPA-03,R00</i>	Document controls to meet WIPP WAC were implemented and how independent verification was accomplished	Information is not extremely detailed
TWCP-882 (UCNI)	D	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste	Memo from Jim Foxx	Lists additional radionuclides and metals potentially in waste, subdivided by process status code. Covers time period from 1978 to present.	Best information available, but it is based on worker recollection because other records are not available.
TWCP-886	C	Color Flow Diagram of Pu-processes at TA-55.	Diagram from Jim Foxx	Indicates that process inputs are thermally treated and that heavy metals from process inputs end up in the nitric acid evaporator bottoms.	Does not indicate solvent input to processes.
TWCP-887	D	Co-mingling of Defense and Non-Defense TRU Waste	Memo from Jim Foxx	Wastes generated from defense and non-defense activities were not segregated at TA-55 through 1997	None
TWCP-2501	B	“Backlog Waste Reassessment Baseline Book, Waste Form 34”	Rocky Flats Environmental Technology Site Report 1995	Page WF34-10 contains results of tests for corrosivity	Tests were conducted on residues rather than on waste.
TWCP-2540 (UCNI)	A	Answers to questions about pyrochemical processes	Jim Foxx, NMT-7-WM/EC-99-118	Also contains old records of analysis of DOR salts	None
M-001/ TWCP-3546 (UCNI)	D	Process description, P/S diagram - APD	Hydrothermal Processing NMT6-SOP-AT-103-R00 04/16/96	Describes an organic destruction process to remove organic and nitrate components and facilitate collection and separation of the actinides.	F-listed solvents may have been used. No information was available to confirm or disprove.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-004/ TWCP-3546 (UCNI)	D	Process description	Superacid Research and Development 403-GEN-R00; 01/30/89 SAS-100-R00; 1/30/89; appears to be the same as 403-GEN-R00 (1/30/89)	Dissolution of actinides and actinide-containing matrices in superacids. Resulting solutions are analyzed by a variety of methods.	P/S code is not identified in procedure but process is consistent with SA.
M-005/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – AX	Operation of the Solution Assay Instruments (SAIs) 413-GEN-R00 through R02; 8/8/88 and 1/23/89, no date for R02	Describes rapid, in-process assay of Pu in nitric or hydrochloric acid. Assay solutions are accumulated for transfer to chloride or nitrate processes. Related procedures include Analyst's Procedure for SAI Samples, 420-GEN-R00, 11/12/86; User Procedure for Solution Assay Instruments IO4 and IO5, 513-ACC-R00, 2/9/87; and 531-MST10-R1, 11/88.	None
M-006/ TWCP-3546 (UCNI)	D	Process description, chemical list; process code AD identified only in latest procedure (403-GEN-R03.1)	Room 208 Purification Process Development, 431-GEN-R00 through R02; 5/6/88 through 7/31/90; Room 208 Process Development Glovebox Operations, 431-GEN-R03 through R03.1; 3/23/92 through 9/30/94	Procedures generally describe a variety of processes involving research, process development, small-scale "trouble-shooting," and special materials preparations of isotopes and isotopic mixtures of Pu, U, Am, and Np. Various acids, caustics, oxidizing and reducing agents, solvent extraction chemicals, and ethanol and methanol ("infrequently"). 431-GEN-R02 indicates the use of carbon tetrachloride as a solvent diluent during the time period 9/91-3/92.	The procedures are brief and state "Because of the variety of operations involved with this research effort, no one detailed procedure can describe all the activities that are carried out."

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-007/ TWCP-3546 (UCNI)	D	Process description, P/S diagram - SO	Safety Considerations in the Operation of the MST-12, Room 105, Ash Pretreatment Loop, 488-REC-R00; 3/24/88	A gas flow loop is used for room temperature fluorination of ash samples containing Pu residues. The fluorinating agent causes Pu in the solid residue to react chemically to form solid PuF ₄ or gaseous PuF ₆ .	Procedure does not contain a chemical list or describe the process inputs. The procedure states "Because the process is in developmental stage, operating procedures and flow configuration are subject to frequent change.
M-008/ TWCP-3546 (UCNI)	D	Process description, reagent list, P/S diagram - SO	Super Oxidizer Fluorination of Ash, FPR-101-R00; 6/6/89 FPR-101-R00 is also known as 488-REC-R00	A gas flow loop is used for room temperature fluorination of ash samples containing Pu residues. The fluorinating agent causes Pu in the solid residue to react chemically to form solid PuF ₄ or gaseous PuF ₆ .	None
M-009/ TWCP-3546 (UCNI)	D	Process description, reagent list, P/S diagram - SO	Operation of the Plutonium FOOF Loop, FPR-100-R01; 10/17/90	The loop is used to flow a gas fluorinating agent through a gas-solid reactor where Pu in the solid residue reacts chemically to form gaseous PuF ₆ . Methanol is used in the cold trap.	None
M-010/ TWCP-3546 (UCNI)	D	Process description, reagent list, P/S diagram - CK	Operation of the Plutonium Fluorination Loop, FPR-101-R0-0; 2/7/91	The loop is used to flow a gas fluorinating agent through a gas-solid reactor where Pu in the solid residue reacts chemically to form gaseous PuF ₆ . 1-propanol and trichloroethylene are used in the cold traps and cooling baths.	Procedure does not describe the configuration of the cold traps and cooling baths, i.e., whether these are located inside or outside the glovebox and whether the chemicals used in cold traps/cooling baths would contaminate the waste stream.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-011/ TWCP-3546 (UCNI)	D	Process description, reagent list, P/S diagram - FDL	Operating the FOOF Demonstration Loop, FPR-102 through R01; 8/7/91 through 3/12/93	FOOF demonstration line is used to conduct experiments that demonstrate the feasibility for fluorination at room temperature. Pu in solid residue reacts chemically to form gaseous PuF ₆ .	Documents do not mention the use of solvents.
M-012/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram - FLU	Halogenation Research and Development, FPR-104-R00; 3/25/92	Basic research operation involving gas-solid and solid-solid halogenation (i.e., fluorination and chlorination) of actinides, particularly Pu and Np. Procedure describes operations and materials similar to fluorination and FOOF loop procedures.	None
M-013/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – EXT	Plutonium Extraction Research and Development, FPR-105-R00; 3/25/92	Document describes an R&D effort exploring aqueous extraction of Pu from various waste streams, particularly pyrochemical salts. Metals in pyrochemical stream would include Na, K, and Ca when exposed to aqueous materials.	Procedure does not identify process inputs. Equipment and supplies list includes “spent pyrochemical salts.”
M-014/ TWCP-3546 (UCNI)	D	Process description, P/S diagram – EDC	Electrochemistry R&D Experiments, FRP-108-R00; 12/19/95	Document describes experiments using electrochemical methodologies to decontaminate items (e.g., gloveboxes), supercede current processes that produce large amounts of waste, or speed up reactions. Electrolytes are typically inert nonhazardous salts.	Process inputs are indicated as being from the vault or P/S code MA, but inputs are not precisely defined or identified.
M-015/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – EOC	Surface Area Analysis Using the Quantasorb/Quantector 280-MRD-R00; 3/30/92 through 4/8/94 (Draft)	Mixtures of helium and nitrogen are passed through a U-shaped cell containing a sample to calculate surface area and pore size distribution of the sample, and analyze surface characteristics.	Solvents or other chemicals are not indicated in the reagent list.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-018/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S code not identified (see limitations)	Americium R&D Facilities, 474-REC-R00; 7/17/79	Experimental operations involve evaporator hydroxide cake dissolution, filtration, sampling and analysis, extraction, separation to remove organics, and determination of Pu and Am. See 474-REC-R02 (M-020).	P/S code not identified in the procedure but process is consistent with process described in 474-REC-R02; therefore, AD seems to be appropriate P/S code. Lead compounds listed in R01 but not in R00 or R02-03.
M-019/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S code not identified (see limitations)	Process Research and Development Facilities, 474-REC-R01; 8/29/83	Various wet chemistry experiments (e.g., chloride anion-exchange separations involving various radioactive elements). Research activities no longer limited to Americium. See 474-REC-R02 (M-020).	P/S code not identified in the procedure but process is consistent with process described in 474-REC-R02; therefore, AD seems to be appropriate P/S code. Lead compounds are listed in this procedure but not in R00, R02 or R03.
M-020/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – AD	Research, Development, and Demonstration Facilities, 474-REC-R02; 12/1/86	Various chemical and electrochemical experimental research with actinide solutions. Chemical list is similar to 474-REC-R01 except for the following: Gallium, Tantalum, and Platinum metals, oxides, or salts; hydrazine dihydrochloride; perchloric acid; tetraethylamine chloride; and tetraethylammonium hydroxide.	Lead compounds are listed in R01 but not in R00, R02 or R03.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-021/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – AD	Research, Development, and Demonstration Facilities, 474-REC-R03; 2/3/89	Various chemical and electrochemical experimental research with actinide solutions. Chemical list identical to 474-REC-R02, with the exception of the following: “DHDCMP, TBP, and CMPO used in extraction experiments.”	Lead compounds are listed in R01 but not in R00, R02 or R03.
M-022/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – AD	Sensors and Instrumentation Development, 476-REC-R00; 2/3/89	Various research studies involving sensors and instrumentation suitable for online chemical analysis.	None
M-023/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – HRS	Low Temperature Multiple Reflection Spectroscopic Cell, SAS-106-R00 through R02; 1/9/90 through 3/30/93	Fluorinated actinide compounds are introduced into a long-path, variable temperature cell for spectroscopic studies. The procedure addresses passivation, filling, cooling, emptying, and maintaining the spectroscopic cell.	Details of procedural information (e.g., chemical lists, diagrams) unavailable for 1/9/90 and 11/12/91 versions of procedure.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-024/ TWCP-3546 (UCNI)	D	Process description, reagent list, P/S diagram – SA	Organoactinide R&D, SAS-107-R00 through R01; 10/23/89 through 5/1/91	R00 describes studies involving organometallic chemistry of uranium, thorium, neptunium, and plutonium in non-aqueous solvents. R01 describes small-scale organoactinide R&D operations involving fundamental research on the synthesis in non-aqueous media of new actinide compounds, their characterization and reaction chemistry, and application to existing actinide processing technologies. Due to the range of experimental studies, a definitive list of reagents cannot be given. Previous studies have involved the use of aliphatic, ethereal, aromatic, and halocarbons (e.g., tetrahydrofuran, diethyl ether, benzene, toluene, pyridine, and dichloromethane.	Chemical reagents and solvents are not specified but may include hydrocarbon, ethereal, and aromatic solvents, organic reagents, and inorganic salts.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-025/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – AC1 and AC2	Actinide Chemistry Research and Development, SAS-107-R03; 3/10/94	Document addresses a broad range of lab activities involving radioactive and non-radioactive materials in support of applied actinide chemistry research. Activities include preparation of solvents and reagents, synthesis of new chemical compounds, and characterization and analysis of new chemical compounds using wet chemistry methods and analytical instrumentation. A variety of chemicals are used, including organic solvents (e.g., tetrahydrofuran, toluene, benzene, and dichloromethane), organic reagents (e.g., alcohols, phosphines, phosphates), acids and bases, and metals.	The chemical list is not definitive. The procedure states “The chemical list is representative of the types of chemicals that are used in operations covered by this procedure.”
M-026/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – CV	Actinide Separation R&D Operations, SAS-108-R00; 3/25/91	A gas loop is used to flow various compounds through a reactor. Pu reacts to form recoverable Pu compounds. Pu compounds or Pu-bearing matrices may be subjected to further treatment to achieve complete recovery. Treatment of ash with carbon tetrachloride to create chlorinated Pu to facilitate further separation. Reagent is destroyed in the process. Chemical list includes acids and bases, chlorinated hydrocarbons (e.g., carbon tetrachloride, tetrachloroethylene), actinides, and compressed gases.	Although not precisely stated in the procedure, it appears that chlorinated hydrocarbons are used as chlorinating agents (therefore, not as solvents) in the reaction loop.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-027/ TWCP-3546 (UCNI)	D	Process description, chemical list, P/S diagram – CV	Plutonium Chlorination, SAS-108-R01 through R02; 10/26/92 through 11/10/94 (See note in limitations.)	Describes the recovery or purification of Pu compounds by reaction with liquid, gaseous, and solid reagents in a gas-flow loop. Process involves conversion of Pu chloride solutions to anhydrous PuCl ₃ . Chemical list includes acids and bases, carbon tetrachloride, hydroxylamine hydrochloride, actinides, and compressed gases.	Procedure revisions appear to be similar with no significant changes indicated. R02 is a draft dated 10/28/93. R01 (11/10/94) incorporates two change sheets (R01.1 and R01.2) that clarified administrative aspects of the procedure.
M-029/ TWCP-3546 (UCNI)	D	Process description, P/S diagram – IB	Matrix Study of Pyrochemical Salts, 556-NMT4-R01 through R03; 9/12/90 through 5/31/93	Feed material inputs may comprise Pu metal, pyrochemical salts of sodium, calcium, and magnesium, and crucible pieces. Describes process for crushing, pulverizing, blending, roasting, and sieving pyrochemical salts in PF-4, Room 208, G264. The research activity determined the effect that pyrochemical salt matrices have on the accuracy of NDA measurements in like materials. The results dictate handling and processing of the salts, and may be used for correction of bias measurements.	None
M-030/ TWCP-3546 (UCNI)	D	P/S code title, description, and effective dates	Jim Foxx, SME, 01/00	SME review of preliminary AK Summary Report for TA-55 Miscellaneous Operations indicated that P/S code IB was referred to as “Incoming Oxide Blending” from May 1986 to July 1992, and that the procedure involved rod milling prior to screening. See also M-029.	A procedure was not identified for this process during the time period indicated.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-031/ TWCP-3546 (UCNI)	D	Process wastes	Jim Foxx, SME, 01/00	SME review of preliminary AK Summary Report for TA-55 Miscellaneous Operations indicated that chromium may be present in the layer of sand and slag removed during the electrolytic decontamination process. See also M-014.	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-034/ TWCP-3546 (UCNI)	D	P/S code description	Gordon Jarvinen, 02/16/00	Interview regarding operations for P/S codes AD, APD	Conclusions are based on the SME's recollections of process activities in which he was directly involved. Mr. Jarvinen could only speak to operations for P/S code AD after 1989.
M-035/ TWCP-3546 (UCNI)	D	P/S code description	Jerry Foropoulos, 02/16/00	Interview regarding operations for P/S codes CK, CV, EXT, FLU, SO, IE, LI	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-036/ TWCP-3546 (UCNI)	D	P/S code description	Tom Mills, 02/16/00	Interview regarding operations for P/S codes FDL and HRS	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-037/ TWCP-3546 (UCNI)	D	P/S code description	Larry Avens, 03/02/00	Interview regarding operations for P/S codes MAS and SA	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-038/ TWCP-3546 (UCNI)	D	P/S code description	Bill Zwick, 02/29/00; and John Byrd, 03/01/00	Interview regarding operations for P/S codes AC1 and AC2	Conclusions are based on the SMEs' recollections of process activities in which they were directly involved.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-039/ TWCP-3546 (UCNI)	D	P/S code description	Steve Long, 02/29/00	Interview regarding operations for P/S codes IB and STF	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-040/ TWCP-3546 (UCNI)	D	P/S code description	Mary Ann Reimus, 02/17/00	Interview regarding operations for P/S code EOC	Conclusions are based on the SME's recollections of process activities in which she was directly involved.
M-041/ TWCP-3546 (UCNI)	D	P/S code description	Doug Wedman, 02/16/00	Interview regarding operations for P/S code EDC	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-042/ TWCP-3546 (UCNI)	D	P/S code description	James Barfield, 02/25/00	Interview regarding operations for P/S codes ACL, ICP, and XES	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-043/ TWCP-3546 (UCNI)	D	P/S code description	John Byrd, 03/01/00	Interview regarding operations for P/S code RASS/RSS	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-044/ TWCP-3546 (UCNI)	D	P/S code description	Charles Davis, 03/01/00	Interview regarding operations for P/S code SMP	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-045/ TWCP-3546 (UCNI)	D	P/S code description	Keith Fife, 02/28/00	Interview regarding operations for P/S code VS	Conclusions are based on the SME's recollections of process activities in which he was directly involved.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
M-046/ TWCP-3546 (UCNI)	D	P/S code description	Jim Foxx, 02/25/00 through 06/23/00	Interviews and correspondence regarding operations for P/S codes RD, NCD, WM, and XO/X0	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-047/ TWCP-3546 (UCNI)	D	P/S code description	Max Martinez, 02/29/00	Interview regarding operations for P/S code LIBS	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-048/ TWCP-3546 (UCNI)	D	P/S code description	Rick Masen, 03/01/00	Interview regarding operations for P/S code ME	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-049/ TWCP-3546 (UCNI)	D	P/S code description	Steve Yarborough, 03/10/00	Interview regarding operations for P/S code XP	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-050/ TWCP-3546 (UCNI)	D	P/S code description	Dennis Wulff, 04/17/00	Interview regarding P/S code XO	Conclusions are based on the SME's recollections of process activities in which he was directly involved.
M-053/ TWCP-3546 (UCNI)	D	Process input information	Jim Foxx, 04/16/00	Information regarding process inputs to P/S code AD	None.
TWCP-3547/CI-25	D	RCRA-listed constituents in analytical solutions from CLS-1	Interview with Jim Foxx, 9/23/99	Analytical laboratory solutions from CLS-1 are potentially contaminated with RCRA-regulated heavy metals, mercury and lead, as well as RCRA-listed organic substances used as solvents, including acetone, carbon tetrachloride, chlorobenzene, chloroform, methanol, methylene chloride, tetrachloroethylene, xylene	

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

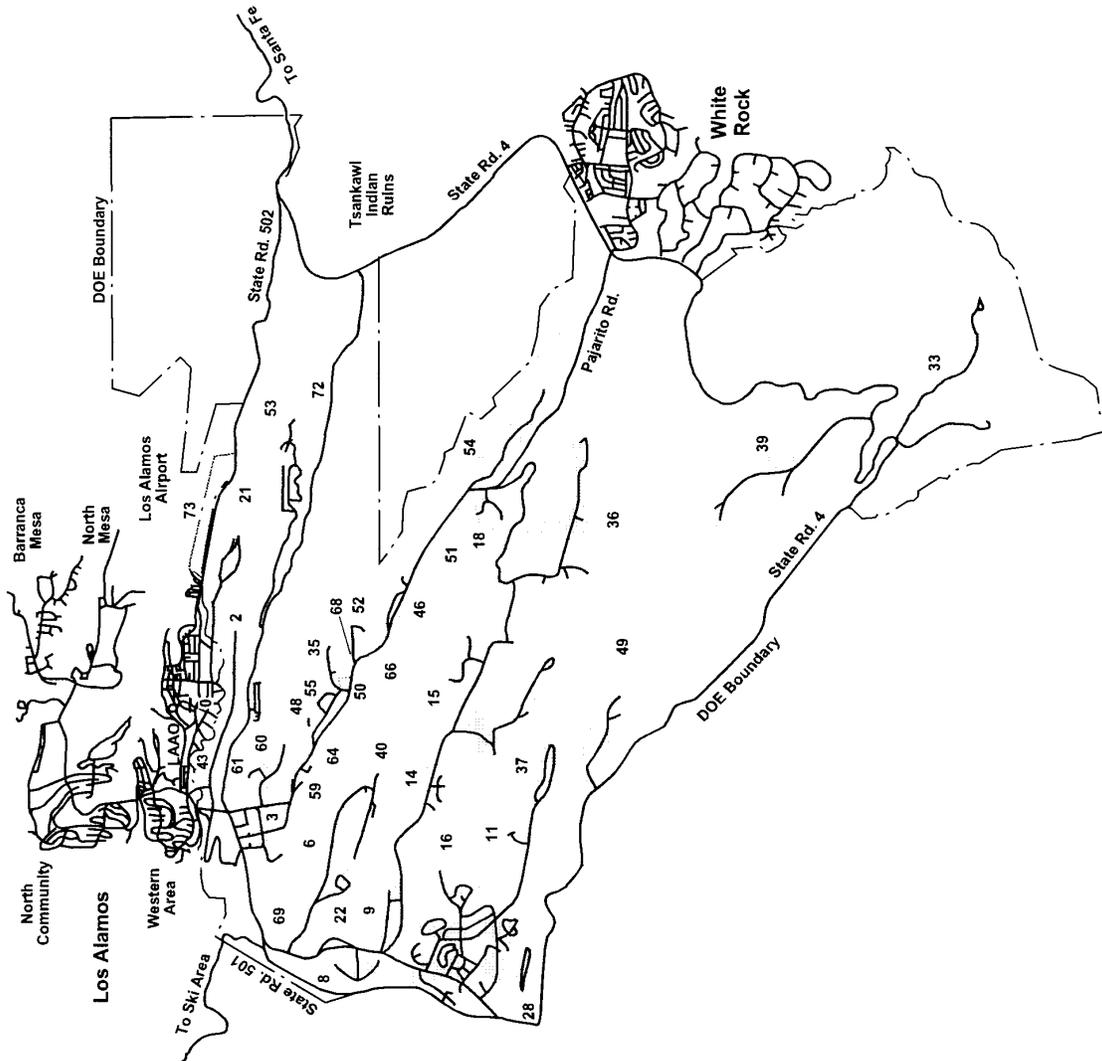
TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3730 (UCNI)	B	Pyrophoricity characterization	Characterization of Direct Oxide Salts (LA-CP-95-0098)	Hydrogen generation and pyrophoricity of DOR salts. Also gives reference for MSE, ER, and Cr-containing salts.	None
TWCP-3731	D	Sodium pyrophoricity in pyrochemical salts	Memo (MST-12-ARO-88-052)	Treatment of sodium in salts is effective	Sodium only
TWCP-3732	C	Experimental data on calcium pyrophoricity in salts	Memo (MST-12-ARO-88-077)	Treatment of calcium in salts is effective	Calcium only
TWCP-3943	D	Procedure for Waste Management at TA-55	TA-55 Document, 406-GEN-R00	Contains information on waste management procedures in 1978	None, but doesn't address today's waste management concerns
TWCP-4162	D	Answers to questions about P/S codes PB, PuBe, CC, MB, MS, FF, BF, and other issues	Interview with Jim Foxx, 10/12/00	Answers to questions on use of asbestos at TA-55, non-defense activities, and specific P/S codes in chloride operations.	None
TWCP-4164	D	Answers to questions about various P/S codes	Interview with Jim Foxx, 10/16/00	Answers to questions on use of Ag, disposal of ash and resins, and use of gases.	None
TWCP-4166	D	Answers to questions about P/S codes DO, EV, HP, CF, OR, RM, PY	Interview with Jim Foxx, 10/17/00	Answers to questions on use of Cr and Ag, RCRA metals in cement, asbestos in furnaces and gloves, and disposal of spray cans used in gloveboxes.	None
TWCP-4167	D	Answers to questions about segregation of non-defense wastes; leachability of Ag from ash	Interview with Jim Foxx, 10/18/00	Segregation of non-defense wastes began on 27 August 1998; analytical data show that Ag in ash is below limits of regulatory concern	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

MAP OF LANL

Technical Area Locations

TA-0	Unassigned Land Reserve
TA-2	Omega Site
TA-3	South Mesa Site
TA-5	Beta Site
TA-6	Two Mile Mesa Site
TA-8	Anchor Site West
TA-9	Anchor Site East
TA-11	K-Site
TA-14	Q-Site
TA-15	R-Site
TA-16	S-Site
TA-18	Pajarito Laboratory
TA-21	DP-Site
TA-22	TD-Site
TA-28	Magazine Area A
TA-33	HP-Site
TA-35	Ten Site
TA-36	Kappa Site
TA-37	Magazine Area C
TA-39	Ancho Canyon Site
TA-40	DF-Site
TA-41	W-Site
TA-43	Health Research Lab & DOE Headquarters
TA-46	WA-Site
TA-48	Radiochemistry Site
TA-49	Frijoles Mesa Site
TA-50	Waste Management Site
TA-51	Radiation Exposure Facility
TA-52	Reactor Development Site
TA-53	Meson Physics Facility
TA-54	Waste Disposal Site
TA-55	Plutonium Facility Site
TA-57	Fenton Hill Site
TA-58	Two Mile North Site
TA-59	OH-Site

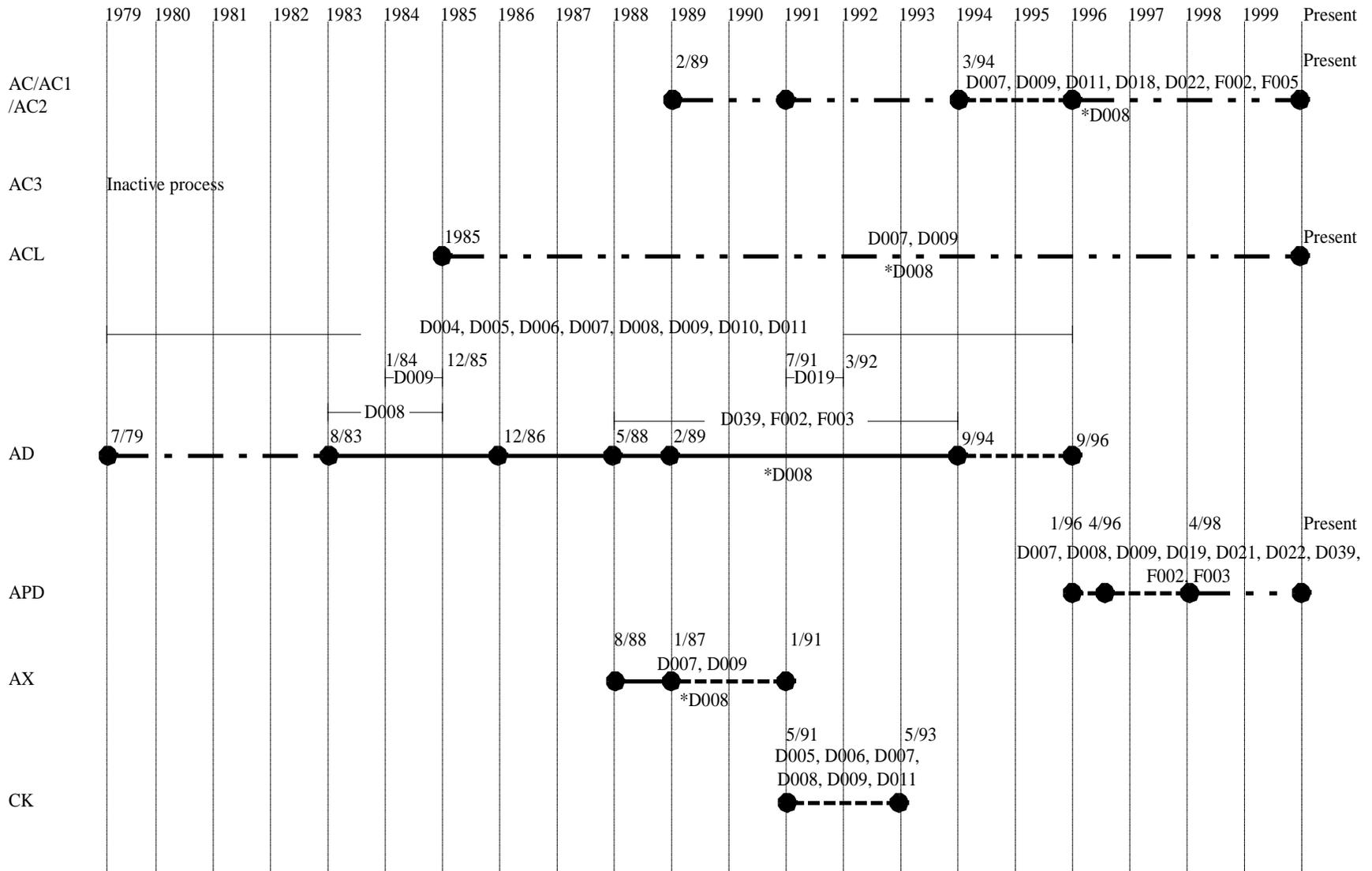


MAP OF TA-55

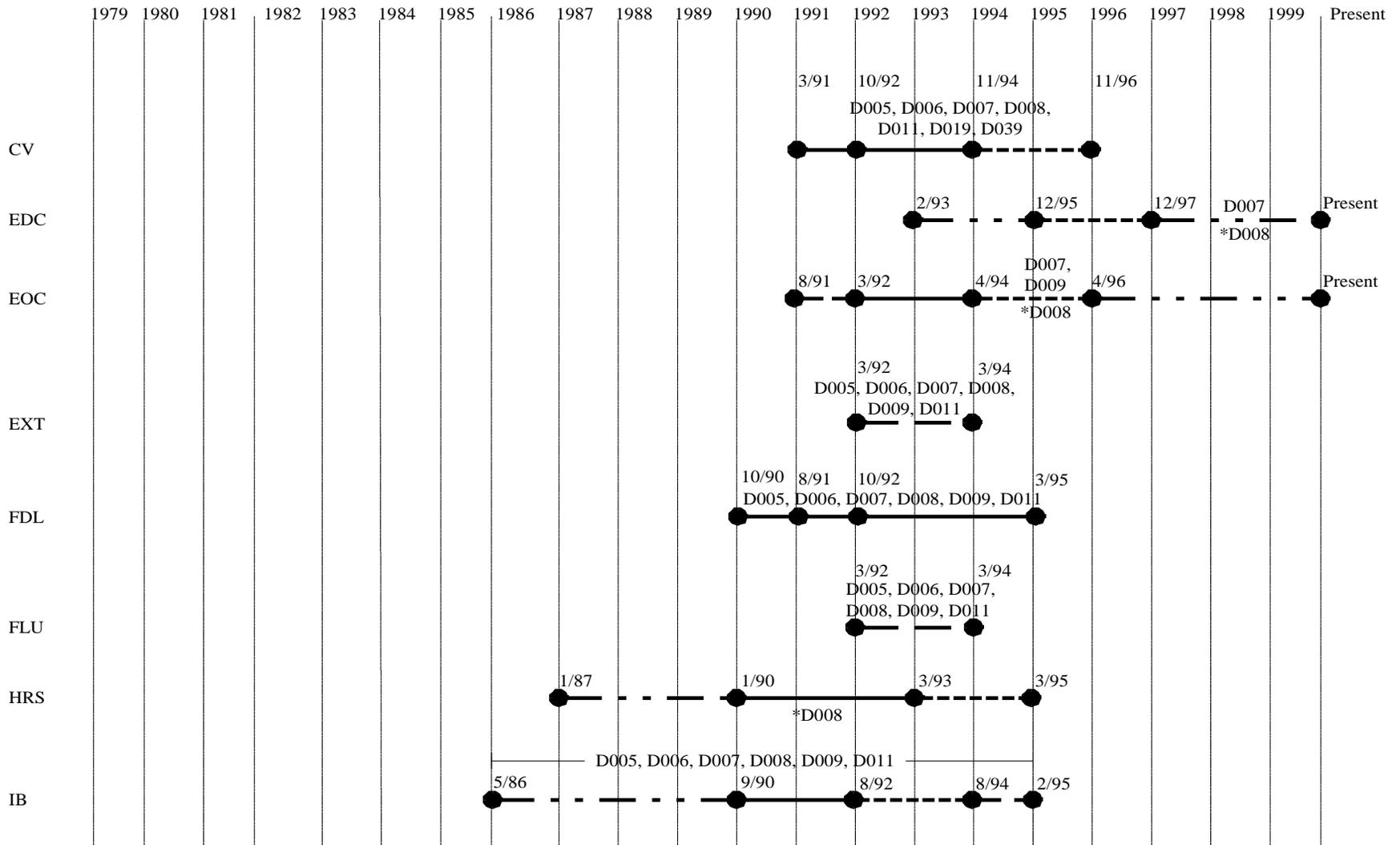
Note: The Plutonium Facility, Building PF-4, is labeled PF-4 on this map.



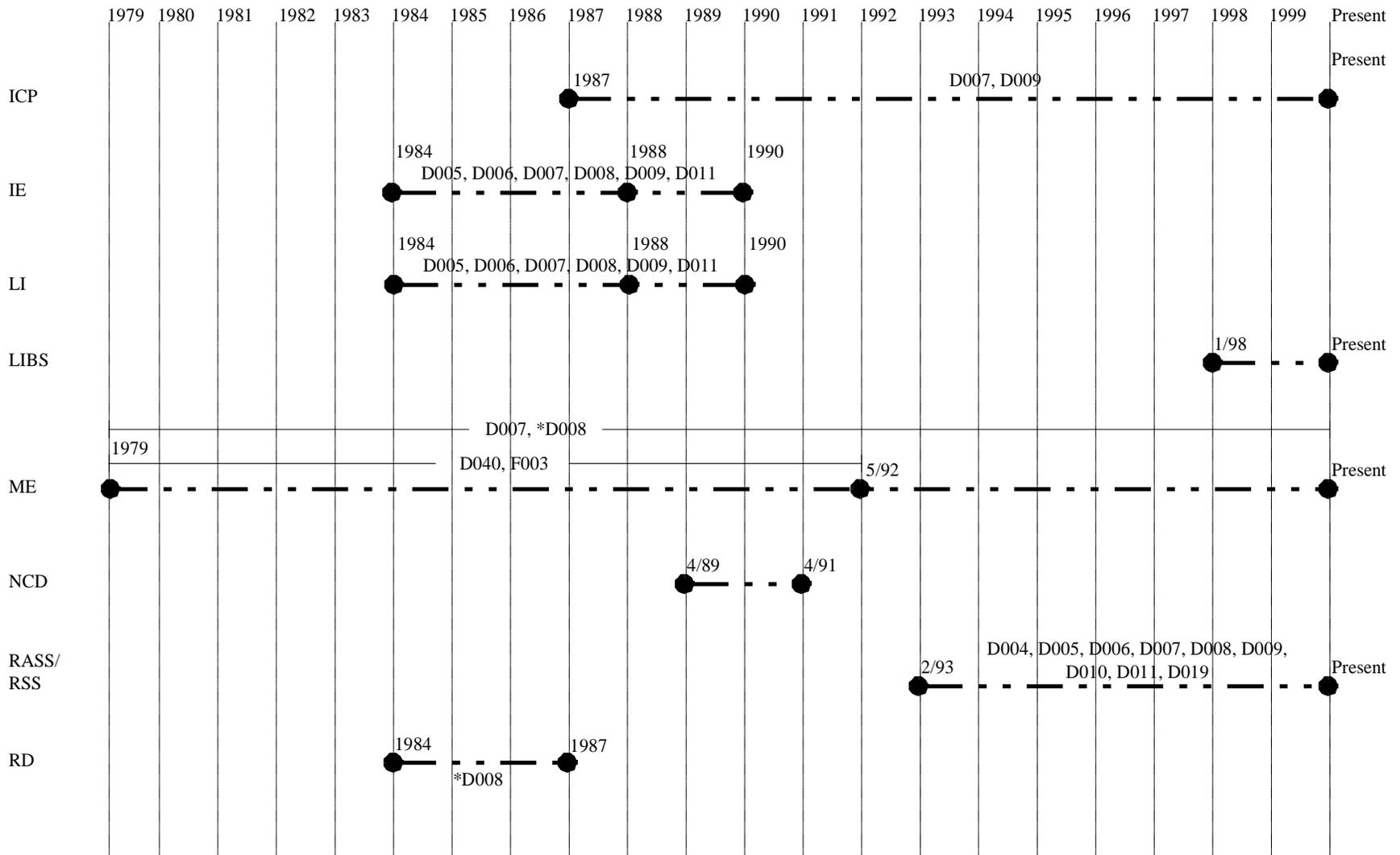
TIMELINE FOR TA-55 MISCELLANEOUS PROCESSES



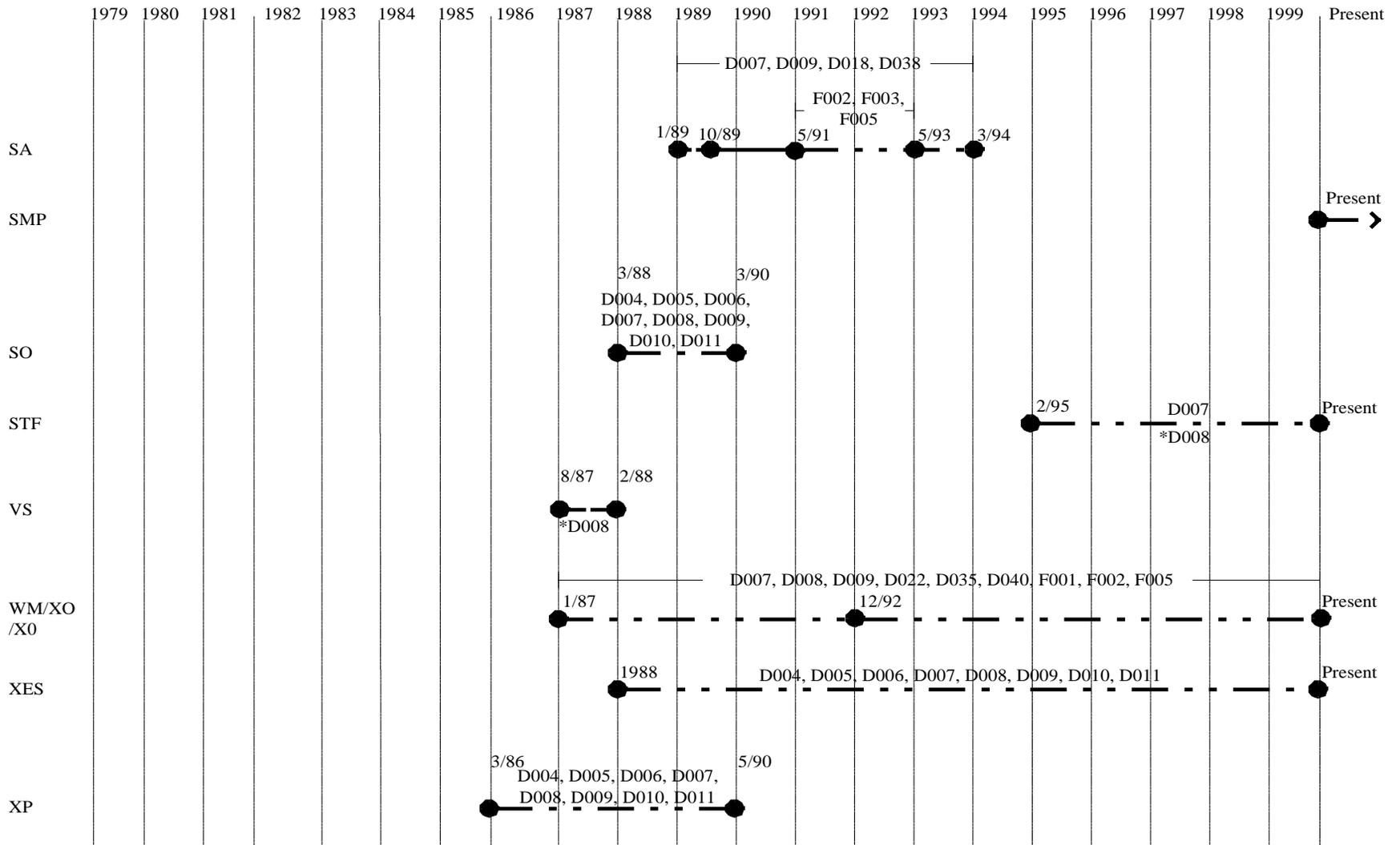
**TIMELINE FOR TA-55 MISCELLANEOUS PROCESSES
 (continued)**



**TIMELINE FOR TA-55 MISCELLANEOUS PROCESSES
 (Continued)**



**TIMELINE FOR TA-55 MISCELLANEOUS PROCESSES
 (continued)**



TIMELINE EXPLANATION



The P/S code is established in either the P/S diagrams or in both (or all) revisions of the procedures designating the start and end dates (e.g., Rev. 0 to Rev. 1; or Rev. 0 to Rev. 5).



The P/S code is not identified in the procedure, but the process description matches the P/S code and the description in previous or later revisions of the same procedure.



Extrapolate out two (2) years beyond the last procedure to next possible review date.



The P/S code is not identified in the procedure, but the process description matches that of the P/S diagram or P/S code description.



Time period based on subject matter expert comments.

PROCESS INPUTS AND OUTPUTS

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
AC AC1 AC2	Actinide Chemistry R&D	Actinide metals	Actinide (Th-Am) metals Alcohols (unspecified) Alkali metals Alkaline earth metals Alkylating agents (unspecified) Benzene Chloroform Cryogenes Dichloromethane Hexane Hydrochloric acid Inorganic reagents/complexes (unspecified) Inorganic salts (unspecified) Lanthanide metals Nitric acid Perchloric acid Phosphates Phosphines Potassium hydroxide Potassium salts Silver salts Sodium hydroxide Sodium salts Tetrahydrofuran Toluene Transition metals Transition-lanthanide-, actinide- metal complexes	Solvated halide complexes yielding homoleptic alkyl complexes; and unspecified	Reaction byproducts, residues, precipitated salts, spent solvents, spent acids, filtration media, debris	D007, D008, D009, D011, D018, D022, F002, F005	M-025 M-038
AC3	Actinide Chemistry	NA	NA	NA	NA	NA	NA

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
ACL	Analytical Chemistry Lab	Plutonium and americium solutions	Nitric acid	None	Unused liquid samples, chromatography residues	D007, D008, D009	M-042
AD	Actinide Processing Demonstration	Evaporator hydroxide cakes; and various isotopes and isotopic mixtures of plutonium and uranium, occasionally ²⁴¹ Am and ²³⁷ Np	Aluminum nitrate Ascorbic acid Carbon tetrachloride CMPO DBBP DBBP/Isopar DHDCMP diisopropyl benzene Ethanol Gallium metal, oxide or salt Hydrazine dihydrochloride Hydrazine hydrochloride Hydrochloric acid Hydrofluoric acid Hydrogen peroxide Hydroxylamine chloride Hydroxylamine hydrochloride Hydroxylamine nitrate Kerosene Lead and lead hydroxide, oxide, or nitrate Methanol Na, K, Li, Mg, Ca, Fe, nitrates, chlorides, carbonates, bicarbonates, oxalate, nitrites n-dodecane Nitric acid Octyl phenyl-N Oxalic acid Perchloric acid	Unspecified	Spent aqueous and organic solutions; extraction solvents; spent acids and bases; lead-bearing hydroxides, nitrates, and oxides; reducing agents; actinide salts, oxides, and metals; debris	D004, D005, D006, D007, D008, D009, D010, D011, D019, D039, F002, F003	M-006 M-018 M-019 M-020 M-021 M-022 M-034 M-053

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
			Platinum and platinum-rhodium alloys Potassium dichromate Potassium hydroxide Potassium permanganate Pu, Am, Np, U, Ga, Pt, Ta metals, oxides, salts ²³⁹ Pu and ²⁴¹ Am metal and various chemical states Sodium carbonate Sodium chlorite Sodium dithionate Sodium hydroxide Sulfuric acid Tantalum metal, oxide or salt TBP TBP/Isopar Tetrachloroethylene Tetraethylamine hydrochloride Tetraethylamine hydroxide Tetraethylammonium hydroxide				
APD	Actinide Processing Demonstration	Aqueous and organic mixtures of carbon tetrachloride, tributyl phosphate, organic solvents (unspecified), ion exchange resins, vacuum pump oil, plastics, rags	Hydrogen peroxide	Reactor effluent (liquids, gases, salts)	Liberated gases Liquid salts, acids Solid oxides, carbonates, sulfates,	D007, D008, D009, D019, D021, D022, D039, F002, F003	M-001 M-034

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
AX	Solution Assay	Nitric and hydrochloric acid solutions with plutonium	Hydrochloric acid Nitric acid	Plutonium chloride solutions to P/S CX Plutonium nitrate solution to P/S RR	Nitric and hydrochloric acid solutions	D007, D008, D009	M-005
CK	RD&D Volatile Fluoride Plutonium Recovery	Solid residues of PuO ₂	1-propanol (as coolant) Aluminum oxide Fluorine gas FOOF Liquid nitrogen Oxygen Sodium bicarbonate Trichloroethylene	Plutonium hexafluoride, unreacted ash	Spent aluminum oxide and sodium bicarbonate, organic reagents and solvents, debris	D005, D006, D007, D008, D009, D011	M-010 M-035
CV	RD&D Experimental Chlorination Processes	Plutonium in various chemical forms; solid PuO ₂	Dilute acids/bases (unspecified) Ammonium chloride Carbon tetrachloride Hydrochloric acid Hydroxylamine hydrochloride Nitric acid Perchlorocarbons Potassium hydroxide ²³⁹ Pu, ²³⁷ Np, ²⁴¹ Am, ^{235/238} U, ²³² Th in various compounds, residues, metal alloys Sodium bicarbonate Tetrachloroethylene Thionyl chloride	Anhydrous plutonium chloride; plutonium hexafluoride	Spent solvents and reagents, spent sodium bicarbonate, inorganic salts, debris	D005, D006, D007, D008, D009, D011, D019, D039	M-027 M-035
EDC	Electrolytic Decontamination	Disassembled weapons components	Alkaline solutions Sodium nitrate Sodium sulfate	Decontaminated components	Evaporated uranyl hydroxide and uranyl sulfate, electrolytes (inert, nonhazardous salts), precipitated solids, spent caustic rinses, debris	D007, D008	M-014 M-041

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
EOC	Experimental Oxide Characterization	Plutonium oxide (high-purity)	Purified nitrogen and helium Liquid nitrogen	Plutonium oxide	Debris	D007, D008, D009	M-015 M-040
EXT	Extraction RD&D	Various plutonium-containing matrices, pyrochemical salts	Hydrochloric acid Hydrofluoric acid Nitric acid Potassium hydroxide Sodium hydroxide	Aqueous solutions of plutonium	Spent aqueous and organic solutions, spent pyrochemical salts, debris	D005, D006, D007, D008, D009, D011	M-013
FDL	FOOF Demonstration Loop	Solid residues of PuO ₂ and PuF ₄	Aluminum oxide Carbon tetrafluoride Fluorine gas FOOF Krypton fluoride Methane Nitrogen, liquid and gas Oxygen Sodium bicarbonate	Plutonium hexafluoride, unreacted ash	Spent aluminum oxide and sodium bicarbonate, debris	D005, D006, D007, D008, D009, D011	M-011 M-036
FLU	Fluorination RD&D	Solid PuO ₂	Aluminum oxide Ammonium chloride, fluoride, bifluoride Argon Fluorine gas FOOF Hydrochloric acid Krypton fluoride Nitrogen Sodium bicarbonate	Recoverable plutonium	Debris	D005, D006, D007, D008, D009, D011	M-012 M-035
HRS	High Resolution Spectroscopy	Actinide compounds	Carbon dioxide Fluorine FOOF Liquid nitrogen Nitrogen dioxide Sodium bicarbonate	Gas-phase actinide-containing species (PuF ₆ , UF ₆ , NpF ₆ , AmF ₆)	Sodium bicarbonate filter (reactive gas traps), debris	D008	M-023 M-036

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
IB	Matrix Study of Pyrochemical Salts	Plutonium metal oxides and pyrochemical salts	Acids/bases (unspecified)	Solid pyrochemical salts	Pyrochemical salts, metal oxides, debris	D005, D006, D007, D008, D009, D011	M-030 M-039
ICP	Inductively Coupled Plasma Atomic Emissions Spectroscopy (ICP-AES) Analysis	Plutonium and americium solutions	Unspecified (process related to ACL)	None	Unused liquid samples, analytical laboratory debris, actinide oxides and metals, MSE salts, ash	D007, D008, D009	M-042
IE	Isotope Enrichment	Solid PuO ₂	Unknown	Plutonium hexafluoride	Debris	D005, D006, D007, D008, D009, D011	M-035
LI	XF6 Experimental Measurements	Solid PuO ₂	Unknown	Plutonium hexafluoride	Debris	D005, D006, D007, D008, D009, D011	M-035
LIBS	Laser-Induced Breakdown Spectroscopy System	High purity plutonium metals/oxides	Unknown		Used samples, debris		M-047
ME	Metallography	Plutonium/uranium carbides, nitrides, oxides, zirconium and tantalum alloys, stainless steel	Acetone Acid/caustic etchants (unspecified) Ethanol Kerosene Trichloroethylene		Grinding paper, polishing compounds (including liquid organic and caustic etchants), metal and ceramic powders, debris	D007, D008, D040, F003	M-048
NCD	Nonconfirming Drums	NA	NA	NA	NA, no waste generated from this activity		M-046

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
RASS/ RSS	RAMAN Spectroscopy System	Solids or solutions with plutonium	Dilute acids (unspecified)	None	Used samples, debris	D004, D005, D006, D007, D008, D009, D010, D011, D019	M-043
RD	Repackaging into Retrievable Drums	NA	NA	NA	NA	D008	M-046
SA	Super Acid RD&D	Various actinide compounds and matrices; actinide (Np, Pu, Th, Am, Cm, U) metals	Aluminum oxide Antimony pentafluoride Benzene Bromine Diethyl ether Hydrofluoric acid Inorganic reagents (such as NaNO ₃) Iodine Magnesium oxide Methylene chloride Organic reagents (such as CMPO) Pyridine Sulfuric acid Hydrocarbon, ethereal, and aromatic solvents (unspecified) Tetrahydrofuran Toluene	Superacid solutions and evaporated solid superacid complexes; solvated halide complexes yielding homoleptic alkyl complexes	Spent aqueous and organic solvents and reagents, organometallic and inorganic compound residues, debris	D007, D008, D009, D018, D038, F002, F003, F005	M-004 M-024 M-037
SMP	SP Mounting Preparation	NA	NA	NA	NA		M-044

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
SO	Super Oxidizer-FOOF Program	Ash samples with plutonium residues of PuO ₂ and PuF ₄	Aluminum oxide Bromine and chlorine fluorides Fluorine gas Nitrogen, liquid and gas Methanol Oxygen Oxygen fluorides (FOOF, FOO) Sodium bicarbonate	Plutonium hexafluoride, unreacted ash	Spent aluminum oxide and sodium bicarbonate, debris	D004, D005, D006, D007, D008, D009, D010, D011	M-007 M-008 M-009 M-035
STF	Standard Fabrication	High purity plutonium oxides	Unknown	High purity plutonium standards	Stainless steel cans with metal oxides, debris	D007, D008	M-029 M-039
VS	Confirmation, Inspection, and Sampling	Plutonium oxides and metals	NA – physical inspection only	Unchanged from process input	Vials (only if input material was sampled), debris	D008	M-045
WM	Waste Management	Waste from the TRU solid waste management operation in Room 432. Glovebox maintenance items. “Hot” room trash (i.e., anything not originating in a glovebox).	NA	None	Miscellaneous waste items from room trash or generated by various P/S codes; leaded gloves and glovebox windows	Default HWNs (see Table 5): D007, D008, D009, D022, D035, D040, F001, F002, F005	M-046, M-050

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
X0	Inactive or Unspecified P/S Material	Waste materials from common areas (e.g., hallway, change rooms, basement) that could not be associated with a specific room	NA	None	Miscellaneous trash and debris	Default HWNs (see Table 5): D007, D008, D009, D022, D035, D040, F001, F002, F005	M-046, M-050
XES	X-Ray Energy Spectroscopy	Solid plutonium samples	Acid/base solutions (unspecified)	None	Unused/spent solid plutonium samples, spent acid/base solutions from sample preparation	D004, D005, D006, D007, D008, D009, D010, D011	M-042
XO	Inactive or Unspecified P/S Material	Waste materials generated within specific rooms but not associated with a specific P/S code; room trash boxes	Chloroform Ethanol Hexane Isopropyl alcohol Methylene chloride Methyl ethyl ketone Trichloroethylene 1,1,2-trichloro-1,2,2-trifluoroethane [freon]	None	Rags contaminated with organic chemicals; other room trash and debris	Default HWNs (see Table 5): D007, D008, D009, D022, D035, D040, F001, F002, F005	M-046, M-050

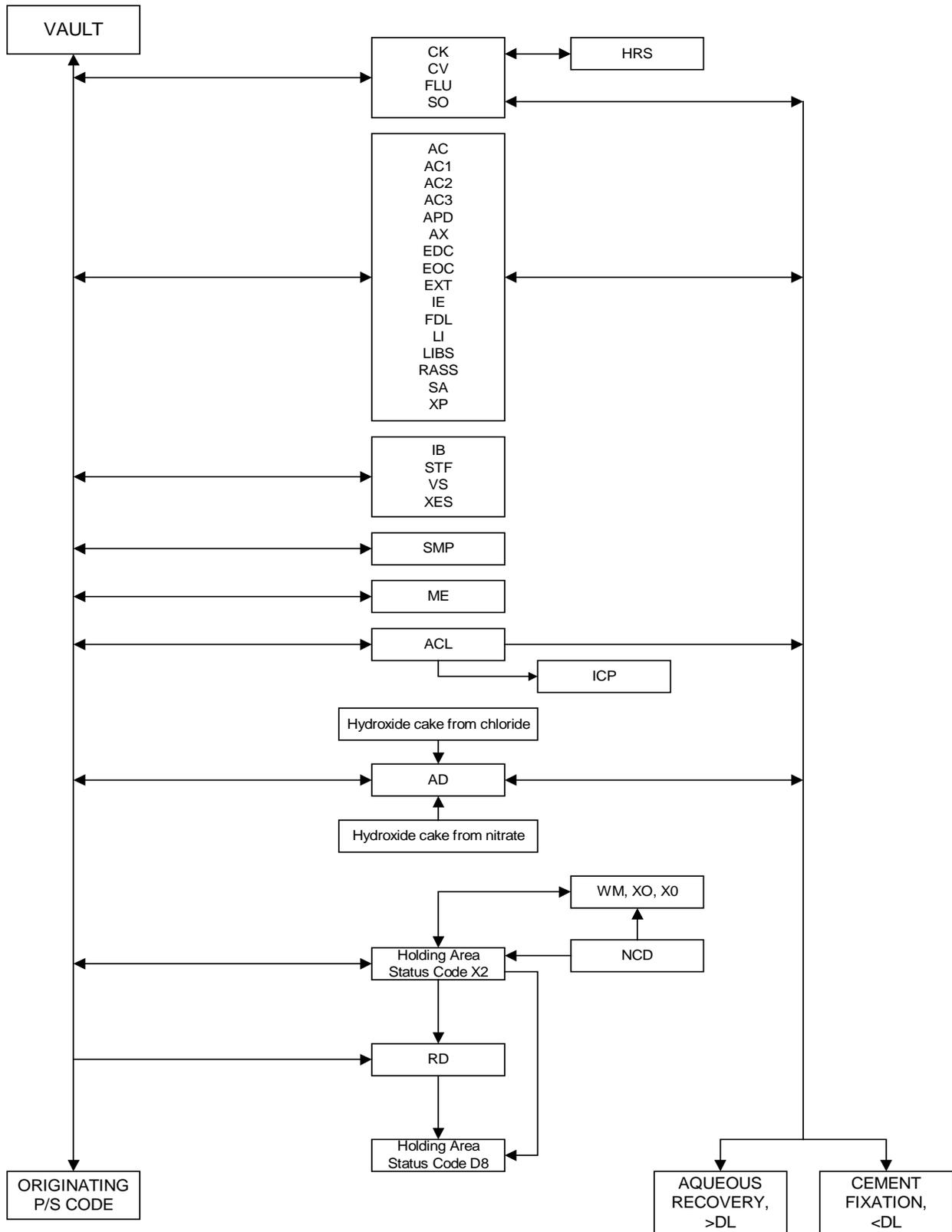
P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
XP	RD&D Experimental Processes	PuO ₂ , PuO ₂ with tantalum chips, MSE salts, ash (Pu/Th O ₂), NpO ₂	CMPO DHDCMP Diisopropyl benzene Fluorinating agents (such as HF, F ₂ , FOOF) Phosphine oxide Potassium chloride Sodium chloride	Plutonium hexafluoride, chlorinated plutonium compounds, neptunium standards	lead shielding, actinide oxides, metals, MSE salts, ash, debris	D004, D005, D006, D007, D008, D009, D010, D011	M-049

¹All P/S codes generate routine laboratory debris waste consisting of glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Leaded gloves may also be generated and are segregated.

² See discussion in Section 4.0 for details on the applicability of the EPA Hazardous Waste Numbers (HWNs) listed in this column. The HWNs listed apply to the solid TRU waste only and not to any other waste forms that may undergo further treatment or processing (e.g., evaporation or cement fixation). The resulting treated waste stream is evaluated for hazardous waste constituents and assigned the applicable HWN. All P/S codes have the potential to generate leaded gloves. The gloves are segregated from other metal debris waste and are assigned the HWN D008 under the originating P/S code.

³ Refer to the Acceptable Knowledge Roadmap in Attachment 1. References listed as M-*nnn* (where *nn* is a 1- to 3-digit number) are in TWCP-3546.

SIMPLIFIED PROCESS FLOW DIAGRAM



TA-55 PLUTONIUM FACILITY ACCEPTABLE KNOWLEDGE REPORT

REPORT TITLE: Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55

REPORT NUMBER: TWCP-AK-2.1-005,R.1 (LA-UR-00-5864)

WASTE GENERATED FROM PROCESS/STATUS CODES: AL, AO, AP, AS, AT, ATL, BAC, BF, BL, BM, BU, CC, CD, CF, CH, COD, COL, CPOD, CR, DF, DP, DS, ED, ETD, EV, FA, FC, FX, GMS, HC, HCD, HD, HGMS, HP, IA, IS, LC, LG1, LG2, LR, MAG, MAS, MB, MELL, MF, ML, MPD, NC, NL, NR, OD, OH, OY, PA, PAF, PR, PS, PT, PTS, RB, RBJ, RC, RCM, RFX, RO, RR, SC, SP, SSD, SX, TDC, UPS, US, US2, VC, VP1, VP2, VP3, VUL, ZD

EFFECTIVE DATE: 12/04/00

NEXT REVIEW DATE: 12/04/02

DOCUMENT PREPARER:

John Musgrave
NAME

12/04/00
DATE

APPROVALS:

June Fabryka-Martin
INDEPENDENT TECHNICAL REVIEWER/EDITOR

12/04/00
DATE

Pamela Rogers
SITE PROJECT MANAGER

12/04/00
DATE

Matt J. Riggs
WASTE CERTIFICATION OFFICIAL

12/04/00
DATE

M A Gavett
SITE PROJECT QA OFFICER

12/04/00
DATE

Charles L. Foxx
FACILITY REPRESENTATIVE

12/04/00
DATE

CONTENTS

Section	Page
ACRONYMS	iv
PROCESS/STATUS (P/S) CODE INDEX.....	vi
PROCESS ACCEPTABLE KNOWLEDGE SUMMARY.....	x
1.0 INTRODUCTION.....	1
2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS	1
3.0 DESCRIPTION OF THE PROCESS WASTE.....	3
3.1 Facility and Mission.....	3
3.2 Waste Physical Form and Content Description.....	3
3.3 Waste Volume and Time Period of Waste Generation	3
3.4 Waste Generation Processes.....	4
3.5 Material Inputs to the Waste Generation Process	42
4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS.....	47
4.1 F, K, and P Listings.....	47
4.2 Toxicity Listings	50
4.3 Corrosivity, Reactivity, and Ignitability.....	51
5.0 DETERMINATION OF THE RADIONUCLIDE ISOTOPIC COMPOSITION	51
6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED	51
7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED	53
8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS ..	53
9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM	54
10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE	54
11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS.....	54
Table	
1 Process Feed Material for Nitrate Operations	43
2 P/S Codes with Radionuclides Other Than Pu in Feed Materials.....	44
3 Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %)...	45
4 Secondary Radionuclides in Process Wastes	45
5 Chemical Inputs to Processes Described in This Report.....	48
Attachments	
1 Acceptable Knowledge Roadmap (19 pages)	
2 LANL and TA-55 Site Maps (2 pages)	
3 Timeline for Nitrate Operations (10 pages)	
4 Process Inputs and Outputs (15 pages)	
5 Generalized Process Status Diagram for Nitrate Processes (1 page)	

ACRONYMS

AK	acceptable knowledge
CFR	<i>Code of Federal Regulations</i>
D	RCRA hazardous waste code for wastes with hazardous characteristics, defined in 40 CFR Subpart C, Sections 261.21 to 261.24
DL	discard limit
DOE	U.S. Department of Energy
DWLS	Discardable Waste Log Sheet
EPA	U.S. Environmental Protection Agency
F	RCRA hazardous waste code for hazardous wastes from non-specific sources, defined in 40 CFR Subpart D, Section 261.31
FFTF	Fast Flux Test Facility
HEPA	high efficiency particulate air
K	RCRA hazardous waste code for hazardous wastes from specific sources, defined in 40 CFR Subpart D, Section 261.32
LANL	Los Alamos National Laboratory
LLW	low-level [radioactive] waste
MSE	molten salt extraction
MT	material type
P	RCRA hazardous waste code for acute hazardous waste defined in 40 CFR Subpart D, Section 261.33
PCB	polychlorinated biphenyl
PF-4	Plutonium Facility, Building 4
P/S [code]	process status [code]
PVC	polyvinyl chloride
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RD&D	research, development, and demonstration
RLWTF	Radioactive Liquid Waste Treatment Facility
RMDC	Records Management/Document Control
Sampling Plan	<i>Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001)</i>
SME	subject matter expert
SOP	safe/standard operating procedure
TA	technical area
TOPO	trioctyl phosphate oxide
TRU	transuranic
TWCP	Transuranic Waste Characterization/Certification Project
UCNI	Unclassified Controlled Nuclear Information
WAC	waste acceptance criteria
WIPP WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)</i>
WIPP WAP	Attachment B, Waste Analysis Plan, to the <i>Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant</i> (EPA No. NM4890139088)
WIPP	Waste Isolation Pilot Plant

WODF
WPRF

Waste Origination and Disposition Form
Waste Profile Request Form

PROCESS/STATUS (P/S) CODE INDEX

Note: This index indicates the main process AK summary report and report section that covers each P/S code mentioned in this report.

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
AL	Ash Leach	Nitrate Operations	3.4.2, Att. 4
AO	Americium Processing Calcination	Nitrate Operations	3.4.3, 3.4.6, Att. 4
AP	Americium Purification	Nitrate Operations	3.4.1, 3.4.6, Att. 4
AS	Anode Heel Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4
AT	Ash Testing	Nitrate Operations	3.4.2, Att. 4
ATL	Advanced Test Line for actinide separation (RD&D)	Nitrate Operations	3.4.2, Att. 4
BAC	Bacterial Decomposition of Cellulose Items	Nitrate Operations	3.4.2, 3.4.6, Att. 4
BF	Unknown name for this P/S code	Nitrate Operations	3.4.6, Att. 4
BL	Blending	Nitrate Operations	3.4.1, 3.4.6, Att. 4
BM	Burning Metal	Nitrate Operations	3.4.1, Att. 4
BU	Button Burning	Nitrate Operations	3.4.1, 3.4.6, Att. 4
CC	Calcination	Nitrate Operations	3.4.3, 3.4.6, Att. 4
CD	Hydroxide Cake Dissolution	Nitrate Operations	3.4.2, Att. 4
CF	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
CH	Characterization	Nitrate Operations	3.4.3, 3.4.6, Att. 4
CK	RD&D Volatile Fluoride Pu Recovery	Miscellaneous Operations	3.4.2, Att. 4
CL	Crucible Processing	Chloride Operations	3.4.2, 3.4.3, Att. 4
CN	C-N-O Analysis	Metal Operation Processes	3.4.1, Att. 4
COD	Chlorinated Oxide Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4
COL	Chlorinated oxide leach	Nitrate Operations	3.4.2, 3.4.6, Att. 4
CPOD	Catalyzed Electrochemical Plutonium Oxide Dissolver	Nitrate Operations	3.4.2, Att. 4
CR	Crushing and Pulverizing	Nitrate Operations	3.4.1, Att. 4
CS	Chloride Solutions	Chloride Operations	3.4.3, Att. 4
CX	Chloride Anion Exchange	Chloride Operations	3.4.2, 3.4.3, 3.4.4, Att. 4
DF	DS Furnace and Oxide Preparation	Nitrate Operations	3.4.3, 3.4.6, Att. 4
DP	Dry Processing	Nitrate Operations	3.4.1, 3.4.6, Att. 4
DS	Ion Exchange	Nitrate Operations	3.4.3, Att. 4

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
ED	Cascade Dissolver	Nitrate Operations	3.4.2, Att. 4
ETD	Experimental Thermal Decomposition	Nitrate Operations	3.4.1, 3.4.6, Att. 4
EV	Evaporator	Nitrate Operations	3.4.4, Att. 4
FA	Americium Processing	Nitrate Operations	3.4.3, 3.4.6, Att. 4
FC	Canning	Nitrate Operations	3.4.3, 3.4.6, Att. 4
FX	Cement to Drum	Nitrate Operations	3.4.6, Att. 4
GMS	Open gradient Magnetic Separation	Nitrate Operations	3.4.1, Att. 4
HC	Calcination	Nitrate Operations	3.4.3, 3.4.6, Att. 4
HCD	Hydroxide Cake Dissolution	Nitrate Operations	3.4.2, Att. 4
HD	Hydroxide Cake Dissolution	Nitrate Operations	3.4.2, Att. 4
HGMS	High Gradient Magnetic Separation	Nitrate Operations	3.4.1, 3.4.6, Att. 4
HP	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
IA	Impure Americium Holding for Discard	Nitrate Operations	3.4.5, 3.4.6, Att. 4
IB	Matrix Study of Pyrochemical Salts	Miscellaneous Operations	3.4.6, Att. 4
IS	Incinerator	Nitrate Operations	3.4.1, Att. 4
LC	Uranium/plutonium Processing	Nitrate Operations	3.4.2, 3.4.6, Att. 4
LG1	Noncombustible Leach	Nitrate Operations	3.4.2, 3.4.6, Att. 4
LG2	Hydroxide Cake Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4
LR	Ion Exchange	Nitrate Operations	3.4.3, Att. 4
MAG	Magnetic Separation	Nitrate Operations	3.4.1, Att. 4
MAS	RD&D Experimental Processes	Nitrate Operations	3.4.1, Att. 4
MB	Nitric Dissolution of Molten Salts	Chloride Operations Nitrate Operations	3.4.2, Att. 4 3.4.2, 3.4.6, Att. 4
MELL	Mediated Electro-Oxidation of LLW	Nitrate Operations	3.4.2, Att. 4
MF	Metals Furnace	Nitrate Operations	3.4.1, 3.4.6, Att. 4
ML	Non Pu Metal Leach	Nitrate Operations	3.4.2, Att. 4
MPD	Cascade Dissolver	Nitrate Operations	3.4.2, Att. 4
NC	Noncombustible Leach	Nitrate Operations	3.4.2, Att. 4
NL	Noncombustible Leach	Nitrate Operations	3.4.2, 3.4.6, Att. 4
NR	Nitrate Recovery	Nitrate Operations	3.4.2, 3.4.6, Att. 4
OD	Oxide Dissolution	Nitrate Operations	3.4.2, Att. 4

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
OH	Hydroxide Precipitation	Nitrate Operations	3.4.1, 3.4.3, Att. 4
OY	Oxalate Precipitation	Nitrate Operations	3.4.1, 3.4.3, Att. 4
PA	Passivation	Nitrate Operations	3.4.1, 3.4.6, Att. 4
PAF	Passivation Furnaces	Nitrate Operations	3.4.1, Att. 4
PR	Peroxide Precipitation	Nitrate Operations	3.4.3, Att. 4
PS	Peroxide Precipitation of MSE Salts	Nitrate Operations	3.4.2, 3.4.6, Att. 4
PT	Plutonium Thorium Separation	Nitrate Operations	3.4.2, 3.4.6, Att. 4
PTS	RD&D Pretreatment Study	Nitrate Operations	3.4.1, 3.4.6, Att. 4
RB	Roasting and Blending	Nitrate Operations	3.4.3, Att. 4
RBJ	Roasting & Blending Jr	Nitrate Operations	3.4.3, Att. 4
RC	Rotary Calciner	Nitrate Operations	3.4.1, 3.4.6, Att. 4
RCM	Rich Column Material Ion Exchange	Nitrate Operations	3.4.3, Att. 4
RFX	Ion Exchange	Nitrate Operations	3.4.3, Att. 4
RO	Oil Recovery	Nitrate Operations	3.4.1, Att. 4
RR	Ion Exchange	Nitrate Operations	3.4.3, 3.4.6, Att. 4
SC	Cascade Dissolver, G437	Nitrate Operations	3.4.2, Att. 4
SE	Solvent Extraction	Chloride Operations	3.4.3, Att. 4
SO	Super Oxidizer, FOOF Program	Miscellaneous Operations	3.4.2, Att. 4
SP	Scrap Dissolution, G438	Nitrate Operations	3.4.2, Att. 4
SSD	Special Scrap Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4
SX	Americium Processing Silicon Removal	Nitrate Operations	3.4.3, 3.4.6, Att. 4
TDC	Thermal Decomposition of Cellulose Items R&D	Nitrate Operations	3.4.1, Att. 4
UPS	Uranium/plutonium Separation	Nitrate Operations	3.4.2, Att. 4
US	Uranium Separation for Solid Solution Feed	Nitrate Operations	3.4.2, 3.4.6, Att. 4
US2	Uranium Separation for Non-solid Solution Feed	Nitrate Operations	3.4.2, 3.4.6, Att. 4
VC	Variable CSMO Scrap Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4
VP1	CSMO Scrap Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4
VP2	Polycube Processing	Nitrate Operations	3.4.1, 3.4.6, Att. 4
VP3	Hydroxide Precipitation	Nitrate Operations	3.4.3, 3.4.6, Att. 4

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
VUL	Vessel Unloading	Nitrate Operations	3.4.1, Att. 4
ZD	Scrap Oxide Dissolution	Nitrate Operations	3.4.2, 3.4.6, Att. 4

* Process AK summary reports: Chloride Operations (TWCP-AK-2.1-002,R.1), Metal Operations (TWCP-AK-2.1-003,R.1), Miscellaneous Operations (TWCP-AK-2.1-004,R.1), and Nitrate Operations (this report)

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY

Waste-generating process: Nitrate Operations

P/S codes: AL, AO, AP, AS, AT, ATL, BAC, BF, BL, BM, BU, CC, CD, CF, CH, COD, COL, CPOD, CR, DF, DP, DS, ED, ETD, EV, FA, FC, FX, GMS, HC, HCD, HD, HGMS, HP, IA, IS, LC, LG1, LG2, LR, MAG, MAS, MB, MELL, MF, ML, MPD, NC, NL, NR, OD, OH, OY, PA, PAF, PR, PS, PT, PTS, RB, RBJ, RC, RCM, RFX, RO, RR, SC, SP, SSD, SX, TDC, UPS, US, US2, VC, VP1, VP2, VP3, VUL, ZD

Type of waste generated:

Retrievably stored and newly generated, mixed and non-mixed debris; waste immobilized in cement

Site: LANL

Facility Mission (including defense and non-defense programs):

TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites in the defense complex. The recovered plutonium is converted into pure plutonium feedstock. These manufacturing and recovery operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste contaminated scrap, residues, and debris generated at TA-55. The scrap and residues are processed to recover as much plutonium as practicable before disposal. Wastes from nitrate operations are generated from plutonium recovery and purification for defense and non-defense programs; these wastes are generated and produced in the same rooms and gloveboxes and so were not segregated until August 27, 1998.

Area(s) or building(s) where the process waste was generated (including operations carried out in those areas):

Process wastes from nitrate operations are generated in Building PF-4, Rooms 208, 401, 409, 420, and 434, of the TA-55 Plutonium Facility. Plutonium operations included reclaiming plutonium from scrap and residues produced from numerous feed sources.

Description of the process waste (physical form and typical content description):

Waste from nitrate operations consists primarily of debris waste, including cellulose-based waste, plastic-based waste, rubber, metal debris, and glass debris; and waste sent for cement fixation.

Description of the waste-generating process:

The overall goal of the nitrate operations is to recover plutonium from metal, metal alloys, scrap, and residues and produce a purified plutonium oxide product or feedstock for conversion to metal. Processes include pretreatment, dissolution, purification, and hydroxide precipitation.

Process feed:

Plutonium metal or metal alloys, oxides and hydroxide cakes; pyrochemical salts; crucible pieces; anode heels; ash; analytical laboratory solutions; and residues from other DOE facilities.

Radioisotopic content of the waste:

Variety of plutonium material types with different isotopic compositions; Am-241, Np-237, and U-234 may be present at detectable concentrations as decay products of their plutonium precursors. Some of the processes separate plutonium and americium so that the waste will usually be enriched in americium, but may also be depleted in some cases.

RCRA Constituents/EPA Hazardous Waste Numbers:

- F002 and F003: P/S codes CF and HP
- No K or P codes
- D008: all P/S codes in nitrate operations for the generation of leaded gloves
- D005: P/S codes COL, MB
- D005, D006, D007, D008, D011: P/S codes AL, AT, ATL, ED, ETD, IS, MPD, PTS, RC, SC, TDC
- D005, D008: P/S code VUL
- D006, D007, D008: P/S codes OD, SSD
- D006, D007, D008, D009, D011: P/S codes CD, DS, EV, FX, HCD, HD, HGMS, IA, LG2, LR, MELL, OH, RR
- D006, D007, D008, D011: P/S codes AS, BF, BU
- D006, D008: P/S codes LG1, ML, NC, NL, VC
- D006, D008, D040: P/S code RO
- D007: P/S codes PT, SP
- D007, D008, D009, D011, D019, D021, D022, D039: P/S codes CF, HP
- D007, D009: P/S codes AP, MB
- D009: P/S codes VP1, VP3
- D011: P/S code CPOD

Process waste volume (if known):

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are segregated into waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

Years of generation for the process waste: 1979–present

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY REPORT FOR NITRATE OPERATIONS AT TA-55

1.0 INTRODUCTION

All transuranic (TRU) waste must be sufficiently characterized and certified before it is shipped to the Waste Isolation Pilot Plant (WIPP). The U.S. Environmental Protection Agency (EPA) allows use of acceptable knowledge (AK) for waste characterization. EPA uses the term AK in its guidance document, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. Attachment B, Waste Analysis Plan, to the *Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088) (WIPP WAP) defines AK and provides guidelines on how AK should be obtained and documented.

This process AK summary report was prepared in accordance with *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5). The primary purpose of this report is to systematically organize, evaluate, and summarize detailed AK information about individual processes used by one of the TRU-waste generators at Los Alamos National Laboratory (LANL). By doing so, this report provides detailed technical support for one or more waste stream AK summary reports that include these process wastes.

2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS

The AK search for the information related to Technical Area (TA)-55 waste streams resulting from nitrate operations covered:

- Review of the *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3) (Sampling Plan) that includes information regarding all TRU waste streams
- Review of documents related to waste generation and waste management activities at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)
- Interviews with personnel involved with waste generation and waste management at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)

NOTE: Much of the AK information related to nitrate operations is contained in Transuranic Waste Characterization/Certification Project (TWCP) Record Nos. TWCP-3548, TWCP-3566, TWCP-3567, and TWCP-3568. Individual documents in this record have been assigned a separate identifier, N-nn, where nn is a sequential 1- or 2-digit number. This referencing nomenclature is used throughout this report and its attachments.

- Analyses of individual processes generating waste, and evaluations of the potential for Resource Conservation and Recovery Act (RCRA)-regulated constituents to be

present in the process wastes, based on subject matter expert (SME) interviews and any available data

The TWCP Records Management/Document Control (RMDC) Center contains copies of the documents referenced in this report. Any Unclassified Controlled Nuclear Information (UCNI) will be contained in these records, and will not be included in this report. Such records are identified as UCNI in the Acceptable Knowledge Roadmap (Attachment 1).

This process AK summary report is part of a set of closely related reports about TRU-waste generating activities at TA-55. For convenience in organizing AK for plutonium processing at this facility, the processes were categorized into six arbitrary operational areas. The multiple processes in each area are then described in detail in the following six process AK reports for plutonium:

- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004)
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005) (this report)
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006)
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007)

Each process AK report contains information on multiple individual processes that are assigned unique identifiers called process/status (P/S) codes. For example, nitrate operations include 80 individual processes that are each assigned a P/S code, as listed on the cover page of this report. The search and compilation of AK information was based on P/S code because that is the most detailed level of process information generally recorded in waste generation records. The process AK reports frequently cross-reference one another because P/S codes in one operational area often provide the material feed for P/S codes in another area. An index of P/S codes cited in this process AK report follows the list of acronyms; this index lists process descriptions and the primary process AK report in which that P/S code is discussed.

3.0 DESCRIPTION OF THE PROCESS WASTE

The following sections describe processes used in nitrate operations, and identify the resulting wastes as well as outputs that are sent to other operations, such as pyrochemical operations, for further processing.

3.1 Facility and Mission

The TA-55 Plutonium Facility (Building PF-4) recovers plutonium from scrap and residues generated throughout the U.S. Department of Energy (DOE) defense complex, and processes it into pure plutonium oxide for conversion to metal and other products. A LANL site map and a detailed map of the buildings at TA-55, including Building PF-4, are shown in Attachment 2.

Most processes in nitrate operations were solely defense related (TWCP-614, TWCP-4162). However, wastes from various processes were not segregated by funding source, waste-generating process, or waste-generating location (e.g., room or glovebox) until recently (August 27, 1998), but rather were segregated and packaged based on waste type (TWCP-887, TWCP-4162, TWCP-4167). Consequently, a single waste container often contains wastes from multiple processes. Some debris waste was also co-mingled with room trash related to these same operations (both defense and non-defense), and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits (DLs) (TWCP-816).

3.2 Waste Physical Form and Content Description

Wastes generated during nitrate operations, primarily debris wastes and wastes entered into the cement fixation process or sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) are covered by this process AK report. General debris waste categories from nitrate operations include

- Cellulose-based waste (for example, paper, cloth)
- Plastic-based waste (for example, gloves, tape, labware)
- Rubber
- Magnesium oxide crucibles
- Metal debris (for example, wire, hose clamps, tools, labware)
- Glass debris

These debris items are contaminated with small amounts of radioactive and chemical substances from nitrate operations.

3.3 Waste Volume and Time Period of Waste Generation

This report covers waste streams generated from 1979, when nitrate operations first began at TA-55, to the present. Process wastes from nitrate operations have

different associated RCRA codes depending on the time period during which they were generated. The P/S codes, their time period of generation, and corresponding RCRA codes are shown graphically in Attachment 3, Time Lines.

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are assigned to waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

3.4 Waste Generation Processes

The following subsections describe the generation of waste by nitrate operations, as well as product and waste outputs to other processes or operations.

Manufacturing and research operations performed at TA-55 in the production of plutonium also generate plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as is practical. TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites. These recovery and manufacturing operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste generated at TA-55.

Detailed information about the TA-55 plutonium recovery processes can be found in *Waste from Plutonium Conversion and Scrap Recovery Operations* (TWCP-352). A full-block flow diagram for plutonium processing and waste management at TA-55 is given in reference TWCP-886. In general, TA-55 plutonium recovery can be divided into six major processes:

- Head-end operations
- Aqueous nitrate-based processes
- Aqueous chloride-based processes
- Purification and oxide preparation
- Metal preparation and purification (pyrochemical processes)
- Aqueous waste treatment

This report addresses the aqueous nitrate-based processes.

The primary feed source for the nitrate recovery operations is plutonium residues from other recovery operations (e.g., chloride or pyrochemical), metal preparation, metal fabrication, analytical laboratory operations, and residues from other DOE facilities (TWCP-3548/N-1). The overall goal of the nitrate recovery operations is to recover plutonium from scrap and residues and produce a purified plutonium oxide for conversion to metal. The nitrate recovery operations can be broken down into the following process steps:

- Pretreatment

- Dissolution
- Purification, including conversion to oxide
- Cement fixation

Each of these process categories is described below. The timeframe and EPA hazardous waste numbers associated with each P/S code are shown on the timelines included as Attachment 3; the dates can be correlated to the dates on the procedures listed in Attachment 1. Attachment 4 contains a complete listing of P/S codes for nitrate operations, their descriptions, feed materials, chemical inputs, outputs and applicable EPA hazardous waste numbers. A simplified process flow diagram for nitrate operations is found in Attachment 5.

3.4.1 Pretreatment (P/S codes BL, BM, BU, CR, DP, ETD, GMS, HGMS, IS, MAG, MAS, MF, OH, OY, PA, PAF, PTS, RC, RO, TDC, VP2, VUL)

Pretreatment primarily includes physical processes used to prepare scrap and residues for the next step, dissolution (TWCP-3548/N-1).

Pretreatment may have included any or all of the following processes: calcination (RC), caustic leaching, chemical separation (hydroxide or oxalate precipitation), crushing and pulverizing (CR), distillation, filtering of liquids or oils, incineration (IS), magnetic separation (GMS, MAG, MAS, HGMS), passivation (PA, PAF), scraping, and sorting (TWCP-3548/N-1 through N-18). As materials are received from various operations within TA-55, they are sorted and sent to various other pretreatment processes or directly to dissolution depending on the physical nature of the scrap or residue and the amount and type of plutonium associated with the material. Loose plutonium may be brushed off of a scrap item and then the item sent to dissolution. Chunks of plutonium-bearing residue (e.g., sand, slag, crucibles) are sent for crushing and pulverizing (CR). Magnetic plutonium-bearing materials are sorted using magnetic separation (GMS, MAG, MAS, HGMS) into either lean or rich plutonium-bearing residues (TWCP-3548/N-1 and N-2). The lean plutonium-bearing residues are sent to cement fixation (CF) if plutonium concentrations are below the DL (TWCP-3548/N-1 and N-2). Finely divided plutonium in sweepings or powder form is sent directly to dissolution. Lapping or grinding oils are filtered if necessary, and the liquid portion is sent to P/S code CF for immobilization in cement, or to P/S code RO for absorption on vermiculite, if plutonium concentrations are below the DL (TWCP-3548/N-10 and N-15). If there are a significant quantity of filtered solids, they are calcined and sent to dissolution (TWCP-3568/N-82).

Many thermal pretreatment processes have also been used to prepare plutonium-bearing materials for dissolution (TWCP-3548/N-1). Passivation (PA, PAF) converts pyrophoric plutonium metal and other reactive metals to a stable oxide prior to dissolution. These materials

were heated in a tube furnace to approximately 600°C (PA, PAF) (TWCP-3548/N-7 and N-11). Cellulose materials contaminated with plutonium (e.g., cheesecloth, wood, paper, cardboard) have been either incinerated (IS) or thermally decomposed (TDC) (TWCP 3548/N-1, N-5, N-6, N-7, N-11, and N-12). Ash from the incinerator was sent to a calciner (P/S code RC) to remove any residual organic materials and to ensure complete oxidation prior to dissolution. Thermal decomposition of cellulose (P/S code TDC) is performed in an argon atmosphere and the vapors and particulate matter are trapped in a caustic scrubber (TWCP 3548/N-6 and N-12, TWCP 3568/N-82). The caustic solution generated by the scrubber is sent to the TA-50-1 RLWTF after meeting the TA-50-1 waste acceptance criteria (WAC) (TWCP-3548/N-12). The wash water is filtered and sent to purification if plutonium concentrations are above the DL, or the TA-50-1 RLWTF if it meets the TA-50-1 WAC. The rags are disposed as debris waste or thermally decomposed (TDC) (TWCP 3548/N-4, TWCP 3568/N-76). The ash from the thermally decomposed rags was rotary calcined (RC) before it was sent to dissolution (TWCP 3568/N-79). The burning of plutonium metal (BM), anode heels, and oxides was used to prepare these materials for either dissolution or storage in the vault (TWCP 3548/N-13 and N-14). Distillation was used to recover plutonium from polystyrene cubes (VP2) (TWCP 3548/N-18).

A caustic (hydroxide) leach process has been used to pretreat electro-refining furnace scrapings from the Rocky Flats Plant, and other residues high in chlorides. Chlorides were removed using sodium hydroxide and the treated residues were then dissolved in nitric and hydrofluoric acid (TWCP 3566/N-26, N-26A, and N-30E). In this case, the caustic solution would be disposed to the TA-50-1 RLWTF if it met the TA-50-1 WAC, and the filtered solids would continue through the dissolution process.

In overview, particulate solids from the pretreatment step are sent to dissolution if plutonium concentrations are above the DL and to cement fixation (CF) if concentrations are below the DL (TWCP-3548/N-1 through N-18). Liquids are sent to purification if plutonium concentrations are above the DL and to the RLWTF if they meet the TA-50-1 WAC (TWCP-3548/N-1 through N-18). Chemicals used in the pretreatment steps are listed in Table 5 in Section 5.3. Chemicals used in these steps that are covered by 40 *Code of Federal Regulations* (CFR) Part 261, including Appendix VIII of those regulations, are (1) hydrofluoric, nitric, oxalic, and sulfuric acid, (2) potassium and sodium hydroxide, (3) hydrogen peroxide (an oxidizer), and (4) trichloroethylene. EPA hazardous waste numbers D001 and D002 do not apply to the solid wastes because of the use of acids, bases and an oxidizing solution in these processes because there is no free liquid in

these wastes. Trichloroethylene was only used in 1979 in P/S code RO, as a diluent for filtering oils (not used for solvent properties [TWCP-3548/N-10 and N-18]). Thus, the EPA hazardous waste number D040, but not F002, applies to waste generated under P/S code RO during 1979.

Additional EPA hazardous waste numbers apply to most of these P/S codes as a result of the presence of regulated chemicals in the feed materials (see Table 1 in Section 3.5) or as a result of contamination introduced from the use of laboratory equipment or supplies or from glovebox maintenance operations (section 4.2). Leaded gloves and other lead-containing items were discarded as described in section 3.5.1.

NOTE: For some of these P/S codes, no formal procedures could be found and the necessary information was extracted from process flow diagrams and SME input. More detailed descriptions of such P/S codes that are included in this pretreatment section are provided in section 3.4.6, as follows: P/S codes BL, BU, DP, ETD, HGMS, MF, PA, PTS, RC, RO, and VP2.

3.4.2 Dissolution (P/S codes AL, AS, AT, ATL, BAC, CD, COD, COL, CPOD, ED, HCD, HD, LC, LG1, LG2, MB, MELL, ML, MPD, NC, NL, NR, OD, PS, PT, SC, SP, SSD, UPS, US, US2, VC, VP1, ZD)

Dissolution is comprised of numerous processes that generate a plutonium-nitrate solution for feed to a purification process (TWCP-3548/N-1, TWCP-3568/N-79). The main chemicals used in dissolution are nitric acid and calcium fluoride and/or hydrofluoric acid, which together form a standard leach solution. Additionally, other chemicals are used for particular dissolution processes. Depending on the particular process involved, dissolution takes place in pots or in cascade systems. Debris waste items may be wiped with a cloth soaked in a nitric acid/calcium fluoride solution to recover surface contamination of plutonium. The cloths are dunked in water a few times and wrung out (TWCP-3568/N-82). The solutions from the cloths are collected and filtered. The solids from the solutions are recycled through the dissolution process if plutonium concentrations are above the DL, or sent to cement fixation or disposed as debris waste if concentrations are below the DL (TWCP-3548/N-1, TWCP-3568/N-79). The plutonium-bearing solutions were sent to purification. The cloths are reused if they are not falling apart; otherwise, they are discarded as solid waste or sent to incineration (IS), depending on the nuclear material content (TWCP-3568/N-82).

Plutonium on the surface of metal and noncombustible debris waste items is also recovered by leaching or dipping the waste item into the

standard leach solution (ML, NC) (TWCP-3548/N-1, TWCP-3566/N-22, N-29, N-30, and N-31, TWCP-3568/N-79). Plutonium-bearing solutions are sent to purification, while the leached items below the DL are discarded. Lead-containing waste items (e.g., leaded gloves) below the DL are segregated, packaged separately, and assigned the EPA hazardous waste number D008 (TWCP-3567/N-39). Other leached metal items containing RCRA-regulated heavy metals are also segregated from metal debris that is not RCRA-regulated and are assigned the appropriate EPA hazardous waste numbers (e.g. D006 for cadmium) (TWCP-3568/N-84).

From the late 1970s to the present, many plutonium-bearing materials are dissolved in a standard leach solution of nitric and hydrofluoric acid after appropriate pretreatment or preparation (TWCP-3566/N-30A through N-30F, TWCP-3568/N-79). These materials include alloys, anodes, carbides, casting skulls, electrorefining residues, metals, and plutonium oxide. After dissolution, solids are discarded if below the DL or recycled if above the DL, while solutions are sent to purification. These solutions contain dissolved heavy metals (e.g., lead, cadmium, mercury, or chromium) below the regulatory levels (TWCP-3568/N-82). These metals may be concentrated to above the regulatory levels in the purification step (as a hydroxide cake) or in the evaporator step, as addressed later in this report.

Starting in 1990, plutonium oxide was also dissolved using an electrochemical process that incorporated the chemicals found in the standard leach solution as well as ferric ammonium sulfate, potassium thiocyanate, and silver nitrate (CPOD) (TWCP-3548/N-1 and TWCP-3566/N-21). The electrochemical cell used in this process relied on silver acting as a catalyst for the dissolution of plutonium. Waste from this process was considered suspect hazardous for the presence of silver and was assigned the EPA hazardous waste number D011. This process was replaced in 1994 by a similar electrochemical process (MELL) that used cobalt nitrate or cerium nitrate in place of silver nitrate to reduce the generation of hazardous and mixed waste at TA-55 (TWCP-3548/N-1 and TWCP-3566/N-33).

Two dissolution processes were designed to remove excess silica from either solid residues during dissolution or from plutonium-bearing solutions after dissolution (TWCP-3567/N-34 and N-35). In both these processes, silica was removed from solutions prior to sending them to purification. One process involved the following steps: adjusting the acidity of the feed solution using nitric acid; distilling to concentrate the solution; adjusting the plutonium valence (to +4) with hydrogen peroxide; heating the solution until the hydrogen peroxide is destroyed; and filtering the solution to remove the silica solids (TWCP-3567/N-34).

The solution from this process went to anion exchange purification process. The second silica-removal process used a hydrofluorinator with a potassium hydroxide scrubber solution (TWCP-3567/N-35). The solution from this process was sent to the TA-50-1 RLWTF via the caustic waste line if the plutonium content was below the DL or to the lean residue ion exchange (LR) purification process if the content was above the DL. The filtered silica solids from both processes were re-dissolved if plutonium concentrations were above the DL or disposed to cement fixation (CF) if concentrations were below the DL.

Uranium-plutonium oxide mixtures were leached using nitric acid to preferentially dissolve the uranium (UPS) (TWCP-3566/N-19). Aluminum nitrate was added to the solution to complex any fluoride ion that might be present. The uranium-bearing filtrate was disposed to cement fixation (CF). The plutonium-bearing solids were sent to dissolution (ED, MPD, or SP) and then to either an anion-exchange process or the oxalate-precipitation process (OY) for purification.

A caustic (hydroxide) leach process has been used to pretreat electro-refining furnace scrapings from the Rocky Flats Plant and other residues high in chlorides. Chlorides were removed using sodium hydroxide, and the treated residues were then dissolved in nitric and hydrofluoric acid (TWCP-3566/N-26, N-26A, and N-30E). The filtered solids continued through the dissolution process. If the plutonium content in the solution was above the DL, the solution was refiltered (TWCP-3566/N-26). If the plutonium content was below the DL, the caustic solution was disposed to the TA-50-1 RLWTF (TWCP-3566/N-26A).

Several dissolution processes involved the use of cascading dissolvers or dissolution pots (AL, AT, ED, MPD, OD, SC, SP) (TWCP-3548/N-1). The choice of dissolution equipment is based on the concentration of plutonium present in the feed material and the physical form of the feed material. Feed materials include ash, glovebox sweepings, ground slag or crucibles, oxides, residues, salts, and sand (TWCP-3566/ N-23, N-24, N-25, and N-28; TWCP-3567/N-36, N-37, and N-37A).

For P/S code OD, the feed materials came from P/S codes PAF, IB, RB, and RBJ (TWCP-3568/N-81). The possible impurities in the feed materials consisted of cadmium, chromium, and/or lead. These metals would be contained in the filtrate, which was sent to the ion exchange processes for further purification. The debris waste generated from this process is not expected to contain cadmium, chromium, or lead above the regulatory limits because the dissolution involved strong acids (any soluble metals should be in the filtrate). However, without analytical data or other acceptable information confirming that the concentrations of these hazardous constituents are below the regulatory levels, the

applicable EPA hazardous waste numbers (D006, D007, and D008) are assigned pending additional information (TWCP-3568/N-83).

Cascading dissolvers consist of a series of heated columns into which the standard leach solution is introduced along with aluminum nitrate in some instances. Air is bubbled through the columns to promote mixing of the solutions and to keep particles in suspension. Solution from the first column overflows to the second column and so on (TWCP-3548/N-1; TWCP-3566/N-23, N-24, N-24A, and N-25; TWCP-3567/N-36). After dissolution in the dissolvers, the solutions are filtered and then sent to purification. The filtered solids are sent to other dissolution processes if plutonium concentrations are above the DL, or to cement fixation (CF) or disposed as debris waste if concentrations are below the DL.

Another feed material for the nitrate operations is hydroxide filtrate cakes from the chloride operations (TWCP-3548/N-1). This material is dissolved using the standard leach solution, which is then filtered (CD, HCD, HD) (TWCP-3566/N-32). Aluminum nitrate is added to the solution and the solution is re-filtered. The filtrate is sent to purification. Filtered solids are re-dissolved if plutonium concentrations are above the DL, or disposed to cement fixation (CF) if concentrations are below the DL. From 1985 to 1994, the hydroxide cakes from the chloride operations contained cadmium, chromium, lead, mercury, and silver (TWCP-3567/N-39 and N-40). After 1994, silver is not present in the cakes. The debris waste generated from the dissolution of hydroxide cakes from the chloride operations is not expected to contain the listed metals above the regulatory limit. However, without analytical data or other acceptable information confirming that the concentrations of these hazardous constituents are below the regulatory levels, the applicable D-codes (D006, D007, D008, D009, and D011) are assigned pending additional information (TWCP-3568/N-83).

In overview, filtered solids from the dissolution step are re-dissolved until plutonium concentrations are below the DL, then sent to cement fixation (CF); debris items are disposed after the plutonium contamination is removed from the surface by leaching; plutonium-bearing solutions are sent on to purification or to the metal preparation line (P/S code MP) (TWCP-3548/N-1; TWCP-3566/N-21 through N-33; TWCP-3567/N-34 through N-36).

Chemicals used in the dissolution steps are listed in Table 5 in Section 3.5.3. Chemicals used in these steps that are covered by 40 CFR Part 261, including Appendix VIII of those regulations, are (1) ascorbic, formic, hydrochloric, hydrofluoric, nitric, oxalic, and sulfuric acid; (2) potassium and sodium hydroxide, (3) hydrogen peroxide (an oxidizer), and (4) mercuric and silver nitrate (TWCP-3566/N-21, N-22, N-23, N-

24, N-25, N-28, N-29, N-30B, N-30C, N-30D, N-30E, N-30F, N-31, N-32, and N-33; TWCP-3567/N-34, N-35, N-36, N-37, and N-37A; TWCP-3568/N-81). EPA hazardous waste numbers D001 and D002 do not apply to the solid wastes because of the use of acids, bases and an oxidizing solution in these processes because there is no free liquid in these wastes. Mercuric nitrate was used as a catalyst in P/S code VP1, which is accordingly assigned the code for mercury, D009. Silver nitrate was used in P/S code AT and CPOD, which are therefore assigned the code for silver, D011.

Additional EPA hazardous waste numbers apply to most of these P/S codes as a result of the presence of regulated chemicals in the material feed (see Table 1 in Section 3.5) or as a result of contamination introduced from the use of laboratory equipment or supplies or from glovebox maintenance operations (discussed in section 4.2). For example, RCRA-regulated hazardous constituents introduced to the nitrate operation at the dissolution step from hydroxide filtrate cakes include cadmium, chromium, lead, mercury, and silver (TWCP-3567/N-39, N-40). Leaded gloves were discarded as described in section 3.5.1.

NOTE: For some of these P/S codes, no formal procedures could be found and the necessary information was extracted from process flow diagrams and SME input. More detailed descriptions of such P/S codes that are included in this dissolution section are provided in section 3.4.6, as follows: P/S codes AS, BAC, COD, COL, LC, LG1, LG2, MB, NL, NR, PS, PT, SSD, US, US2, VC, VP1, and ZD.

3.4.3 Purification and Oxide Conversion (P/S codes AO, AP, CC, CH, DF, DS, FA, FC, HC, LR, OH, OY, PR, RB, RBJ, RCM, RFX, RR, SX, and VP3)

A peroxide precipitation process (PR) was used to achieve excellent separation of plutonium from the cationic impurities calcium, chromium, magnesium, cesium, cobalt, and aluminum, as well as americium (TWCP-3567/N-52). Peroxide was added to the oxide dissolution filtrate feed material to convert the plutonium to valence state (+4). Additional peroxide resulted in the precipitation of $[\text{PuO}_2]^{+5}$, then $[\text{PuO}_4]^{+4}$, and finally Pu_2O_7 . The resulting peroxide filter cake was dissolved in nitric acid and the solution was sent to oxalate precipitation (OY). The filtrate solution from the peroxide precipitation was sent to hydroxide precipitation (OH), also known as the peroxide kill process.

Plutonium-bearing solutions generated in the dissolution step are directed to purification for plutonium recovery (TWCP-3548/N-1). Purification consists of both ion exchange and precipitation processes.

There are three primary ion exchange processes based on the concentration of plutonium in solution: rich feed (RCM), dissolver solutions (DS), and lean residue (LR). After ion exchange, plutonium-bearing solutions are directed to oxide precipitation and then to an oxidation process. The oxidation process generates plutonium oxide, a stable form of plutonium suitable for storage or further processing into plutonium metal.

The ion exchange processes use resin-filled columns to collect plutonium (P/S codes DS, RCM, LR, RR, RFX) (TWCP-3548/N-1; TWCP-3567/N-41, N-42, N-43, N-44, N-46, N-47, and N-53). The pH of incoming solutions is adjusted with nitric acid and the plutonium is stabilized by changing the plutonium valence state to (+4) using hydrogen peroxide. Other chemicals used to adjust acidity or to “condition” incoming solutions to address the presence of fluoride, silica, metal impurities, or plutonium (+6) include: aluminum nitrate, ferrous ammonium sulfate, hydrogen peroxide, sodium hydroxide, sodium nitrite, sulfuric acid, and urea. Certain intermediate solutions used to condition the ion exchange feed, especially caustic solutions used to “kill” the peroxide, are filtered and then disposed to the TA-50-1 RLWTF if they meet the TA-50-1 WAC.

If solutions high in americium are “conditioned” with hydrogen peroxide, an americium hydroxide precipitate forms when the solutions are dripped into sodium hydroxide to “kill” the peroxide (TWCP-3567/N-55). This precipitate is dissolved using nitric acid, sent through an ion exchange column, and then sent on to the oxalate precipitation process to recover the americium and convert it to americium oxide (P/S codes AO, AP, FA, and SX).

Plutonium (+4) binds to the resin while impurities such as americium, uranium, and other metals flow through the columns (TWCP-3548/N-1; TWCP-3567/N-41, N-42, N-43, N-44, N-46, and N-47). The plutonium remains on the resin in the (+4) valence state until an eluting agent (hydroxylamine nitrate or 0.35-1.0 M nitric acid) is flowed through the columns. This releases purified plutonium in solution for further processing (i.e., precipitation and oxidation). The plutonium-poor solutions or effluents from the ion exchange columns are sent to the evaporator (EV) for re-concentration. Ion exchange resins are reconditioned using nitric acid; spent ion exchange resins are periodically sent to cement fixation (CF) for disposal.

After ion exchange, plutonium-bearing solutions are sent on to a precipitation process (P/S codes OY and OH) to convert the plutonium solution to plutonium oxide (TWCP-3548/N-1; TWCP-3567/N-41, N-42, N-43, N-47, N-48, N-50, N-51, N-51A, and N-53;

TWCP-3568/N-79). This process involves the addition of oxalic acid to form a plutonium oxalate precipitate. The precipitate is then filtered out of the solution, washed, dried, and converted to an oxide using calcination, heat lamps, or hot plates. The plutonium solutions are either sent to the evaporator (EV) for volume reduction or, for a short time, were treated with hydroxide precipitation.

Hydroxide cakes from the chloride operations, which started in 1985 (TWCP-3567/N-40), are introduced to the nitrate operations in the dissolution step (TWCP-3567/N-39). The outputs from the dissolution of chloride operations hydroxide cakes are sent to P/S code LR or DS. Therefore, RCRA-regulated hazardous constituents associated with the feed materials from the chloride operations may carry through to P/S codes DS and LR (TWCP-3567/N-38). The hazardous metal constituents contained in hydroxide cakes from 1982 (based on the start of the chloride operations) until 1994, include cadmium, chromium, lead, mercury, and silver (TWCP-3567/N-40). Beginning in 1994, only cadmium, chromium, lead, and mercury are expected to be present. These metals may be present above the regulatory limits in the waste streams generated by P/S codes DS and LR. Therefore, the EPA hazardous waste numbers D006, D007, D008, D009, and D011 are assigned to the waste from 1982 to 1994; and D006, D007, D008, and D009 are assigned from 1994 forward.

In overview, plutonium oxide from the purification step is transferred to the vault for storage or to the metal preparation line; solutions are sent to the evaporator for re-concentration and then returned to ion exchange or sent to P/S codes CF or HP for immobilization in cement. The distillates are disposed to the RLWTF if they meet the TA-50 WAC. Spent ion exchange resins are disposed to cement fixation (CF) (TWCP-3567/N-41 through N-53).

Chemicals used in the dissolution steps are listed in Table 5 in Section 3.5.3. Chemicals used in these steps that are covered by 40 CFR Part 261, including Appendix VIII of those regulations, are (1) hydrofluoric, nitric, and oxalic acid; (2) sodium hydroxide, and (3) hydrogen peroxide (an oxidizer)(TWCP-3567/N-41 through N-47, N-50, N-51, N-53, N-54, and N-55; TWCP-3568/N-81). EPA hazardous waste numbers D001 and D002 do not apply to the solid wastes because of the use of acids, bases and an oxidizing solution in these processes because there is no free liquid in these wastes.

However, EPA hazardous waste numbers apply to most of these P/S codes as a result of the presence of regulated chemicals in the material feed (see Table 1 in Section 3.5) or as a result of contamination introduced from the use of laboratory equipment or supplies or from

glovebox maintenance operations (discussed in section 4.2). For example, RCRA-regulated hazardous constituents introduced to P/S codes DS and LR with the hydroxide filtrate cakes include cadmium (D006), chromium (D007), lead (D008), mercury (D009), and silver (D011) (TWCP-3567/N-39 and N-40). Similarly, plutonium oxide from the vault may have been roasted and blended in P/S codes RB and RBJ to provide a more homogeneous feed for the metal preparation line (P/S code MP); these oxides may have contained cadmium (D006), chromium (D007), and lead (D008) (TWCP-3567/N-56, N-57, N-57A, and N-57B). Leaded gloves were discarded as described in section 3.5.1.

NOTE: For some of these P/S codes, no formal procedures could be found and the necessary information was extracted from process flow diagrams and SME input. More detailed descriptions of such P/S codes that are included in this purification section are provided in section 3.4.6, as follows: P/S codes AO, AP, CC, CH, DF, FA, FC, HC, and VP3.

3.4.4 Evaporator (P/S code EV)

Plutonium-poor ion exchange effluents and oxalate precipitation filtrates are sent to the evaporators to re-concentrate plutonium, if possible, and reduce the volume of disposed waste (TWCP-3548/N-1, TWCP-3568/N-61 through N-65). General facility maintenance solutions (e.g., wet vacuum water, mop water, chiller water) are also sent to the evaporator if they do not meet the TA-50-1 WAC (TWCP-3568/N-76). The wet vacuum water and chilled circulating water are contaminated with nitric acid, hydrochloric acid, or caustic solutions having the same characteristics as those sent to the TA-50-1 RLWTF, only richer in nuclear material content (e.g., diluted processing solutions) (TWCP-3568/N-82). The mop water is taken back into the evaporator only if it has a significant nuclear material content, which means that it originated in the processing solutions before escaping the confines of the glovebox system. There has never been an indication that spilled materials included a solvent.

Plutonium-poor solutions are collected in storage tanks and sent to the evaporators in batches of up to 600 liters (TWCP-3548/N-1; TWCP-3568/N-61 through N-65). These solution batches are then concentrated to approximately 25-liter volumes called "bottoms." As the bottoms cool, salts precipitate out and settle on the bottom of cooling trays. After cooling, the bottoms are sent back to ion exchange if plutonium concentrations are above the DL or to cement fixation (CF) if concentrations are below the DL. Attempts are made to re-dissolve settled salts, but if this is not possible, the bottoms are filtered and the

salts are sent to dissolution if plutonium concentrations are above the DL or disposed as uncemented (debris) waste or sent to cement fixation (CF) if concentrations are below the DL. Nitric acid is used in the evaporator process to wash nitrate salts having a plutonium concentration above the DL. Except for approximately one year in 1990/1991, no other chemicals are used in the evaporator step in addition to those found in the ion exchange effluents and oxalate precipitation filtrates waste (TWCP-3548/N-1; TWCP-3558/N-61 through N-65). In the 1990/1991 timeframe, formic acid was added to the evaporator as an experiment to decrease the nitric acid concentration (by converting nitrate to nitrogen oxides) (TWCP-3568/N-76).

Chemicals used in the evaporator that are covered by 40 CFR Part 261, including Appendix VIII of those regulations, are nitric and formic acid. However, EPA hazardous waste numbers D001 and D002 do not apply to the solid wastes from the evaporator because there is no free liquid in these wastes.

However, EPA hazardous waste numbers apply to waste from P/S code EV as a result of the presence of regulated chemicals in the evaporator feed material. Hydroxide cakes from chloride operations, which started in 1982 (TWCP-3567/N-40), are introduced to nitrate operations in the dissolution step (TWCP-3567/N-39). Therefore, RCRA-regulated hazardous constituents associated with the feed materials from chloride operations may carry through from dissolution to P/S codes DS and LR to the evaporator (TWCP-3567/N-38). The hazardous constituents contained in the hydroxide cakes from 1982 (based on the start of the chloride operations) until 1994 include cadmium (D006), chromium (D007), lead (D008), mercury (D009), and silver (D011) (TWCP-3567/N-39 and N-40). After 1994, only cadmium, chromium, lead, and mercury are expected to be present. Analysis of evaporator bottoms at TA-55 and statistical evaluation of analytical results using control charts have also shown that chromium, lead and mercury are above regulatory limits in this waste (TWCP-3568/N-66).

3.4.5 Cement Fixation (P/S codes CF, HP, IA)

In the cement fixation step, various wastes with plutonium concentrations below the DL from nitrate and other operations at TA-55 are collected and immobilized in cement for interim and long-term storage (TWCP-3548/N-1; TWCP-3568/N-67 through N-74). Cement fixation has been carried out in 55-gallon drums under P/S code CF, and in one-gallon cans under P/S code HP (TWCP-3568/N-72).

The cement fixation process came into existence in 1980 under what became P/S code HP. The following information was provided by a subject matter expert (SME) (TWCP-3568/N-81) because documented

procedures for this process could not be identified. Wastes sent to P/S code HP for disposal in one-gallon cans included: americium oxide; calcium chloride salts from direct oxide reduction, pyroreodox, and salt stripping; chloride solutions; evaporator bottoms; filter aid; glovebox sweepings; graphite powder; high efficiency particulate air (HEPA) filter media; high-fired ash; leached ash residues; leached particulate solids (e.g., sand, slag, crucible parts); passivated uranium carbide; plutonium/thorium fluoride filter cakes; plutonium/thorium hydroxide filter cakes; pump oils; silica solids; spent ion exchange resins; trioctyl phosphine oxide and iodine in kerosene; uranium oxide; and uranium solutions (TWCP-3568/N-72).

Since 1981, the primary feed to this process was the evaporator bottoms solution. Evaporator bottoms were treated by hydroxide precipitation and filtered. The cakes would dry only very slowly so the wet cakes were rolled in plastic bags with Portland cement powder or were stirred in one-gallon cans with Portland cement to make them set. In 1981, hydroxide precipitation was discontinued and the neutralized bottoms solutions were stirred directly with Portland cement powder in one-gallon cans. In January 1983, Gypsum cement powder replaced the Portland cement powder. The evaporator bottoms solution was adjusted to a pH of about 3 for Gypsum cement or to a basic pH (7-10) for Portland cement. The cement powder was then mixed into the solution. Any particulate matter was added during the stirring operations.

Waste oil/organic solutions set up in cement were restricted to TRU vacuum pump oils and mixtures of trioctyl phosphine oxide (TOPO) and iodine dissolved in kerosene. Some of the miscellaneous solutions sent for cement fixation included analytical chemistry solution residues that contained RCRA-regulated organics or heavy metals. Oils and organic liquids are emulsified by the addition of a surfactant before they are mixed with the neutralized evaporator bottom solutions (TWCP-3568/N-74). The miscellaneous solutions were treated in a manner much like the evaporator bottoms solution.

The discard of impure americium oxide from P/S code AO (section 3.4.6.1) was mostly accomplished by stirring it into a one-gallon can of evaporator bottom cement paste (up to 140 g americium/can). When all cement was being stirred in one-gallon cans, the americium-containing can was placed in the center of the middle layer of cans in a drum to provide maximum shielding. When storage of the impure americium hydroxide cakes in P/S code AO became a radiation exposure problem, a significant portion of the stored material was placed in P/S code IA until the material could be immobilized in cement for disposal. P/S code IA was active from April 1986 to December 1988. It did not involve any type of processing and, therefore, did not generate any waste.

In July 1988, the cementation process was changed from stirring the cement in one-gallon cans to stirring cement monoliths in 55-gallon drums attached to the glovebox (under P/S code CF). Although P/S code HP is still open, it has not been used since July 1988.

NOTE: The strategy proposed for shielding americium-containing cans, after the operation converted to 55-gallon drum monoliths, was to push the one-gallon americium-containing can down into the wet cement paste in the drum. However, the SME did not believe that it was ever attempted.

P/S code CF began in August 1988 and continues to the present time. Wastes collected for disposal in 55-gallon drums include aqueous and organic liquids from analytical chemistry; evaporator bottoms and evaporator salts; fine particulate materials, such as salts filtered from solutions, leached filter paper residues, and ash; oils, organic petroleum-based liquids, and spent ion exchange resins. As was the case for P/S code HP, the primary feed to this process has been the evaporator bottoms solutions. In 1996, the cementation process again converted from Gypsum cement powder (last used in June 1996) back to Portland cement powder (reuse began in July 1996).

Chemicals used in the cement fixation step under P/S codes CF and HP include: cement accelerator, Gypsum cement, nitric acid (pH adjustment), organic liquid emulsifier (which acts as a surfactant), Portland cement, silicon defoamer, sodium citrate retarder, and sodium hydroxide (pH adjustment) (TWCP-3568/N-69, N-71, N-72, N-74). Phthalate buffer solution for pH 4 and phosphate buffer solution for pH 7 were used in P/S code CF only. EPA hazardous waste numbers D001 and D002 do not apply to the solid wastes from cement fixation as a result of these chemicals because there is no free liquid in these wastes.

Although RCRA-regulated organics and metals were not used in either of the two cement fixation processes, regulated chemicals were present in the materials sent to be immobilized in cement. Therefore, the waste streams generated by these processes may contain RCRA-regulated solvents and metals above the regulatory limits.

- Analysis of evaporator bottoms at TA-55 between 1994 and 1998 and statistical evaluation of analytical results using control charts have also shown that chromium (D007), lead (D008) and mercury (D009) are above the regulatory limit for this waste (TWCP-3568/N-66).
- Hydroxide cakes from the chloride operations, which started in 1982 (TWCP-3567/N-40), are introduced to the nitrate operations in the

dissolution step (TWCP-3567/N-39). Therefore, RCRA-regulated hazardous constituents associated with the feed materials from the chloride operations as well as those derived from other nitrate dissolution processes may carry through to cement fixation (TWCP-3567/N-38). The hazardous constituents contained in the hydroxide cakes from chloride operations include cadmium (D006), chromium (D007), lead (D008), mercury (D009), and silver (D011) (TWCP-3567/N-39 and N-40). The use of silver in chloride operations ended at the end of 1993. After 1993, heavy metal analyses have been conducted on the solutions, with chromium, lead, cadmium, and mercury being detected at levels above the regulatory levels at times.

- Gypsum cement was found to leach heavy metals above regulatory levels, but the Portland cement does not (N-66/TWCP-3568). Thus, the chromium, lead and mercury are no longer considered hazardous after 1995. In addition, arsenic, barium, cadmium, selenium and silver concentrations were all below the regulatory threshold limits for these metals.
- The presence of RCRA constituents in waste analytical chemistry solutions was noted in the data packages beginning in 1990. The RCRA-regulated organic chemicals found in these solutions included carbon tetrachloride (D019), n-butanol (F003), acetone (F003), methanol (F003), tetrachloroethylene (D039, F003), xylene (F003), methylene chloride (F002), chloroform (D022), and chlorobenzene (D021).

Based on this information, the following EPA hazardous waste numbers apply to P/S codes CF and HP (until cessation of this process in August 1988):

- P/S codes CF and HP. Applicable hazardous waste numbers for organic chemicals are F002, F003, D019 (carbon tetrachloride); D021 (chlorobenzene), D022 (chloroform); and D039 (tetrachloroethylene).
- P/S code HP (from 1980 to December 1982): Applicable hazardous waste numbers for heavy metals for waste immobilized in Portland cement are D007 (chromium), D008 (lead), and D009 (mercury).
- P/S codes HP (from January 1983 to July 1988) and CF (from August 1988 to July 1996): Applicable hazardous waste numbers for heavy metals for waste immobilized in Gypsum cement are D007 (chromium), D008 (lead), D009 (mercury), and D011 (silver, until its use ended in 1992).

- P/S code CF (from July 1996 to the present time): Applicable hazardous waste numbers for heavy metals for waste immobilized in Portland cement are D007 (chromium), D008 (lead), and D009 (mercury). However, immobilization with Portland cement is an approved treatment and the final waste form is no longer hazardous.

Because P/S code IA simply held excess americium hydroxide cakes from P/S code AO, the EPA hazardous waste numbers applicable to P/S code AO also apply to P/S code IA. These EPA hazardous waste numbers are D007, D008, D009, and D011.

3.4.6 Additional P/S codes

Other P/S codes included in the Nitrate Operations, for which no procedures were found during this AK documentation review, are described in this section. The information for these P/S codes was derived from process flow diagrams and SME input (TWCP-3568/N-77 and N-81). The timeframe and EPA hazardous waste numbers associated with each P/S code are shown on the timelines included as Attachment 3. The inputs, outputs, and applicable EPA hazardous waste numbers are provided in Attachment 4.

3.4.6.1 Americium Processing Calcination (AO)

This process was active from 1979 to 1984 and from 1986 to 1988 and went through three variations. The process was inactive from 1984 to 1986. From 1979 to 1984, this process received high purity americium oxalate cakes from P/S code FA. These cakes were calcined in a furnace resulting in a pure americium oxide product, which went to the vault and eventually most of this supply was sent to Oak Ridge National Laboratory for distribution to manufacturers to be used for smoke detectors, well logging, and anti-static brushes. Beginning in February 1986 until about 1987, this process received oxalate cakes from P/S code PS. This impure americium oxalate was calcined to the oxide and sent to the vault as a reserve that could be converted to high purity oxide if a need arose. Finally, from April 1986 to December 1988, impure americium hydroxide cakes were received from chloride ion exchange processing of molten salt extraction salts. Those cakes were calcined and stored in P/S code AO and IA until they were ready for disposal by cement fixation (CF).

RCRA-regulated organic solvents were not used in any variation of this process and were not present in the feed materials; therefore, there would not be any RCRA-regulated

solvents in the waste streams generated by this process. RCRA-regulated metals also were not used in this process and were not introduced by the feed materials from P/S codes FA and PS; therefore, there would not be any RCRA-regulated metals in the waste streams generated from 1979 to June 1986. The presence of RCRA-regulated metals in the chloride operations, however, could carry over into this process. Therefore, waste generated from June 1986 to December 1988 may contain concentrations of cadmium, chromium, lead, mercury, and silver above the regulatory level (TWCP-3567/N-39 and N-40), resulting in EPA hazardous waste numbers D006, D007, D008, D009, and D011 being assigned. The waste stream generated by this process consisted of the usual glovebox waste items.

3.4.6.2 Americium Purification (AP)

This process was performed from 1979 to June 1986, with a period of inactivity from 1984 to early 1986. The nitric acid concentration in americium solutions from P/S code SX was adjusted to 7 molar and run through an ion exchange column. The plutonium (+4) would bind to the ion exchange resin and the americium (+3) would pass through the column, resulting in a purified americium solution. At the conclusion of the run, the plutonium was eluted off the column by washing the column with 1 molar nitric acid, and the plutonium solution collected separately. The plutonium solution was then sent to one of the plutonium ion exchange columns for recovery of the plutonium.

RCRA-regulated organic solvents and metals were not used in this process and were not present in the feed material from P/S code SX; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. Chemicals, such as hydroxylamine nitrate, were used to adjust the valence of the plutonium. The waste stream generated by this process consisted of the usual glovebox waste items, such as glass vessels, HEPA filters, and rags. Leaded gloves were disposed into the TA-55 metal waste stream.

3.4.6.3 Anode Heel Dissolution (AS)

This process was performed from 1980 to November 1988. The plutonium oxide generated as the result of burning anode heels in P/S code BU was dissolved in a nitric acid/hydrofluoric acid mixture or in calcium fluoride, and

filtered to remove the nondissolving residues. These residues were dried and collected and sent after assay to P/S code SP for more rigorous dissolution. The filtrate was sent to the rich residue ion exchange column (RR) for purification.

Although RCRA-regulated organic solvents and metals were not used in this process, residual RCRA-regulated heavy metals present in the electrorefining step were concentrated in the anode heels. Therefore, any RCRA-regulated metals in the anode heel feed could also be present in the waste generated by this process. These are cadmium (D005), chromium (D007), lead (D008), and silver (D011). The waste generated by this process includes glassware, plastic filter boats, cleaning rags, HEPA filters, metal cans, and brushes. Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.4 Bacterial Decomposition of Cellulose Items (BAC)

This process was performed from mid-1995 to mid-1996 and was an alternative to thermal decomposition. The process involved the decomposition of cellulose rags using a living organism to digest the cellulose to glucose and other byproducts. Cheesecloth rags, bacteria, and water were added to a flask and allowed to sit while the bacteria digested the rags. The resulting solution was sent to the lean residue ion exchange (LR).

RCRA-regulated organics and metals were not used in this process and were not introduced by the feed materials; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process.

3.4.6.5 P/S code BF

Activities under this P/S code were nearly identical to those under P/S code BU because the feed was also anode heel metal. Heels were burned under P/S code BF between September 1985 and November 1986 came from the electrorefining step (P/S codes ER or SS) at TA-55. Although RCRA-regulated organic solvents and metals were not used in this process, residual RCRA-regulated heavy metals present in the electrorefining step were concentrated in the anode heels. Therefore, any RCRA-regulated metals in the anode heel feed could also be present in the waste generated by this process. These are cadmium (D005), chromium (D006), lead (D007), and silver (D011). The waste generated

by this process includes glassware, plastic filter boats, cleaning rags, HEPA filters, metal cans, and brushes. Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.6 Blending (BL)

This process was performed from 1979 to May 1988. Various lots of plutonium oxide in the vault or in-house P/S codes were fed into this process. Each container of oxide was weighed, opened, and screened to remove oversized material. The oversized material was ground with a mortar and pestle and rescreened. The individual contents were combined and blended in a V-blender to make a homogeneous lot of feed oxide that was sent as feed to the roasting and blending process (RB).

This is a physical process in which no additional materials or chemicals are used. RCRA-regulated organics and metals were not used in the process and were not introduced with the feed material; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. The waste generated consisted of typical glovebox waste items, such as HEPA filters, glass, ceramic boats and plates, cleaning rags, brushes, metal containers and equipment, and plastics. Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.7 Button Burning (BU)

This process was performed from approximately 1979 to 1986. Metal buttons were received from offsite DOE facilities (usually Hanford, but possibly Rocky Flats as well). The metal buttons were burned in a furnace at about 600°C. The oxide produced from six buttons was combined and blended to make up a uniform feed lot for the anode heel dissolution process (AS).

Although RCRA-regulated organic solvents and metals were not used in this process, residual RCRA-regulated heavy metals present in the electrorefining step were concentrated in the anode heels. Therefore, any RCRA-regulated metals in the anode heel feed could also be present in the waste generated by this process. These are cadmium (D005), chromium (D006), lead (D007), and silver (D011). The waste generated by this process includes glassware, plastic filter boats, cleaning rags, HEPA filters, metal cans, and brushes.

Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.8 Calcination (CC)

This process was performed from 1979 to November 1988. Plutonium oxalate cakes from the oxalate precipitation process (OY) were calcined by heating in air in a furnace to form pure plutonium oxide. The oxide became feed for the oxide reduction process.

This was a physical process, not involving any chemical reagents. RCRA-regulated organics and metals were not used in this process and were not introduced by the feed materials. The oxalate cakes were of high purity. Therefore, the waste generated from this process would not contain any RCRA-regulated organics or metals. The waste generated from this process consists of the usual glovebox waste items plus metal tools, containers, and equipment; ceramic furnace elements; rags; and brushes.

3.4.6.9 Characterization (CH)

This process was performed from 1979 to February 1989 and received samples of blended lots of oxide from the blending process (BL). Portions of the samples were weighed out for four analyses to demonstrate that the oxide powders met the acceptance criteria for preparation of driver fuel for the Fast Flux Test Facility (FFTF). The Loss on Ignition Analysis involved heating the powder and measuring the weight loss from driving off adsorbed water and gases. The Surface Area Analysis involved absorption of nitrogen gas on the oxide at liquid nitrogen temperatures. The Particle Size Analysis measured the settling rate of oxide particles dispersed in a viscous, water-soluble liquid by the absorption of X-rays by the particles. The slurry was discarded to cement fixation (HP). Finally, some of the powder was pressed into pellets and sintered at 160 degrees C before measuring and weighing them for density. The pellets and oxide residues were packaged separately and sent to the vault as archives and eventually recycled. Oxide powders from other sources were also partially characterized many times. The process was also used to make water-dampened plutonium oxide pucks for a criticality experiment and to test the reactivity of calcium nodules from pyrochemical operations.

RCRA-regulated organics and metals were not used in this process and were not introduced by the feed materials. The oxide samples were high-purity materials. Therefore, the waste generated from this process would not contain any RCRA-regulated organics or metals. The waste generated by this process included the usual glovebox waste of HEPA filters, window glass and glass containers, metal containers and tools, brushes, and cleaning rags. Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.10 Chlorinated Oxide Dissolution (COD)

This process was performed from August 31, 1988 to July 1991. The front-end of this process looked identical to the chlorinated oxide leach process (COL). Chloride pyrochemical salts were dissolved in sodium hydroxide solution and filtered. The filtrate was discarded into the caustic waste line to the TA-50-1 RLWTF or immobilized in cement (CF). The dried plutonium oxide cake was dissolved in a nitric acid-hydrofluoric acid mixture as part of this process, or sent to a cascade dissolver (ED). The solution from the acid dissolution step was filtered and the solids were returned to the dissolution step. The solution volume was reduced by distillation. The distillate was processed in one of the ion exchange columns. The concentrated solution was refiltered and all of the filter residues were sent to a cascade dissolver (ED) or to the filter residues dissolution process (SP). The filtrate was sent to one of the ion exchange columns for recovery.

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials. The pyrochemical salts should be of high purity. Therefore, the waste generated from this process would not contain any RCRA-regulated organics or metals.

3.4.6.11 Chlorinated Oxide Leach (COL)

This process was performed from June 13, 1989 to June 1991. Chlorinated oxides or plutonium oxide contained in chloride-based pyrochemical salts from Rocky Flats were subjected to leaching with sodium hydroxide. The chloride salts would dissolve in the solution that would then be filtered. If the filtrate met the TA-50-1 WAC, it would be discarded into the process caustic waste line to the TA-50-1 RLWTF. If not, it would be discarded to cement fixation (CF). The cake containing the plutonium oxide would be

dried and sent to the cascade dissolver (ED) or to chlorinated oxide dissolution (COD).

RCRA-regulated organics were not used in this process and were not introduced with the feed materials. RCRA-regulated metals also were not used in this process. However, the Rocky Flats salts that fed this process would contain any barium present in their electrorefining salts. Barium is not expected to be present above the regulatory limits in the waste generated by this process; however, without analytical results or other acceptable information to support this, the EPA hazardous waste number for barium (D005) is assigned to the liquid waste sent to cement fixation (CF) (TWCP-3568/N-83). The waste generated by this process consists of the usual glovebox waste, such as glassware, plastic filter boats and tubing, and rags. Leaded gloves were disposed to the TA-55 metal waste stream.

3.4.6.12 DS Furnace and Oxide Prep (DF)

This process was performed from 1979 to April 1990. The wet plutonium oxalate cake from the ion exchange process (DS) was placed in a metal can and heated in air in a furnace to dry the cake and then decompose the oxalate to an oxide product. The oxide product was returned to the ion exchange process (DS) prior to being sent to the vault.

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials. The oxalate cakes were of high-purity. Therefore, the waste generated from this process would not contain any RCRA-regulated organics or metals. The waste generated by this process consists of the usual glovebox waste items plus metal tools, containers, and equipment; ceramic furnace elements; rags; and brushes.

3.4.6.13 Dry Processing (DP)

This process was performed from 1979 to December 1985 and was the front-end treatment of polycubes, which were blocks of polystyrene with plutonium oxide embedded in them (TWCP-4100). The Hanford polycubes were skinned to remove the uncontaminated surface and perhaps some of the oxide embedded beneath the surface. If the skins met the DL, they would be discarded as plastic waste. If not, the skins would be sent to polycube processing (VP2) along with the

bulk of the cube material. In preparation for that treatment, the cubes would be crushed and milled into small fragments.

This is a physical process. RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials; therefore, the waste generated from this process would not contain any RCRA-regulated organics or metals. The waste generated by this process consists of the usual glovebox waste items plus plastic, metal tools and equipment, rags, and brushes.

3.4.6.14 Experimental Thermal Decomposition (ETD)

This process has been performed from June 4, 1996 to the present. Combustible residues from various P/S codes are heated in a furnace under argon until the organic matrix is volatilized and decomposed, and a carbon-rich residue containing plutonium oxide and impurities remain. This residue is then sent to a rotary calciner (RC) to remove the carbon.

RCRA-regulated organics and metals are not used in this process. Organics may be introduced with the feed materials depending upon the P/S codes from which the materials come; however, any solvents are dissipated during the heating process. The feed materials may initially contain low levels of RCRA-regulated metals, but the thermal decomposition process drives off most of the mass, thereby concentrating the non-volatile heavy metals. Therefore, the waste generated from this process may contain RCRA-regulated metals (but no organics). The waste generated by this process consists of the usual glovebox waste items plus metal tools, containers, and equipment; rags; brushes; and a water scrub solution from scrubbing the off-gas.

3.4.6.15 Americium Processing (FA)

This process was performed from 1979 to 1984. The 7 molar nitric acid solution from the americium purification process (AP) was distilled to reduce volume, and the acidity was adjusted to a low concentration of approximately one molar prior to oxalate precipitation in P/S code AO. The oxalate filtrate was sent to one of the hydroxide precipitation processes, such as P/S code VP3.

RCRA-regulated organics and metals were not used in this process. RCRA-regulated organics also were not introduced

with the feed materials. Therefore, the waste generated from this process would not contain any RCRA-regulated solvents. Any RCRA-regulated metals present as impurities in the feed materials would be contained in the oxalate filtrate sent to a hydroxide precipitation process. However, the process description for P/S code AP does not indicate the presence of metals above the regulatory limit. The waste generated by this process consists of glass vessels, sintered glass frits, HEPA filters, rags, and other glovebox waste discarded as TRU solid waste. Because this is predominantly americium, waste materials were always discarded. Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.16 Canning (FC)

This process has been run from 1979 to the present. Plutonium oxide coming out of the blending process (BL) for storage in the vault is weighed into a food pack can (approximately 1 kg of oxide per can) and a lid is placed on the can in the canning operation. The can is wiped down with a water-dampened rag and passed out into a hand-held plastic bag in a hood. The plastic bag is sealed with vinyl tape and the unit is canned into a second larger food pack can that is entirely uncontaminated, for storage.

This is a physical process. RCRA-regulated organics and metals are not used in this process and are not introduced with the feed materials. The feed material is high-purity plutonium oxide. Therefore, the waste generated by this process would not contain any RCRA-regulated solvents or metals. The waste generated by this process includes typical glovebox waste, such as HEPA filters and glass windows, as well as rags and stainless steel tools, cans, and equipment. Any wastewater generated by this process is sent to the ion exchange processes. Leaded gloves were disposed in the TA-55 metal waste stream until 1992, when this waste began to be segregated and disposed of as RCRA-regulated waste.

3.4.6.17 Cement to Drum (FX)

This process was performed from 1980 to July 1988. During the time that all cement was stirred in a one-gallon can (HP), the cans were initially bagged out a few cans at a time in a polyvinyl chloride (PVC) plastic bag and placed in a drum as they could best be fitted in. Eventually, a drum-out port was dedicated to this purpose. A 26-lb bag attached to a glovebox would be allowed to fit down into a drum. The one-gallon

can would be stacked inside the bag in the drum, seven cans to a layer with five layers, for a total of 35 cans contained inside one bagout bag. No processing of materials was performed in this process.

This is a packaging process. RCRA-regulated organics and metals were not used in this process. Any applicable RCRA codes based on the feed materials are assigned to the cement fixation (CF and HP). The waste generated by this process was the usual glovebox waste, including large amounts of plastic. Leaded gloves were disposed in the TA-55 metal waste stream.

3.4.6.18 Calcination (HC)

This process was performed from 1979 to August 1989. Plutonium oxalate cakes from P/S code OY were first calcined in air up to 700 degrees C. Water vapor was then passed through the cakes as it was heated to 850–900 degrees C to remove any fluoride impurity from the oxide. This prevented fluoride-catalyzed low temperature sintering in the oxide product.

RCRA-regulated organics and metals are not used in this process and are not introduced with the feed materials. The feed materials (oxalate cakes) are of high purity. Therefore, the waste generated by this process would not contain any RCRA-regulated solvents or metals. This process generates the usual glovebox waste, plus metal tools, containers, and equipment; ceramic furnace elements; rags; and brushes.

3.4.6.19 High Gradient Magnetic Separation (HGMS)

This process has been performed from May 10, 1994 to the present. This P/S code is very similar to P/S codes GMS, MAG, and MAS. In this process, a steel mesh placed in a magnetic field becomes a magnetic attractor for plutonium particles of less than 50 microns. The particles are removed from slurries of soil and clays in water. This method reduces the quantity of soil that must be treated to remove the plutonium. The soil is first screened to separate the particles that are larger than 53 microns and cannot be separated in this process. The less than 53-micron fraction is slurried in water and passed around the magnet. The lean fraction is discarded as waste in cement fixation (CF) or sent to storage if the plutonium concentration is above the DL. The plutonium-rich fraction is stored until can be taken into a

dissolution process. The slurry is filtered and the water is reused.

RCRA-regulated organics and metals are not used in this process and are not introduced with the feed materials. The only possible source of RCRA-regulated organics and metals would be associated with the original dispersal or as naturally occurring (metals) in the soil. No such soil was used in this process. Therefore, the waste generated by this process would not contain any RCRA-regulated solvents or metals. The waste generated by this process includes the usual glovebox waste plus metal screens and tools, rags, brushes, and containers.

3.4.6.20 Impure Americium Holding for Discard (IA)

This P/S code was active from April 1986 to December 1988. When storage of the impure americium hydroxide cakes in P/S code AO became a radiation exposure problem, a significant portion of the stored material was placed in P/S code IA until the material could be fixed in cement for disposal. This P/S code did not involve any type of processing and, therefore, did not generate any waste.

Because this P/S code simply held excess americium hydroxide cakes from P/S code AO, the EPA hazardous waste numbers applicable to P/S code AO apply to P/S code IA. These EPA hazardous waste numbers include D006, D007, D008, D009, and D011.

3.4.6.21 Uranium/Plutonium Processing Nitrate Hydrofluoric Dissolution (LC)

This process was active from August 12, 1985 to August 1987. Plutonium oxides from P/S codes US (later renamed US1) and US2 were dissolved in nitric acid and hydrofluoric acid, concentrated by distillation, and filtered. The distillate solution was sent to P/S code EV. Any filter residues were calcined and recycled into the dissolution process. The uranium-plutonium solution was subjected to an oxalate precipitation with oxalic acid or sodium oxalate to precipitate the plutonium. The slurry was filtered and the plutonium oxalate was sent to a calcination process. The uranium nitrate solution was cemented in P/S code HP.

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials;

therefore there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated the usual glovebox waste, plus glassware, heating mantles, plastic filter boats, filter paper, rags, brushes, and metal tools and equipment.

3.4.6.22 Non Combustible Leach (LG1)

This process was active from October 1982 to December 1985. Metal, glass, and plastic from most PF-4 processes were leached with nitric acid to remove plutonium surface contamination from those matrices. The solution mixture was filtered to separate insoluble residues, which were dried and discarded as solid TRU waste. The plutonium nitrate-containing filtrate was sent to P/S code LR for purification. This filtrate may have contained chromium, cadmium, and/or lead that was leached out from the stainless steel, shielding, or other metal feed materials (TWCP-3568/N-84).

RCRA-regulated organics were not used in this process and were not introduced with the feed materials (TWCP-3568/N-81). Therefore, there would not be any RCRA-regulated solvents in the waste streams generated by this process. The metal feed materials generally consisted of steel, stainless steel, aluminum, and copper. Any RCRA-regulated metals leached from these feed materials would be in the filtrate sent to P/S code LR. However, the leached materials may still contain concentrations of cadmium and/or lead that may leach out above the regulatory limit, resulting in the debris waste requiring the applicable EPA hazardous waste numbers (D006, D008) (TWCP-3568/N-84). The chromium in stainless steel does not leach out above the regulatory limit. This process generated the usual glovebox waste, plus metal, glass, plastic, plastic filter boats, filter papers, glassware, rags, and brushes (TWCP-3568/N-81).

3.4.6.23 Hydroxide Cake Dissolution (LG2)

This process was active from October 1982 to December 1985. Hydroxide cakes from P/S codes CS and VP3 were dissolved in nitric acid and the solution was filtered. Any residue or filter cake was sent back to the dissolution step. The filtrate containing the plutonium nitrate was sent to P/S code LR for purification.

RCRA-regulated metals and organics were not used in this process; however, during the 1985 time period, certain metals could have been introduced with P/S code CS (from chloride operations), and mercury could have been introduced with the P/S code VP3 feed material. These metals would be found in the nitric acid filtrate, which fed into P/S code LR. Therefore, there would not be any RCRA-regulated solvents in the waste streams generated by this process. However, there may have been cadmium (D005), chromium (D006), mercury (D007), or silver (D011) in the feed material from 1984 through December 1985. This process generated the usual glovebox waste, plus glassware, metal tools and equipment, plastic filter boats, filter papers, rags, and brushes.

3.4.6.24 Nitric Dissolution of Molten Salts (MB)

This process was active from February 1986 to January 1987 and included both a hydrochloric acid dissolution path and a nitric acid dissolution path. The hydrochloric acid path began with refluxing the molten salt extraction (MSE) salts in hydrochloric acid and filtering the material. The solid residues were sent back into the dissolution process. The plutonium solution was sent to P/S code SE for purification. The distillate from the condenser tube was neutralized if it would meet the process caustic waste WAC for the TA-50-1 RLWTF. If it would not meet the WAC, the material was sent to either P/S code CS or CX. In the nitric acid dissolution, the nitric acid refluxed solution was filtered and sent to P/S code PS. The solid residues were recycled back into dissolution. The distillate from the condenser tube was recycled if there was low plutonium content, but was sent to P/S code LR if the plutonium content was high.

RCRA-regulated organics and metals were not used in this process and organics were not introduced with the feed material. However, the feed material may have contained barium as a low-level impurity in calcium chloride. In the hydrochloric acid dissolution, the barium would remain with the plutonium solution that is sent to P/S code SE. In the nitric acid dissolution, the barium would flow ultimately to the evaporator bottoms and become immobilized in cement. According to the SME, the barium has never been shown to be above the RCRA-established limits; however, without analytical data or other acceptable information to support this, the EPA hazardous waste number D005 is assigned to

the waste stream from the nitric acid dissolution (TWCP-3568/N-83).

3.4.6.25 Metals Furnace (MF)

This process was active from May 23, 1986 to February 1989. Plutonium metal items were roasted in air at a carefully controlled temperature. After the metal was completely converted to plutonium oxide, the materials were divided into one-kg lots and canned for storage in the vault to await blending.

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials. The metal items feed materials were of reasonable purity. Therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated typical glovebox waste, plus metal tools, containers, plastic bags, metal equipment, ceramic boats, rags, and brushes.

3.4.6.26 Non Combustible Leach (NL)

This process was active from 1979 to February 1989 and is very similar to P/S code LG1. Surface contaminated metal, glass, and plastic were subjected to nitric acid leaching and filtration. The filter residues were dried and discarded if they met the DL. Otherwise, the residues were recycled back into the leaching step. The bulk matrix materials leached were assayed to see if they met the DL for disposal. If not, they were recycled into the leaching step. The filtrate containing the plutonium nitrate was sent to P/S LR for purification. This filtrate may have contained chromium, cadmium, and/or lead from stainless steel, shielding, and other metal feed materials (TWCP-3568/N-84).

RCRA-regulated organics were not used in this process and were not introduced with the feed materials. Therefore, there would not be any RCRA-regulated solvents in the waste streams generated by this process. The metal feed materials may have consisted of steel, stainless steel, aluminum, and copper. Any RCRA-regulated metals leached from these feed materials would be in the filtrate sent to P/S code LR. However, the leached metals may still contain concentrations of cadmium and/or lead above the regulatory limit, resulting in the debris waste requiring the applicable EPA hazardous

waste numbers (D006, D008) (TWCP-3568/N-84). The chromium in stainless steel does not leach out above the regulatory limit. This process generated the usual glovebox waste, plus glassware, metal tools and equipment, plastic filter boats, filter papers, rags, and brushes, as well as the metal, glass, and plastic matrices being leached (TWCP-3568/N-81).

3.4.6.27 Nitrate Recovery (NR)

The processes under P/S codes ED, HCD, MPD, and RFX were combined into this one P/S code; however, this P/S code was never activated. Therefore, waste was never generated under this P/S code.

3.4.6.28 Passivation (PA)

This process was active from 1979 to January 1990. Glovebox sweepings, oxides that may contain unoxidized plutonium metal, carbides, and nitrides that can be very reactive in an oxidizing acid are burned in a tube furnace in air to passivate the material and moderate its reactivity. It can then be sent to a dissolution process such as P/S SP or OD.

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated the typical glovebox waste, plus metal tools, containers, and equipment; ceramic furnace elements; rags; and brushes.

3.4.6.29 Peroxide Precipitation of MSE Salts (PS)

This P/S code was active from February 1986 to January 1987. Plutonium-containing nitric acid solutions from P/S code MB were filtered, diluted, stirred, and sampled for nuclear material content and to verify that the proper concentrations of materials existed in the solutions. The plutonium in the solution was precipitated out using hydrogen peroxide. The precipitate was filtered to separate it from the solution. The peroxide cake was redissolved in nitric acid and sent to P/S code SO. The americium-rich filtrate was dripped into sodium hydroxide solution to destroy the peroxide. The hydroxide slurry was acidified with nitric acid and an oxalate precipitation performed on the solution. The americium oxalate was separated as a cake by

filtration and the cakes were sent to P/S code AO. The filtrate was sent to P/S code LR for recovery of plutonium.

RCRA-regulated organics were not used in this process and were not introduced with the feed materials. RCRA-regulated metals were not used in this process; however, if barium was present in the MSE salt feed material, it would be present in the americium oxalate filtrate that was sent to P/S code LR. According to the SME, however, it is very unlikely that barium was present in the feed material. Therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated the usual glovebox waste materials, plus plastic filter boats, glassware, metal stirrers and column end caps. This waste was disposed as solid TRU waste.

3.4.6.30 Plutonium/Thorium Separation (PT)

This process was active from 1979 to December 1985. Initially, plutonium/thorium oxides were dissolved in nitric and hydrofluoric acid (TWCP-3567/N-54). Sodium chromate and lanthanum nitrate were added to this solution. Thorium was removed from solution through formation of a thorium fluoride precipitate. After filtering out this precipitate, the plutonium and chromium were reduced to the (+3) valence state in solution using hydroxylamine nitrate and then sent to oxalate precipitation to recover the plutonium. Chromium in solution was sent to the evaporator (EV). Because of the chromium, the waste solution from this activity is assigned the EPA hazardous waste number D007.

Later, the process changed to separate plutonium from thorium and americium using technologies similar to those used for ion exchange (TWCP-3567/N-54, N-55). Plutonium/thorium oxide residues were dissolved in nitric acid and passed through a nitrate-based ion exchange column to separate the two actinides. The column effluent containing thorium was subjected to a hydroxide precipitation and filtration. The filtrate was discarded into the process caustic waste line to the TA-50-1 RLWTF. The residue from filtration was calcined and discarded as a solid waste. The plutonium-containing ion exchange eluate was also subjected to a hydroxide precipitation and filtration. Because the plutonium cake is still contaminated with thorium, the slurry was redissolved in nitric acid and passed through a chloride ion exchange column. The thorium effluent underwent a

hydroxide precipitation and filtration. The thorium residue is calcined and discarded. The filtrate is discarded into the process caustic waste line to the TA-50-1 RLWTF. The plutonium-bearing hydrochloride eluate undergoes hydroxide precipitation and filtration. The filtrate is discarded into the process caustic waste line to the TA-50-1 RLWTF. The plutonium hydroxide cake is dissolved again in nitric acid and sent to P/S code RR for recovery.

RCRA-regulated organics were not used in this process and were not introduced with the feed materials; therefore there would not be any RCRA-regulated solvents in the waste streams generated by this process. Chromium (D007) could be present due to the use of a chromate salt in the process from 1979 until December 1985. This process generated the typical glovebox waste streams, plus glassware; metal tools, equipment, and containers; plastic filter boats; filter papers; rags; and brushes.

3.4.6.31 RD&D Pretreatment Study (PTS)

This process was active from January 4, 1990 to February 1992. A variety of residue matrices were pulled into P/S code PTS to be characterized for impurities, state of division, and even pretreatment (milling, grinding, etc.) to achieve a desired state for use in fluoride volatility studies in P/S code CK. Most of the effort was expended on ash from LANL and Rocky Flats.

RCRA-regulated organics and metals were not used in this process, but the ash feed would have been high in heavy metals such that this P/S code would generate waste potentially contaminated with non-volatile heavy metals: barium (D004), cadmium (D005), chromium (D006), lead (D009), and silver (D011). Arsenic, mercury and selenium would not be present because they would have been volatilized. This process generated the typical glovebox waste streams, plus metal tools, containers, and equipment; plastic bags; ceramic furnace elements; ceramic boats; rags; and brushes.

3.4.6.32 Rotary Calciner (RC)

This process has been active from 1985 to the present. Ash from P/S codes IS and TDC and other carbon-containing ash and graphite crucibles are calcined in an oxygen or air stream. This removes organic carbon. The calcined ash is

blended and sent to recovery. This process is also used to calcine uranium oxides before uranium separation.

RCRA-regulated organics and metals were not used in this process, but the ash feed would have been high in heavy metals such that this P/S code would generate waste potentially contaminated with non-volatile heavy metals: barium (D004), cadmium (D005), chromium (D006), lead (D009), and silver (D011). Arsenic, mercury and selenium would not be present because they would have been volatilized. This process generated the typical glovebox waste streams, plus metal tools, containers, and equipment; plastic bags; ceramic furnace elements; ceramic boats; rags; and brushes.

3.4.6.33 Oil Recovery (RO)

This process was active from 1979 to March 1989. Vacuum pump oils and other contaminated organics from various PF-4 operations were analyzed for nuclear material content. If they met the DL for plutonium, they were mixed with vermiculite and packaged in a drum for disposal. If the oils or organics contained plutonium above the DL, they were filtered through a glass frit so as to meet the DL. Any plutonium residue caught in the filter was to be sent to recovery operations.

Once in 1979, trichloroethylene (D040) was used as a diluent to reduce the viscosity of vacuum pump oil so that the oil could be filtered through a glass frit. Otherwise, RCRA-regulated chemicals were not used in this code or present in the feed materials. Therefore, other than D040 in 1979, there would not be any RCRA-regulated solvents in the waste generated by this process.

RCRA-regulated metals were not used in this process. However, metal particles from the wear of vacuum pumps, such as lead, cadmium, and steel, could be in the oil; however, the metals are not soluble. The oils contain less than three percent of solids. Lead is the typical heavy metal in vacuum pump oils, while cadmium is found in hydraulic oils. The chromium from the steel is present in the oils in concentrations below the regulatory limit, based on analyses of similar low-level radioactive waste oils. These metal particles remain with the oil when it is absorbed on vermiculite. In the absence of analytical data or other acceptable information confirming that the concentrations of

lead and cadmium are below the regulatory levels, the applicable D-codes (D006 and D008) are assigned pending additional information (TWCP-3568/N-83).

This process also generated the typical glovebox waste, plus glassware; metal tools, equipment, and containers; plastic bags and tubing; rags; and brushes.

3.4.6.34 Special Scrap Dissolution (SSD)

This process was active from March 10, 1988 to February 1991. Miscellaneous oxide scrap items were combined, dissolved in nitric acid/hydrofluoric acid, and filtered. The filter residues were dried on a hot plate and assayed. If the residues met the DL for plutonium, they were discarded as solid waste. If the plutonium concentration in the residues did not meet the DL, the materials were recycled back into the dissolution/filtering process. The plutonium nitrate-containing filtrate was sent to one of the ion exchange columns for purification.

RCRA-regulated organics were not used in this process and were not introduced with the feed materials; therefore, there would not be any RCRA-regulated solvents in the waste streams generated by this process. RCRA-regulated metals were not used in this process; the presence of heavy metals in the feed materials depends on the source of the feed materials. The feed materials could have contained cadmium, chromium, and/or lead as impurities. These metals would be contained in the filtrate, which was sent to the ion exchange processes for further purification. The debris waste generated from this process is not expected to contain cadmium, chromium, or lead above the regulatory limits because the dissolution involved strong acids (any soluble metals should be in the filtrate). However, without analytical data or other acceptable information confirming that the concentrations of these hazardous constituents are below the regulatory levels, the applicable EPA hazardous waste numbers (D006, D007, and D008) are assigned pending additional information (TWCP-3568/N-83). This process generated the typical glovebox waste, plus glassware; metal containers, tools, and equipment; plastic filter boats; filter papers; rags; and brushes.

3.4.6.35 Americium Processing Silicon Removal (SX)

This process was active from 1979 through 1984. The americium-containing hydroxide cakes from the peroxide kill process (initially P/S code PR, but later P/S code OH) were redissolved in nitric acid and the solution concentrated through distillation to precipitate a gel of silica. The silica gel was separated by filtration, air dried, and discarded as solid waste at first and later immobilized in cement. The americium-containing filtrate was sent to P/S code AP.

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated the following TRU solid waste: glass vessels, heating mantles, HEPA filters, and other glovebox waste, and rags. Because this process involved predominantly americium-containing feed material, waste materials were always discarded

3.4.6.36 Uranium Separation for Solid Solution Feed (US)

This process was active from January 25, 1984 to January 1986. Calcined solid solutions (consisting of uranium or plutonium oxide from P/S code RC) were dissolved in concentrated nitric acid, followed by oxalate precipitation of plutonium oxalate, and filtration. The uranium-bearing filtrate was partially neutralized, immobilized in cement (HP), and discarded. The plutonium oxalate cake was dried on a hot plate and calcined to the oxide. The oxide was again heated in concentrated nitric acid with the remaining uranium impurity dissolving. The resulting solution went to cement fixation (HP). The insoluble plutonium oxide was separated by filtration, calcined, and sent to P/S code LC (for dissolution) or RR (for purification).

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials, which were of high purity; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated the usual glovebox waste, plus glassware, metal tools and equipment, plastic filter boats, filter papers, rags, and brushes.

3.4.6.37 Uranium Separation for Non-Solid Solutions (US2)

This process was active from January 25, 1984 to January 1986. The uranium in mixed plutonium-uranium oxide was dissolved in 5 molar nitric acid and filtered. The uranium solution was fixed in cement (HP) and discarded as waste. The solid plutonium oxide separated by filtration was dried on a hot plate and sent to P/S code LC (for dissolution) or RR (for recovery).

RCRA-regulated organics and metals were not used in this process and were not introduced with the feed materials; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated the usual glovebox waste streams, plus glassware, heating mantles or hot plates, metal tools and equipment, plastic filter boats, filter papers, rags, and brushes.

3.4.6.38 Variable CSMO Scrap Dissolution (VC)

This process was active from April 1986 to December 1989 and is identical to P/S code SSD. Miscellaneous oxide scrap items were combined, dissolved in nitric acid/hydrofluoric acid, and filtered. The filter residues were dried on a hot plate and assayed. If the residues met the DL for plutonium, they were discarded as solid waste. If the plutonium concentration in the residues did not meet the DL, the materials were recycled back into the dissolution/filtering process. The plutonium nitrate-containing filtrate was sent to one of the ion exchange columns for purification. This filtrate may have contained chromium, cadmium, and/or lead from stainless steel, shielding, or other metal scrap items (TWCP-3568/N-84).

RCRA-regulated organics were not used in this process and were not introduced with the feed materials. The oxide feed materials have usually been through a heating process that would volatilize/decompose any organics. Therefore, there would not be any RCRA-regulated solvents in the waste streams generated by this process. The presence of heavy metals in the feed materials depends on the source of the feed materials. Any RCRA-regulated metals leached from these feed materials would be in the filtrate sent to ion exchange. However, the leached residues may still contain concentrations of cadmium and/or lead above the regulatory limit, resulting in the debris waste requiring the applicable

EPA hazardous waste numbers (D006, D008) (TWCP-3568/N-84). Any chromium in scrap metal does not leach out above the regulatory limit. This process generated the typical glovebox waste, plus glassware; metal containers, tools, and equipment; plastic filter boats; filter papers; rags; and brushes (TWCP-3568/N-81).

3.4.6.39 CSMO Scrap Dissolution (VP1)

This process was active from September 26, 1985 to April 1986. Plutonium-aluminum alloy from Hanford was dissolved in nitric acid using mercuric nitrate as a catalyst. If the item was pyrophoric, it was first calcined in P/S code PA. The quantity of mercuric nitrate was quite small because it was present as a catalyst. Filtration separated the solution of plutonium from aluminum metal pieces and a sludgy salt of aluminum nitrate. The metal pieces were picked out of the salt, which was discarded into cement. If the metal was discardable, it went to metallic waste. Plutonium-rich metal went back into dissolution. The plutonium solution was subjected to oxalate precipitation using oxalic acid or sodium oxalate, and filtered to form a cake that would be calcined to the oxide. The oxalate filtrate went to P/S code VP3. This process was modified to perform dissolution of the aluminum in sodium hydroxide after the first month because of the difficulty in controlling the reactivity of this system. The undissolved plutonium oxide could be separated by filtration and sent to one of the dissolution processes.

RCRA-regulated organics were not used in this process and were not introduced with the feed materials. RCRA-regulated metals were not introduced with the feed materials. However, in the first month of operation of this process (September 1985 to October 1985) mercuric nitrate was used in a very small quantity as a catalyst in the dissolution step. The mercury would be found in the oxalate filtrate and, therefore, also introduced into P/S code VP3 during this time period. RCRA codes D009 (mercury) applies to waste generated under P/S codes VP1 and VP3 during the latter part of 1985. This process generated the usual glovebox waste streams, plus glassware, heating mantles, metal tools and equipment, rags, and brushes.

3.4.6.40 Polycube Processing (VP2)

This process was active from 1979 to April 1986. The skins and fragments of polycubes from P/S code DP were placed in

a furnace and the polystyrene was decomposed to form volatile breakdown products in the form of oils, which were sent to Room 425 for absorption on vermiculite (eventually P/S code RO). The dry oxide residue was stored in the vault or sent to the dissolution processes.

RCRA-regulated organics and metals were not used in this process and were not introduced as feed materials; therefore, there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. This process generated glovebox waste, plus furnaces and furnace elements, metal containers and tools, vacuum pump oil, rags, and brushes.

3.4.6.41 Hydroxide Precipitation (VP3)

This process was active from 1979 to April 1986. In the early years of TA-55, the oxalate filtrates from P/S codes LR, RR, LC, SO, and VP1 were brought to P/S code VP3 to perform a hydroxide precipitation and filtration to separate out the plutonium hydroxide cake. The hydroxide cake went to P/S code LG2 for dissolution. The filtrate was discarded through the process caustic waste line to the TA-50-1 RLWTF. The oxalate filtrates from P/S code LC went to P/S code EV after June 1, 1984.

RCRA-regulated organics were not used in this process and were not introduced with the feed materials; therefore there would not be any RCRA-regulated solvents in the waste streams generated by this process. RCRA-regulated metals were not used in this process; however, mercury (D009) would have entered the process with the feed material from P/S code VP1 (from September 26, 1985 to October 31, 1985). The mercury would have precipitated in the hydroxide cake. If the hydroxide cake contained plutonium below the DL, the mercury would accompany it to cement fixation (CF); therefore, this waste stream would be RCRA-regulated. If the hydroxide cake could not be discarded, it was sent to dissolution (P/S code LG2). This process generated the usual glovebox waste, plus plastic filter boats, filter papers, glassware, metal tools and equipment, rags, and brushes.

3.4.6.42 Scrap Oxide Dissolution (ZD)

This process was active from September 25, 1984 to November 1988. Scrap oxide from the vault and impure oxide from P/S code CL were dissolved in nitric acid and

hydrofluoric acid, and filtered. The residues were collected into 900-gram batches and recycled through the process before being sent to the vault as intractable. The filtrates were sent to P/S code LR or RR ion exchange column for purification of the plutonium.

RCRA-regulated organics were not used in this process and were not introduced with the feed materials; therefore there would not be any RCRA-regulated solvents or metals in the waste streams generated by this process. RCRA-regulated metals were not used in this process; however, heavy metals are possible in the feed materials. These metals would end up in the filtrate that ultimately goes to the evaporator (EV). This process generated the typical glovebox waste streams, plus glassware; metal tools, containers, and equipment; plastic bags and filter boats; filter papers; rags; and brushes.

3.5 Material Inputs to the Waste Generation Process

Attachment 4 lists P/S codes for nitrate operations at TA-55, including process descriptions, feed material, other process inputs, process outputs, and type of waste. The feed materials for nitrate operations consist of the general types of materials listed in Table 1 that are obtained either from the storage vault, as process output from other P/S codes, or from sources outside TA-55, including other DOE sites. Although Pu is usually the radioactive element of interest in the feed materials, in some cases the feed material consisted of other radioactive elements, as indicated by Table 2.

The remainder of this section summarizes the nature of the process waste in terms of its physical, chemical and radioisotopic characteristics.

3.5.1 Physical Form Identification

Solid waste from nitrate operations primarily consists of metal and debris waste, as well as cemented waste discarded under P/S codes CF or HP. Debris waste contains glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Lead-containing debris items are segregated and packaged separately (TWCP-3567/N-39). Prior to May 1992, leaded gloves were discarded as metal debris and were not segregated from other metal wastes. Since that time, they have been routinely segregated from other metal debris waste and assigned RCRA code D008.

Because items from several different processes are usually combined into individual waste drums, the physical waste form of each drum must be determined independently. This information is documented on a

Table 1. Process Feed Materials for Nitrate Operations

Feed Materials	Potential Presence of RCRA-Regulated Substances	P/S Codes in Nitrate Operations
Analytical laboratory solutions	<p>Potentially contaminated with RCRA-regulated constituents</p> <ul style="list-style-type: none"> All analytical laboratory solutions are potentially contaminated with chromium (D007), lead (D008), and mercury (D009) CLS-1 solutions potentially contaminated with mercury (D009) and lead (D008), as well as RCRA-listed organic substances used as solvents, including acetone (F003), butyl alcohol (F003), carbon tetrachloride (D019), chlorobenzene (F002, D021), chloroform (D022), methanol (F003), methylene chloride (F002), tetrachloroethylene (F002, D039), xylene (F003) (CI-25/TWCP-3547). 	CF, HP (if solutions contained Pu >DL)
Anode heels	Typically contaminated with RCRA-regulated heavy metals Cd, Cr, Pb and Ag (D006, D007, D008, D011). Heavy metals As, Hg, and Se are not present because they are volatilized from the Pu oxide feed at the high temperatures to which this material is subjected in P/S codes ER, RM, and SS (electrorefining step).	AS, BU, NC
Ash from P/S codes ETD and TDC; or from other DOE sites	Usually suspect contaminated with Ba, Cd, Cr, Pb, and Ag (D005, D006, D007, D008, D011). As, Hg, and Se may also be present although these metals are volatilized at high temperatures if present in the oxide and chloride forms.	AL, AT, ATL, ED, HGMS, IS, MPD, PTS, RC, SC
Crucible pieces (tantalum, magnesium oxide)	Typically fairly pure, no RCRA substances present	MAS, SC
Disassembled weapons components	High-purity Pu and U material types, no RCRA substances present	BM, RB, RBJ
Experimental R&D feed materials; various isotopes and isotopic mixtures of actinides in various matrices	Variable purity	MAS
Hydroxide cakes	Typically contaminated with RCRA-regulated heavy metals Cd, Pb, Hg, Ag and possibly Cr (D006, D008, D009, D011, and D007)	CD, HCD, HD, LG2

Feed Materials	Potential Presence of RCRA-Regulated Substances	P/S Codes in Nitrate Operations
Miscellaneous materials contaminated with Pu (e.g. sand, slag, tools, crucibles, metal, glass, plastic, labware, scrap, rags, glovebox sweepings, pump oils, HEPA filters)	Typically contaminated with RCRA-regulated heavy metals Ag, Cd, Hg, Pb and possibly Cr (D006, D008, D009, D011, and D007)	ATL, BAC, CPOD, CR, ED, ETD, GMS, HGMS, IS (combustible debris), LG1 (non-combustible material), MAG, MAS, MELL (cellulosic material), ML (metal equipment), NC (non-combustible material), NL (non-combustible material), PA (glovebox sweepings), PAF, RO (organics), SC, SP, TDC (cellulosic material), VC, ZD
MSE salts	Typically fairly pure, suspect contaminated with barium but no other RCRA substances present	MB, PS
Pu metal or metal alloy	High purity, no RCRA-regulated substances, unless noted otherwise	ATL, BM, BU, MF, PAF, VP1
Pu oxalates	High purity, no RCRA-regulated substances, unless noted otherwise	CC, DF, HC
Pu oxides	Variable purity from P/S codes RB, RBJ and others, and from the vault; suspect contaminated with RCRA-regulated heavy metals Cd, Cr and Pb (D006, D007, D008) High purity oxides from P/S codes CA, DO, and MA, and from the vault	ATL, BL, CH, CPOD, DP, ED, FC, LC, MPD, OD, PT, RB, RBJ, SP, SSD, UPS, US, US2
Pyrochemical salts	Typically fairly pure, no RCRA substances other than Ba are present	COD, COL, MB

Table 2. P/S Codes with Radionuclides Other Than Pu in Feed Materials

P/S code in nitrate operations	Radionuclide in feed material
AO, AP, FA, PR	Am-241
ATL	Np-237
CF	Am, U, Th-232
HP, IA, OH, SX	Am
LC, RC, UPS, US	U
PT	Th-232

Waste Origination and Disposition Form (WODF) by the waste generator according to controlled procedures. The P/S code for each waste item is also documented on this form. In the packaging process, a standard form, the Discardable Waste Log Sheet (DWLS), was used to list each item number and record its matrix material. This form was signed by the waste packager, reviewed, and approved by quality assurance (QA) personnel. Example forms for one drum of waste generated can be viewed in record TWCP-2513.

3.5.2 Radionuclide Content Identification

The primary plutonium material type inputs for nitrate operations at TA-55 are listed in Table 3. The designation *material type* (MT) (e.g., MT 52) is used within the DOE Complex to describe the isotopic composition of common blends of radioactive materials used within the Complex. The material type notation was developed because it is a convenient way to describe material types that have very consistent isotopic compositions. Please note that Table 3 indicates the isotopic composition of the material types at the time the waste was characterized.

The material type provides the basis for estimating an upper bound for U-234, U-235, and Am-241 contents based on the rate of decay of their precursors, Pu-238, Pu-239 and Pu-241, respectively. The results of these calculations are also tabulated in Table 3, assuming (a) none of these isotopes were initially present in the material, (b) the oldest Pu material in inventory dates back to 1 January 1960, and (c) the waste was packaged on 1 January 1996, making it 36 years old (TWCP-698).

The material type used in the process generating each waste item was documented on the WODF and DWLS. However, some of the plutonium recovery processes separate plutonium and americium, or plutonium and uranium so that their relative ratios may be altered in the process outputs and wastes. Waste items may be either depleted or enriched in americium depending on whether the source of contamination is the process product or the process residues (TWCP-882). Table 4 indicates some P/S codes in which enrichment of radioelements other than Pu are expected to be greater than usual.

Residues submitted for reprocessing often contain Np-237, the decay product of Am-241 (half-life, 458 yr). This radioisotope is expected to be present in minor amounts in nearly all debris waste from nitrate operations at TA-55, with exceptions as noted in Tables 2 and 4.

**Table 3. Average Isotopic Content of Plutonium Material Types and Enrichments
(Weight %)**

Material Type (MT)	Plutonium isotope and half-life						Upper limits for weight ratios		
	Pu-238 (87.74 yr)	Pu-239 (24120 yr)	Pu-240 (6564 yr)	Pu-241 (14.35 yr)	Pu-242 (376,300 yr)	Pu-244 (8.26 x 10 ⁷ yr)	U-234/ Total Pu	U-235/ Total Pu	Am-241/ Total Pu
MT 51	0.006	96.77	3.13	0.076	0.018	—	1 x 10 ⁻⁵	0.001	0.0006
MT 52	0.01	93.78	6	0.2	0.02	—	2 x 10 ⁻⁵	0.001	0.002
MT 53	0.03	91.08	8.45	0.366	0.071	—	7 x 10 ⁻⁵	0.0009	0.003
MT 54	0.046	87.42	11.5	0.81	0.22	—	0.0001	0.0009	0.007
MT 55	0.06	83.88	14.73	1.03	0.304	—	0.0002	0.0009	0.009
MT 56	0.061	81.9	16.51	1.18	0.355	—	0.0002	0.0009	0.01
MT 57	0.433	74.63	20.7	2.55	1.69	—	0.001	0.0008	0.02
MT 42									
84%	1.02	1.37	10.32	3.13	84.14	0.02	0.003	1 x 10 ⁻⁵	0.03
90%	0.72	1.26	6.4	1.86	89.77	—	0.002	1 x 10 ⁻⁵	0.02
95%	0.45	0.56	2.47	0.906	95.58	0.029	0.001	6 x 10 ⁻⁶	0.008
MT 83									
83%	83.89	13.8	1.9	0.32	0.09	—	0.26	0.0002	0.003
89%	89.26	10.07	0.633	0.021	0.015	—	0.28	0.0001	0.0002

Source: TWCP-698

Table 4. Secondary Radionuclides in Process Wastes

P/S code	Secondary radionuclide in process waste
AO	Am-241 (1979—1984, Am-241 production) Am-241 (1985—1987, impure AmO ₂ for disposal)
AP	Am-241 (1979—1984, Am-241 production)
ATL	Np-237 (1993—1994, NDA standards material)
CD, HCD, HD	Am-241 (1992—present)
CF, ED, EV, RB, RFX	Np-237 as decay product in MSE (1992—present)
EV	Am-241 (1979—1984, Am-241 production) Am-241 (1992—present)
FA	Am-241 (1979—1984, Am-241 production)
HP	Am-241 (1979—1984, Am-241 production) Am-241 (1985—1987, impure AmO ₂ for disposal) Am-241 (1992—present)
IS	Cm-244 (March 1987—April 1987)
LR, PR	Am-241 (1979—1984, Am-241 production)
PS	Am-241 (1985—1987, impure AmO ₂ for disposal)
PT	Th-232 (1980—1985)

Source: TWCP-882

In general, uranium and its isotopes are expected to be present only at trace levels, if at all. U-238 would only be present if uranium was the feed material (e.g., as has been the case for P/S codes LC, RC, UPS, US, and sometimes CF; Table 2). U-235 in growth from the decay of Pu-239 (half-life, 24,120 years) would be negligible due to the long half-life of Pu-239. Uranium-234 would be present in MT 83 as a decay product of Pu-238 (half-life, 87.74 years). After 20 years, 14.6 percent of the initial Pu-238 would have decayed to U-234. For MT 83 with an initial content of 83.89 percent Pu-238, the atomic ratio U-234 to total Pu would be about 0.14. No U-236 is present.

During TWCP characterization, the contents of each waste package undergo non-destructive analysis to provide detailed radioisotopic data. These data will be used to evaluate the accuracy of AK information in accordance with *Waste Characterization Data Reconciliation with Acceptable Knowledge* (TWCP-DTP-1.2-064). If warranted, this AK report will be updated to incorporate the results of these comparisons.

3.5.3 Chemical Content Identification

Chemical inputs to nitrate operation processes are listed in Table 5. The use of strong acids, bases, or oxidizers does not result in RCRA listings for solid debris waste from these processes because of the absence of free liquids in this waste.

4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS

The assignment of EPA hazardous waste numbers, or RCRA codes, to process wastes from nitrate operations is summarized below, as well as on the process timelines in Attachment 3, and the table of process inputs and outputs in Attachment 4. These assignments take into account the possible presence of RCRA chemicals in process waste as a result of their suspected or known presence in feed materials, chemical inputs, equipment, and glovebox surfaces.

4.1 F, K, and P Listings

F002 and F003 apply to waste discarded under P/S codes CF and HP. Some of the solutions sent to these P/S codes for immobilization in cement contain the following organic chemicals:

- F002: methylene chloride
- F003: acetone, butyl alcohol (n-butanol), methanol, tetrachloroethylene, and xylene.

Table 5. Chemical Inputs to Processes Described in This Report

Chemical Input	P/S Codes in which RCRA-Listed Chemicals Are Used	Comments on Applicability of RCRA Listings
Gases		
Argon gas Nitrogen gas	NA	
Acids		
Ascorbic acid Formic acid Hydrochloric acid Hydrofluoric acid Nitric acid Oxalic acid Sulfuric acid	NA	D002 does not apply to the TRU solid waste because there are no free liquids in this waste
Bases		
Potassium hydroxide Sodium hydroxide	NA	D002 does not apply to the TRU solid waste because there are no free liquids in this waste
Inorganic Chemicals		
Aluminum nitrate		
Calcium fluoride		
Calcium nitrate		
Cerium nitrate		
Cobalt nitrate		
Ferric ammonium sulfate hydrate		
Ferric nitrate		
Ferrous ammonium sulfate		D003 does not apply to the TRU solid waste because there are no free liquids in this waste.
Ferrous sulfamate		
Gypsum cement		
Hydrogen peroxide		
Lanthanum nitrate		
Magnesium oxide		
Mercuric nitrate	VP1	D009. Used as catalyst in P/S code VP1; hydroxide cake produced in VP1 is processed in P/S code VP3
Portland cement		
Potassium fluoride hydrate		
Potassium thiocyanate		
Silver nitrate	AT, CPOD	D011, used as catalyst from 1990 to 1994 in CPOD. D011 does not apply to P/S code AT because it was used in a cold lab and did not become part of any TRU waste.
Sodium chloride		
Sodium chromate	PT	D007, used in separation of Th from Pu/Am
Sodium nitrite		
Sodium oxalate		
Metals		
Platinum		
Stainless steel		
Titanium		
Organic Chemicals		
Acetone	OH, OY	F003 if used as a solvent

Chemical Input	P/S Codes in which RCRA-Listed Chemicals Are Used	Comments on Applicability of RCRA Listings
Diethyl oxalate		
Ethanol		
Formamide		
Hydroxylamine nitrate		
Ion exchange resin		
Oil (engine)		
Organic liquid emulsifier		
Phenolphthalein		
Phosphate buffer solution		
Phthalate buffer solution		
Polyoxyethylene-20-Sorbitan laurate (surfactant)		
Silicon adhesive		
Silicon defoamer (General Electric AF9020, Silicon Antifoam Emulsion)		
Sodium citrate retarder		
Trichloroethylene	RO	D040 applies to P/S code RO; used once in 1979 as diluent for oils
Urea		
Vacuum grease		

No K or P listings apply to solid wastes generated from any of the P/S codes in this report because no K-listed or P-listed chemicals were present in the feed materials, chemicals or equipment used in these processes. All drums destined for WIPP will undergo headspace gas sampling and analysis to confirm the presence of listed solvents.

4.2 Toxicity Listings

D008 (lead) applies to all P/S codes due to the potential to generate leaded gloves. Prior to May 1992, leaded gloves were disposed in the metal debris waste stream. Since May 1992, the gloves have been routinely segregated from other debris waste although they are still discarded under the originating P/S code (TWCP-4166). Lead-containing debris waste is segregated and packaged separately from other debris waste (TWCP-3567/N-39); these wastes also are assigned D008.

Waste from most P/S codes in nitrate operations carry several EPA hazardous waste numbers due to the presence of metals with toxicity characteristics in the feed materials. P/S codes covered by this report carry the following codes for heavy metals:

AL	D005, D006, D007, D008, D011
AP	D007, D009
AS	D006, D007, D008, D011
AT	D005, D006, D007, D008, D011
ATL	D005, D006, D007, D008, D011
BF	D006, D007, D008, D011
BU	D006, D007, D008, D011
CD	D006, D007, D008, D009, D011
CF	D007, D008, D009, D011, D019, D021, D022, D039
COL	D005
CPOD	D011
DS	D006, D007, D008, D009, D011
ED	D005, D006, D007, D008, D011
ETD	D005, D006, D007, D008, D011
EV	D006, D007, D008, D009, D011
FX	D006, D007, D008, D009, D011
HCD	D006, D007, D008, D009, D011
HD	D006, D007, D008, D009, D011
HGMS	D006, D007, D008, D009, D011
HP	D007, D008, D009, D011, D019, D021, D022, D039
IA	D006, D007, D008, D009, D011
IS	D005, D006, D007, D008, D011
LG1	D006, D008

LG2	D006, D007, D008, D009, D011
LR	D006, D007, D008, D009, D011
MB	D005 (D007, D008, and D009 also apply in accordance with discussion in TWCP-AK-2.1-002,R.1, section 3.4.2)
MELL	D006, D007, D008, D009, D011
ML	D006, D008
MPD	D005, D006, D007, D008, D011
NC	D006, D008
NL	D006, D008
OD	D006, D007, D008
OH	D006, D007, D008, D009, D011
PT	D007
PTS	D005, D006, D007, D008, D011
RC	D005, D006, D007, D008, D011
RO	D006, D008, D040
RR	D006, D007, D008, D009, D011
SC	D005, D006, D007, D008, D011
SP	D007
SSD	D006, D007, D008
TDC	D005, D006, D007, D008, D011
VC	D006, D008
VP1	D009
VP3	D009
VUL	D005, D008

No D001 (ignitable), D002 (corrosive) or D003 (reactive) listings apply to the solid wastes from nitrate operations because no ignitable chemicals were used in these processes and because the solid wastes do not contain any free liquids (see Section 6.0).

4.3 Corrosivity, Reactivity, and Ignitability

See Section 6.0.

5.0 DETERMINATION OF THE RADIONUCLIDE ISOTOPIC COMPOSITION

See Section 3.5.2.

6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED

According to the WIPP WAP, “The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes.” Administrative controls

on waste packaging were in place at various times to ensure the absence of such items from the waste stream.

- Liquids were prohibited from solid waste streams at TA-55 when the facility opened in January 1978. A waste management procedure written to cover operations at the new facility, *TA-55 Standard Operating Procedure (SOP) 406-GEN-R00*, stated that “Liquids are not permitted in any container of solid waste materials” (TWCP-3943).
- Chemical Waste Disposal Requests introduced in June 1980 included checkboxes which the waste generator was required to check if the waste contained corrosive acids or bases, or pyrophoric, flammable, corrosive, explosive, toxic, carcinogenic or highly reactive materials.
- The Certification Plan (TWCP-697) and related Generator Attachments (TWCP-701) were implemented in 1987. Waste generators were required to sign a statement on the WODF documenting that the waste contained “no free liquids, pyrophorics, explosives, compressed gases, powders or materials other than the indicated matrix.” Checkboxes were also present for indicating the presence or absence of corrosive chemicals. Full implementation of this generator statement occurred in May 1987.
- Waste management inspectors perform visual examination of the waste prior to its initial packaging, thus allowing the inspectors to verify the generator’s WODF statement (TWCP-701, Sections 3.8.5 to 3.8.6).
- Explosives were prohibited from TA-55 until installation of the Impact Test Facility in the early 1990s. Explosives continue to be banned in the solid waste streams up to the present time. If a misfire should occur, the requirement is to destroy the unspent powder by burning.
- The Waste Profile Request Form (WPRF), which has been in use at LANL since 1991, includes a statement which must be authenticated by the waste generator, that the waste is not ignitable (flash point >200°F), reactive, or corrosive.
- The TA-55 Generator Attachments to the Certification Plan were updated in 1995 (TWCP-700) but the prohibition on liquids in the waste, and the waste management inspection, remained in effect.

Hence, since the inception of operations at TA-55, corrosive and reactive wastes have been excluded from TA-55 solid wastes through the prohibition of liquids.

The absence of these prohibited items is verified through radiography of each waste container and visual examination of selected containers during TWCP characterization activities. These data will be used to assess the accuracy of AK information in accordance with *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028). Any free liquids are remediated, or the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007).

7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED

Section 6.0 summarizes administrative controls in place at TA-55 that prohibit incompatible chemicals in the waste, and measures taken to verify their absence. In addition, all waste containers shipped from TA-55 to TA-54 for storage were evaluated for potentially incompatible chemicals in accordance with 49 CFR Subpart C— Segregation and separation chart of hazardous materials; Section 177.848, Segregation of hazardous materials, and were determined to be in compliance with this requirement.

8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS

Most gases used at the TA-55 Plutonium Facility are stored outside the building and the gas is plumbed into the glovebox from outside the building (TWCP-4164). Occasionally, a lecture bottle may have been used for a process inside the building, but these bottles were kept outside of the glovebox with the gas plumbed into the glovebox. Consequently, compressed gas cylinders or containers are not expected to be in any of the TRU wastes generated by TA-55 operations.

Spray cans, especially WD-40, were in common use in TA-55 gloveboxes until May 1992 (TWCP-4166). These were routinely discarded as metal debris waste. From 1988 until May 1992, the protocol was to vent or puncture the spray cans inside the glovebox; venting was indicated by inserting a metal wire into the valve. After May 1992, spray cans were no longer used in gloveboxes.

For items of pyrochemical salt waste, the procedures of oxygen sparging and/or carbonate oxidation have been used since May 1987 to ensure that pyrophorics were oxidized. In addition, screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501) have shown (1) no autoignition, (2) no spontaneous combustion, (3) and no sparking. Experimental results on the reactivity of LANL Direct Oxide Reduction (DOR) salt with water and the reactivity in air of heated calcium metal nodules from DOR salts indicate the absence of “dangerous when wet materials” and pyrophoricity in these salts (TWCP-3730, TWCP-3731, TWCP-3732).

Verification that individual waste drums do not contain compressed gases, free liquids, or sealed containers greater than 4 L in volume is obtained from radiography of each waste containers and visual examination of selected containers during TWCP characterization activities. Any free liquids are remediated, and any sealed containers greater than 4 L in volume, or unpunctured or unvented gas containers, are removed; or else the waste container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007). For administrative controls on the prohibition of pyrophorics, see Sections 6.0 and 7.0.

9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM

No PCBs were introduced into the nitrate operations, based on documentation in TA-55 procedures reviewed during the AK investigation and summarized in the process inputs listed in Table 1, Table 5, and Attachment 4. In the cement fixation process (P/S codes CF and HP), oils are sometimes added to drums of cemented waste. There is no indication these oils contain PCBs, and they are added to the 55-gallon drums of cement in small quantities (maximum of 6 liters [TWCP-3568/N-74]). The oils are primarily vacuum pump oils, along with some oils used in heat-treating (cooking or silicone oils) or in grinding (TWCP-3568/N-82). None of these oils are known to contain PCBs. All transformers known to contain PCBs have been tracked from the time of startup of TA-55 in 1978. Whenever any transformer oil is drained, it is handled by a subcontractor who is wholly responsible for its disposal. This oil does not enter the LANL disposal operations.

10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE

Asbestos heating mantles were never used at TA-55. Asbestos gloves were used in glovebox operations in P/S codes OR and RM (TWCP-4162, TWCP-4166), which are discussed in *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006,R.1) and *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007,R.1), respectively. Asbestos-bearing transite was widely used until recently for thermal insulation, including as a coverplate over the furnace in glovebox wells, and as part of end plates on Lindberg furnaces (TWCP-4162, TWCP-4166). Although many Lindberg furnaces have been replaced with newer asbestos-free furnaces, some are still in use at TA-55. The transite would have been disposed either as metal or as ceramic and glass debris waste.

11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS

- 40 CFR Part 261, Subpart C—Characteristics of hazardous waste, Sections 261.21 (*Characteristic of ignitability*), 261.22 (*Characteristic of corrosivity*), 261.23 (*Characteristic of reactivity*), and 261.24 (*Toxicity characteristic*)
- 40 CFR Part 261—Identification and Listing of Hazardous Wastes
- 40 CFR Part 261, Subpart D—Lists of hazardous waste, Sections 261.31 (*Hazardous wastes from non-specific sources*), 261.32 (*Hazardous wastes from specific sources*), and 261.33 (*Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof*)
- 49 CFR Subpart C—Segregation and separation chart of hazardous materials. Section 177.848, *Segregation of hazardous materials*
- *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5)

- *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001,R.3)*
- *Nonconformance Reporting and Tracking (TWCP-QP-1.1-007)*
- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55 (TWCP-AK-2.1-002,R.1)*
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55 (TWCP-AK-2.1-003,R.1)*
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55 (TWCP-AK-2.1-004,R.1)*
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55 (TWCP-AK-2.1-006,R.1)*
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55 (TWCP-AK-2.1-007,R.1)*
- *Reconciliation of Visual Examination and Radiography Information (TWCP-QP-1.1-028)*
- *Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)*
- *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste (EPA/OSWER 9938.4-03)*
- *Waste Analysis Plan, Attachment B to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088)*
- *Waste Characterization Data Reconciliation with Acceptable Knowledge (TWCP-DTP-1.2-064)*

ACCEPTABLE KNOWLEDGE ROADMAP

Waste from P/S Codes AL, AT, ATL, BM, CD, CF, CPOD, CR, DS, ED, EV, GMS, HCD, HD, IS, LR, MAG, MAS, MELL, ML, MPD, NC, OH, OY, PAF, PR, RB, RBJ, RCM, RFX, RR, SC, SP, TDC, UPS, VUL

Copies of these documents are in the TWCP RMDC Center.

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-352	B	Description of plutonium recovery processes	Wastes from Plutonium Conversion and Scrap Recovery Operations, LA-11069, March 1988	Document describes the Pu residues and the various treatment approaches used in recovering plutonium from scrap	Document does not give information about RCRA constituents introduced or present in the processes
TWCP-614	D	All TA-55 waste is Defense related.	Memo from Doug Sankey.	All TA-55 waste is Defense related.	Budget information may not be acceptable.
TWCP-697	C	Waste was controlled to meet WIPP WAC requirements as early as 1983.	<i>Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , WCP-HSE7-CPL-01, R.2 (November 1984)	Waste was controlled to meet WIPP WAC requirements as early as 1983. Generator Attachments were used to describe and reference specific generator procedures.	Overview document - Generator Attachments provide more detailed information.
TWCP-698	B	Gives Material Type compositions	NMT Memo, NMT-7 WM/EC-96-032 Benchmark Environmental Corp. Memo, AL-7193 BEC	Gives Material Type compositions	Does not give information on how material may fractionate in TA-55 waste processes.
TWCP-700	C	<i>Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , R05	<i>NMT-7 Attachment, January 1995</i> , TRUWM-TA55-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.
TWCP-701	C	<i>TA-55 Generator Attachment to the TRU Waste Certification Plan for Newly Generated TRU Waste</i>	<i>TA-55 Attachment, 1987</i> , TRU-MST12-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-816	D	Jim Foxx Interview on Number of Layers of Packaging	C.L. Foxx, Los Alamos National Laboratory	Waste was co-mingled with room trash, and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level DLs.	None
TWCP-882 (UCNI)	D	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste	Memo from Jim Foxx	Lists additional radionuclides and metals potentially in waste, subdivided by process status code. Covers time period from 1978 to present.	Best information available, but it is based on worker recollection because other records are not available.
TWCP-886	C	Color Flow Diagram of Pu-processes at TA-55.	Diagram from Jim Fixx	Indicates that process inputs are thermally treated and that heavy metals from process inputs end up in the nitric acid evaporator bottoms.	Does not indicate solvent input to processes.
TWCP-887	D	Co-mingling of Defense and Non-Defense TRU Waste	Memo from Jim Foxx	Wastes generated from defense and non-defense activities were not segregated at TA-55 through 1997	None
TWCP-2501	B	“Backlog Waste Reassessment Baseline Book, Waste Form 34”	Rocky Flats Environmental Technology Site Report 1995	Page WF34-10 contains results of tests for corrosivity	Tests were conducted on residues rather than on waste.
TWCP-2513	A	Example of Generator Reports for Drum 54856	TA-55 Records Management Center	Example of generator records including WPRF #07045 and WODF form showing the waste generator certification statement.	Older forms are often hard to read.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3548/ N-1 (UCNI)	B	General description of the overall Nitrate recovery process.	<i>TA-55 Final Safety Analysis Report (07/13/95)</i>	Each step of the nitrate recovery process is described. This includes pretreatment, dissolution, purification, oxidation, and evaporation.	It provides mostly a current (as of 1995) description of the process. It alludes to past practices in places.
Nitrate Pretreatment Procedures					
TWCP-3548/ N-2 (UCNI)	C	P/S diagram; process diagram; process description (P/S GMS, MAG, MAS)	Magnetic Separation Research and Development; Magnetic Separation, 460-REC-R00 through R01, 1/30/89 through 11/2/92	Describes magnetic separation processes for lean and rich residues. Lean residues <EDL are sent to cement fixation.	None
TWCP-3548/ N-3 (UCNI)	C	Process description	Standard Operating Procedure for Handling Process Generated Residues at TA-55, 503-GEN-R00, 2/28/78	Procedure for residue handling, including liquid residues sent to recovery, not specified if nitrate or chloride processing.	None
TWCP-3548/ N-4 (UCNI)	C	Process description	Standard Operating Procedure for the Packaging of Rags for Recovery, 504-GEN-R00, 2/25/78	Describes rinsing of nitrated rags in water. Water sent to ion exchange.	None
TWCP-3548/ N-5 (UCNI)	C	Chemical list; process description (P/S IS based on description)	Incinerator, 422-REC-R00 through R04, 3/1/78 through 1/15/87	Describes incinerator process and disposition of ash.	P/S code IS assigned based on title and description
TWCP-3548/ N-6 (UCNI)	C	P/S Diagram; process description (P/S TDC)	Thermal Decomposition of Cellulose Items, 402-REC-R00, no date	Describes thermal decomposition of rags in an inert atmosphere and also how nitrated rags were soaked in water and the water sent to ion exchange.	No date is available for this procedure.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3548/ N-7 (UCNI)	C	Process diagram; chemical list; process description (P/S PAF)	Oxidation of Pu Metal and Alloys Prior to Dissolution; Oxidation of Pu Metal and Alloys; Passivation Furnaces, 429-REC-R00 through R05, 3/1/78 through 12/12/95	Describes passivation furnace process.	None
TWCP-3548/ N-8 (UCNI)	C	Process description	Procedure for Burning of (Pu, U) Carbides; Burning Plutonium and/or Uranium Carbides and Nitrides, 428-REC-R00 through R02, 3/1/78 through 12/8/86	Pu and U nitrides or carbides are burned to remove pyrophorics.	None
TWCP-3548/ N-9 (UCNI)	C	P/S diagram, chemical list, process description (P/S VUL)	Vessel Handling and Unloading, 494-REC-R00, R01, R02, and R04, 11/15/91 through 3/12/93		R04 is marked as "Draft" with no approval signatures or date.
TWCP-3548/ N-10 (UCNI)	C	Chemical list; process description	Procedure for Disposal of Oils Containing Recoverable Amounts of Pu in the Form of (U, Pu) Carbides, 431-REC-R00, 1/26/78; 431-REC-R01, no date	Oils are filtered for Pu recovery. Oils <EDL are absorbed on vermiculite for disposal. Filtered solids are sent to dissolution.	None
TWCP-3548/ N-11 (UCNI)	C	Process description	Passivation, 431-REC-R00, 12/19/86	Passivation of Pu bearing materials to remove pyrophorics (Ca, Mg metal).	None
TWCP-3548/ N-12 (UCNI)	C	P/S Diagram; chemical list; process description (P/S TDC)	Thermal Decomposition of Cellulose Items, 498-REC-R00 and R02, 6/2/95 and 8/15/97	Thermal decomposition of rags in inert atmosphere. Off gases removed with caustic scrubber. Caustic is filtered and sent to RLWTF if <EDL.	None
TWCP-3548/ N-13 (UCNI)	C	Process description	Anode Heel Burning; Burning Metal, 434-REC-R00 through R01, 2/6/87 through 1/30/89	Oxidation of the metal heel from electrorefining and preparation of oxide as feed for aqueous recovery.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3548/ N-14 (UCNI)	C	P/S diagram; process description (P/S BM)	Plutonium Metal Burning; The Burning and Brushing of Plutonium Metal; 433-NMT7, R03; 433-REC-R00 through R03, 9/6/90; 5/13/94 through 8/15/97	Removal of friable plutonium oxide from metal and calcination of the metal.	None
TWCP-3548/ N-15 (UCNI)	C	Process description	Processing Lapping Oil and Similar Organics, 435-REC-R00, 3/1/78; 435-REC-R01, no date	Oils are filtered for Pu recovery. Oils <EDL are absorbed on vermiculite for disposal. Filtered solids are sent to dissolution.	None
TWCP-3548/ N-16 (UCNI)	C	Process description	Evaluation of Pu (VI) Reduction by Nitrous Oxide, 493-REC-R00, no date	Experimental procedure to use nitrous oxide to reduce Pu (VI) to Pu (IV).	Procedure has no approval signatures or date. Assume this procedure was never implemented.
TWCP-3548/ N-17 (UCNI)	C	P/S diagram; chemical list; process description (P/S CR)	Crushing and Pulverizing, 435-REC-R00 through R05, 2/18/87 through 8/25/97	Crushing and pulverizing residues to approximately 20 mesh for dissolution in nitric acid.	None
TWCP-3548/ N-18 (UCNI)	C	Diagram (not P/S); chemical list; process description	Polystyrene Cube Processing, 437-REC-R00 through R02, 1/19/83 through 10/22/84	Plutonium and depleted uranium is recovered from polystyrene plastic using crushing followed by distillation.	None
Nitrate Dissolution Procedures					
TWCP-3566/ N-19 (UCNI)	C	P/S diagram; chemical list; process description (P/S UPS)	Preferential Dissolution of Uranium Oxides from a Uranium-Plutonium Oxide Mixture, 445-REC-R00 through R03, 3/14/84 through 4/15/92	Calcined residues containing depleted uranium and plutonium are dissolved in nitric acid. The uranium is contained in the filtrate and wash solutions, which are discarded to cement fixation. The insoluble plutonium oxide is then recovered by ion exchange or oxalate precipitation.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3566/ N-20 (UCNI)	C	P/S diagram; chemical list; process description (P/S ATL)	Advanced Testing Line for Actinide Separations (ATLAS) Unit Operations, 491-REC-R00 through R03; 12/23/91 through 8/25/97	The ATLAS unit was a design and development, pilot plant operation that encompassed all steps of the NO ₃ operations.	None
TWCP-3566/ N-21 (UCNI)	C	P/S diagram; chemical list; process description (P/S CPOD)	Catalyzed Electrochemical Plutonium Oxide Dissolver (CEPOD), 490-REC-R00 through R01; 10/10/90 through 10/13/92	Electrochemical dissolution of Pu residues. Silver nitrate was used as a catalyst.	None
TWCP-3566/ N-22 (UCNI)	C	Chemical list; process description	Recovery of Contaminated Platinum, 430-REC-R00, 3/1/78	Recovery of Pu from platinum boats using nitric/hydrofluoric acid.	None
TWCP-3566/ N-23 (UCNI)	C	P/S diagram; chemical list; process description (P/S ED)	Casting Crucible Dissolution, 425-REC-R00 and R01, 1/26/78 through ?; Four-Inch Cascading Airlift Dissolvers, 425-REC-R00 through R07, 2/18/87 through 8/15/97	Casting crucible dissolution for plutonium recovery. Dissolution of Pu residues and finely divided materials using the 4" cascading dissolvers.	None
TWCP-3566/ N-24 (UCNI)	C	P/S diagram; chemical list; process description (P/S SC)	Slag and Crucible Dissolution Procedure; 424-REC-R00, 1/26/78 Dissolution of Sand, Slag, and Crucible in 6-inch Cascade Dissolvers; Six-Inch Cascade Dissolvers, 424-REC-R00 and R03 through R08, 5/18/88 through 8/26/97	Slag and crucible dissolution for plutonium recovery. Later revisions addressed recovery of Pu from residues of sand, slag, and crucible using a 6" cascade dissolver system.	None
TWCP-3566/ N-24A (UCNI)	C	Process description	Pneumatic Salt Crusher, 444-REC-R00, 1/29/90	Salt crusher is used to prepare feed materials for the six-inch cascading dissolver. No chemicals used.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3566/N-25 (UCNI)	C	P/S diagram; chemical list; process description (P/S MPD)	Multipurpose Cascade Dissolver System, 489-REC-R00 through R01, 10/04/91 through 9/27/94	Operation of multipurpose cascade dissolver system for processing impure Pu bearing feeds.	None
TWCP-3566/N-26 (UCNI)	C	Process diagram (not P/S); process description	Alkaline Leach of Chloride Contaminated Plutonium Oxides, 450-REC-R00, 08/21/89	Chloride contaminated Pu oxides are leached using 0.5 M sodium hydroxide to remove chloride contamination.	None
TWCP-3566/N-26A (UCNI)	C	Process description	Dissolution of High Salt and/or Chloride Contaminated Plutonium Dioxide, 448-REC-R00, 1/6/88	Recovery of plutonium from chlorinated oxide received from Rocky Flats.	This is a hand written, temporary? procedure. It may have been a proposed procedure that was never implemented. No final version of this procedure was found.
TWCP-3566/N-27 (UCNI)	C	Process description	Distillation of Am IX Column Effluents to Reduce Acidity and Volume, 470-REC-R01, 08/27/84	Distillation of Am ion exchange column effluents to reduce acidity and volume.	None
TWCP-3566/N-28 (UCNI)	C	Diagram (not P/S); chemical list; process description, (P/S AL based on description)	Ash Leaching, 423-REC-R00 through R05, 1/26/78 through 9/14/90	Recovery of Pu from on-site and off-site ash by leaching with nitric acid and calcium fluoride.	P/S code of AL assigned based on title and description.
TWCP-3566/N-29 (UCNI)	C	Diagram (not P/S); chemical list; process description (P/S ML based on description)	Leaching of Contaminated Metals in Nitric Acid, 431-REC-R00 and R01, 10/18/90 through 1/27/94	Recovery of Pu from non-Pu metal pieces by leaching in hot nitric acid – calcium fluoride/hydrofluoric acid.	P/S code of ML assigned based on title and description.
TWCP-3566/N-30 (UCNI)	C	Process description	Processing of Contaminated Solids, 420-REC-R00 and R01, 01/26/78 through 07/09/84	Processing of contaminated solids for Pu recovery.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3566/ N-30A (UCNI)	C	Process description	Dissolution of Materials, 440-REC-R00 through R01, 2/25/78 through 12/16/85	Dissolution of metals, alloys, casting skulls and plutonium compounds in nitric acid and hydrofluoric acid. Cr may be in the waste from metals, alloys and skulls.	None
TWCP-3566/ N-30B (UCNI)	C	Chemical list, process description.	Plutonium Metal Dissolution, 441-REC-R00 through R01, 2/25/78 through 3/2/83	Dissolution of plutonium metal and alloys in nitric acid and hydrofluoric acid.	R00 was renewed on 3/2/83. R01 has no approval signatures or date.
TWCP-3566/ N-30C (UCNI)	C	Chemical list, process description.	Dissolution of Oxide Derived from Calcination of Oxalate; Standard Operating Procedure for the Dissolution of Oxide Whose Nitrate Solutions are Destined for the Metal Prep Line; The Dissolution of Plutonium Dioxide Derived from Calcined Plutonium Oxalate, 442-REC-R00 through R02, 2/25/78 through 5/23/84	Dissolution of plutonium dioxide derived from calcined plutonium oxalate in nitric acid and hydrofluoric acid.	None
TWCP-3566/ N-30D (UCNI)	C	Chemical list, process description.	Dissolution of Oxide Derived from Passivation of Carbides, Metal or Casting Skulls, 443-REC-R00 through R01, 2/25/78 through 8/2/78	Dissolution of plutonium oxides derived from plutonium carbides, anodes, metal or casting skulls that have been passivated in a furnace. The oxides are dissolved in nitric acid and hydrofluoric acid.	None
TWCP-3566/ N-30E (UCNI)	C	Diagram (not P/S), chemical list, process description.	Dissolving Chloride Melt Portion of Electrefining Residues; Dissolving the Chloride Melt Portion of Salt-Stripping Residue, 444-REC-R00 through R01, 2/25/78 through 9/26/83	Chloride salts from electrefining are dissolved in sodium hydroxide. Then nitric-hydrofluoric acid is used to dissolve filtered solids. Acid filtrate is sent to ion exchange. Appears to be related to hydroxide cake dissolution.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3566/ N-30F (UCNI)	C	Chemical list, process description.	Dissolution of Residues for Ion-Exchange Feed; Standard Operating Procedure for the Residue for Ion-Exchange Feed, 447-REC-R00 through R01, 7/13/79 through 6/30/81	Dissolution of plutonium residues from oxide dissolution in nitric acid and hydrofluoric acid.	None
TWCP-3566/ N-31 (UCNI)	C	P/S diagram, chemical list, process description (P/S NC)	Pickling or Surface Leaching, 421-REC-R00 and R01, 1/26/78 through ?; Leaching of Noncombustible Materials in Nitric Acid, 421-REC-R03 through R09, 2/18/87 through 3/27/97	Recovery of Pu from surface contamination of noncombustible material by pickling or surface leaching.	Draft R09 also contains P/S code DO (Dissolution of Oxide)
TWCP-3566/ N-32 (UCNI)	C	P/S diagram; chemical list; process description (P/S HD, CD, HCD)	Dissolution of Chloride Generated Cake in Nitric Acid; Dissolution of Pu Hydroxide Cake in Nitric Acid, 442-REC-R00 through R03, 11/14/88 through 01/16/97	Dissolution of Pu hydroxide cake from chloride operations in nitric acid.	None
TWCP-3566/ N-33 (UCNI)	C	P/S diagram; chemical list; process description (P/S MELL)	Mediated Electro-Oxidation of Low-Level Organic Waste (formerly Catalyzed Electrochemical Plutonium Oxide Dissolver), 490-REC-R02, 9/26/94	Mediation electro-oxidation of low-level organic waste (MELLOW) uses cobalt nitrate or cerium nitrate as a catalyst to recover Pu from cellulose-based material.	None
TWCP-3567/ N-34 (UCNI)	C	Chemical list; process description	Silica Removal from Americium Feed Solutions, 468-REC-R00 and R01, 10/06/83 through 11/29/83	Silica removal from Am feed solution.	None
TWCP-3567/ N-35 (UCNI)	C	Diagram (not P/S); chemical list; process description	Residue Leaching, 426-REC-R00, 2/27/87	Removal of SiO ₂ from solid residues by hydrofluorination to recover Pu.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3567/ N-36 (UCNI)	C	P/S diagram; chemical list; process description (P/S AT)	Incinerator Ash R&D Facility, 427-REC-R00, 8/22/88	Incinerator ash R&D facility for processing of incinerator ash from Los Alamos and Rocky Flats.	None
TWCP-3567/ N-37 (UCNI)	C	P/S diagram; chemical list; process description (P/S SP)	Dissolution of Filter Residues and Glovebox Sweepings in Hot HNO ₃ -HF; Dissolution of Filter Residues, Impure Oxide, and Glovebox Sweepings, 446-REC-R00 through R06, 2/3/89 through 3/27/97	Plutonium recovery from residues using nitric acid with a fluoride catalyst.	None
TWCP-3567/ N-37A (UCNI)	C	P/S diagram, chemical list, process description (P/S OD and SP)	Dissolution of Impure Plutonium Dioxides, Filter Residues, and Glovebox Sweepings in Hot HNO ₃ -HF, 447-REC-R02, 12/18/86	Plutonium recovery from residues using nitric acid with a fluoride catalyst.	P/S diagrams were added via memo on 1/28/85 and 2/13/87. Appears as though P/S diagrams were not finalized.
TWCP-3567/ N-38 (UCNI)	D	LANL policy on RCRA F-codes	Interview with Pam Rogers and Alice Barr	Solvent F-codes will apply to all waste streams generated from a processing an intermediate product once solvents are identified in that process.	None
TWCP-3567/ N-39 (UCNI)	D	RCRA codes associated with hydroxide cakes.	Interview with Jim Foxx of TA-55	RCRA codes associated with hydroxide cakes from the chloride process that are fed into the nitrate process.	None
TWCP-3567/ N-40 (UCNI)	B	RCRA codes associated with hydroxide cakes from chloride operations that are fed to the nitrate operations at the dissolution step.	Acceptable Knowledge Summary for the TA-55 Chloride Operations	Description of the chloride operations and wastes generated based on review of historic operation procedures from the plutonium facility at TA-55.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
Nitrate Ion Exchange Procedures					
TWCP-3567/ N-41 (UCNI)	C	Diagram (not P/S); chemical list; process description (P/S RCM)	Nitrate Anion Exchange for the Rich Column Material System, 472-REC-R00, 2/02/90	Nitrate anion exchange for the rich column material.	None
TWCP-3567/ N-42 (UCNI)	C	P/S diagram; chemical list; process description (P/S LR)	Nitrate Anion Exchange for the Lean Residue System, 471-REC-R00 through R02, 1/29/90 through 3/22/93	Nitrate anion exchange for the lean residue system to recover and purify Pu to weapon's grade specifications for storage as an oxide.	None
TWCP-3567/ N-43 (UCNI)	C	Diagram (not P/S); chemical list; process description (P/S RR)	Nitrate Anion Exchange for the Rich Residues Ion Exchange Column, 470-REC-R00, 11/22/89	Pu eluate solution from the ion exchange process is precipitated as an oxalate. The Pu oxalate is calcined to an oxide.	None
TWCP-3567/ N-44 (UCNI)	C	Diagram (not P/S); chemical list; process description	Nitrate Anion Exchange, 461-REC-R00 through R02, 2/25/78 through 11/29/88	Nitrate anion exchange utilizing an anion exchange resin in nitric acid that retains the nitrate complex of Pu (IV) over most cationic impurities.	None
TWCP-3567/ N-45 (UCNI)	C	P/S diagram, chemical list, process description (P/S RFX LR DS)	Nitrate Anion Exchange [for the Dissolved Solids (DS) System], 473-REC-R00 through R06, 10/17/89 through 7/24/98	Nitrate anion exchange process in general. The procedure starts out describing only the dissolved solids system and changes to a general description of nitrate anion exchange.	None
TWCP-3567/ N-46 (UCNI)	C	Chemical list; process description	Procedure for Eluting Plutonium From Ion Exchange Columns, 473-REC-R00 and R01, 8/15/79 through 12/2/82	Recovery of accountable amounts of Pu by eluting the Pu from the ion exchange columns used in Am production.	None
TWCP-3567/ N-47 (UCNI)	C	P/S diagram; chemical list; process description (P/S RFX)	Nitrate Anion Exchange for the Rich-Feed Ion-Exchange System, 495-REC-R00 and R01, 4/29/92 through 12/15/93	Nitrate anion exchange for the rich-feed ion exchange system.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3567/ N-48 (UCNI)	C	Process description	Alternate Procedure for Conversion of Plutonium Oxalate to Oxide; Conversion of Plutonium Oxalate to Oxide Using Heat Lamp and Hot Plate, 477-REC-R00 through R02, 2/03/81 through 5/14/87	Pu oxalate is converted to an oxide by heating with a heat lamp and hot plate.	None
TWCP-3567/ N-50 (UCNI)	C	P/S diagram; chemical list; process description (P/S OY)	Oxalate Precipitation of Nitrate Solutions, 479-REC-R00 through R03, 4/30/81 through 2/14/89	The feed for this precipitation process comes from the nitrate dissolution of relatively pure on-site and off-site oxides.	None
TWCP-3567/ N-51 (UCNI)	C	P/S diagram; chemical list; process description (P/S LR, DS, RCM, RR)	Oxalate Precipitation and Calcination of Ion-Exchange Elutes, 466-REC-R00 through R03, 2/25/78 through 6/15/89	Pu in ion exchange elutes are precipitated as an oxalate and the oxalate is calcined to an oxide. This operation feeds P/S OY.	None
TWCP-3567/ N-51A (UCNI)	C	Process description	Calcination; Hydrocalcination, 437-REC-R00 through R01, 3/5/87 through 2/13/89	Wet plutonium oxalate cake is burned in a furnace and converted to plutonium oxide.	None
TWCP-3567/ N-52 (UCNI)	C	P/S diagram; chemical list, process description (P/S PR)	Peroxide Precipitation, 480-REC-R00 and R01, 1/21/87 to 2/14/89	Separation of Pu from catatonic impurities with the use of hydrogen peroxide for precipitation of the Pu.	None
TWCP-3567/ N-53 (UCNI)	C	Diagram (not P/S); chemical list; process description	Peroxide Precipitation, 464-REC-R00 and R01, 2/25/78 through ?	Separates Pu from cationic impurities such as Ca, Cr, Mg, Ce, Co, Al, and Am by peroxide precipitation	None
TWCP-3567/ N-54 (UCNI)	C	Diagram (not P/S); chemical list; process description	Thorium Fluoride Precipitation, 468-REC-R00 and R01, 1/26/78 through ?	Separates thorium from Pu by forming the insoluble ThF ₄ precipitate.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3567/ N-55 (UCNI)	C	P/S diagram; chemical list; process description (P/S OH)	Procedure for Americium Hydroxide Precipitation and Filtration ; Filtration of Caustic-Treated Peroxide Filtrates, 469-REC-R00 through R03, 8/15/79 through 12/19/86	Am recovery from the filtrate which results from the precipitation of Pu peroxide in the FFTF Oxide Production Process. Filtration of caustic-treated peroxide filtrates. These solutions are generated with the peroxide filtrate solutions and are dripped in to a caustic solution to destroy peroxide.	None
TWCP-3567/ N-56 (UCNI)	C	Process description	Homogenization of Plutonium Oxide Product by Auger Mixing, 432-REC-R00, 02/14/89	Homogenization of PuO ₂ by auger mixing.	None
TWCP-3567/ N-57 (UCNI)	C	P/S diagram; process description (P/S RB and RBJ)	Oxide Roasting and Blending, 433-REC-R00 through R01, 1/28/87 through 1/30/89	Assayed oxide from the vault is blended, sintered, reblended and sampled. This material is then used as feed for Pu metal production or direct oxide reduction. Pu metal may also be burned to an oxide.	None
TWCP-3567/ N-57A (UCNI)	C	P/S diagram; process description (P/S RBJ)	Roasting and Blending JR., 443-REC-R00 and 443-REC-R02, 1/30/89 through 10/30/89	Pu oxide is returned, sieved, blended, and sampled.	None
TWCP-3567/ N-57B (UCNI)	C	P/S diagram; process description (P/S RBJ, RB)	Roasting and Blending JR., 434-NMT7-R00, 3/6/92; 434-NMT7-R03, 3/3/93; 434-REC-R00 (Draft and Final) through 434-REC-R02, 4/15/94 through 8/15/97	Pu oxide is returned, sieved, blended, and sampled.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3567/N-59 (UCNI)	C	Process description (P/S DS and RR)	Sampling Procedure for the Ion-Exchange Process – DS and RR, 417-GEN-R00 and R01, 4/17/86 through 1/23/89	Collecting samples of nitrate solutions to determine plutonium content and determine which ion exchange process should be used for recovery	None
Nitrate Evaporator Procedures					
TWCP-3568/N-61 (UCNI)	C	P/S diagram; chemical list; process description (P/S EV)	Treatment of Evaporator Bottoms, 485-REC-R00 through R02, 7/13/84 through 2/09/89	Treatment of evaporator bottoms generated from the volume reduction of feed from ion exchange columns. The reduced solution goes to cement fixation and the salts are discarded.	None
TWCP-3568/N-62 (UCNI)	C	P/S Diagram; process description (P/S EV)	Computer Operated Nitric Acid Volume Reduction & Treatment of Evaporator Bottoms, 485-REC-R00 through R03, 10/4/89 through 8/31/95	Computer operated nitric acid volume reduction and treatment of evaporator bottoms.	None
TWCP-3568/N-63 (UCNI)	C	P/S diagram; process description (P/S EV)	Nitric Acid Process Evaporator, 485-REC-R04 and R05, 11/20/96 through 9/9/97	Evaporation process for reducing the volume of process-generated nitric acid/salt mixtures.	None
TWCP-3568/N-64 (UCNI)	C	P/S diagram; chemical list process description (P/S EV)	Process Nitric Acid Volume Reduction, 484-REC-R00 through R02, 10/5/84 through 3/15/90	Nitric acid volume reduction by processing ion exchange effluent through an evaporator.	None
TWCP-3568/N-65 (UCNI)	C	Chemical list; process description	Volume Reduction of Nitrate Feed Solutions Using a Mini-Evaporator, 496-REC-R00, 10/23/95	Operation of the mini-evaporator to reduce the volume of nitrate feed solutions.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3568/ N-66 (UCNI)	B	RCRA-codes for evaporator bottoms	Development of Control Charts for the Evaporator Bottoms Newly Generated Waste Stream from TA-55, 3/19/99	Based on the development of control charts for analytical results, evaporator bottoms were determined to be hazardous for chromium, lead, and mercury.	None
Nitrate Cement Fixation Procedures					
TWCP-3568/ N-67 (UCNI)	C	Process description (P/S CF)	Auxiliary Activities for Cement Fixation, TRU-NMT2-DP11-R00 (Draft), 04/13/94	Auxiliary activities for cement fixation, such as preparing the 55-gallon drum, attaching and detaching drums from glovebox, and filing the cement hopper.	None
TWCP-3568/ N-68 (UCNI)	C	Process description (P/S CF)	Calibration of the pH Electrode for Cement Fixation, TRU-NMT2-DP-06-R00, no date	Calibration and maintenance of pH electrodes used to measure the pH of waste solutions as part of the CF process.	None
TWCP-3568/ N-69 (UCNI)	C	P/S Diagram; chemical list; process description (P/S CF)	Cement Fixation of Process Residues in 55-Gallon Drums, TRU-NMT2-DP-04, R00; TRU-NMT7-DP-04, R01 and R02; TRUWM-TA55-DP-04-R00 (Draft), 8/6/93 through 06/21/94	Cement fixation of liquid and particulate process residues in 55-gallon drums.	None
TWCP-3568/ N-70 (UCNI)	C	P/S Diagram; Process; description (P/S CF)	Certification of Waste for Cement Fixation, TRU-NMT2-DP-12, R00; Certifying Waste for Cement Fixation, TRUWM-TA55-DP-12-R00; 4/20/93 through 7/10/97	Describes how TA-55 personnel ensure waste destined for CF are properly characterized, accounted for, and documented.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3568/N-71 (UCNI)	C	Process description (P/S CF)	Documentation for Cement Fixation, TRU-NMT2-DP-14, R00 and R01; TRUWM-TA55-DP-14-R00; 3/04/93 through 7/10/97	Documentation for cement fixation. Describes completing the paperwork and assembling the data package that is required to accompany each drum destined for WIPP.	None
TWCP-3568/N-72 (UCNI)	C	Chemical list; process description (P/S CF)	Cement Fixation of Process Residues in One-Gallon Cans, TRU-MST12-DP-03, R00, 04/27/87	Process residue TRU waste at TA-55 immobilized for compliance with WIPP WAC.	None
TWCP-3568/N-73 (UCNI)	C	Diagram (not P/S); chemical list; process description	Scrubber System for Cement Fixation Operations, 483-REC-R00, 01/30/89	Operation of the nitric acid scrubber system to prevent the premature replacement of HEPA filters used in cementing operations.	None
TWCP-3568/N-74 (UCNI)	C	Chemical list; process description (P/S CF)	Organic Liquid Emulsification, TRU-NMT2-DP-13, R00; TRUWM-TA55-DP-13-R00; 8/30/93 through 9/30/94	Emulsifying waste oil and other organic liquids for cement fixation.	None
General Documents Applicable to the Nitrate Process					
TWCP-3568/N-76 (UCNI)	D	Comments on draft Nitrate AK Summary Report	Interview with Tim Hayes of TA-55 Nitrate Operations, 1/4/00	Clarifications on various aspects of the Nitrate process, including P/S codes, time periods for P/S codes and specific operations, and appropriate terminology.	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3568/N-77 (UCNI)	D	Additional P/S diagrams assigned to Nitrate Process	Memo from Jim Foxx of TA-55, 1/17/2000	P/S diagrams and codes assigned to Nitrate Operations by TA-55 personnel.	The diagrams are provided as "stand-alone" pieces of information. There are no procedures associated with these diagrams and so chemical use, process description, and applicability to the nitrate process can not be established.
TWCP-3568/N-79 (UCNI)	C	Clarification of information for all processes within the nitrates operations	Comments from Tim Hayes and Jim Foxx on the Acceptable Knowledge Summary for TA-55 Nitrate Operations, 2/25/00	Details provided for all processes within the nitrates operations.	None
TWCP-3568/N-81 (UCNI)	C	Process descriptions, RCRA constituents, dates of generation, waste disposition (various P/S codes)	Nitrate Acceptable Knowledge Report forms completed by SMEs Tim Hayes and Jim Foxx	General process descriptions, RCRA constituents, dates of generation, and waste disposition for P/S codes without procedures.	Procedures do not exist for these P/S codes. This information is based on SME knowledge.
TWCP-3568/N-82 (UCNI)	D	Clarification of specific processes within the Nitrates operations	Jim Foxx, SME, response to comments received on the Acceptable Knowledge Summary for TA-55 Nitrate Operations, 2/25/00	Resolutions to the questions and issues raised by Pam Rogers during her review of the Acceptable Knowledge Summary for TA-55 Nitrate Operations, 2/25/00	Information is based on SME knowledge.
TWCP-3568/N-83 (UCNI)	D	Clarification of policy on assigning EPA hazardous waste numbers to D-listed constituents in TRU waste streams.	Pam Rogers, email to John Musgrave, "Re: A Few Issues," 4/11/00.	All TRU waste streams containing RCRA D-listed hazardous constituents will be assigned the applicable D-code(s) unless analytical data or other acceptable information demonstrates that the concentration of the constituent is below the regulatory limit. The text will establish the caveat that the D-code can be revised (removed) based on obtaining additional information.	This policy is contrary to the WIPP WAP; however, the policy allows revisions to D-code assignments based on additional information obtained.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3568/ N-84 (UCNI)	D	Leaching equipment may result in chromium, cadmium, and/or lead being in the solution. Text regarding ensuring that incompatible waste is not packaged together is provided.	Rosemary Glenn, email to Karen Chandler, "Re: Chromium," 6/8/00 and John Musgrave, email to Karen Chandler, "Re: Light Bulb!" 6/14/00. This email conveys information received from John Musgrave and Pam Rogers.	Processes that leach equipment may have chromium, cadmium, and/or lead in the solutions from stainless steel, shielding, and other metal feed materials. TA-55 runs a DOT incompatibility analysis on waste being sent to TA-54.	
TWCP-3568/ N-85 (UCNI)	D	Clarification of policy on assigning EPA hazardous waste numbers to constituents in outputs from one process that are feed materials for another process.	Jeff Carmichael, emails to Karen Chandler, "Re: RCRA code assignments," 5/23/00; "Re: RCRA codes," 5/26/00.	EPA hazardous waste numbers are assigned only to outputs from processes that are waste streams or are being sent to a waste treatment process. Outputs from one process that are feed materials for another process are not waste.	This policy is solely that of NMT-7 and is contrary to the policy established by ESH-19.
TWCP-3730 (UCNI)	B	Pyrophoricity characterization	Characterization of Direct Oxide Salts (LA-CP-95-0098)	Hydrogen generation and pyrophoricity of DOR salts. Also gives reference for MSE, ER, and Cr-containing salts.	None
TWCP-3731	D	Sodium pyrophoricity in pyrochemical salts	Memo (MST-12-ARO-88-052)	Treatment of sodium in salts is effective	Sodium only
TWCP-3732	C	Experimental data on calcium pyrophoricity in salts	Memo (MST-12-ARO-88-077)	Treatment of calcium in salts is effective	Calcium only
TWCP-3943	B	Procedure for Waste Management at TA-55	TA-55 Document, 406-GEN-R00	Contains information on waste management procedures in 1978	None, but doesn't address today's waste management concerns
TWCP-4100	D	Information on P/S/ code VP2	Nitrate AK report form completed by SME Jim Foxx, and corrected on 09/26/00	General process description, RCRA constituents, time line, and waste disposition	Procedures do not exist for these P/S codes. This information is based on SME knowledge

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

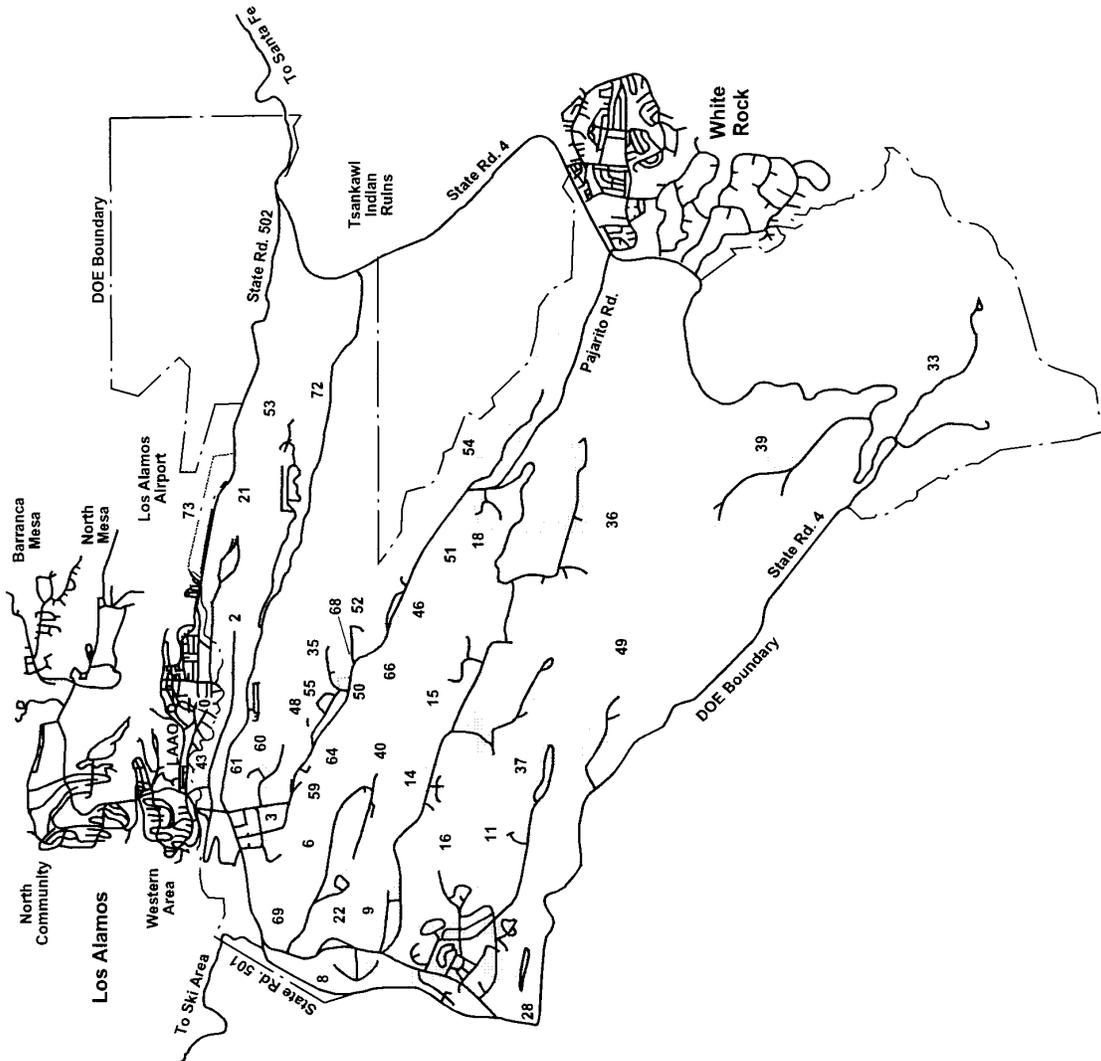
TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-4162	D	Answers to questions about P/S codes PB, PuBe, CC, MB, MS, FF, BF, and other issues	Interview with Jim Foxx, 10/12/00	Answers to questions on use of asbestos at TA-55, non-defense activities, and specific P/S codes in chloride operations.	None
TWCP-4164	D	Answers to questions about various P/S codes	Interview with Jim Foxx, 10/16/00	Answers to questions on use of Ag, disposal of ash and resins, and use of gases.	None
TWCP-4166	D	Answers to questions about P/S codes DO, EV, HP, CF, OR, RM, PY	Interview with Jim Foxx, 10/17/00	Answers to questions on use of Cr and Ag, RCRA metals in cement, asbestos in furnaces and gloves, and disposal of spray cans used in gloveboxes.	None
TWCP-4167	D	Answers to questions about segregation of non-defense wastes; leachability of Ag from ash	Interview with Jim Foxx, 10/18/00	Segregation of non-defense wastes began on 27 August 1998; analytical data show that Ag in ash is below limits of regulatory concern	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

MAP OF LANL

Technical Area Locations

TA-0	Unassigned Land Reserve
TA-2	Omega Site
TA-3	South Mesa Site
TA-5	Beta Site
TA-6	Two Mile Mesa Site
TA-8	Anchor Site West
TA-9	Anchor Site East
TA-11	K-Site
TA-14	Q-Site
TA-15	R-Site
TA-16	S-Site
TA-18	Pajarito Laboratory
TA-21	DP-Site
TA-22	TD-Site
TA-28	Magazine Area A
TA-33	HP-Site
TA-35	Ten Site
TA-36	Kappa Site
TA-37	Magazine Area C
TA-39	Ancho Canyon Site
TA-40	DF-Site
TA-41	W-Site
TA-43	Health Research Lab & DOE Headquarters
TA-46	WA-Site
TA-48	Radiochemistry Site
TA-49	Frijoles Mesa Site
TA-50	Waste Management Site
TA-51	Radiation Exposure Facility
TA-52	Reactor Development Site
TA-53	Meson Physics Facility
TA-54	Waste Disposal Site
TA-55	Plutonium Facility Site
TA-57	Fenton Hill Site
TA-58	Two Mile North Site
TA-59	OH-Site

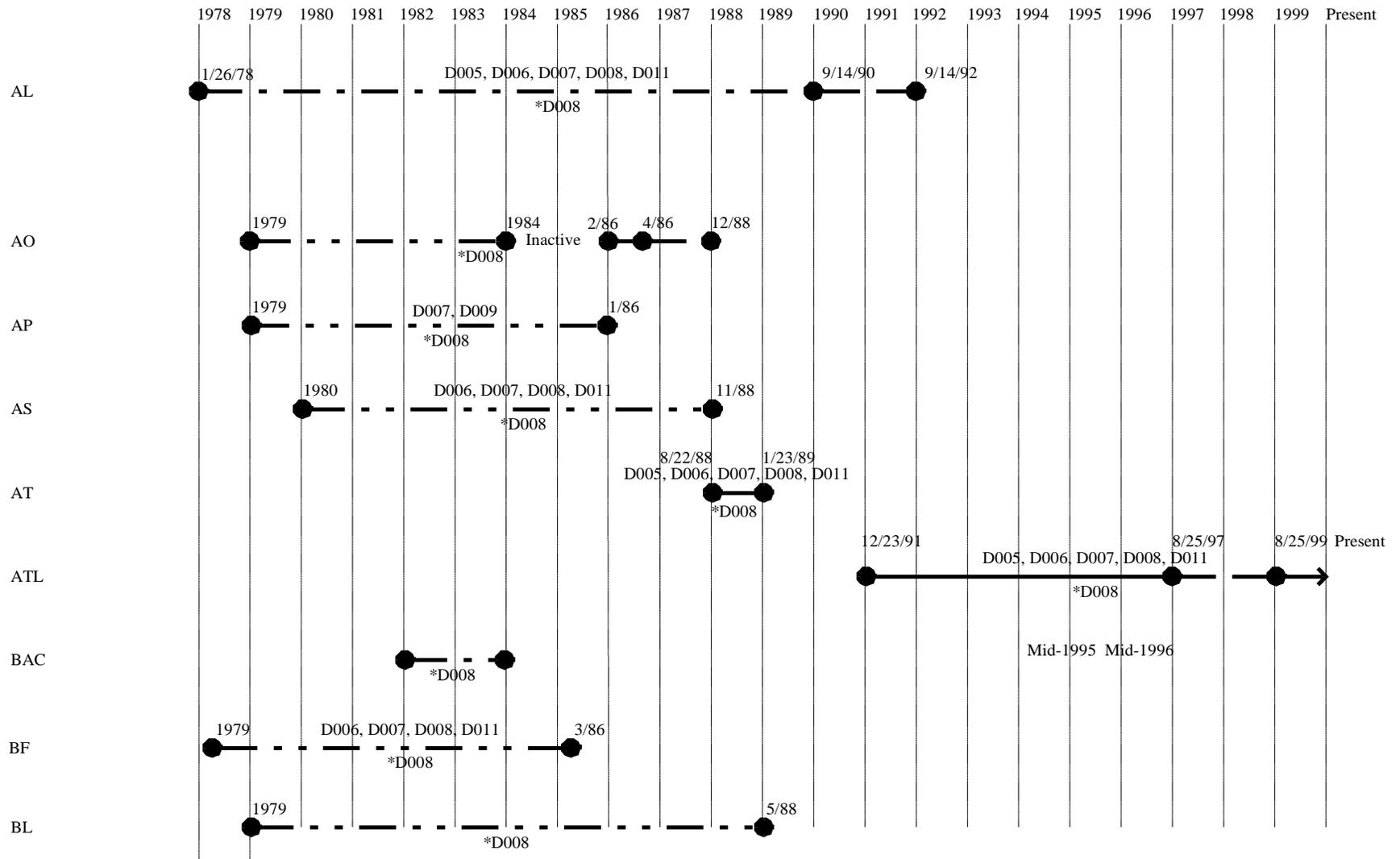


MAP OF TA-55

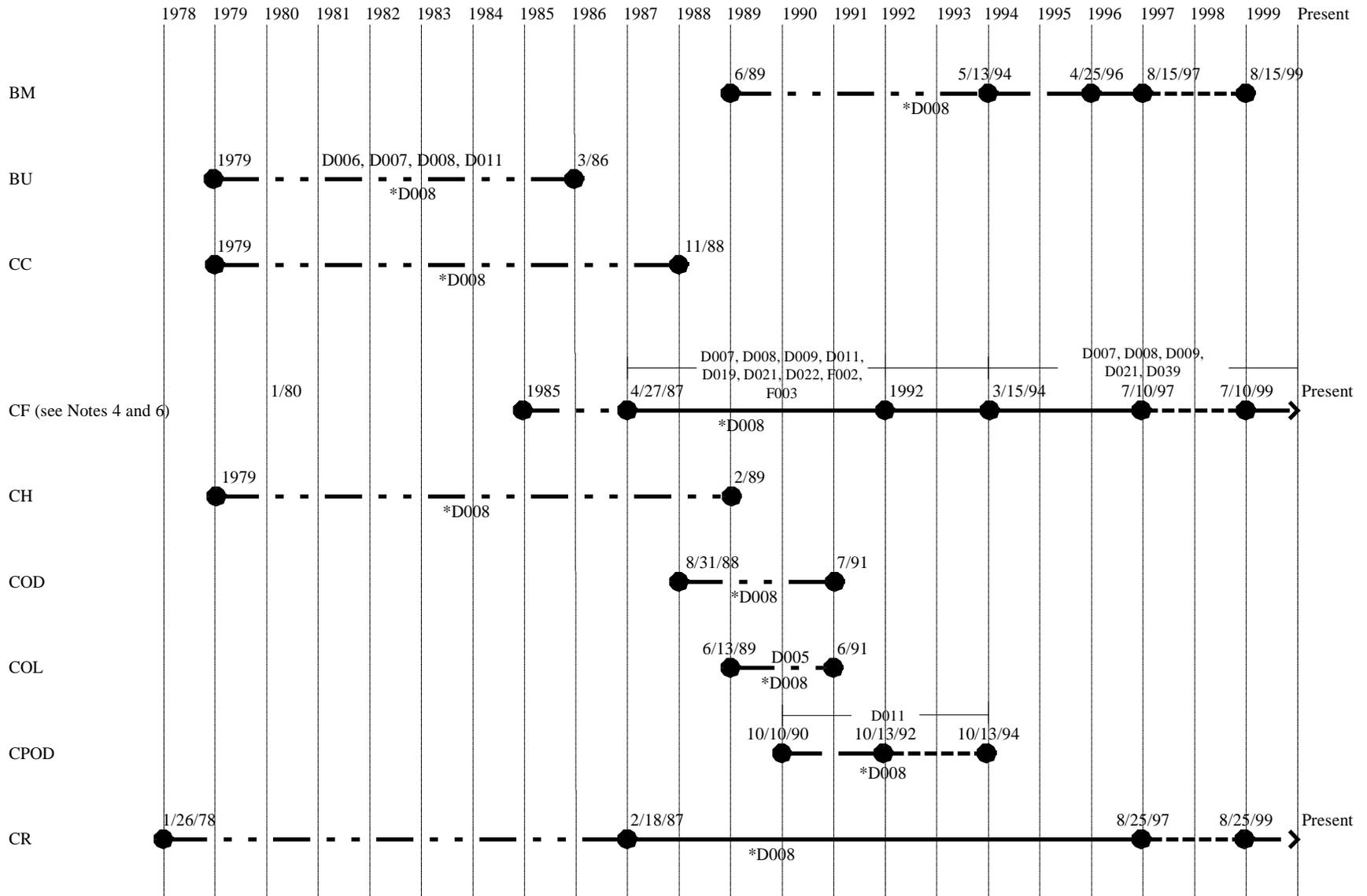
Note: The Plutonium Facility, Building PF-4, is labeled PF-4 on this map.



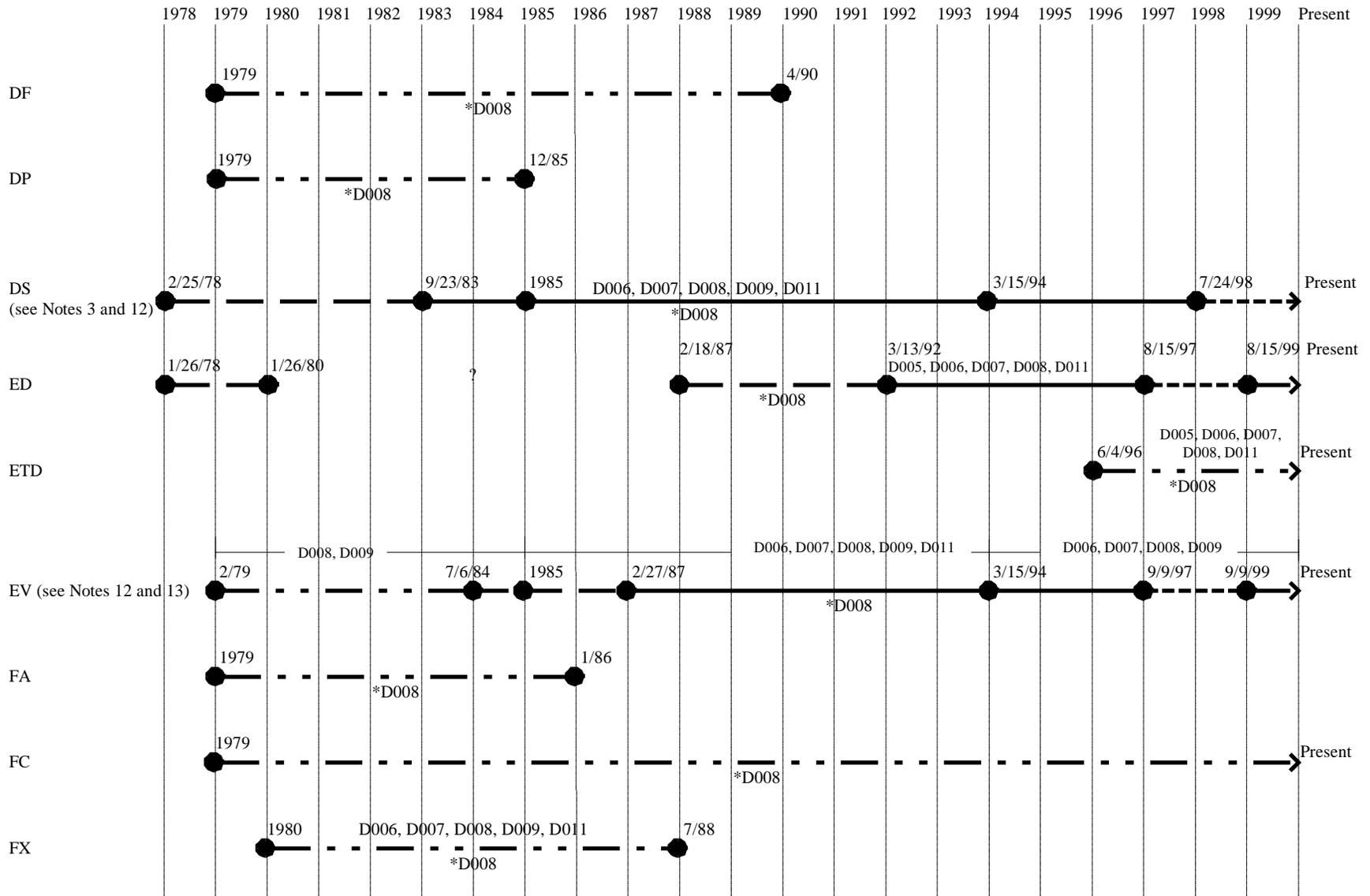
TIMELINE FOR NITRATE OPERATIONS



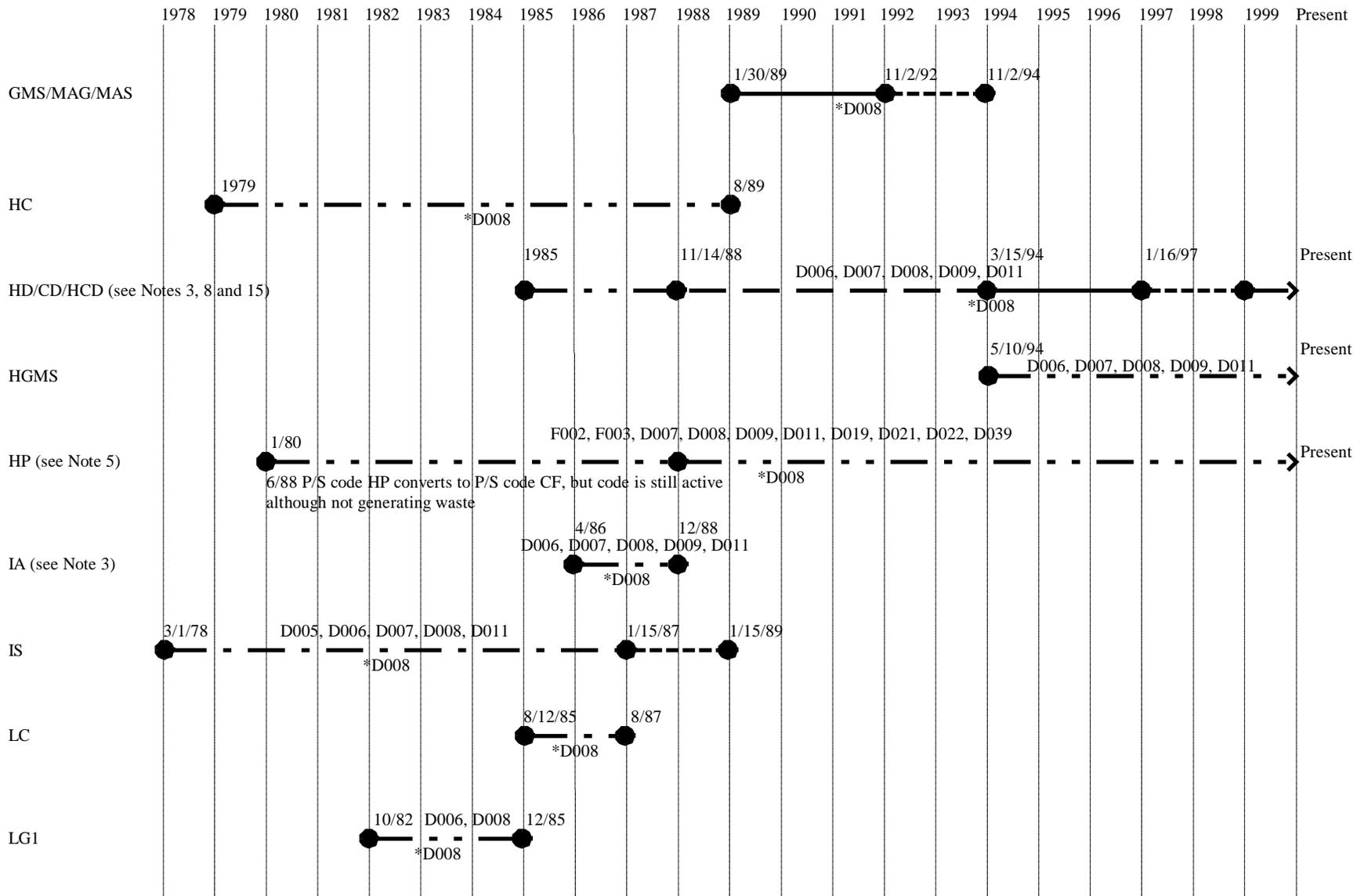
TIMELINE FOR NITRATE OPERATIONS (continued)



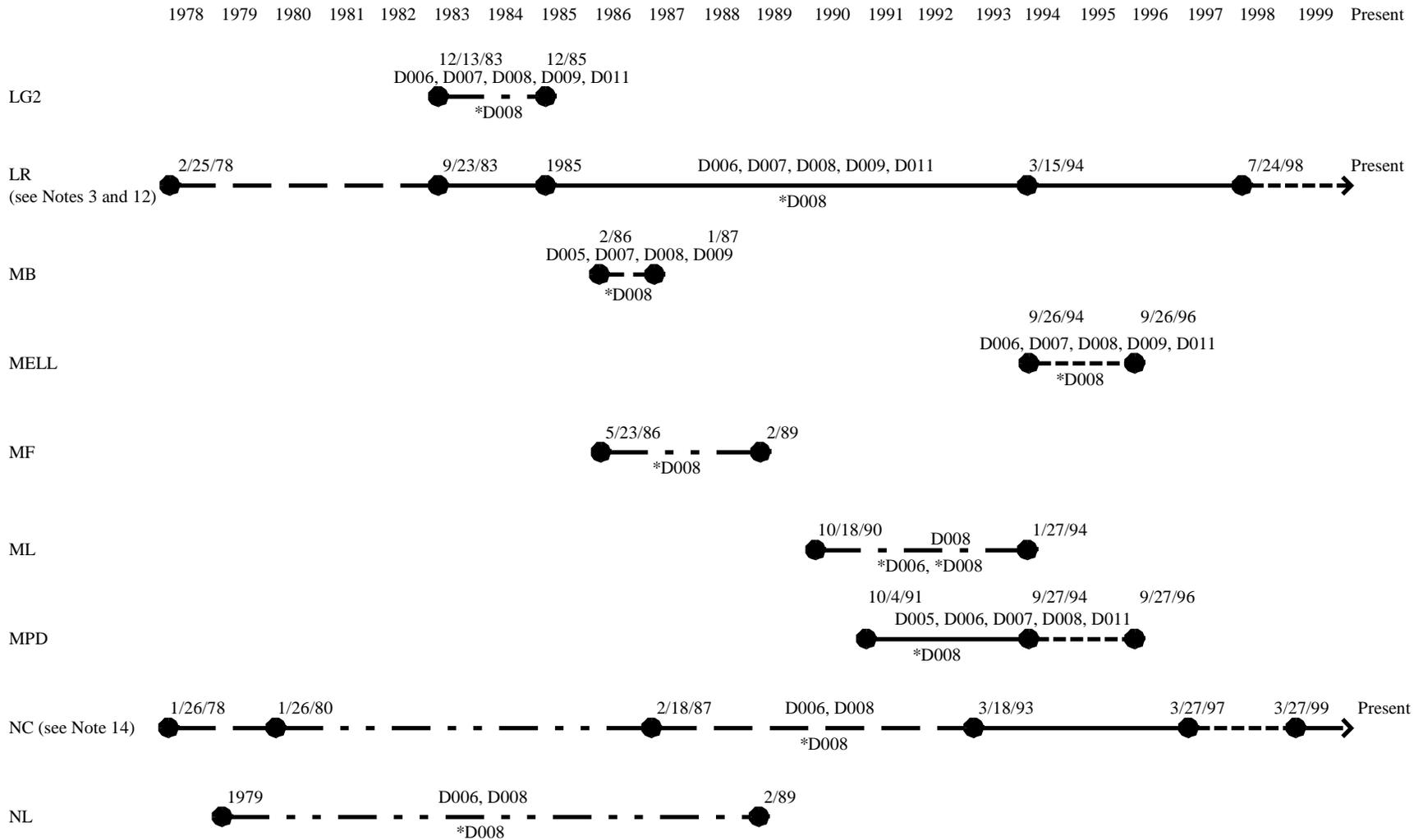
TIMELINE FOR NITRATE OPERATIONS (continued)



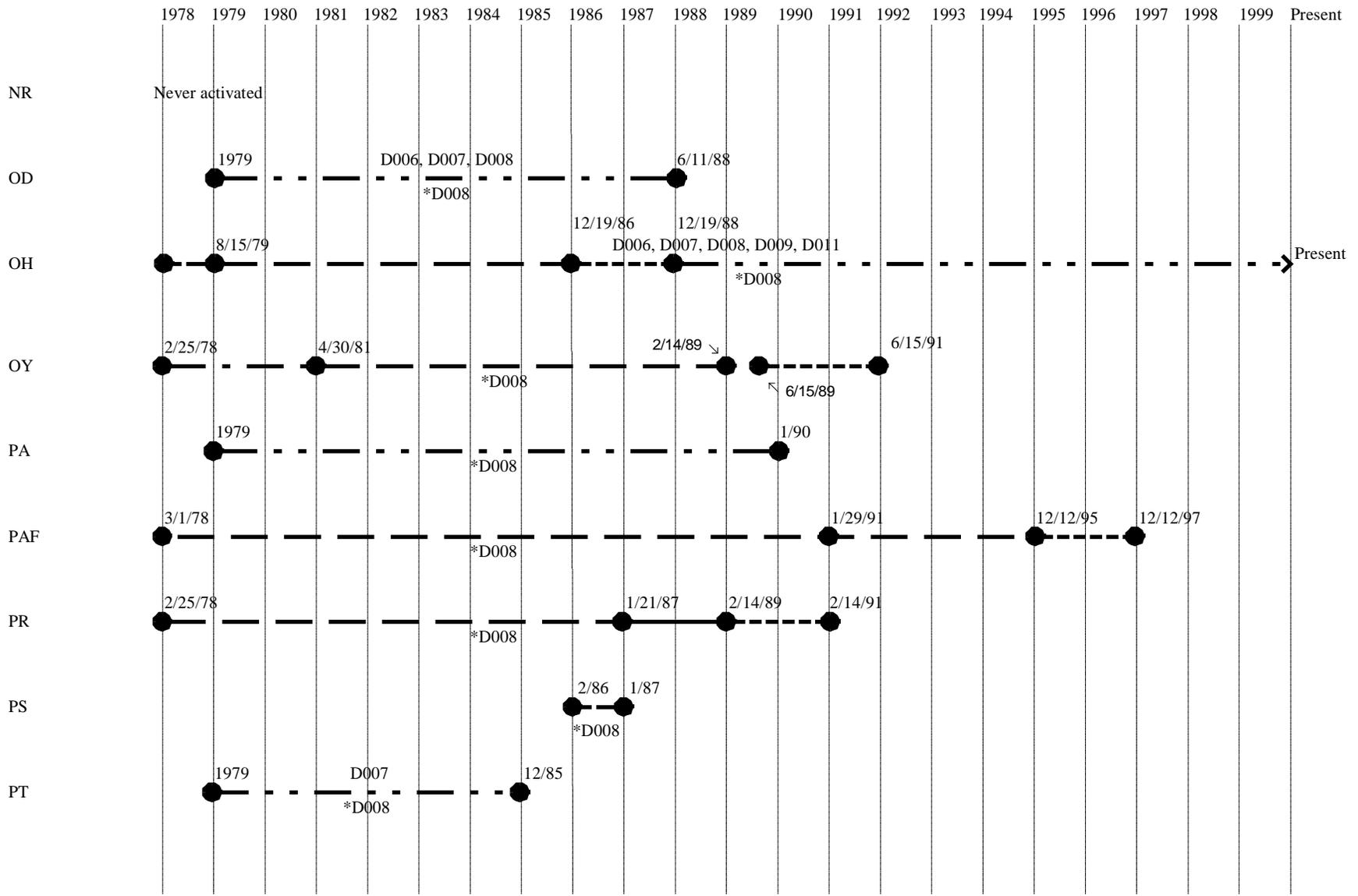
TIMELINE FOR NITRATE OPERATIONS (continued)



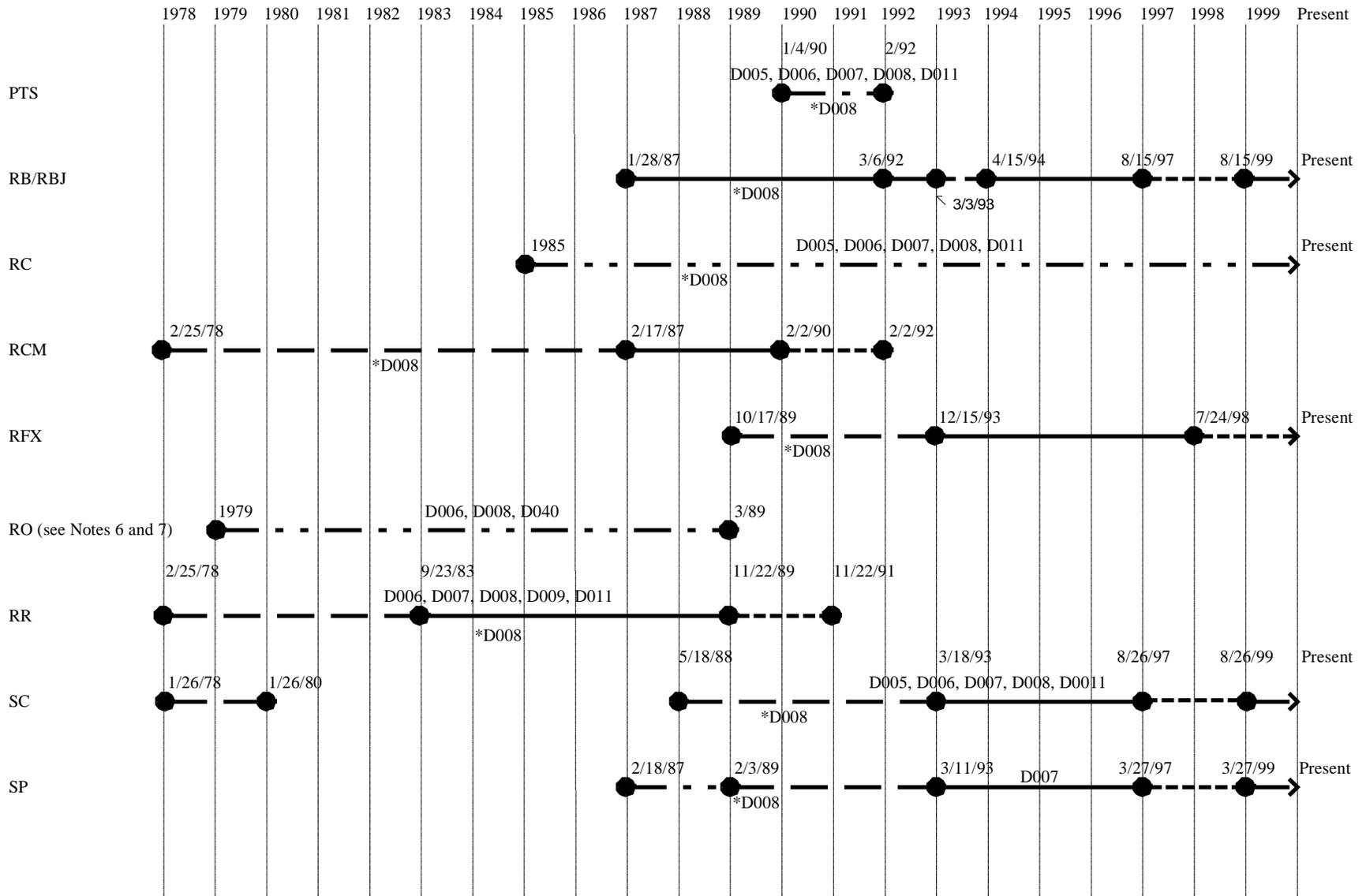
TIMELINE FOR NITRATE OPERATIONS (continued)



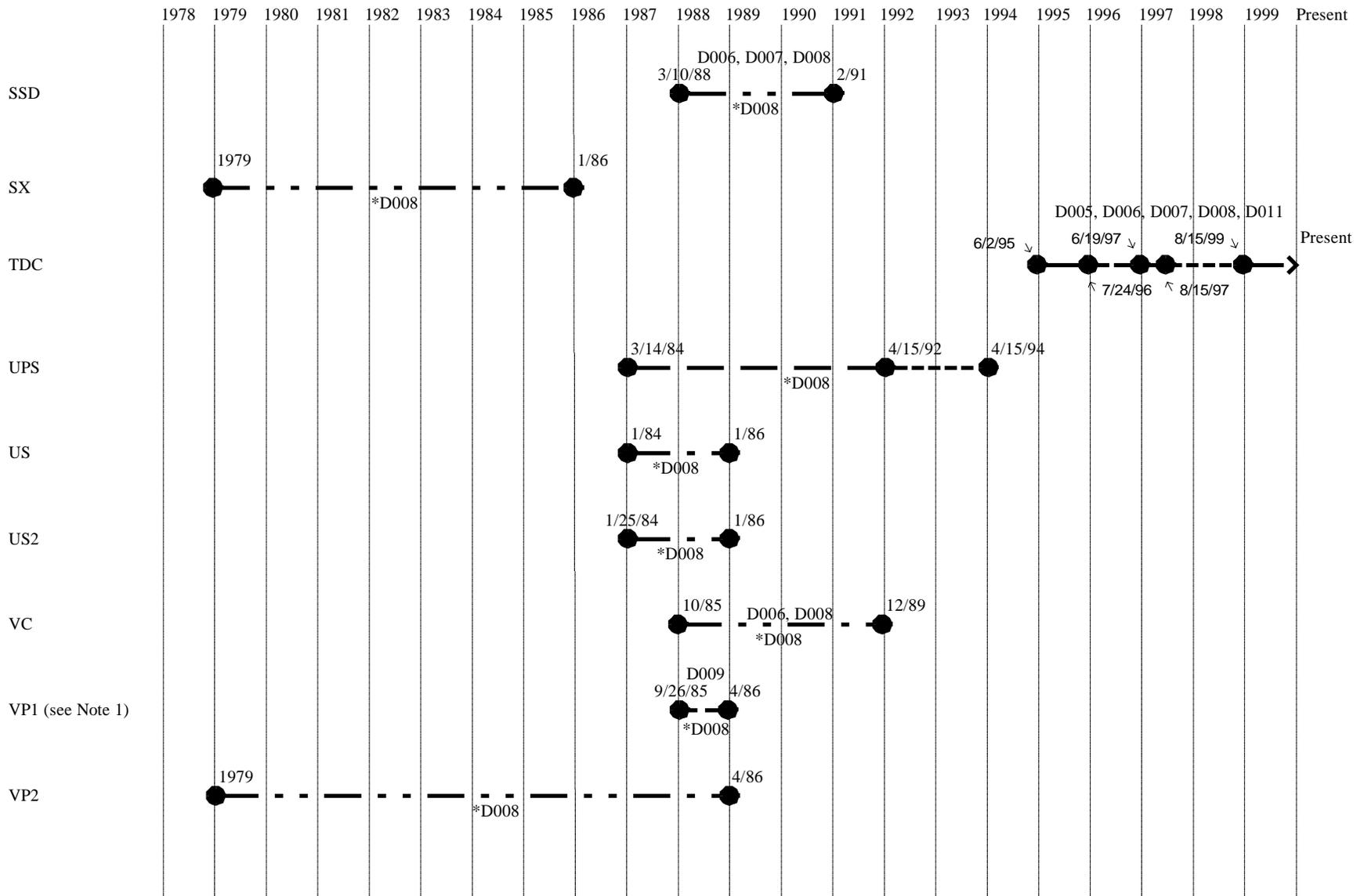
TIMELINE FOR NITRATE OPERATIONS (continued)



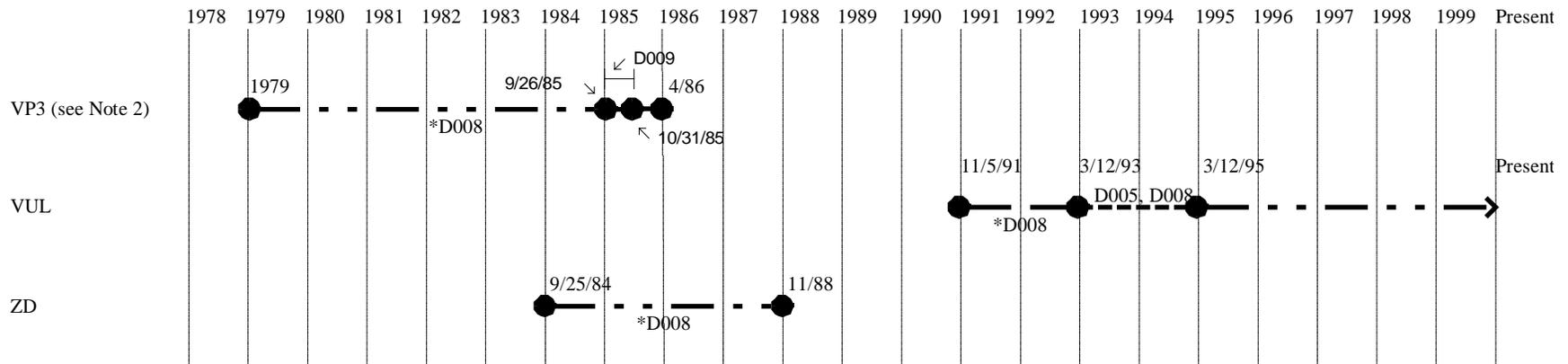
TIMELINE FOR NITRATE OPERATIONS (continued)



TIMELINE FOR NITRATE OPERATIONS (continued)



TIMELINE FOR NITRATE OPERATIONS (continued)



Notes on Time Dependence of RCRA Codes

* D008 - Applies to leaded gloves which were discarded in a separate waste stream after 1992, still under the originating P/S code.

¹ D009 - Mercuric nitrate used in P/S code VP1 from 9/85 to 10/85.

² D011 applies to hydroxide cakes in VP3 from 9/85 to 10/85.

³ D011 -Silver nitrate used in chloride ion exchange from 1985 until end of 1993, hence D011 applies to CD, EV, HCD, HD, IA, DS, and LR.

⁴ D011 applies to P/S code CF from 1985 through 1993.

⁵ F002 - RCRA-listed solvent use discontinued in chloride operations in 1992, but waste containing these solvents may have been generated until the end of 1993. Affected P/S codes in nitrate are CF and HP.

⁶ D006 and D008 applies to P/S code RO from 1979 to 3/89.

⁷ D040 applies to P/S code RO during 1979.

⁸ D006, D007, D008, D009 applies to P/S codes CD, HCD, and HD from 1985 to the present.

⁹ D006 and D008 applies to P/S code ML from 10/18/90 to 1/27/94.

¹⁰ D006 and D008 applies to P/S code VC from 10/85 to 12/89.

¹¹ D006, D007, and D008 applies to P/S code SSD from 3/88 to 2/91.

¹² D006, D007, D008, D009 applies to P/S codes DS, EV, and LR from 1985 to the present.

¹³ D008 and D009 applies from 2/79 to 7/84.

¹⁴ D006 and D008 applies from 1/78 to present.

¹⁵ D019, D021, D022, D039 apply from 1985 to the end of 1996.

TIMELINE EXPLANATION



The P/S code is established in either the P/S diagrams or in both (or all) revisions of the procedures designating the start and end dates (e.g., Rev. 0 to Rev. 1; or Rev. 0 to Rev. 5).



The P/S code is not identified in the procedure, but the process description matches the P/S code and the description in previous or later revisions of the same procedure.



Extrapolate out two (2) years beyond the last procedure to next possible review date.



The P/S code is not identified in the procedure, but the process description matches that of the P/S diagram or P/S code description.



Time period based on subject matter expert comments

PROCESS INPUTS AND OUTPUTS

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
AL	Ash Leach	Incinerator ash	Nitric acid Calcium fluoride Aluminum nitrate	Plutonium solutions	Leached solids Leaded gloves	D005, D006, D007, D008, D011	N-28/TWCP- 3566
AO	Americium Processing Calcination	Americium oxalate and hydroxide cakes	None (physical process)	Pure americium oxide	Americium oxide cakes Leaded gloves	D008	N-81/TWCP- 3568
AP	Americium Purification	Americium in nitric acid solutions	Hydroxylamine nitrate Nitric acid Anion exchange resin	Purified americium solutions Plutonium solutions	Leaded gloves	D007, D008, D009	N-81/TWCP- 3569
AS	Anode Heel Dissolution	Plutonium oxide	Nitric acid Hydrofluoric acid Calcium fluoride	Plutonium solutions Filtered solids	Leaded gloves	D006, D007, D008, D011	N-81/TWCP- 3568
AT	Ash Testing	Incinerator ash	Anion exchange resin Sodium nitrite (20% solution) Ferrous sulfamate (20% solution) Nitric acid Calcium fluoride Silver nitrate (only used in a cold lab; not present in TRU waste)	Plutonium solutions Filtered solids	Filtered solids (< DL) Leaded gloves	D005, D006, D007, D008, D011	N-36/TWCP- 3567

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
ATL	Advanced Test Line for Actinide Separations RD&D	Oxides Ash Chloride salts Metals Sand, slag, crucibles	Aluminum nitrate solution Calcium nitrate solution Calcium fluoride Hydrochloric acid Hydrofluoric acid Nitric acid Anion exchange resin Ascorbic acid Ferrous ammonium sulfate Hydrogen peroxide Hydroxylamine nitrate Sodium nitrite Urea Diethyl oxalate Formamide Formic acid Oxalic acid Sodium hydroxide Sulfuric acid	Plutonium oxide cakes	Residues Nitrate salt solutions Bottoms solutions Leaded gloves	D005, D006, D007, D008, D011	N-20/TWCP-3566
BAC	Bacterial Decomposition of Cellulose Items	Cellulose rags (cheesecloth)	Bacteria	Solutions of glucose and other byproducts	Leaded gloves	D008	N-81/TWCP-3568
BF	Unknown name for this code	Anode heel metal (plutonium oxide)	None (physical process)	Plutonium oxide	Leaded gloves	D006, D007, D008, D011	N-81/TWCP-3568
BL	Blending	Plutonium oxide	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-81/TWCP-3568
BM	Burning Metal	Plutonium oxide Plutonium metal	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-14/TWCP-3548
BU	Button Burning	Plutonium metal buttons; anode heels	None (physical process)	Plutonium oxide	Leaded gloves	D006, D007, D008, D011	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CC	Calcination	Plutonium oxalate cakes	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-81/TWCP-3568
CD	Hydroxide Cake Dissolution	Hydroxide cakes (from chloride operations)	Hydrofluoric acid Nitric acid Aluminum nitrate Calcium fluoride	Plutonium in nitric acid solutions	Residues (< DL) Leaded gloves	D006, D007, D008, D009, D011	N-32/TWCP-3566
CF	Cement Fixation	Aqueous analytical solutions Organic analytical solutions Evaporator bottoms Evaporator salts Fine particulate materials Oils Organic petroleum-based liquids Spent ion exchange resins Americium oxide Calcium chloride salts Chloride solutions Filter aid Glovebox sweepings Graphite powder HEPA filter media High-fired ash Leached ash residues Leached particulate solids	Cement accelerator Nitric acid Organic liquid emulsifier Silicon defoamer Sodium citrate retarder Sodium hydroxide pH 4 phthalate buffer solution pH 7 phosphate buffer solution Gypsum cement	Cemented TRU waste	Leaded gloves	D007, D008, D009, D011, D019, D021, D022, D039, F002, F003	N-1/TWCP-3548 N-67/TWCP-3568 N-68/TWCP-3568 N-69/TWCP-3568 N-70/TWCP-3568 N-71/TWCP-3568 N-72/TWCP-3568 N-73/TWCP-3568 N-74/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CF (continued)		Passivated uranium carbide Plutonium/thorium fluoride filter cakes Plutonium/thorium hydroxide filter cakes Plutonium/uranium filings Pump oils Silica solids Trioctyl phosphine oxide (TOPO) and iodine in kerosene Uranium oxide					
CH	Characterization	Plutonium oxide	Nitrogen gas Viscous water-soluble liquid	Plutonium oxide	Plutonium oxide slurries Leaded gloves	D008	N-81/TWCP-3568
COD	Chlorinated Oxide Dissolution	Chloride pyrochemical salts	Sodium hydroxide solution Nitric acid Hydrofluoric acid	Plutonium oxide cakes Plutonium solutions Plutonium residues	Caustic liquids Leaded gloves	D008	N-81/TWCP-3568
COL	Chlorinated Oxide Leach	Chlorinated oxides Chloride pyrochemical salts	Sodium hydroxide solution	Plutonium oxide cakes (may contain barium)	Caustic liquids Leaded gloves	D005, D008	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CPOD	Catalyzed Electrochemical Plutonium Oxide Dissolver	Plutonium oxide Filter residues Glovebox sweepings Plastic	Nitric acid Silver nitrate Hydrochloric acid Ferric ammonium sulfate hydrate Potassium thiocyanate Calcium fluoride Sodium chloride Water Argon	Plutonium solutions	Electrolytic solutions Silver chloride residues Leaded gloves	D008, D011	N-21/TWCP-3566
CR	Crushing and Pulverizing	Sand, slag, crucible residues Skull oxide Graphite Magnesium oxide Ash	None (physical process)	Crushed materials	Leaded gloves	D008	N-17/TWCP-3548
DF	DS Furnace and Oxide Preparation	Plutonium oxalate cake	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-81/TWCP-3568
DP	Dry Processing	Polycubes (polyethylene with plutonium oxide)	None (physical process)	Crushed polycubes	Leaded gloves	D008	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
DS	Ion Exchange	Plutonium in nitric acid	Anion exchange resin Aluminum nitrate Nitric acid Sodium nitrite Hydroxylamine nitrate Hydrogen peroxide (30%) Oxalic acid Hydrofluoric acid Sodium hydroxide Ferrous sulfamate Ferrous ammonium sulfate Urea Phenolphthalein in ethanol Potassium fluoride hydrate	Plutonium in nitric acid solutions Plutonium oxide	Acidic effluents and filtrate solutions Ion exchange resins Leaded gloves	D006, D007, D008, D009, D011	N-45/TWCP-3567 N-51/TWCP-3567 N-59/TWCP-3567
ED	Cascade Dissolver	Magnesium oxide crucibles Plutonium oxide Oxidized metal, skulls, etc. Incinerator ash	Nitric acid Calcium fluoride Aluminum nitrate	Plutonium in nitric acid solutions	Crucible and metal residues Leaded gloves	D005, D006, D007, D008, D011	N-23/TWCP-3566
ETD	Experimental Thermal Decomposition	Combustible residues	Argon gas	Plutonium oxide Ash	Water scrub solutions	D005, D006, D007, D008, D011	N-81/TWCP-3568
EV	Evaporator	Ion exchange solutions Nitrate salts Oxalate filtrates Nitric acid distillates Vacuum pump seal waters Negative-chilled waters	Nitric acid Formic acid	Plutonium in nitric acid solutions	Nitrate salts Distillate solutions Filtrate solutions Leaded gloves	D006, D007, D008, D009, D011	N-61/TWCP-3568 N-62/TWCP-3568 N-64/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
FA	Americium Processing	Americium/nitric acid solution	Oxalic acid Sodium oxalate	Americium oxalate cakes Americium oxalate solutions	Leaded gloves	D008	N-81/TWCP-3568
FC	Canning	Plutonium oxide	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-81/TWCP-3568
FX	Cement to Drum	Cemented waste, evaporator bottoms	None (physical process)	None	Packaged cemented waste Leaded gloves	D006, D007, D008, D009, D011	N-81/TWCP-3568
GMS	Open Gradient Magnetic Separation	Magnesium oxide Graphite Sand, slag, and crucible residues Plutonium processing residues	None (physical process)	Plutonium-rich materials	Plutonium-lean materials (< DL) Leaded gloves	D008	N-2/TWCP-3548
HC	Calcination	Plutonium oxalate cakes	Water vapor	Plutonium oxide	Leaded gloves	D008	N-81/TWCP-3568
HCD	Hydroxide Cake Dissolution	Hydroxide cakes (from chloride operations)	Hydrofluoric acid Nitric acid Aluminum nitrate Calcium fluoride	Plutonium in nitric acid solutions	Residues (< DL) Leaded gloves	D006, D007, D008, D009, D011	N-32/TWCP-3566
HD	Hydroxide Cake Dissolution	Hydroxide cakes (from chloride operations)	Hydrofluoric acid Nitric acid Aluminum nitrate Calcium fluoride	Plutonium in nitric acid solutions	Residues (< DL) Leaded gloves	D006, D007, D008, D009, D011	N-32/TWCP-3566
HGMS	High Gradient Magnetic Separation	Soil and clay	Water	Plutonium residues	Plutonium residues (< DL)	D006, D007, D008, D009, D011	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
HP	Cement Fixation	Evaporator bottoms Vacuum pump oils Tributylphosphate and iodine in kerosene Analytical chemistry solutions Salts Leached filter paper residues Ash Miscellaneous solutions Americium oxide	Sodium hydroxide Portland cement Gypsum cement Surfactant (polyoxyethylene-20-sorbitan)		Cemented waste Leaded gloves	D007, D008, D009, D011, D019, D021, D022, D039, F002, F003	N-81/TWCP-3568
IA	Impure Americium Holding for Discard	Americium hydroxide cakes	None (no processing performed)	Americium hydroxide cake	Leaded gloves	D006, D007, D008, D009, D011	N-81/TWCP-3568
IS	Incinerator	Combustible materials (e.g., rags, paper wipes, wood) (less than 10% plastic and rubber)	Sodium hydroxide solution Potassium hydroxide solution	Scrubber solutions	Ash Scrubber solutions (< DL) Pump seal solutions Leaded gloves	D005, D006, D007, D008, D011	N-5/TWCP-3548
LC	Uranium/Plutonium Processing	Plutonium oxide	Nitric acid Hydrofluoric acid Oxalic acid Sodium oxalate	Plutonium oxalate	Acidic solutions Uranium nitrate solutions Leaded gloves	D008	N-81/TWCP-3568
LG1	Non Combustible Leach	Debris (metal, glass, plastic)	Nitric acid	Plutonium in nitric acid solutions	Leaded gloves	D006, D008	N-81/TWCP-3568
LG2	Hydroxide Cake Dissolution	Hydroxide cakes	Nitric acid	Plutonium in nitric acid solutions	Leaded gloves	D006, D007, D008, D009, D011	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
LR	Ion Exchange	Plutonium in nitric acid solutions	Ferrous ammonium sulfate Nitric acid Hydroxylamine nitrate Oxalic acid Aluminum nitrate Hydrofluoric acid Urea Anion exchange resin Sodium nitrite Hydrogen peroxide Ferrous sulfamate Phenolphthalein in ethanol Potassium fluoride hydrate	Plutonium in nitric acid solutions Plutonium oxide	Acidic effluents Acidic filtrate solutions Anion exchange resins Leaded gloves	D006, D007, D008, D009, D011	N-42/TWCP-3567 N-45/TWCP-3567 N-51/TWCP-3567
MAG	Magnetic Separation	Magnesium oxide Graphite Sand, slag, and crucible residues Plutonium processing residues	None (physical process)	Plutonium-rich materials	Plutonium-lean materials (< DL) Leaded gloves	D008	N-2/TWCP-3548
MAS	RD&D Experimental Process	Magnesium oxide Graphite Sand, slag, and crucible residues Plutonium processing residues	None (physical process)	Plutonium-rich materials	Plutonium-lean materials (< DL) Leaded gloves	D008	N-2/TWCP-3548
MB	Nitric Dissolution of Molten Salts	Molten salt extraction salts	Hydrochloric acid Nitric acid	Plutonium solutions	Acidic solution Leaded gloves	D005, D007, D008, D009	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
MELL	Mediated Electro-Oxidation of Low Level Waste (LLW)	Cellulose-based materials	Nitric acid Cobalt nitrate Cerium nitrate Platinum anode Titanium anode Stainless steel cathode	Plutonium solutions Plutonium oxide	Plutonium oxide (< DL) Leaded gloves	D006, D007, D008, D009, D011	N-33/TWCP-3566
MF	Metals Furnace	Plutonium metal items	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-81/TWCP-3568
ML	Non-Plutonium Metal Leach	Metal equipment w/ Pu surface contamination	Nitric acid Calcium fluoride Hydrofluoric acid	Plutonium solutions	Metal equipment Leaded gloves	D006, D008	N-29/TWCP-3566
MPD	Cascade Dissolver	Plutonium oxide (salts or residues) Incinerator ash	Nitric acid Calcium fluoride Potassium hydroxide Sodium hydroxide Aluminum nitrate	Plutonium solutions	Plutonium residues (< DL) Leaded gloves	D005, D006, D007, D008, D011	N-25/TWCP-3566
NC	Non-Combustible Leach	Noncombustible material w/ surface Pu contamination	Calcium fluoride Nitric acid Hydrofluoric acid Aluminum nitrate Argon	Plutonium solutions	Leached noncombustible solids Leaded gloves	D006, D008	N-31/TWCP-3566
NL	Non-Combustible Leach	Debris (metal, glass, plastic)	Nitric acid	Plutonium in nitric acid solutions	Residues (< DL) Leaded gloves	D006, D008	N-81/TWCP-3568
NR	Nitrate Recovery	None (not activated)	None	None	None	None	N-81/TWCP-3568
OD	Oxide Dissolution	Coarse oxides	Nitric acid Hydrofluoric acid Aluminum nitrate Calcium fluoride Argon	Plutonium in acidic solutions	Plutonium residues (< DL) Leaded gloves	D006, D007, D008	N-37A/TWCP-3567 N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
OH	Hydroxide Precipitation	Americium hydroxide solutions from the FFTF and Breeder Oxide Production processes	Nitric acid Sodium Hydroxide	Americium solutions Plutonium solutions	Americium solutions (<DL) Leaded gloves	D006, D007, D008, D009, D011	N-55/TWCP-3567
OY	Oxalate Precipitation	Plutonium nitrate solution (eluate from anion exchange)	Oxalic acid Urea Hydroxylamine nitrate Nitric acid Aluminum nitrate solution	Plutonium oxalate cakes Plutonium oxide Plutonium solutions	Plutonium solutions (< DL) Leaded gloves	D008	N-50/TWCP-3567
PA	Passivation	Glovebox sweepings, oxides containing unoxidized plutonium metal, carbides, and nitrides	None (physical process)	Plutonium oxide Passivated materials	Leaded gloves	D008	N-81/TWCP-3568
PAF	Passivation Furnaces	Pyrophoric plutonium metal and alloys	Argon gas	Plutonium oxide	Leaded gloves	D008	N-7/TWCP-3548
PR	Peroxide Precipitation	Oxide dissolution filtrate	Hydrogen peroxide Nitric acid Sulfuric acid Sodium hydroxide	Plutonium in nitric acid solutions	Leaded gloves	D008	N-52/TWCP-3567
PS	Peroxide Precipitation of MSE Salts	Plutonium-containing nitric acid solutions	Hydrogen peroxide Nitric acid Sodium hydroxide solution	Plutonium in nitric acid solutions Americium oxalate cakes	Leaded gloves	D008	N-81/TWCP-3568
PT	Plutonium/Thorium Separation	Plutonium/thorium oxide residues	Nitric acid Nitrate-based ion exchange resin Sodium hydroxide Chloride-based ion exchange resin	Plutonium in nitric acid solutions	Caustic liquids Thorium-containing residues Leaded gloves	D007, D008	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
PTS	RD&D Pretreatment Study	Variety of residue matrices, including ash	None (physical process)	None	Leaded gloves	D005, D006, D007, D008, D011	N-81/TWCP-3568
RB	Roasting and Blending	Plutonium oxide	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-57 N-57A N-57B (all in TWCP-3567)
RBJ	Roasting and Blending Jr	Plutonium oxide	None (physical process)	Plutonium oxide	Leaded gloves	D008	N-57 N-57A N-57B (all in TWCP-3567)
RC	Rotary Calciner	Ash Graphite crucibles Uranium oxide	None (physical process)	Calcined ash	Leaded gloves	D005, D006, D007, D008, D011	N-81/TWCP-356
RCM	Rich Column Material Ion Exchange	Plutonium in nitric acid solutions	Anion exchange resin Aluminum nitrate Nitric acid Sodium nitrite Hydroxylamine nitrate Hydrogen peroxide Oxalic acid Hydrofluoric acid	Plutonium in nitric acid solutions Plutonium oxide	Acidic effluent solutions Filtrate solutions Leaded gloves	D008	N-41/TWCP-3567 N-51/TWCP-3567

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
RFX	Ion Exchange	Plutonium in nitric acid solutions	Anion exchange resin Aluminum nitrate Nitric acid Hydroxylamine nitrate Hydrogen peroxide Oxalic acid Hydrofluoric acid Sodium Nitrite Sodium Hydroxide Phenolphthalein in ethanol Potassium fluoride hydrate	Plutonium in nitric acid solutions Plutonium oxide	Acidic effluents and filtrate solutions Ion exchange resins Leaded gloves	D008	N-45/TWCP-3567 N-47/TWCP-3567
RO	Oil Recovery	Vacuum pump oils Contaminated organics	Trichloroethylene (used once in 1979)	Plutonium residues	Oils and organics on vermiculite Leaded gloves	D006, D008, D040	N-81/TWCP-3568
RR	Ion Exchange	Plutonium in nitric acid solutions	Anion exchange resin Aluminum nitrate Nitric acid Sodium nitrite Hydroxylamine nitrate Hydrogen peroxide Oxalic acid Hydrofluoric acid	Plutonium in nitric acid solutions Plutonium oxide	Acidic effluents and filtrate solutions Ion exchange resins Leaded gloves	D006, D007, D008, D009, D011	N-43/TWCP-3567 N-51/TWCP-3567 N-59/TWCP-3567
SC	Cascade Dissolver, G437	Sand, slag, and crucible residues Ash Magnesium oxide crucibles	Potassium hydroxide Sodium hydroxide Nitric acid Aluminum nitrate Calcium fluoride Hydrofluoric acid	Plutonium in nitric acid solutions Plutonium oxide residues	Alkaline scrubber solutions Residues (< DL) Leaded gloves	D005, D006, D007, D008, D011	N-24/TWCP-3566

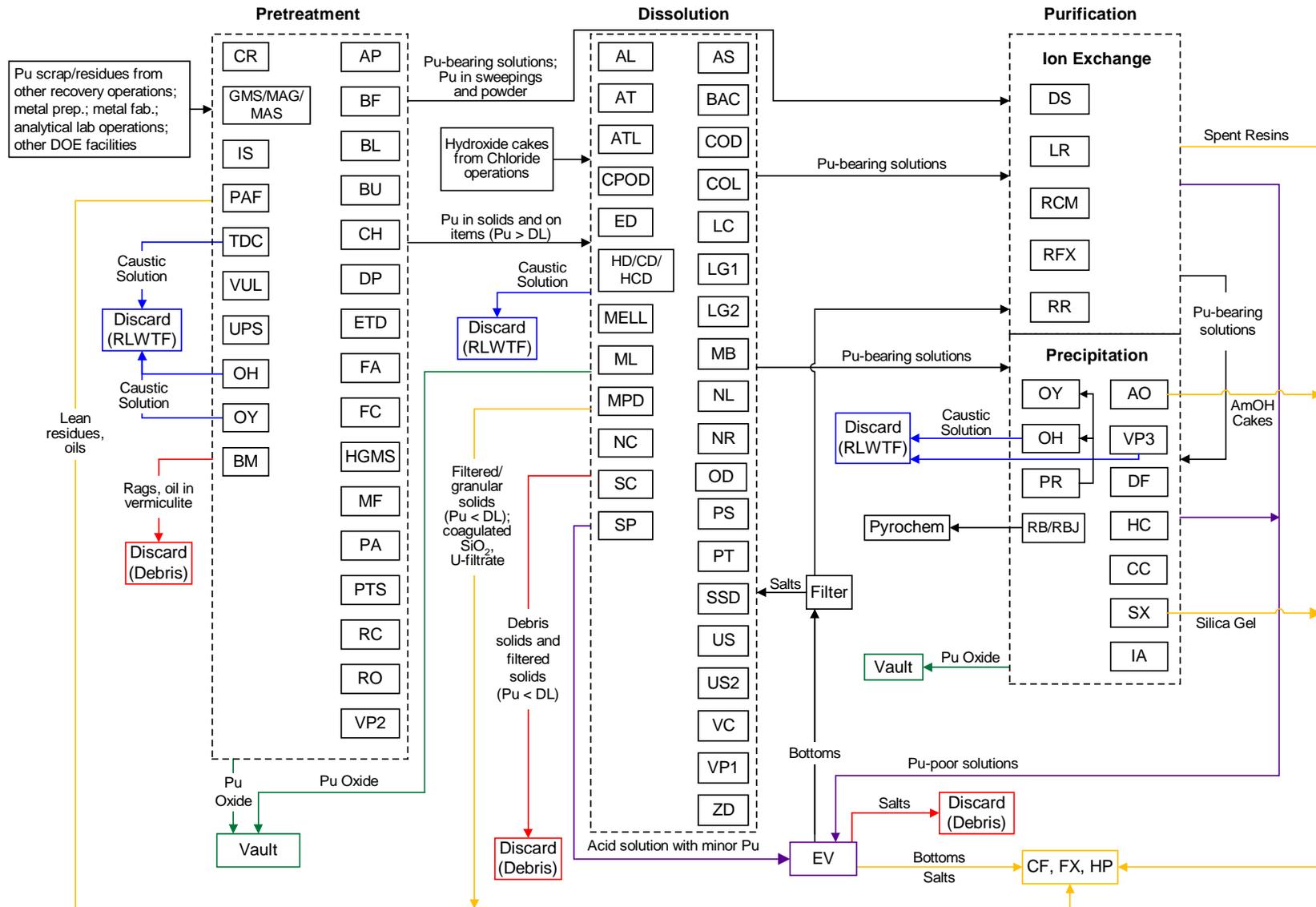
P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
SP	Scrap Dissolution, G438	Filter residues Glovebox sweepings Coarse oxides	Nitric acid Hydrofluoric acid Aluminum nitrate Calcium fluoride Argon	Plutonium oxide residues Plutonium filtrate solutions	Acidic scrubber solutions Residues (<DL) Leaded gloves	D007, D008	N-37/TWCP-3567 N-37A/TWCP-3567
SSD	Special Scrap Dissolution	Miscellaneous oxide scrap items	Nitric acid Hydrofluoric acid	Plutonium in nitric acid solutions	Residues Leaded gloves	D006, D007, D008	N-81/TWCP-3568
SX	Americium Processing Silicon Removal	Americium-containing hydroxide cakes	Nitric acid	Americium solutions	Silica gels Leaded gloves	D008	N-81/TWCP-3568
TDC	Thermal Decomposition of Cellulose Items R&D	Cellulose items	Potassium hydroxide Argon Filter Aid	Plutonium solutions Plutonium residue Ash	Caustic scrubber solutions Plutonium solutions (< DL) Leaded gloves	D005, D006, D007, D008, D011	N-6/TWCP-3548 N-12/TWCP-3548
UPS	Uranium/Plutonium Separation	Uranium-plutonium oxide mixtures	Aluminum nitrate Nitric acid	Plutonium oxide	Uranium wash and filtrate solutions Leaded gloves	D008	N-19/TWCP-3566
US	Uranium Separation for Solid Solution Feed	Calcined solid solutions containing uranium or plutonium oxide	Nitric acid Oxalic acid Sodium oxalate	Plutonium oxide	Acidic uranium solutions Leaded gloves	D008	N-81/TWCP-3568
US2	Uranium Separation for Non-Solid Solution Feed	Plutonium/uranium oxide	Nitric acid	Plutonium oxide	Acidic uranium solutions Leaded gloves	D008	N-81/TWCP-3568
VC	Variable CSMO Scrap Dissolution	Miscellaneous oxide scrap items	Nitric acid Hydrofluoric acid	Plutonium nitrate solutions	Residues (< DL) Leaded gloves	D006, D008	N-81/TWCP-3568

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
VP1	CSMO Scrap Dissolution	Plutonium/aluminum alloy	Nitric acid Mercuric nitrate (catalyst) Sodium hydroxide Oxalic acid Sodium oxalate	Plutonium oxide cakes Plutonium oxalate solutions	Aluminum metal pieces Aluminum nitrate sludge Leaded gloves	D008, D009	N-81/TWCP-3568
VP2	Polycube Processing	Skins and fragments of polycubes	None (physical process)	Plutonium oxide	Polystyrene breakdown products (oils) Vacuum pump oil Leaded gloves	D008	N-81/TWCP-3568
VP3	Hydroxide Precipitation	Oxalate solutions	Sodium hydroxide	Plutonium hydroxide cakes	Caustic waste Hydroxide cakes (< DL) Leaded gloves	D008, D009	N-81/TWCP-3568
VUL	Vessel Unloading	Vessels	WD-40 Vacuum grease Silicon adhesive Pneumatic tool oil	Vessels Residues	Metal and wire debris Leaded gloves	D005, D008	N-9/TWCP-3548
ZD	Scrap Oxide Dissolution	Scrap and impure plutonium oxide	Nitric acid Hydrofluoric acid	Plutonium oxide Plutonium solutions	Leaded gloves	D008	N-81/TWCP-3568

¹All P/S codes generate routine laboratory debris waste. For those P/S codes that generate only debris waste, this column is left blank. The debris waste may consist of glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools.

²The EPA hazardous waste codes listed apply to the solid TRU waste only and not to any other waste forms that may undergo further treatment or processing (e.g., evaporation or cement fixation) before becoming the final waste form to be shipped to the WIPP. The resulting treated waste stream in its final waste form is evaluated for hazardous waste constituents and assigned the applicable EPA hazardous waste codes at that time. All P/S codes have the potential to generate leaded gloves. See discussion in sections 3.5.1 and 4.2 for the disposition of these gloves.

GENERALIZED PROCESS STATUS DIAGRAM FOR NITRATE PROCESSES



TA-55 PLUTONIUM FACILITY

ACCEPTABLE KNOWLEDGE REPORT

REPORT TITLE: Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55

REPORT NUMBER: TWCP-AK-2.1-006,R.1 (LA-UR-00-5862)

WASTE GENERATED FROM PROCESS/STATUS CODES: CRD, ER, MO, MP, Neptunium, OR, PK, PTP, RA, SCB, SD, SS, and SSMD

EFFECTIVE DATE: 12/04/00

NEXT REVIEW DATE: 12/04/02

DOCUMENT PREPARER:

John Musgrave 12/04/00
NAME DATE

APPROVALS:

June Fabryka-Martin 12/04/00
INDEPENDENT TECHNICAL REVIEWER/EDITOR DATE

Pamela Rogers 12/04/00
SITE PROJECT MANAGER DATE

Matt J. Riggs 12/04/00
WASTE CERTIFICATION OFFICIAL DATE

M A Gavett 12/04/00
SITE PROJECT QA OFFICER DATE

Charles L. Foxx 12/04/00
FACILITY REPRESENTATIVE DATE

CONTENTS

Section	Page
ACRONYMS	iv
PROCESS/STATUS (P/S) CODE INDEX.....	vi
PROCESS ACCEPTABLE KNOWLEDGE SUMMARY.....	vii
1.0 INTRODUCTION.....	1
2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS	1
3.0 DESCRIPTION OF THE PROCESS WASTE.....	3
3.1 Facility and Mission	3
3.2 Waste Physical Form and Content Description.....	3
3.3 Waste Volume and Time Period of Waste Generation	4
3.4 Waste Generation Processes.....	4
3.5 Material Inputs to the Waste Generation Process	13
4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS.....	17
4.1 F, K, and P Listings.....	17
4.2 Toxicity Listings.....	17
4.3 Corrosivity, Reactivity, and Ignitability	19
5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION.....	19
6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED	19
7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED	20
8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS ...	21
9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM	22
10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE.....	22
11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS	22
Tables	
1 Process Feed Materials for Pyrochemical Operations.....	14
2 Average Isotopic Content of Plutonium Material Types and Enrichments (Weights %) .	15
3 Chemical Inputs to Processes Described in This Report.....	18
Attachments	
1 Acceptable Knowledge Roadmap (7 pages)	
2 LANL and TA-55 Sites Maps (2 pages)	
3 Timeline for Pyrochemical Processes (3 pages)	
4 Process Inputs and Outputs (4 pages)	
5 Simplified Process Status Diagram (1 page)	

ACRONYMS

AK	acceptable knowledge
CFR	Code of Federal Regulations
D	RCRA hazardous waste code for wastes with hazardous characteristics, defined in 40 CFR Subpart C, Sections 261.21 to 261.24
DL	discard limit
DOE	U.S. Department of Energy
DOR	direct oxide reduction (process conducted under P/S code OR)
DWLS	Discardable Waste Log Sheet
EPA	U.S. Environmental Protection Agency
ER	electrorefining
F	RCRA hazardous waste code for hazardous wastes from non-specific sources, defined in 40 CFR Subpart D, Section 261.31
HEPA	high-efficiency particulate air
K	RCRA hazardous waste code for hazardous wastes from specific sources, defined in 40 CFR Subpart D, Section 261.32
LANL	Los Alamos National Laboratory
MCDOR	multicycle direct oxide reduction
MPL	metal preparation line
MSE	molten salt extraction
MT	Material Type
NMT	Nuclear Material Technology
P	RCRA hazardous waste code for discarded commercial chemical products, off-specification species, container residues, and spill residues, defined in 40 CFR Subpart D, Section 261.33
P/S [code]	process/status [code]
PCB	polychlorinated biphenyl
PF-4	Plutonium Facility, Building 4
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RD&D	research, development and demonstration
RLWTF	Radioactive Liquid Waste Treatment Facility
RMDC	records management/document control
Sampling Plan	<i>Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001)</i>
SME	subject matter expert
SOP	safe/standard operating procedure
TA	technical area
TRU	transuranic
TWCP	Transuranic Waste Characterization/Certification Program
UCNI	Unclassified Controlled Nuclear Information
WAC	waste acceptance criteria
WIPP WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)</i>

WIPP WAP	Attachment B, Waste Analysis Plan, to the <i>Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant</i> (EPA No. NM4890139088)
WIPP	Waste Isolation Pilot Plant
WODF	Waste Origination and Disposition Form
WPRF	Waste Profile Request form

PROCESS/STATUS (P/S) CODE INDEX

Note: This index indicates the main process AK summary report and report section that covers each P/S code mentioned in this report.

P/S Code	P/S Name	Process AK Summary Report and Report Section*
CA	Casting	Metal Operation Processes 3.4.2, Att. 4
CRD	Chlorination/reduction RD&D	Pyrochemical Processes 3.4, Att. 4
CX	Chloride Anion Exchange	Chloride Operations 3.4.2, 3.4.3, 3.4.4, Att. 4
CXL	Experimental Chloride Extraction Line	Chloride Operations 3.4.2, 3.4.3, Att. 4
DO	Dissolution of Oxide	Special Processing 3.4.3, 3.4.5, 3.4.7, Att. 4
DS	Ion Exchange	Nitrate Operations 3.4.3, Att. 4
ED	Cascade Dissolver	Nitrate Operations 3.4.2, Att. 4
ER	Electrorefining	Pyrochemical Processes 3.4.4, Att. 4
LR	Ion Exchange	Nitrate Operations 3.4.3, Att. 4
MA	Machining	Metal Operation Processes 3.4.2, Att. 4
MO	Metal Oxidation, Room 429	Pyrochemical Processes 3.4.9, Att. 4
MP	Metal Preparation	Pyrochemical Processes 3.4.1, Att. 4
NEPTUNIUM	Neptunium	Pyrochemical Processes 3.4.10, Att. 4
OR	Direct Oxide Reduction	Pyrochemical Processes 3.4.2, Att. 4
PK	Pickling and Nitrate Holding	Pyrochemical Processes 3.4.11, Att. 4
PTP	Plutonium Trichloride Preparation	Pyrochemical Processes 3.4.12, Att. 4
RA	Recovery of Anodes	Pyrochemical Processes 3.4.6, Att. 4
RB	Roasting and Blending	Nitrate Operations 3.4.3, Att. 4
RBJ	Roasting and Blending Jr	Nitrate Operations 3.4.3, Att. 4
SC	Cascade Dissolver, G437	Nitrate Operations 3.4.2, Att. 4
SCB	Chlorination Ca/Al Scrubbing RD&D	Pyrochemical Processes 3.4.2, Att. 4
SD	Salt Distillation	Pyrochemical Processes 3.4.5, Att. 4
SS	Salt Stripping	Pyrochemical Processes 3.4.3, 3.4.4, 3.4.5, 3.4.7, 3.4.8, Att. 4
SSMD	SS Material Development	Pyrochemical Processes 3.4, Att. 4
WM	Waste Management	Miscellaneous Operations 3.4.9, Att. 4

* Process AK summary reports: Chloride Operations (TWCP-AK-2.1-002,R.1), Metal Operation Processes (TWCP-AK-2.1-003,R.1), Miscellaneous Operations (TWCP-AK-2.1-004,R.1), Nitrate Operations (TWCP-AK-2.1-005,R.1), Pyrochemical Processes (this report), Special Processing (TWCP-AK-2.1-007,R.1)

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY

Waste-generating process: Pyrochemical Processes

P/S codes: CRD, ER, MO, MP, Neptunium, OR, PK, PTP, RA, SCB, SD, SS, and SSMD

Type of waste generated:

Retrievably stored and newly generated, mixed and non-mixed pyrochemical salts and debris.

Site: LANL

Facility Mission (including defense and non-defense programs):

TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites in the defense complex. The recovered plutonium is converted into pure plutonium feedstock. These manufacturing and recovery operations, as well as associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste contaminated scrap, residues, and debris generated at TA-55. The scrap and residues are processed to recover as much plutonium as practicable before disposal. Wastes from pyrochemical operations are generated from plutonium metal preparation and purification for defense programs; these wastes may have been generated and produced in the same rooms as were used for non-defense activities and so were not segregated from non-defense waste until August 27, 1998.

Area(s) or building(s) where the process waste was generated (including operations carried out in those areas):

TA-55 Plutonium Facility (Building PF-4), 400 Wing. Pyrochemical operations include processes for the preparation and purification of plutonium metal.

Description of the process waste (physical form and typical content description):

Waste from pyrochemical operations consists primarily of slag containing chloride salts, calcium fluoride and calcium oxide salts; crucibles; debris waste including cellulosic, plastic, rubber, glass, and metal items. Liquid waste is sent to the Radioactive Liquid Waste Treatment Facility at TA-50.

Description of the waste-generating process:

The overall goal of the pyrochemical operations is to prepare plutonium from impure metal, metal alloys, oxides, scrap, and residues and produce a purified plutonium metal. Processes include the metal preparation line, single-pass and multicycle direct oxide reduction, electrorefining, molten salt extraction, salt stripping, salt distillation, carbonate oxidation, oxygen sparge, and pyroredox.

Process feed:

Plutonium metal, metal alloys, or oxides; plutonium scrap; Np-237 (briefly in 1993).

Radioisotopic content of the waste:

Variety of plutonium material types with different isotopic compositions. Am-241, Am-243, Np-237, and U-234 may be present at detectable concentrations as decay products of their plutonium precursors. Some processes separate plutonium and americium so that the waste will usually be enriched in americium, but may also be depleted in some cases. Np-237 may be the dominant radionuclide in some cases.

RCRA Constituents/EPA Hazardous Waste Numbers:

- D005 (barium) applies to salt waste generated under P/S code RA
- D006 (cadmium) and D008 (lead) apply to P/S codes ER and SS
- D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver): zinc metal waste from P/S code RA
- D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver): waste from P/S code PK
- D008 (lead): metal waste debris from all P/S codes in pyrochemical processes due to disposal of leaded gloves; after May 1992, leaded gloves were separated from other metal debris
- D009 (mercury): waste from P/S code SSMD during the summer of 1994
- D019 (carbon tetrachloride): waste from P/S code PTP (1986 to early 1988)
- No F or K codes
- P120 (vanadium pentoxide): waste from P/S code SD from 02/98 to 03/98; and P/S code SS from 5/27/98 to 6/10/98

Process waste volume (if known):

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are segregated into waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

Years of generation for the process waste: 1979–present

ACCEPTABLE KNOWLEDGE SUMMARY REPORT FOR PYROCHEMICAL PROCESSES AT TA-55

1.0 INTRODUCTION

All transuranic (TRU) waste must be sufficiently characterized and certified before it is shipped to the Waste Isolation Pilot Plant (WIPP). The U.S. Environmental Protection Agency (EPA) allows use of acceptable knowledge (AK) for waste characterization. EPA uses the term AK in its guidance document, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. Attachment B, Waste Analysis Plan, to the *Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088) (WIPP WAP) defines AK and provides guidelines on how AK should be obtained and documented.

This process AK summary report was prepared in accordance with *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5). The primary purpose of this report is to systematically organize, evaluate, and summarize detailed AK information about individual processes used by one of the TRU-waste generators at Los Alamos National Laboratory (LANL). By doing so, this report provides detailed technical support for one or more waste stream AK summary reports that include these process wastes.

2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS

The AK search for the information related to Technical Area (TA)-55 waste streams resulting from pyrochemical processes covered:

- Review of the *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3) (Sampling Plan) that includes information regarding all TRU waste streams
- Review of documents related to waste generation and waste management activities at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)
- Interviews with personnel involved with waste generation and waste management at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)

NOTE: Much of the AK information related to pyrochemical processes is contained in Transuranic Waste Characterization/Certification Project (TWCP) Record No. TWCP-3542. Individual documents in this record have been assigned a separate identifier, PYRO-nn, where nn is a sequential 1- or 2-digit number. This referencing nomenclature is used throughout this report and its attachments.

- Analyses of individual processes generating waste, and evaluations of the potential for Resource Conservation and Recovery Act (RCRA)-regulated constituents to be

present in the process wastes, based on subject matter expert (SME) interviews and any available data

The TWCP Records Management/Document Control (RMDC) Center contains copies of the documents referenced in this report. Any Unclassified Controlled Nuclear Information (UCNI) will be contained in these records, and will not be included in this report. Such records are identified as UCNI in the Acceptable Knowledge Roadmap (Attachment 1).

This process AK summary report is part of a set of closely-related reports about TRU-waste generating activities at TA-55. For convenience in organizing AK for plutonium processing at this facility, the processes were categorized into six arbitrary operational areas. The multiple processes in each area are then described in detail in the following six process AK reports for plutonium:

- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004)
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005)
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006 [this report])
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007)

Each process AK report contains information on multiple individual processes that are assigned unique identifiers called process/status (P/S) codes. For example, pyrochemical processes include 13 individual processes that are each assigned a P/S code, as listed on the cover page of this report. The search and compilation of AK information was based on P/S code because that is the most detailed level of process information generally recorded in waste generation records. The process AK reports frequently cross-reference one another because P/S codes in one operational area often provide the material feed for P/S codes in another area. An index of P/S codes cited in this process AK report follows the list of acronyms; this index lists process descriptions and the primary process AK report in which that P/S code is discussed.

3.0 DESCRIPTION OF THE PROCESS WASTE

The following sections describe processes used in pyrochemical processes, and identify the resulting wastes as well as outputs that are sent to other operations, such as nitrate operations, for further processing.

3.1 Facility and Mission

The TA-55 Plutonium Facility (Building PF-4) recovers plutonium from scrap and residues generated throughout the U.S. Department of Energy (DOE) defense complex, and processes it into pure plutonium oxide for conversion to metal and other products. A LANL site map and a detailed map of the buildings at TA-55, including Building PF-4, are shown in Attachment 2.

Processes in pyrochemical operations were solely defense related (TWCP-614, TWCP-4162). However, wastes from various processes were not segregated by funding source, waste-generating process, or waste-generating location (e.g., room or glovebox) until recently (August 27, 1998), but rather were segregated and packaged based on waste type (TWCP-887, TWCP-4162, TWCP-4167). Consequently, a single waste container often contains wastes from multiple processes. Some debris waste was also co-mingled with room trash related to these same operations (both defense and non-defense), and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits (TWCP-816).

3.2 Waste Physical Form and Content Description

Wastes generated during pyrochemical operations are defined as retrievably stored TRU waste. The waste contains a variety of pyrochemical chloride salts as well as mixtures of calcium fluoride and calcium oxide salts, that were generated as byproducts of the operations and that met the discard limit for plutonium content. Debris wastes and caustic liquid wastes sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50 are also covered by this process AK report. General debris waste categories from pyrochemical processes include

- Cellulose-based waste (for example, paper, cloth)
- Plastic-based waste (for example, gloves, tape, labware)
- Rubber
- Magnesium oxide crucibles

- Metal debris (for example, tantalum crucibles, wire, hose clamps, tools, labware)
- Glass debris

These debris items are contaminated with small amounts of radioactive and chemical substances from pyrochemical processes.

3.3 Waste Volume and Time Period of Generation

This report covers waste streams generated from 1979, when pyrochemical processes first began in Building PF-4, to the present. Wastes from the pyrochemical processes have different associated RCRA codes depending on the time period during which they were generated. The P/S codes, their time period of generation, and corresponding RCRA codes are shown graphically in Attachment 3, Timeline for Pyrochemical Processes.

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are assigned to waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

3.4 Waste Generation Processes

The following subsections describe the generation of waste by pyrochemical processes, as well as product and waste outputs to other processes or operations.

Manufacturing and research operations performed at TA-55 results in the production of plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as is practical (TWCP-352). TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities. The metal production and purification operations as well as associated maintenance operations are the sources of most TRU waste generated from pyrochemical processing.

Detailed information about the TA-55 plutonium recovery processes can be found in *Waste from Plutonium Conversion and Scrap Recovery Operations* (TWCP-352). A full-block flow diagram for plutonium processing and waste management at TA-55 is given in reference TWCP-886. In general, TA-55 plutonium recovery processes can be divided into six major processes:

- Head-end operations
- Aqueous nitrate-based processes
- Aqueous chloride-based processes
- Separation and purification by precipitation

- Metal preparation and purification (pyrochemical processes)
- Aqueous waste treatment

This report focuses on metal preparation and purification processes (pyrochemical processes). Pyrochemical operations for plutonium include the following processes:

- metal preparation line (MPL) (P/S code MP),
- single-pass direct oxide reduction (DOR) and multiple-cycle direct oxide reduction (MCDOR) with in-situ regeneration and electrorefining (P/S code OR),
- electrorefining (ER) (initially P/S code ER; but now part of P/S code SS),
- molten salt extraction (MSE) (P/S code SS),
- salt stripping (salt stripping, salt distillation, carbonate oxidation, and oxygen sparging) (P/S code SS),
- pyroredox (P/S code RA),
- pickling (P/S code PK) and metal oxidation (P/S code MO).

NOTE: In contrast with most P/S codes, P/S code SS has grown over the years to encompass several activities that are different steps in the metal refining process, rather than representing a single distinct operation. As such, discussion of this P/S code is covered under more than one subsection.

Several research and development (R&D) processes also took place in pyrochemical operations:

- Chlorination/Reduction R&D (P/S code CRD),
- Chlorination Ca/Al Scrubbing R&D (P/S code SCB) (PYRO-24/TWCP-3542), and
- Salt Stripping Materials Development (P/S code SSMD) (PYRO-22/TWCP-3542).

Each of these processes is described below. A complete listing of P/S codes for pyrochemical processes, their descriptions, feed materials, and inputs and outputs is found in Attachment 4. A simplified process flow diagram for pyrochemical processes is found in Attachment 5.

3.4.1 Metal Preparation Line (P/S code MP)

The MPL (conducted under P/S code MP) produced plutonium metal from the tetrafluoride salt until 1992 (TWCP-352). Plutonium oxides derived from the calcination of oxalate or peroxide precipitates (in nitrate operations) are reacted with hydrogen fluoride gas to form plutonium tetrafluoride. Because the plutonium oxide feed material had been purified in previous aqueous processes, it contained less than trace amounts of RCRA-regulated metal impurities. Input material came from the vault or P/S codes RB or RBJ (in nitrate operations). In the metal production process, plutonium oxide is converted to plutonium tetrafluoride, which in turn is reacted at high temperature (600°C to 2000°C) with metallic calcium in a magnesium oxide crucible. Iodine was added as a reaction initiator. The desired product was plutonium metal, which was recovered as a button by breaking the crucible and mechanically separating the contents. The metal was transferred to P/S codes SS or CA or sent to the vault.

The waste products were calcium fluoride (CaF_2) and calcium iodide (CaI_2), which formed a slag, magnesium oxide sand, and magnesium oxide crucible pieces. These were discarded under P/S code MP if the plutonium content was below the discard limit (DL). If the plutonium content was above the DL, the slag and crucible pieces were sent to nitrate operations (TWCP-AK-2.1-005,R.1) to be dissolved in nitric acid (HNO_3) and aluminum oxide (Al_2O_3). The leached materials were then discarded under P/S codes ED or SC, with the waste described as leached solids. The leachate was also treated in nitrate operations under P/S code DS to recover the plutonium. The magnesium oxide sand was reused if possible.

Little or no purification of the plutonium occurred during this process. However, because the reagents introduced no impurities and the highest purity feed material was used, the resulting metal was often satisfactory for high-purity applications. In this process, any trace metals were below the toxicity characteristic levels, so that the associated debris and slag wastes were below the toxicity characteristic levels in RCRA metal content (TWCP-2502).

3.4.2 DOR and MCDOR (P/S codes OR and SCB)

Prior to the multiple-cycle DOR process, a single pass DOR process was used for plutonium oxide (TWCP-2507, PYRO-14/TWCP-3542). Plutonium oxide and calcium metal are reacted in molten calcium chloride (CaCl_2) or CaCl_2 mixed with calcium fluoride (CaF_2), to produce plutonium metal. The reaction is conducted in a magnesium

oxide (MgO) crucible at 820°C to 875°C. Any arsenic, mercury or selenium present in the impure plutonium oxide would be driven off due to their volatility at this high temperature (TWCP-1258). The reaction proceeds to completion when excess calcium is present and when sufficient CaCl_2 is available to dissolve the calcium oxide (CaO) product.

After cooling, a plutonium metal button is removed by breaking the crucible. A layer of salt above the button contains unreacted oxide and metal shot, which was sometimes recovered by addition of fresh salt plus additional calcium metal. The process was then rerun. If the unreacted oxide and metal shot did not process after the second run, the material was sent to aqueous recovery. The product plutonium metal contains significant impurities, including additional metal impurities derived from the calcium metal and calcium chloride reagents. It must be further purified by ER. All DOR salts were oxygen sparged, which would have oxidized any pyrophoric metals that might have been present. The salt is then either routed through aqueous chloride operations to recover the plutonium, or else discarded as waste along with the remaining calcium metal and MgO crucible pieces. After May 1987, spent salts above the DL were sent to controlled oxidation to oxidize the pyrophoric metals.

The feed oxide, reagent salts and reductant are of the highest purity available because the process is non-purifying. In fact, the plutonium metal produced from this operation is always less pure than the feed material due to impurities derived from the reductant reagents. Plutonium metal from this process typically requires further processing to meet purity requirements.

To minimize the salt waste, the MCDOR process was started in 1988 (TWCP-2502, PYRO-16/TWCP-3542). In this process, the molten salt is regenerated by sparging the CaCl_2 -CaO mixture with chlorine gas between multiple plutonium metal production runs. After approximately five cycles of metal production, the mixture is cooled and the salt and metal phases are separated. The salt is chlorinated and reused for MCDOR. The salt is discarded under P/S code OR if the plutonium concentration is below the DL. The salts above the DL are returned to P/S code CXL for dissolution and recovery. Before 1987, the salts may have been discarded under P/S code OR or routed to chloride operations. The chlorine off-gas is passed through a caustic scrubber, with the caustic solution going to the RLWTF at TA-50 for disposal if the solution meets this facility's Waste Acceptance Criteria (WAC). If the solution does not meet the WAC, it is returned to P/S code CXL for additional treatment.

MCDOR process inputs are low in contaminants. Only high-purity reagent chemical salts are used in the process, and the plutonium oxide feed materials are also of high purity, with absorbed water being the main impurity. MCDOR metal feed material analytical samples were analyzed for cadmium, chromium, lead, and silver. A review of 100 analyses showed that, even in the most impure sample, these D-listed toxicity characteristic metals were well below RCRA regulatory limits (TWCP-2540), as follows:

Metal	Totals Analysis	Calculated TCLP Result	Regulatory Level
Cadmium	<10 ppm	<0.5 mg/L	1 mg/L
Chromium	30 ppm	1.5 mg/L	5 mg/L
Lead	20 ppm	1 mg/L	5 mg/L
Silver	2 ppm	0.1 mg/L	5 mg/L

All metal impurities except barium would be reduced to the metal state and remain with the plutonium metal phase rather than be transferred into the molten salt phase. Hence, the molten salt phase is purified of regulated metals except for barium. These regulated metals will be present in the waste salt at levels below the toxicity characteristic levels. Because the salts are reused, only the initial reduction in fresh salt would contain any of the salt feed impurities.

The waste salt, crucibles, and debris waste items associated with this process are discarded under P/S codes OR or CXL. Asbestos gloves were also used in glovebox operations under P/S code OR, and were disposed as part of ceramic and glass debris wastes.

P/S code SCB was an R&D effort examining the feasibility of this process at extracting Pu (MT 52) from salt before discarding the salt. Pu was chlorinated then reduced to the metal with calcium metal (similar to DOR).

3.4.3 Molten Salt Extraction (P/S code SS)

MSE is used to separate americium and the more reactive elements such as rare earth elements, alkali metals, and alkaline earth metals from plutonium metal (PYRO-4/TWCP-3542, TWCP-352). This process is employed only if the americium content is greater than 1000 ppm (TWCP-2506). In the original process, which operated from 1979 to 1988, magnesium chloride ($MgCl_2$) was added to the impure plutonium metal in a molten salt of sodium chloride (NaCl) and potassium chloride

(KCl), contained in a MgO crucible and heated to 750°C. The magnesium chloride oxidized americium to AmCl_3 , although some plutonium was also converted to the chloride salt form. In 1988, the MSE process was converted to use plutonium chloride (PuCl_3) produced by in-situ chlorination in a tantalum crucible. In the LANL process, 90 percent of the americium and 10 percent of the plutonium are transferred from the feed metal to the salt. After cooling, the salt and metal are mechanically separated. The salts are transferred to the salt stripping process under P/S code SS.

In the late 1980s, several chloride salt systems were studied, including lithium chloride (LiCl), potassium chloride (KCl), calcium chloride (CaCl_2), and NaCl/ CaCl_2 .

3.4.4 Electrorefining (currently part of P/S code SS, historically P/S code ER)

The ER process was introduced in 1962 at TA-21 and was moved to TA-55 in 1979. This process takes impure metal from the MSE and MCDOR (DOR) processes and produces high purity plutonium metal (PYRO-2, PYRO-3, PYRO-4, PYRO-6, PYRO-17 [all in TWCP-3542], TWCP-2505). Impure plutonium is cast as an anode, which is then placed in a magnesium oxide crucible with a salt mixture, a metal cathode (typically tungsten), and a seeding reagent that is MgCl_2 or PuCl_3 (TWCP-2505). After the anode and salt melt, current is applied to the system, and plutonium at the anode is oxidized to plutonium ions, which travel to the cathode and are reduced back to the metal state. Impurities in the original plutonium anode that are less electroactive than plutonium (including cadmium, chromium, lead, and silver) remain in the anode, while impurities more electroactive than plutonium (including barium) are left in the molten salt. After cooling, the crucible is broken and the residues are physically separated from the high purity product metal. Anode heels were sent to pyroredox (P/S code RA) from 1984 to 1986. Currently, salts are sent to P/S code CXL (chloride operations) or carbonate oxidation/distillation (section 3.4.5).

From 1987 to 1989, secondary solvent metals such as cadmium, bismuth, lead, and gallium were added to experimental studies of the electrorefining process (PYRO-15/TWCP-3542). The salts and crucibles from those ER runs may be contaminated with additional cadmium and lead, although those metals should have remained in the anode heels. However, these particular anode heels are retained in the vault at TA-55, with no plans to reprocess them in the near future. Crucible wastes were discarded under P/S code SS. Salts are stored in the vault; very little salt from this process met the DL.

3.4.5 Salt Stripping (P/S codes SD and SS)

The MSE and ER salts are further treated by salt stripping, oxygen sparging or carbonate oxidation, and salt distillation (PYRO-7, PYRO-8, PYRO-9, PYRO-10 [all in TWCP-3542], TWCP-2498). The salt stripping process treats the residue by melting and stirring the salt with calcium metal in a magnesium oxide crucible at 850°C (TWCP-2502). This treatment reduces the plutonium in the salt to metal and allows the metal to coalesce for physical removal and recovery. After cooling, the crucible is broken and the metal physically separated and recycled to the ER process or burned to oxide and sent back through aqueous recovery. The crucible shards are transferred to P/S code CXL, leached in hydrochloric acid, then discarded under CXL. During the salt stripping, the RCRA-regulated metals, except for barium, will be reduced with plutonium into the metal product, so that the salt is essentially free of heavy metals but may still contain barium, although this element is unlikely to be present above RCRA threshold levels.

Oxygen sparging and, since 1996, carbonate oxidation are used to ensure that any plutonium, americium, or metallic sodium or potassium left in the salts are converted to nonpyrophoric oxide forms. The NaCl/KCl salt is either discarded under P/S code SS or distilled for recycle and discarded under P/S codes SS or SD. CaCl₂ salts are routed to aqueous chloride processing for further plutonium recovery before being discarded under P/S code CXL.

Vanadium pentoxide (V₂O₅) was used in place of carbonate to convert metals to oxide as part of the salt stripping process for a few months in 1998. V₂O₅ was used in experiments under P/S code SD from early February to early March of 1998 and under P/S code SS from May 27 to June 10 of 1998 (PYRO-27/TWCP-3542). Molybdenum oxide was used for the same purpose during the same period of time.

Salt distillation, begun in 1997, allows the recovery of plutonium oxide from the salt and produces purified salt for reuse (PYRO-23/TWCP-3542, TWCP-2498]). NaCl/KCl salt is distilled at 850°C. Process wastes from the salt distillation are the bottoms from the distillation, which are composed of metal oxides, including any RCRA heavy metals originally present in the salt. These metal oxides are rerouted for plutonium recovery. The purified salts are reused or discarded under P/S code SD or SS. However, at the present time salt distillation is on hold awaiting the installation of a new still (PYRO-18/TWCP-3542). In the meantime, the salts and crucibles from ER and MSE are dissolved in P/S code CXL.

3.4.6 Pyroredox (P/S code RA)

The pyroredox operation was used to recover plutonium from spent anode heels in the mid to late 1980s (TWCP-2541). The anode heel was polished with calcium metal to remove surface oxide, then oxidized to plutonium (III) with zinc chloride ($ZnCl_2$) in molten KCl, forming plutonium chloride ($PuCl_3$). Elements more electroactive than zinc (including barium) were oxidized into the salt phase, and the zinc formed a metal button. Any of the residual RCRA-regulated heavy metals that may have been present in the spent anode heel (barium, cadmium, chromium, lead, and silver), with the exception of barium, would be present in the zinc button. The salt was then mixed with calcium metal in $CaCl_2$ to reduce the plutonium to the metal phase, as well as reducing all elements less electroactive than calcium. The salt phase containing small amounts of the impurity barium was mechanically separated from the metal phase and discarded under P/S code RA. The metal phase containing zinc was placed in the vault or further treated (TWCP-2540), and the plutonium eventually was routed back to ER. In the ER process, the RCRA-regulated metals are concentrated in the anode heel, which then may be treated in the pyroredox process to transfer these RCRA metals to the zinc button, or may be roasted in air to form metal oxides and then be dissolved in nitrate operations. Thus, the zinc button output could contain RCRA-regulated heavy metals (D006, D007, D008, D011) above the toxicity characteristic limits. Salt waste could contain barium (D005) above the limit.

3.4.7 Ingot Casting (P/S code SS)

Metal is melted in an MgO crucible to cast the ingot. If the plutonium content of the crucible is greater than the DL, the crucible goes to CXL for plutonium recovery. If its plutonium content is less than the DL, the crucible is discarded under P/S code SS.

3.4.8 Metal Coalescence (P/S code SS)

Metal coalescence is used for plutonium turnings to coalesce the turnings into a metal button. Calcium metal and $CaCl_2$ are added to a MgO crucible along with the turnings and melted. Turnings may contain Freon from the machining process, but any Freon would be destroyed and volatilized by the high temperatures. Residues are handled in the same manner as MCDOR/DOR residues (section 3.4.2). Metal coalescence is conducted under P/S code SS.

3.4.9 Metal Oxidation (P/S code MO)

Small pieces of metal remaining on furnace or crucible surfaces are collected for conversion to the oxide phase in P/S code MO. These metal pieces are placed in a furnace for the conversion process. The oxide is then transferred to the vault (PYRO-11/TWCP-3542).

3.4.10 Neptunium (P/S code Neptunium)

A campaign to work off neptunium residues stored in the vault was undertaken in 1993 (PYRO-21/TWCP-3542). This operation was only active during 1993. Any debris wastes generated from this operation would carry the P/S code Neptunium. SME information indicates that wastes generated under P/S code Neptunium would not contain RCRA-listed constituents nor would they have any RCRA hazardous characteristics (PYRO-21/TWCP-3542).

3.4.11 Pickling and Nitrate Holding (P/S code PK)

Pickling (i.e., leaching metal with a strong acid) is typically a head-end operation. However, P/S code PK is included in this report because, after a few furnace runs, plutonium metal begins to accumulate on tools and furnace parts. It then becomes necessary to leach the plutonium from these items. In addition, after calcium metal reduction processes such as the metal preparation line (section 3.4.1), direct oxide reduction (section 3.4.2), and molten salt extraction (section 3.4.3), plutonium metal will have an adherent skin of calcium metal. Hydrochloric acid is used to dissolve Pu from tantalum furnace parts, and nitric acid is used to pickle Pu from other metals. The plutonium-bearing leachate solution is transferred to P/S codes CX or CXL in chloride operations, or to P/S code LR in nitrate operations (PYRO-12/TWCP-3542). P/S code PK has not been active since 1992 and may have been incorporated into P/S code SS at that time (PYRO-28/TWCP-3542). Due to the potential for leaching heavy metals from the items treated, D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver) are assigned to waste produced from P/S code PK

3.4.12 Plutonium Trichloride Preparation (P/S code PTP)

P/S code PTP was an intermediate process used in Pu metal production. Under this code, carbon tetrachloride was used to prepare plutonium trichloride by bubbling a carrier gas through carbon tetrachloride and passing the mixed gas stream through a bed of plutonium oxide at 500°–600°C before being absorbed in a 5–6 molar potassium hydroxide solution. The scrubber solution went in the caustic waste line to the RLWTF at TA-50. The carrier gases were argon, hydrogen chloride gas,

and chlorine gas. The carbon tetrachloride was broken down into hydrogen chloride, carbon monoxide, and carbon dioxide gases in this process, which was active between January 1987 and June 1989, at which time the process switched to the use of phosgene gas until the process ended in May 1991.

Feed material for P/S code PTP was high purity oxides from the vault or from P/S codes CA and MA. The product plutonium trichloride was sent to P/S code SS to be reduced to metal by the MSE or ER processes.

3.5 Material Inputs to the Waste Generation Process

Attachment 4 lists P/S codes for pyrochemical processes at TA-55, including process descriptions, feed material, other process inputs, process outputs, and type of waste. The feed materials for pyrochemical processes consist of the general types of materials listed in Table 1 that are obtained either from the storage vault, as process output from other P/S codes, or from sources outside TA-55, including other DOE sites.

The remainder of this section summarizes the nature of the process waste in terms of its physical, chemical and radioisotopic characteristics.

3.5.1 Physical Waste Form Identification

Solid waste from pyrochemical processes primarily consists of spent salts, magnesium oxide crucibles, and debris waste. Debris waste contains glassware, plastics, ceramic materials, paper, rags, high-efficiency particulate air (HEPA) filters, metal containers, and small tools. Asbestos and leaded gloves may also be generated as process waste. Prior to May 1992, leaded gloves were discarded as metal debris but were not otherwise segregated from other metal wastes. Since that time, they have been routinely segregated from other metal debris although they continue to be discarded under the originating P/S code.

Because items from several different processes are usually combined into individual waste drums, the physical waste form of each drum must be determined independently. This information is documented on a Waste Origination and Disposition Form (WODF) by the waste generator according to controlled procedures. The P/S code for each waste item is also documented on this form. In the packaging process, a standard form, the Discardable Waste Log Sheet (DWLS), was used to list each item identifier code and record its matrix material. This form was signed by the waste packager, reviewed, and approved by quality assurance (QA) personnel. Example forms for one drum of waste generated by pyrochemical processes can be viewed in record TWCP-2513.

Table 1. Process Feed Materials for Pyrochemical Operations

Feed Materials	Potential Presence of RCRA-Regulated Substances	P/S Codes in Pyrochemical Processes
Anode heels from P/S codes ER or SS (electrorefining step)	Typically contaminated with RCRA-regulated heavy metals Cd, Cr, Pb and Ag (D006, D007, D008, D011). Heavy metals As, Hg, and Se are not present because they are volatilized from the Pu oxide feed at the high temperatures to which this material is subjected in P/S codes ER, RM, and SS (electrorefining step).	ER, RA, SS
Miscellaneous materials with Pu contamination	Typically contaminated with RCRA-regulated heavy metals Cd, Pb, Hg, Ag and possibly Cr (D006, D008, D009, D011, and D007)	MO: Pu scrap and crucible pieces from P/S code SS PK: hardware, metal, anode chips from other P/S codes
Neptunium residues from vault	No RCRA-regulated substances	Neptunium (only active in 1993)
Pu chlorides and fluorides from various P/S codes	Variable purity	ER, SD, SS
Pu metal or metal alloy from vault or from various P/S codes	High purity, no RCRA-regulated substances, unless noted otherwise	CRD (variable purity), MO, SCB, SS, SSMD
Pu oxalates	Typically fairly pure, no RCRA substances present	MP
Pu oxides from vault or from P/S codes CA, DO, MA, RB, or RBJ	High purity oxides from P/S codes CA and MA. Variable purity oxides from P/S codes RB and RBJ; suspect contaminated with RCRA-regulated heavy metals Cd, Cr and Pb (D006, D007, D008).	MP (generally high purity), OR (variable purity), PTP (generally high purity)

3.5.2 Radionuclide Content Identification

The primary plutonium material type inputs for plutonium feed materials at Building PF-4 are listed in Table 2. The designation *material type* (MT) (e.g., MT 52) is used within the DOE Complex to describe the isotopic composition of common blends of radioactive materials used within the Complex. The material type notation was developed because it is a convenient way to describe material types that have very consistent isotopic compositions. Table 2 indicates the isotopic composition of the material types at the time the waste was characterized. The material type provides the basis for estimating an upper bound for U-234, U-235, and Am-241 contents based on the rate of decay of their precursors, Pu-238, Pu-239 and Pu-241, respectively.

Table 2. Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %)

Material Type (MT)	Plutonium isotope and half-life						Upper limits for weight ratios		
	Pu-238 (87.74 yr)	Pu-239 (24120 yr)	Pu-240 (6564 yr)	Pu-241 (14.35 yr)	Pu-242 (376,300 yr)	Pu-244 (8.26 x 10 ⁷ yr)	U-234/ Total Pu	U-235/ Total Pu	Am-241/ Total Pu
MT 51	0.006	96.77	3.13	0.076	0.018	—	1 x 10 ⁻⁵	0.001	0.0006
MT 52	0.01	93.78	6	0.2	0.02	—	2 x 10 ⁻⁵	0.001	0.002
MT 53	0.03	91.08	8.45	0.366	0.071	—	7 x 10 ⁻⁵	0.0009	0.003
MT 54	0.046	87.42	11.5	0.81	0.22	—	0.0001	0.0009	0.007
MT 55	0.06	83.88	14.73	1.03	0.304	—	0.0002	0.0009	0.009
MT 56	0.061	81.9	16.51	1.18	0.355	—	0.0002	0.0009	0.01
MT 57	0.433	74.63	20.7	2.55	1.69	—	0.001	0.0008	0.02
MT 42									
84%	1.02	1.37	10.32	3.13	84.14	0.02	0.003	1 x 10 ⁻⁵	0.03
90%	0.72	1.26	6.4	1.86	89.77	—	0.002	1 x 10 ⁻⁵	0.02
95%	0.45	0.56	2.47	0.906	95.58	0.029	0.001	6 x 10 ⁻⁶	0.008
MT 83									
83%	83.89	13.8	1.9	0.32	0.09	—	0.26	0.0002	0.003
89%	89.26	10.07	0.633	0.021	0.015	—	0.28	0.0001	0.0002

Source: TWCP-698

The results of these calculations are also tabulated in Table 2, assuming (a) none of these isotopes were initially present in the material, (b) the oldest plutonium material in inventory dates back to 1 January 1960, and (c) the waste was packaged on 1 January 1996, making it 36 years old (TWCP-698).

The material type used in the process generating each waste item was documented on the WODF and DWLS. However, some of the plutonium recovery processes separate plutonium and americium, or plutonium and uranium so that their relative ratios may be altered in the process outputs and wastes. Waste items may be either depleted or enriched in americium depending on whether the source of contamination is the process product or the process residues (TWCP-882).

Residues submitted for reprocessing often contain Np-237, the decay product of Am-241 (half-life, 458 yr). This radioisotope is expected to be present in minor amounts in nearly all debris waste from pyrochemical processes at TA-55, and may be enriched in some cases, such as in MSE process waste from P/S code SS from 1992 to the present (TWCP-882). Am-241, Am-243, and Np-237 are present as secondary radionuclides in process waste from P/S code SS from 1984 to 1990 (TWCP-882). Np-237 is expected to be the dominant radionuclide in waste from P/S code Neptunium.

In general, uranium and its isotopes are expected to be present only at trace levels, if at all. U-238 would only be present if purposefully added to the feed material. U-235 ingrowth from the decay of plutonium-239 (half-life, 24,120 years) would be negligible due to the long half-life of Pu-239. U-234 would be present in MT 83 as a decay product of Pu-238 (half-life, 87.74 years). After 20 years, 14.6 percent of the initial Pu-238 would have decayed to U-234. For MT 83 with an initial content of 83.89 percent Pu-238, the atomic ratio U-234 to total plutonium would be about 0.14. No U-236 is present.

During TWCP characterization, the contents of each waste package undergo non-destructive analysis to provide detailed radioisotopic data. These data will be used to evaluate the accuracy of AK information in accordance with *Waste Characterization Data Reconciliation with Acceptable Knowledge* (TWCP-DTP-1.2-064). If warranted, this AK report will be updated to incorporate the results of these comparisons.

3.5.3 Chemical Content Identification

Chemical inputs to pyrochemical processes are listed in Table 3. The use of strong acids, bases, or oxidizers does not result in RCRA listings for

solid wastes from these processes because of the absence of free liquids in this waste. However, D006, D008, D019 and P120 codes apply to some of the pyrochemical process wastes, as noted in Table 3.

4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS

The assignment of EPA hazardous waste numbers to process wastes from pyrochemical operations is summarized below, as well as on the process timelines in Attachment 3, and the table of process inputs and outputs in Attachment 4. These assignments take into account the possible presence of RCRA chemicals in process waste as a result of their suspected or known presence in feed materials, chemical inputs, equipment, and glovebox surfaces.

4.1 F, K, and P Listings

P120 (vanadium pentoxide) applies to waste generated under P/S code SD from February to March 1998, and under P/S code SS from May 27, 1998 to June 10, 1998.

No F or K codes apply to solid wastes generated by pyrochemical processes. Although used for cleaning metal parts, Freon would not be present in the waste because the parts were air-dried. Carbon tetrachloride was used as a chlorination reagent, and not as a solvent. No K-listed chemicals were present in the feed materials, chemicals or equipment used in these processes.

4.2 Toxicity Listings

No D001 (ignitable), D002 (corrosive), or D003 (reactive) listings apply to solid wastes from pyrochemical processes because no ignitable chemicals were used in these processes and because the solid wastes do not contain any free liquids (see Section 6.0).

D005 (barium) applies to salt waste generated under P/S code RA.

D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver) are assigned to the zinc metal waste produced from P/S code RA. In the ER process, these RCRA-regulated heavy metals concentrate in the anode heel, which then may be treated in the pyroredox process (P/S code RA) to transfer them to the zinc button, or may be roasted in air to form metal oxides and then be dissolved in nitrate operations. Thus, only the zinc button output could contain RCRA-regulated metals above the toxicity characteristic limits.

D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver) are assigned to waste produced from P/S code PK.

Table 3. Chemical Inputs to Processes Described in This Report

Chemical input	P/S codes in which RCRA-listed chemical is used	Comments on applicability of RCRA hazardous waste numbers (if any)
Gases		
Chlorine gas Hydrogen chloride Hydrogen fluoride Phosgene gas	PTP, CRD, SCB, SS MP MP PTP	D001 and D002 do not apply to these gases because there are no free liquids in this waste. Also the gas cylinders are outside the building, and the gases are plumbed into the glovebox. D003 does not apply to phosgene because any excess chemical was passed through a solution of sodium hydroxide or potassium hydroxide, thereby producing a chloride salt solution.
Acids		
Hydrochloric acid Nitric acid		D002 does not apply to the solid wastes because there are no free liquids in this waste
Bases		
Potassium hydroxide Sodium hydroxide		D002 does not apply to the solid wastes because there are no free liquids in this waste
Inorganic chemicals		
Aluminum oxide Calcium chloride Calcium fluoride Iodine Lithium chloride Molybdenum oxide Potassium chloride Sodium chloride Vanadium pentoxide Zinc chloride	 SD, SS	 P120 applies to waste generated under P/S code SD from February to March 1998, and under P/S code SS from May 27, 1998 to June 10, 1998
Metals		
Bismuth metal Cadmium metal Calcium metal Gallium metal Lead metal Mercury metal	ER ER SSMD	D006 applies to a limited number of anode heels produced in P/S code ER using cadmium as a solvent. However, these heels are in the vault, with no plans to purify them in the near future. D008 applies to a limited number of anode heels produced in P/S code ER using lead as a solvent. However, these heels are in the vault, with no plans to purify them in the near future D009 applies to P/S code SSMD, in which it was used for about one week in the summer of 1994.
Organic chemicals		
Carbon tetrachloride Freon	PTP SCB	D019 applies to P/S code PTP in which this chemical was used between 1/87 and 6/89. F002 does not apply because carbon tetrachloride was used as a chlorination reagent, not as a solvent. F002 does not apply to debris waste from P/S code SCB. While freon may have been used to clean parts (PYRO-24/TWCP-3542), the parts were air dried, and no free liquids are present in the waste.

D006 (cadmium) and D008 (lead) apply to waste from P/S codes ER and SS due to their use as secondary solvent metals.

D008 (lead) is assigned to metal waste debris from all P/S codes in pyrochemical processes due to the disposal of leaded gloves. Prior to May 1992, leaded gloves were disposed as metal debris without otherwise being segregated. Since May 1992, however, these gloves have been routinely segregated from other metal debris although they are still discarded under the originating P/S code (TWCP-4166).

D009 (mercury) is assigned to wastes generated under P/S code SSMD during the summer of 1994, when a week-long set of experiments contacted small amounts of plutonium with mercury (under 10 grams) (PYRO-22/TWCP-3542). At the end of these experiments, the mercury was solidified to allow disposal.

D019 (carbon tetrachloride): Until sample analyses become available, debris waste items from P/S code PTP (1986 to early 1988) are conservatively assigned D019 although the carbon tetrachloride was probably destroyed in the process.

4.3 Corrosivity, Reactivity, and Ignitability

See Section 6.0.

5.0 DETERMINATION OF THE RADIONUCLIDE ISOTOPIC COMPOSITION

See Section 3.5.2.

6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED

According to the WIPP WAP, "The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes." Administrative controls on waste packaging were in place at various times to ensure the absence of such items from the waste stream.

- Liquids were prohibited from solid waste streams at TA-55 when the facility opened in January 1978. A waste management procedure written to cover operations at the new facility, *TA-55 Standard Operating Procedure (SOP) 406-GEN-R00*, stated that "Liquids are not permitted in any container of solid waste materials" (TWCP-3943).
- Chemical Waste Disposal Requests introduced in June 1980 included checkboxes which the waste generator was required to check if the waste contained corrosive acids or bases, or pyrophoric, flammable, corrosive, explosive, toxic, carcinogenic or highly reactive materials.

- The Certification Plan (TWCP-697) and related Generator Attachments (TWCP-701) were implemented in 1987. Waste generators were required to sign a statement on the WODF documenting that the waste contained “no free liquids, pyrophorics, explosives, compressed gases, powders or materials other than the indicated matrix.” Checkboxes were also present for indicating the presence or absence of corrosive chemicals. Full implementation of this generator statement occurred in May 1987.
- Waste management inspectors perform visual examination of the waste prior to its initial packaging, thus allowing the inspectors to verify the generator’s WODF statement (TWCP-701, Sections 3.8.5 to 3.8.6).
- Explosives were prohibited from TA-55 until installation of the Impact Test Facility in the early 1990s. Explosives continue to be banned in the solid waste streams up to the present time. If a misfire should occur, the requirement is to destroy the unspent powder by burning.
- The Waste Profile Request Form (WPRF), which has been in use at LANL since 1991, includes a statement which must be authenticated by the waste generator, that the waste is not ignitable (flash point $>200^{\circ}\text{F}$), reactive, or corrosive.
- The TA-55 Generator Attachments to the Certification Plan were updated in 1995 (TWCP-700) but the prohibition on liquids in the waste, and the waste management inspection, remained in effect.

Hence, since the inception of operations at TA-55, corrosive and reactive wastes have been excluded from TA-55 solid wastes through the prohibition of liquids. Corroborative data are provided by screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501, page WF-34-10). These tests yielded liquid with pH greater than 3, so the wastes cannot be considered corrosive, and demonstrated that the liquid does not corrode steel at a rate greater than 0.25 inch per year.

The absence of these prohibited items is verified through radiography of each waste container and visual examination of selected containers during TWCP characterization activities. These data will be used to assess the accuracy of AK information in accordance with *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028). Any free liquids are remediated, or the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007).

7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED

Section 6.0 summarizes administrative controls in place at TA-55 that prohibit incompatible chemicals in the waste, and measures taken to verify their absence. In addition, all waste containers shipped from TA-55 to TA-54 for storage were evaluated

for potentially incompatible chemicals in accordance with 49 *Code of Federal Regulations* (CFR) Subpart C—Segregation and separation chart of hazardous materials; Section 177.848, Segregation of hazardous materials, and were determined to be in compliance with this requirement.

8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS

Most gases used at the TA-55 Plutonium Facility are stored outside the building and the gas is plumbed into the glovebox from outside the building (TWCP-4164). Occasionally, a lecture bottle may have been used for a process inside the building, but these bottles were kept outside of the glovebox with the gas plumbed into the glovebox. Consequently, compressed gas cylinders or containers are not expected to be in any of the TRU wastes generated by TA-55 operations.

Spray cans, especially WD-40, were in common use in TA-55 gloveboxes until May 1992 (TWCP-4166). These were routinely discarded as metal debris waste. From 1988 until May 1992, the protocol was to vent or puncture the spray cans inside the glovebox; venting was indicated by inserting a metal wire into the valve. After May 1992, spray cans were no longer used in gloveboxes.

For items of pyrochemical salt waste, the procedures of oxygen sparging and/or carbonate oxidation have been used since May 1987 to ensure that pyrophorics were oxidized. In addition, screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501) have shown (1) no autoignition, (2) no spontaneous combustion, (3) and no sparking. Experimental results on the reactivity of LANL DOR salt with water and the reactivity in air of heated calcium metal nodules from DOR salts indicate the absence of “dangerous when wet materials” and pyrophoricity in these salts (TWCP-3730, TWCP-3731, TWCP-3732).

Verification that individual waste drums do not contain compressed gases, free liquids, or sealed containers greater than 4 L in volume is obtained from radiography of each waste containers and visual examination of selected containers during TWCP characterization activities. Any free liquids are remediated, and any sealed containers greater than 4 L in volume, or unpunctured or unvented gas containers, are removed; or else the waste container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007). For administrative controls on the prohibition of pyrophorics, see Sections 6.0 and 7.0.

9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM

No PCBs were introduced into the pyrochemical processes, based on documentation in TA-55 procedures reviewed during the AK investigation and summarized in the process inputs listed in Table 1, Table 3, and Attachment 4. Oils used in the reviewed processes include vacuum pump oils, and cutting fluids used for cooling purposes; none of these oils are known to contain PCBs. Any organic compounds present in the process materials would be destroyed or vaporized by the high temperatures of the pyrochemical processes that dominate pyrochemical processing. All transformers known to contain PCBs have been tracked from the time of startup of TA-55 in 1978. Whenever any transformer oil is drained, it is handled by a subcontractor who is wholly responsible for its disposal (TWCP-AK-2.1-005,R.1, Section 9.0). This oil does not enter the LANL disposal operations.

10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE

Asbestos heating mantles were never used at TA-55. Asbestos gloves were used in glovebox operations in P/S codes OR and RM (TWCP-4162, TWCP-4166), which are discussed in section 3.4.2 of this report and in the *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007,R.1), respectively. Asbestos-bearing transite was widely used until recently for thermal insulation, including as a coverplate over the furnace in glovebox wells, and as part of end plates on Lindberg furnaces (TWCP-4162, TWCP-4166). Although many Lindberg furnaces have been replaced with newer asbestos-free furnaces, some are still in use at TA-55. The transite would have been disposed either as metal or as ceramic and glass waste.

11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS

- 40 CFR Part 261, Subpart C—Characteristics of hazardous waste, Sections 261.21 (*Characteristic of ignitability*), 261.22 (*Characteristic of corrosivity*), 261.23 (*Characteristic of reactivity*), and 261.24 (*Toxicity characteristic*)
- 40 CFR Part 261, Subpart D—Lists of hazardous waste, Sections 261.31 (*Hazardous wastes from non-specific sources*), 261.32 (*Hazardous wastes from specific sources*), and 261.33 (*Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof*)
- 49 CFR Subpart C—Segregation and separation chart of hazardous materials. Section 177.848, *Segregation of hazardous materials*
- *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5)
- *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3)

- *Nonconformance Reporting and Tracking (TWCP-QP-1.1-007)*
- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55 (TWCP-AK-2.1-002,R.1)*
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55 (TWCP-AK-2.1-003,R.1)*
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55 (TWCP-AK-2.1-004,R.1)*
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55 (TWCP-AK-2.1-005,R.1)*
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55 (TWCP-AK-2.1-007,R.1)*
- *Reconciliation of Visual Examination and Radiography Information (TWCP-QP-1.1-028)*
- *Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)*
- *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste (EPA/OSWER 9938.4-03)*
- *Waste Analysis Plan (Attachment B) to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088)*
- *Waste Characterization Data Reconciliation with Acceptable Knowledge (TWCP-DTP-1.2-064)*

ACCEPTABLE KNOWLEDGE ROADMAP

P/S codes: CRD, ER, MO, MP, OR, Neptunium, PK, PTP, RA, SCB, SD, SS, and SSMD.

Copies of these documents are in the TWCP RMDC Center.

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-352	B	Description of plutonium recovery processes	<i>Wastes from Plutonium Conversion and Scrap Recovery Operations</i> , LA-11069-MS, March 1988.	Document describes the Pu residues and the various treatment approaches used in recovering plutonium from scrap	Document does not give information about RCRA constituents introduced or present in the processes
TWCP-614	D	All TA-55 waste is Defense related.	Memo from Doug Sankey.	All TA-55 waste is Defense related.	Budget information may not be acceptable.
TWCP-697	C	Waste management requirements to meet WIPP WAC requirements were formalized in 1984.	<i>Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , WCP-HSE7-CPL-01, R.2 (November 1984)	Waste management requirements to meet WIPP WAC requirements. Generator Attachments were used to describe and reference specific generator procedures.	Overview document - Generator Attachments provide more detailed information.
TWCP-698	B	Gives Material Type compositions	NMT Memo, NMT-7 WM/EC-96-032 Benchmark Environmental Corp. Memo, AL-7193 BEC	Gives Material Type compositions	Does not give information on how material may fractionate in TA-55 waste processes.
TWCP-700	C	<i>Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , R05	<i>NMT-7 Attachment, January 1995</i> , TRUWM-TA55-CPA-03,R00	Documents how controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.
TWCP-701	C	<i>TA-55 Generator Attachment to the TRU Waste Certification Plan for Newly Generated TRU Waste</i>	<i>TA-55 Attachment, 1987</i> , TRU-MST12-CPA-03,R00	Documents how controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-816	D	Jim Foxx Interview on Number of Layers of Packaging	C.L. Foxx, Los Alamos National Laboratory	Waste was co-mingled with room trash, and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits.	None
TWCP-882 (UCNI)	D	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste	Memo from Jim Foxx	Lists additional radionuclides and metals potentially in waste, subdivided by process status code. Covers time period from 1978 to present.	Best information available, but it is based on worker recollection because other records are not available.
TWCP-886	C	Color Flow Diagram of Pu-processes at TA-55.	Diagram from Jim Foxx	Indicates that process inputs are thermally treated and that heavy metals from process inputs end up in the nitric acid evaporator bottoms.	Does not indicate solvent input to processes.
TWCP-887	D	Co-mingling of Defense and Non-Defense TRU Waste	Memo from Jim Foxx	Wastes generated from defense and non-defense activities were not segregated at TA-55 through 1997	None
TWCP-1258	B	“Waste Determination Report for Waste Stream TA-55-43, Lot No.1”	LANL internal report	Table B-1 lists the decomposition and vaporization temperatures of Hg, Se, and As and their oxides and chlorides.	None
TWCP-2498	C	Procedure for Salt Distillation in Room 429, PF-4	TA-55 Document, 103-MPP-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-2501	B	“Backlog Waste Reassessment Baseline Book, Waste Form 34”	Rocky Flats Environmental Technology Site Report 1995	Page WF34-10 contains results of tests for corrosivity	Tests were conducted on residues rather than on waste.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-2502	D	“Acceptable Knowledge Personnel Interview Form” for Waste Stream TA-55-39 (pyrochemical salts) and P/S codes MP, OR, SS, PX, PY, ER and RM	Jim Foxx, NMT-7	Answers to miscellaneous questions on pyrochemical processes.	Not a good overview
TWCP-2505 (UCNI)	C	Procedure for Plutonium Electrorefining (P/S code SS)	TA-55 Document, 432-MPP-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-2506 (UCNI)	C	Procedure for Fused Salt Extraction of Americium and Plutonium Metal (P/S code SS)	TA-55 Document, 440-MPP-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-2507 (UCNI)	C	Procedure for Direct Oxide Reduction (P/S code OR)	TA-55 Document, 426-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-2513	A	Example of Generator Reports for Drum 54856	TA-55 Records Management Center	Example of generator records including WPRF #07045 and WODF form showing the waste generator certification statement.	Older forms are often hard to read
TWCP-2539 (UCNI)	C	Preparation of Pu Metal by the Fluoride Reduction Process	TA-55 Document, 487-REC-R01	Contains materials used in the process	No RCRA analyses documents
TWCP-2540 (UCNI)	A	Answers to questions about pyrochemical processes	Jim Foxx, NMT-7-WM/EC-99-118	Also contains old records of analysis of DOR salts	None
TWCP-2541 (UCNI)	C	Procedure for Pyroredox Processing of Spent Electrorefining Anodes (P/S code RA)	TA-55 Document, 460-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-1)	C	Procedure for Metal Breaking Press (P/S code SS)	TA-55 Document, 408-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-2)	C	Procedure for Electrorefining Plutonium Metal - CRAC Cell (P/S code SS)	TA-55 Document, 410-MPP-R03	Contains materials used in the process	No RCRA analyses documents

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3542 (UCNI) (PYRO-3)	C	Procedure for Electrorefining of Plutonium Metal, Nominal Four Kg Scale (P/S code SS)	TA-55 Document, 430-MPP-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-4)	C	Procedure for Chloride Melt Preparation for Electrorefining and Fused Salt Extraction (P/S code SS)	TA-55 Document, 431-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-5)	C	Procedure for Transporting Material out of Gloveboxes Using Heat Sealer Method (P/S code SS)	TA-55 Document, 433-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-6)	C	Procedure for Reverse Cell Electrorefining (P/S code SS)	TA-55 Document, 435-MPP-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-7)	C	Procedure for In-Situ Chlorination of Plutonium Metal (P/S code SS)	TA-55 Document, 437-MPP-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-8)	C	Procedure for Coalescence of Plutonium Metal (P/S code SS)	TA-55 Document, 445-MPP-R06.1	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-9)	C	Procedure for Salt Stripping of Electrorefining Salts (P/S code SS)	TA-55 Document, 450-MPP-R04	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-10)	C	Procedure for Salt Stripping of Electrorefining Salts Using Oxygen/Argon Sparging (P/S code SS)	TA-55 Document, 453-MPP-R07	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-11)	C	Procedure for Actinide Metal and Alloy Oxidation (P/S code MO)	TA-55 Document, 497-MPP-R04	Contains materials used in the process	No RCRA analyses documents

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3542 (UCNI) (PYRO-12)	C	Procedure for Pickling of Plutonium Metal and Pyrochemical Process Equipment (P/S code PK)	TA-55 Document, 405-MPP-R03	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-13)	C	Procedure for Chlorination of Plutonium Compounds (P/S code PTP)	TA-55 Document, 407-MPP-R04	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-14)	C	Procedure for Reduction of PuO ₂ to Metal, 700g Scale (P/S code OR)	TA-55 Document, 420-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-15)	C	See Special Processing reference SP-29 in TWCP-3543	TA-55 Document, 434-MPP-R01	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-16)	C	Procedure for Semi-continuous DOR with Salt Regeneration (P/S code OR)	TA-55 Document, 426-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-17)	C	Procedure for Electrowinning of Pu Metal, Nominal 6 kg Scale (P/S code SS)	TA-55 Document, 432-MPP-07	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-18)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Jim McNeese, NMT-2	SME review of Pyrochemical Processing AK Report	Generally good comments, but SME couldn't always recall specific information about an aspect of a process.
TWCP-3542 (UCNI) (PYRO-19)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Jim Foxx, NMT-7	SME review of Pyrochemical Processing AK Report	None
TWCP-3542 (UCNI) (PYRO-21)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Sammi Owens, NMT-2	Answers to questions about P/S code Neptunium	Classified nature of information places limitations on information

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3542 (UCNI) (PYRO-22)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Peter Lopez, NMT-5 Walt Griego, NMT-2	Answers to questions about P/S code SSMD	Project occurred long enough in the past that SMEs had difficulty recalling details.
TWCP-3542 (UCNI) (PYRO-23)	C	Procedure for Salt Distillation (P/S code SD)	TA-55 Document, 102-MPP-R01	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-24)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Mike West, NMT-2 Greg Bird, NMT-2	Answers to questions regarding P/S codes SBB and SCB. No RCRA-listed metals used in processes, Freon may have been used to clean parts.	SMEs couldn't recall some specific information.
TWCP-3542 (UCNI) (PYRO-25)	C	Procedure for Fused Salt Extraction of Americium from Plutonium Metal	TA-55 Document 440-MPP-R00 – R08	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-27)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Jim Foxx, NMT-7	Answers to questions regarding usage timeframe for vanadium pentoxide	Answers to specific questions or topics
TWCP-3542 (UCNI) (PYRO-28)	C	Acceptable Knowledge Interview Form for Pyrochemical Processing	Jim Foxx, NMT-7 9/23/99	Answers to questions regarding processes done in Special Processing and Pyrochemical Processes	Answers to specific questions
TWCP-3543 (SP-40) (UCNI)	D	Acceptable Knowledge Interview Form for Pyrochemical Processing	Jim Foxx, NMT-7	Answers to questions regarding processes done in Special Processing and Pyrochemical operations	Answers to specific questions or topics
TWCP-3730 (UCNI)	B	Pyrophoricity characterization	Characterization of Direct Oxide Salts (LA-CP-95-0098)	Hydrogen generation and pyrophoricity of DOR salts. Also gives reference for MSE, ER, and Cr-containing salts.	None
TWCP-3731	D	Sodium pyrophoricity in pyrochemical salts	Memo (MST-12-ARO-88-052)	Treatment of sodium in salts is effective	Sodium only

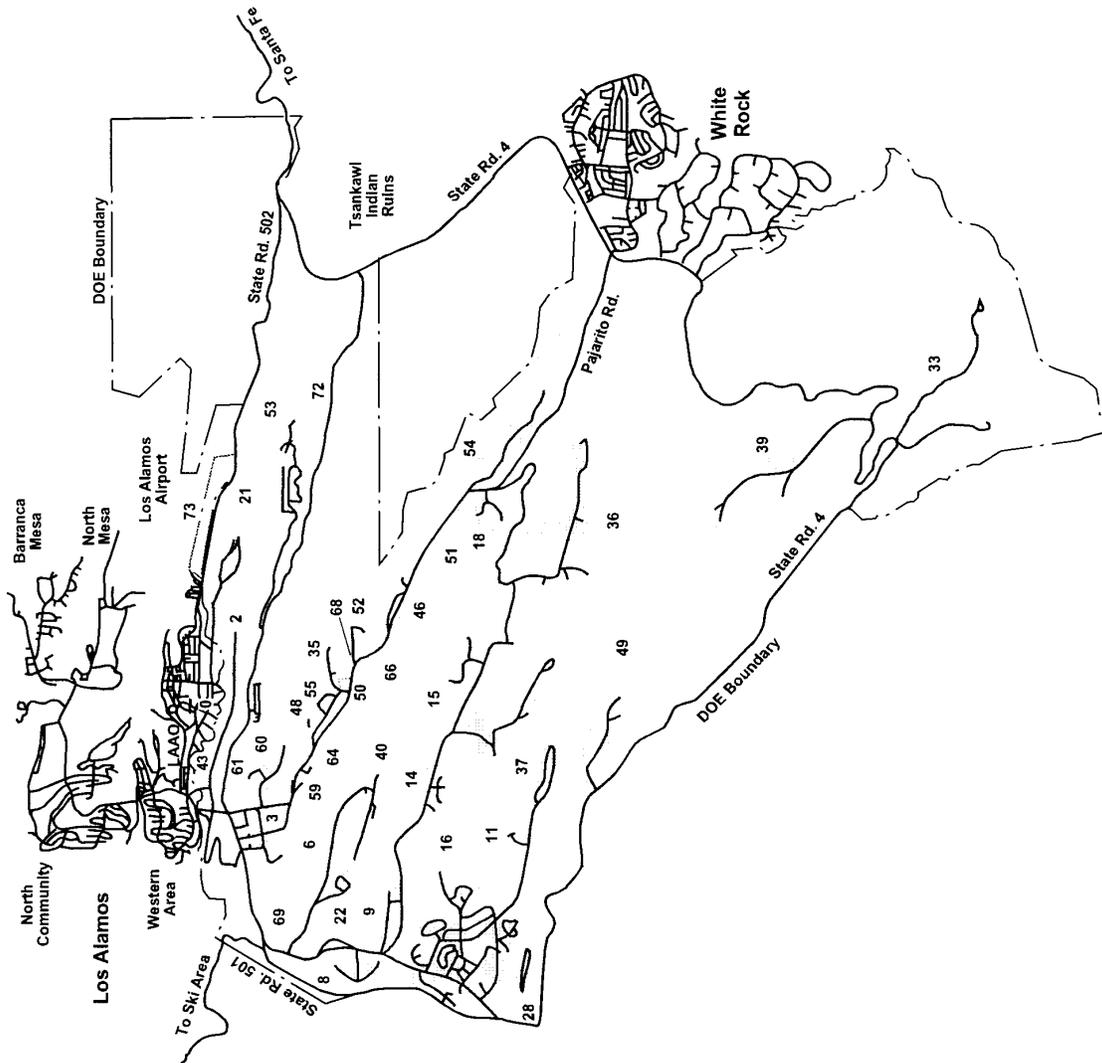
* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code*	Information	Source	Summary	Limitations
TWCP-3732	C	Experimental data on calcium pyrophoricity in salts	Memo (MST-12-ARO-88-077)	Treatment of calcium in salts is effective	Calcium only
TWCP-3943	D	Procedure for Waste Management at TA-55	TA-55 Document, 406-GEN-R00	Contains information on waste management procedures in 1978	None, but doesn't address today's waste management concerns
TWCP-4162	D	Answers to questions about P/S codes PB, PuBe, CC, MB, MS, FF, BF, and other issues	Interview with Jim Foxx, 10/12/00	Answers to questions on use of asbestos at TA-55, non-defense activities, and specific P/S codes in chloride operations.	None
TWCP-4164	D	Answers to questions about various P/S codes	Interview with Jim Foxx, 10/16/00	Answers to questions on use of silver, disposal of ash and resins, and use of gases.	None
TWCP-4166	D	Answers to questions about P/S codes DO, EV, HP, CF, OR, RM, PY	Interview with Jim Foxx, 10/17/00	Answers to questions on use of chromium and silver, RCRA metals in cement, asbestos in furnaces and gloves, and disposal of spray cans used in gloveboxes.	None
TWCP-4167	D	Answers to questions about segregation of non-defense wastes; leachability of silver from ash	Interview with Jim Foxx, 10/18/00	Segregation of non-defense wastes began on 27 August 1998; analytical data show that silver in ash is below limits of regulatory concern	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

MAP OF LANL

Technical Area Locations	
TA-0	Unassigned Land Reserve
TA-2	Omega Site
TA-3	South Mesa Site
TA-5	Beta Site
TA-6	Two Mile Mesa Site
TA-8	Anchor Site West
TA-9	Anchor Site East
TA-11	K-Site
TA-14	Q-Site
TA-15	R-Site
TA-16	S-Site
TA-18	Pajarito Laboratory
TA-21	DP-Site
TA-22	TD-Site
TA-28	Magazine Area A
TA-33	HP-Site
TA-35	Ten Site
TA-36	Kappa Site
TA-37	Magazine Area C
TA-39	Ancho Canyon Site
TA-40	DF-Site
TA-41	W-Site
TA-43	Health Research Lab & DOE Headquarters
TA-46	WA-Site
TA-48	Radiochemistry Site
TA-49	Frijoles Mesa Site
TA-50	Waste Management Site
TA-51	Radiation Exposure Facility
TA-52	Reactor Development Site
TA-53	Meson Physics Facility
TA-54	Waste Disposal Site
TA-55	Plutonium Facility Site
TA-57	Fenton Hill Site
TA-58	Two Mile North Site
TA-59	OH-Site

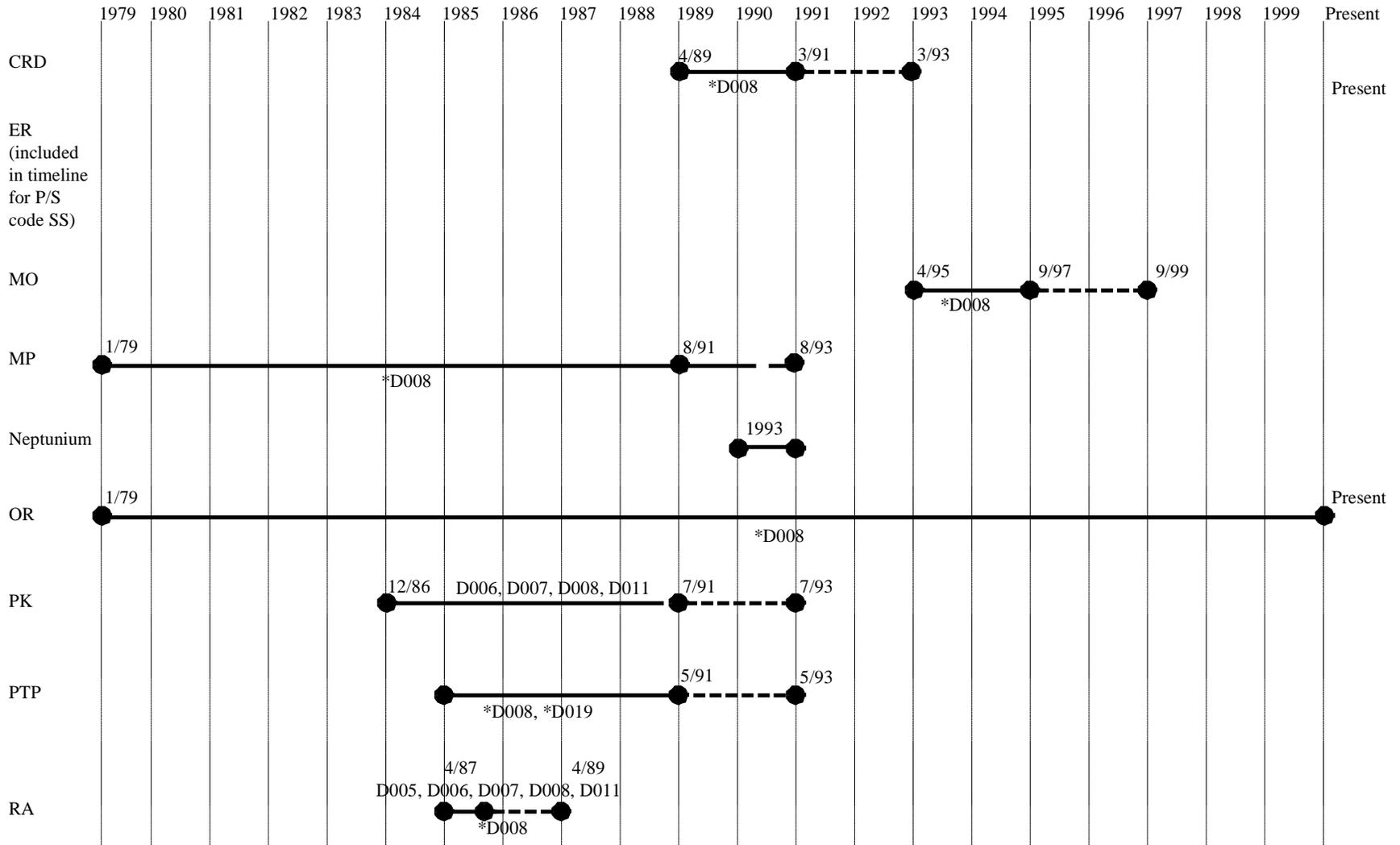


MAP OF TA-55

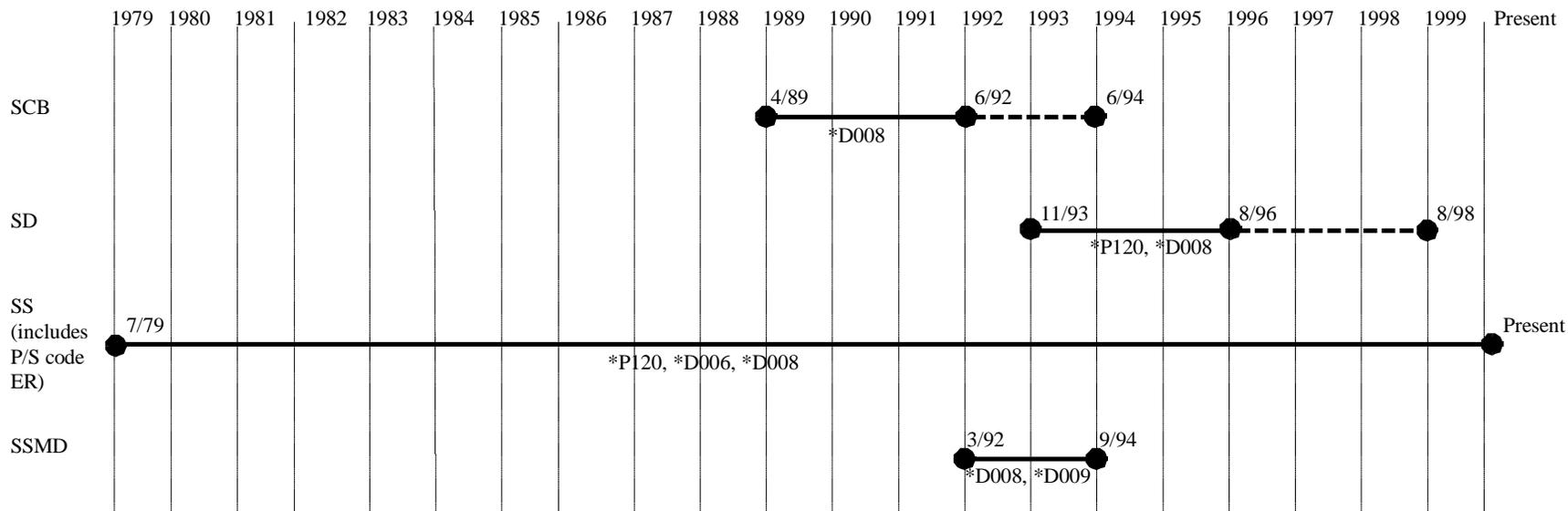
Note: The Plutonium Facility, Building PF-4, is labeled PF- 4 on this map.



TIMELINE FOR PYROCHEMICAL PROCESSES



TIMELINE FOR PYROCHEMICAL PROCESSES (continued)



***Notes on time-dependence of RCRA codes**

P120 = applies to waste generated under P/S code SD from 2/98 - 3/98 and under P/S code SS from 5/27/98 - 6/10/98

D006 = applies to crucibles and salts discarded under P/S code ER from 1987 to 1989

D008 = applies to leaded gloves which were discarded in a separate waste stream after 1992, still under the originating P/S code

D009 = applies to waste discarded under P/S code SSMD from 6/94 - 8/94

D019 = applies to waste discarded under P/S code PTP from 1/87 - 6/98

TIMELINE EXPLANATION



The P/S code is established either in the P/S diagrams and/or in the procedures designating the start and end dates.



Extrapolate out two (2) years beyond the last revision date for the procedure to next possible review date.

PROCESS INPUTS AND OUTPUTS

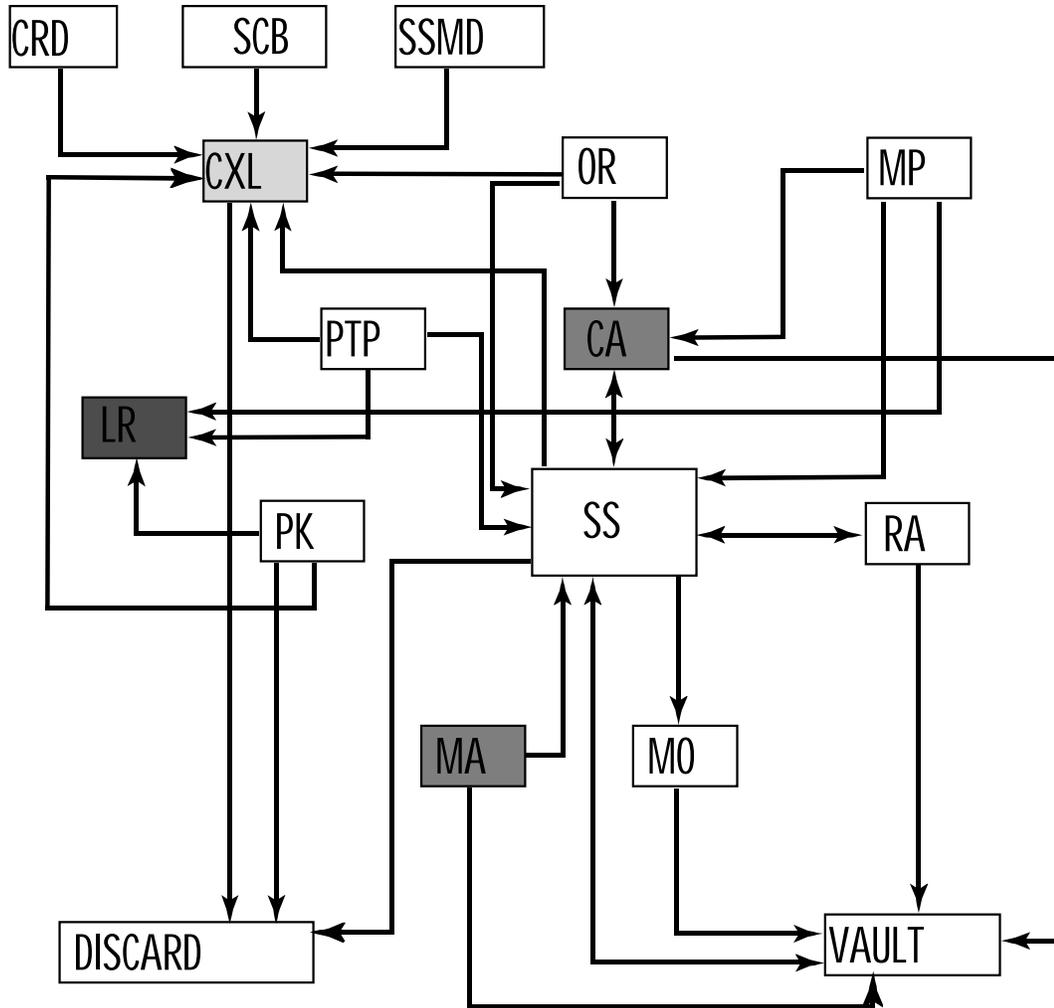
P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
CRD	Chlorination/reduction RD&D	plutonium metal (varying purity)	Calcium metal, chlorine gas	Pu to vault; salt and crucibles to vault if >DL.	Salt and crucibles to discard if <DL Rags, tools, labware, gloves to discard	D008	TWCP-3542 (PYRO-18)
ER (currently included in P/S code SS)	Electrorefining	Impure Pu metal from P/S code OR	Magnesium chloride, cadmium metal, bismuth metal, lead metal, gallium metal	Pu metal (high purity); anode heels sent to vault or to P/S code RA; molten salts sent to vault or to P/S code CXL (1984-86) or to carbonate oxidation/distillation	Magnesia crucibles, metal cathodes (usually tungsten)	D006 D008	
MO	Metal Oxidation, Room 429	plutonium scrap and crucibles from P/S code SS	No chemicals used.	Pu oxide to vault. Crucible >DL to vault	Crucibles <DL to discard. Labware, gloves, rags to discard	D008	TWCP-3542 (PYRO-11)
MP	Metal Preparation	Pu oxide (varying purity, generally high), from vault or from P/S codes RB or RBJ	Calcium metal, iodine, hydrogen fluoride gas, magnesium oxide	Pu metal to vault or to P/S codes CA or SS. Slag and crucibles to P/S codes ED or SC if > DL. MgO sand reused if possible.	Labware, tools, rags, gloves to discard. Slag (calcium fluoride and calcium iodide), magnesium oxide sand, and crucible pieces sent to P/S codes ED or SC if < DL, to be leached and discarded	D008	TWCP-352, TWCP-2502, TWCP-2506, TWCP-2539

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
Neptunium	Neptunium	Neptunium residues from vault; no RCRA-regulated constituents or characteristics	Chemicals used not described, but no RCRA-regulated constituents or characteristics were used.	Classified	Waste description is classified, but does not contain any RCRA-regulated constituents or characteristics		TWCP-3542 (PYRO-21)
OR	Direct Oxide Reduction	plutonium oxide (varying purity)	Calcium metal, oxygen gas, chlorine gas	Pu metal to P/S CA or SS depending on purity. Salts and crucibles >DL to vault or P/S code SS or CXL. Chlorine off-gas sent through scrubber, and caustic solution to P/S code CXL if > DL	Salts and crucibles <DL sent to chloride operations and discarded under P/S code CXL or DO after 1988 (or under OR before 1988); caustic solution < DL sent to RLWTF	D008	TWCP-1258, TWCP-2502, TWCP-2507; TWCP-3542 (PYRO-14, PYRO-15, PYRO-16, PYRO-18, PYRO-19)
PK	Pickling and Nitrate Holding	Hardware, metal, anode chips.	Hydrochloric acid, nitric acid	Pu metal to originating P/S. HCl leach solution to P/S CX or CXL, nitric acid leach solution to P/S LR.	Hardware to discard	D006 D007 D008 D011	TWCP-3542 (PYRO-12)
PTP	Plutonium Trichloride Preparation	Plutonium dioxide	Chlorine gas, hydrogen chlorine gas, carbon tetrachloride, phosgene gas, calcium metal, aluminum metal, calcium chloride, sodium chloride, potassium chloride, sodium hydroxide, potassium hydroxide, hydrochloric acid, nitric acid	Pu metal to P/S code SS, CA, or vault. HCl leach solution to P/S CX, nitric acid leach solution to P/S LR.	Salt, crucibles < DL to discard. Tools, labware, rags, gloves to discard	D008 D019	TWCP-3542 (PYRO-13)

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
RA	Recovery of Anode	Anode heels from vault	Calcium metal, zinc chloride, potassium chloride	Pu metal to vault or to P/S code ER, zinc metal (containing any RCRA heavy metals) to vault or further treated	Salt Labware, gloves, rags to discard	D005 D006 D007 D008 D011	TWCP-2541
SCB	Chlorination Ca/Al Scrubbing RD&D	Pu samples from P/S codes OR or SS	Calcium metal, aluminum metal, calcium chloride, sodium chloride, potassium chloride, chlorine gas	Pu to Vault. Salt, crucibles > DL to vault.	Salt, crucibles < DL to discard Tools labware, rags, gloves to discard	D008	TWCP-3542 (PYRO-25)
SD	Salt Distillation	Salts from various P/S codes	Vanadium pentoxide, molybdenum oxide	Calcium chloride salts to P/S CXL or vault. Sodium and potassium chloride salts to vault or distillation. Pu residue to vault	Distilled salts to discard Crucible pieces to discard	D008 P120	TWCP-2498, TWCP-3542 (PYRO-23, PYRO-24)
SS	Salt Stripping	Pu oxide or metal from the vault or from P/S codes DO, CA, MA (Pu turnings)	Calcium metal, calcium chloride, sodium chloride, potassium chloride, chlorine gas, vanadium pentoxide, oxygen gas, molybdenum oxide, magnesium chloride, lithium chloride	Pu metal (high purity) to P/S CA. Impure metal pieces to P/S MO. Salt and crucibles to P/S codes CXL or WM. Labware, tools to aqueous recovery or vault if >DL.	Labware, tools, magnesium oxide crucible to discard if <DL	D006 D008 P120	TWCP-352, TWCP-2498, TWCP-2505, TWCP-2506; TWCP-3542 (PYRO-1 through PYRO-10, PYRO-17, PYRO-18, PYRO-28)
SSMD	SS Material Development	Samples of Pu from P/S codes CA and SS.	Calcium chloride, sodium chloride, potassium chloride, mercury metal,	Pu metal returned to P/S codes CA and SS.	Salt residue to P/S code SS and vault. Crucible residue to vault or discard.	D008 D009	TWCP-3542 (PYRO-22)

- ¹ All P/S codes generate routine laboratory debris waste which typically consists of glassware, plastics, ceramic materials, paper, rags, high-efficiency particulate air filters, metal containers, brushes, and small tools. Leaded gloves may also be generated and are segregated from other metal debris.
- ² See discussion in Section 4.0 for details on the applicability of the RCRA codes listed in this column. The RCRA hazardous waste codes listed apply to the solid TRU waste only and not to any other waste forms that may undergo further treatment or processing (e.g., evaporation or cement fixation). The resulting treated waste stream is evaluated for hazardous waste constituents and assigned the applicable EPA hazardous waste codes. All P/S codes have the potential to generate leaded gloves. The gloves are segregated from other metal debris waste and are assigned EPA hazardous waste code D008 under the originating P/S code.
- ³ Refer to the Acceptable Knowledge Roadmap in Attachment 1.

SIMPLIFIED PROCESS STATUS DIAGRAM



 Chloride Operations

 Nitrate Operations

 Metal Operations

TA-55 PLUTONIUM FACILITY

ACCEPTABLE KNOWLEDGE REPORT

REPORT TITLE: Process Acceptable Knowledge Summary Report for Special Processing at TA-55

REPORT NUMBER: TWCP-AK-2.1-007,R.1 (LA-UR-00-5863)

WASTE GENERATED FROM PROCESS/STATUS CODES: ACC, ACD, DO, IAM, IX, PI, POSM, PPD, PX, RM, SB, SBB, SL, and VU

EFFECTIVE DATE: 12/04/00

NEXT REVIEW DATE: 12/04/02

DOCUMENT PREPARER:

John Musgrave 12/04/00
NAME DATE

APPROVALS:

June Fabryka-Martin 12/04/00
INDEPENDENT TECHNICAL REVIEWER/EDITOR DATE

Pamela Rogers 12/04/00
SITE PROJECT MANAGER DATE

Matt J Riggs 12/04/00
WASTE CERTIFICATION OFFICIAL DATE

M A Gavett 12/04/00
SITE PROJECT QA OFFICER DATE

Charles L. Foxx 12/04/00
FACILITY REPRESENTATIVE DATE

CONTENTS

Section	Page
ACRONYMS	iv
PROCESS/STATUS (P/S) CODE INDEX.....	vi
PROCESS ACCEPTABLE KNOWLEDGE SUMMARY.....	vii
1.0 INTRODUCTION	1
2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS.....	1
3.0 DESCRIPTION OF THE PROCESS WASTE	3
3.1 Facility and Mission.....	3
3.2 Waste Physical Form and Content Description	3
3.3 Waste Volume and Time Period of Waste Generation.....	4
3.4 Waste Generation Processes	4
3.5 Material Inputs to the Waste Generation Processes.....	16
4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS	19
4.1 F, K, and P Listings	21
4.2 Toxicity Listings	21
4.3 Corrosivity, Reactivity, and Ignitability.....	22
5.0 DETERMINATION OF THE RADIONUCLIDE ISOTOPIC COMPOSITION.....	22
6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED	22
7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED.....	23
8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS ...	24
9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM	24
10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE	25
11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS	25
Tables	
1 Process Feed Materials for Special Processing	17
2 Average Isotopic Content of Plutonium Material Types and Enrichments (Weight %) ...	19
3 Chemical Inputs to Processes Described in This Report.....	20
Attachments	
1 Acceptable Knowledge Roadmap (8 pages)	
2 LANL and TA-55 Sites Maps (2 pages)	
3 Timeline for Special Processing (3 pages)	
4 Process Inputs and Outputs (3 pages)	
5 Simplified Process Flow Diagram for Special Processing (1 page)	

ACRONYMS

AK	acceptable knowledge
CFR	<i>Code of Federal Regulations</i>
D	RCRA hazardous waste code for wastes with hazardous characteristics, defined in 40 CFR Subpart C, Sections 261.21 to 261.24
DL	discard limit
DOE	U.S. Department of Energy
DOR	direct oxide reduction
DWLS	Discardable Waste Log Sheet
EPA	U.S. Environmental Protection Agency
ER	electrorefining
F	RCRA hazardous waste code for hazardous wastes from non-specific sources, defined in 40 CFR Subpart D, Section 261.31
HEPA	high-efficiency particulate air
K	RCRA hazardous waste code for hazardous wastes from specific sources, defined in 40 CFR Subpart D, Section 261.32
LANL	Los Alamos National Laboratory
MCDOR	multicycle direct oxide reduction
MSE	molten salt extraction
MT	material type
P	RCRA hazardous waste code for acute hazardous waste defined in 40 CFR Subpart D, Section 261.33
PCB	polychlorinated biphenyl
PF-4	Plutonium Facility, Building 4
P/S [code]	process/status [code]
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
RLWTF	Radioactive Liquid Waste Treatment Facility
RMDC	Records Management/Document Control
Sampling Plan	<i>Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan (TWCP-PLAN-0.2.7-001)</i>
SME	subject matter expert
SOP	safe/standard operating procedure
TA	technical area
TRU	transuranic
TWCP	Transuranic Waste Characterization/Certification Project
UCNI	Unclassified Controlled Nuclear Information
WAC	waste acceptance criteria
WIPP WAC	<i>Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)</i>
WIPP WAP	Attachment B, Waste Analysis Plan, to the <i>Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant</i> (EPA No. NM4890139088)
WIPP	Waste Isolation Pilot Plant

WODF
WPRF

Waste Origination and Disposition Form
Waste Profile Request Form

PROCESS/STATUS (P/S) CODE INDEX

Note: This index indicates the main process AK summary report and report section that covers each P/S code mentioned in this report.

P/S Code	P/S Name	Process AK Summary Report and Report Section*	
ACC	Ammonium Chloride Conversion	Special Processing	3.4.8, Att. 4
ACD	Cascade Dissolver	Special Processing	3.4.1, Att. 4
CA	Casting	Metal Operation Processes	3.4.2, Att. 4
CF	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
DO	Dissolution of Oxide	Special Processing	3.4.3, 3.4.5, 3.4.7, Att. 4
EV	Evaporator	Nitrate Operations	3.4.4, Att. 4
HP	Cement Fixation	Nitrate Operations	3.4.5, Att. 4
IAM	Inspection and Measurement	Special Processing	3.4.1, Att. 4
IX	Ion Exchange	Special Processing	3.4.2, Att. 4
MA	Machining	Metal Operation Processes	3.4.2, Att. 4
PI	Preparation of Isotopes	Special Processing	3.4.4, Att. 4
POSM	Processing Out-of-Specification Material	Special Processing	3.4.3, Att. 4
PPD	Pu Pellet Dissolution	Special Processing	3.4.11, Att. 4
PX	Multiple DOR with In-Situ Regeneration and Electrorefining	Special Processing	3.4.6, 3.4.7, 3.4.8, 3.4.9, 3.4.10, Att. 4
RM	Reduction to Metal	Special Processing	3.4.4, 3.4.6, 3.4.7, Att. 4
SB	Scrap Burning	Special Processing	3.4.1, Att. 4
SBB	Ca/Al Scrubbing RD&D	Special Processing	3.4.9, Att. 4
SE	Solvent Extraction	Chloride Operations	3.4.3, Att. 4
SL	Scrap Leaching	Special Processing	3.4.1, Att. 4
VU	Vessel Unloading	Special Processing	Att. 4
VUL	Vessel Unloading	Nitrate Operations	3.4.1, Att. 4

* Process AK summary reports: Chloride Operations (TWCP-AK-2.1-002,R.1), Metal Operation Processes (TWCP-AK-2.1-003,R.1), Nitrate Operations (TWCP-AK-2.1-005,R.1), Special Processing (this report)

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY

Waste-generating process: Special Processing Operations

P/S codes: ACC, ACD, DO, IAM, IX, PI, POSM, PPD, PX, RM, SB, SBB, SL, and VU

Type of waste generated:

Retrievably stored and newly generated, mixed and non-mixed debris.

Site: LANL

Facility Mission (including defense and non-defense programs):

TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites in the defense complex. The recovered plutonium is converted into pure plutonium feedstock. These manufacturing and recovery operations, as well as associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste contaminated scrap, residues, and debris generated at TA-55. The scrap and residues are processed to recover as much plutonium as practicable before disposal. Wastes from special processing operations are generated from plutonium recovery and purification for defense and non-defense programs; these wastes are generated and produced in the same rooms and gloveboxes and so were not segregated until August 27, 1998.

Area(s) or building(s) where the process waste was generated (including operations carried out in those areas):

TA-55 Plutonium Facility, Building PF-4, rooms 209 and 401. Plutonium operations included preparing ultra-pure plutonium metals, alloys, and compounds; and reclaiming plutonium from scrap and residues produced by numerous feed sources.

Description of the process waste (physical form and typical content description):

Waste from special processing operations consists primarily of debris waste, including cellulose-based waste, plastic-based waste, rubber, metal debris, glass debris. Some waste was also sent to nitrate operations for cement fixation.

Description of the waste-generating process:

The overall goal of the special processing operations is to recover plutonium from impure metal, metal alloys, scrap, and residues and produce a purified plutonium oxide product or purified Pu metal. Processes include head-end ion exchange, metal preparation, separation and purification by precipitation, and pyrochemical operations.

Process feed:

Plutonium metal or metal alloys and oxides; pyrochemical salts; crucible pieces; anode heels; and ash.

Radioisotopic content of the waste:

Variety of plutonium material types with different isotopic compositions. Am-241, Np-237, and U-234 may be present at detectable concentrations as decay products of their plutonium precursors. Some of the processes separate plutonium and americium so that the waste will usually be enriched in americium, but may also be depleted in some cases.

RCRA Constituents/EPA Hazardous Waste Numbers:

- D005 (barium) and D008 (lead): P/S code VU
- D005 (barium), D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver): P/S codes ACD, IAM, SB and SL.
- D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver): P/S code PX (zinc metal button)
- D006 (cadmium), D007 (chromium), D008 (lead), D009 (mercury), and D011 (silver): P/S code IX
- D006 (cadmium), D008 (lead), and D019 (carbon tetrachloride): P/S code PX because the salts, crucibles, and debris waste items discarded under this code may include some RCRA-regulated metal residues above the toxicity characteristic limits
- D007 (chromium) and D011 (silver): P/S codes DO and POSM
- D008 (lead): metal waste debris from all P/S codes in special processing, except ACD and PPD, due to disposal of leaded gloves; after May 1992, leaded gloves were separated from other metal debris
- No F, K or P codes

Process waste volume (if known):

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are segregated into waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

Years of generation for the process waste: 1980–present

PROCESS ACCEPTABLE KNOWLEDGE SUMMARY REPORT FOR SPECIAL PROCESSING AT TA-55

1.0 INTRODUCTION

All transuranic (TRU) waste must be sufficiently characterized and certified before it is shipped to the Waste Isolation Pilot Plant (WIPP). The U.S. Environmental Protection Agency (EPA) allows use of acceptable knowledge (AK) for waste characterization. EPA uses the term AK in its guidance document, *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste*. Attachment B, Waste Analysis Plan, to the *Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant* (EPA No. NM4890139088) (WIPP WAP) defines AK and provides guidelines on how AK should be obtained and documented.

This process AK summary report was prepared in accordance with *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5). The primary purpose of this report is to systematically organize, evaluate, and summarize detailed AK information about individual processes used by one of the TRU-waste generators at Los Alamos National Laboratory (LANL). By doing so, this report provides detailed technical support for one or more waste stream AK summary reports that include these process wastes.

2.0 METHODOLOGY USED TO SEARCH FOR AK RECORDS

The AK search for the information related to Technical Area (TA)-55 waste streams resulting from special processing covered:

- Review of the *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3) (Sampling Plan) that includes information regarding all TRU waste streams
- Review of documents related to waste generation and waste management activities at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)
- Interviews with personnel involved with waste generation and waste management at TA-55 as listed on the Acceptable Knowledge Roadmap (Attachment 1)

NOTE: Much of the AK information related to special processing is contained in Transuranic Waste Characterization/Certification Project (TWCP) Record No. TWCP-3543. Individual documents in this record have been assigned a separate identifier, SP-nn, where nn is a sequential 1- or 2-digit number. This referencing nomenclature is used throughout this report and its attachments.

- Analyses of individual processes generating waste, and evaluations of the potential for Resource Conservation and Recovery Act (RCRA)-regulated constituents to be

present in the process wastes, based on subject matter expert (SME) interviews and any available data

The TWCP Records Management/Document Control (RMDC) Center contains copies of the documents referenced in this report. Any Unclassified Controlled Nuclear Information (UCNI) will be contained in these records, and will not be included in this report. Such records are identified as UCNI in the Acceptable Knowledge Roadmap (Attachment 1).

This process AK summary report is part of a set of closely-related reports about TRU-waste generating activities at TA-55. For convenience in organizing AK for plutonium processing at this facility, the processes were categorized into six arbitrary operational areas. The multiple processes in each area are then described in detail in the following six process AK reports for plutonium:

- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004)
- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55* (TWCP-AK-2.1-005)
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006)
- *Process Acceptable Knowledge Summary Report for Special Processing at TA-55* (TWCP-AK-2.1-007 [this report])

Each process AK report contains information on multiple individual processes that are assigned unique identifiers called process/status (P/S) codes. For example, special processing includes 14 individual processes that are each assigned a P/S code, as listed on the cover page of this report. The search and compilation of AK information was based on P/S code because that is the most detailed level of process information generally recorded in waste generation records. The process AK reports frequently cross-reference one another because P/S codes in one operational area often provide the material feed for P/S codes in another area. An index of P/S codes cited in this process AK report follows the list of acronyms; this index lists process descriptions and the primary process AK report in which that P/S code is discussed.

3.0 DESCRIPTION OF THE PROCESS WASTE

The following sections describe processes used in special processing, and identify the resulting wastes as well as outputs that are sent to other operations, such as nitrate operations, for further processing.

3.1 Facility and Mission

The TA-55 Plutonium Facility (Building PF-4) recovers plutonium from scrap and residues generated throughout the U.S. Department of Energy (DOE) defense complex, and processes it into pure plutonium oxide for conversion to metal and other products. A LANL site map and a detailed map of the buildings at TA-55, including Building PF-4, are shown in Attachment 2.

Most processes in special processing were solely defense related (TWCP-614, TWCP-4162). However, wastes from various processes were not always segregated by funding source, waste-generating process, or waste-generating location (e.g., room or glovebox) until recently (August 27, 1998), but rather were segregated and packaged based on waste type (TWCP-887, TWCP-4162, TWCP-4167) as well as material type. For example, plutonium material type MT-42 (enriched in Pu-242) has always been segregated from other wastes; this material type is exclusively defense-related. Similarly, plutonium material type MT-83 (enriched in Pu-238) is also segregated from other wastes; but this material type is not used solely for defense activities. Consequently, a single waste container often contains wastes from multiple processes. Some debris waste was also co-mingled with room trash related to these same operations (both defense and non-defense), and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level discard limits (DLs) (TWCP-816).

3.2 Waste Physical Form and Content Description

Wastes generated during special processing, primarily debris wastes and wastes entered into the cement fixation process or sent to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50 are covered by this process AK report. General debris waste categories from special processing include

- Cellulose-based waste (for example, paper, cloth)
- Plastic-based waste (for example, gloves, tape, labware)
- Rubber
- Magnesium oxide crucibles
- Metal debris (for example, tantalum crucibles, wire, hose clamps, tools, labware)

- Glass debris

These debris items are contaminated with small amounts of radioactive and chemical substances from special processing.

3.3 Waste Volume and Time Period of Waste Generation

This report covers waste streams generated from 1980, when special processing first began in Building PF-4, to the present. Process wastes from special processing have different associated RCRA codes depending on the time period during which they were generated. The P/S codes, their time period of generation, and corresponding RCRA codes are shown graphically in Attachment 3, Timeline for Special Processing.

Waste volumes for each P/S code have not been tracked. Instead, waste items are segregated into similar material types and packaged in waste containers. Waste containers are assigned to waste streams in the Sampling Plan, and waste stream volumes are reported in that document.

3.4 Waste Generation Processes

The following subsections describe the generation of waste by special processing, as well as product and waste outputs to other processes or operations.

Manufacturing and research operations performed at TA-55 in the production of plutonium also generate plutonium-contaminated scrap and residues. These residues are processed to recover as much plutonium as is practical. TA-55 has extensive capabilities for the extraction and recovery of plutonium from residues and scraps generated from operations at various LANL facilities and other DOE sites. These recovery and manufacturing operations, associated maintenance operations, and TA-55 plutonium research are the sources of TRU waste generated at TA-55.

Detailed information about the TA-55 plutonium recovery processes can be found in *Waste from Plutonium Conversion and Scrap Recovery Operations* (TWCP-352). A full-block flow diagram for plutonium processing and waste management at TA-55 is given in reference TWCP-886. In general, TA-55 plutonium recovery processes can be divided into five major processes:

- Head-end operations
- Aqueous nitrate-based processes
- Aqueous chloride-based processes
- Separation and purification by precipitation
- Metal preparation and purification (pyrochemical processes)

Each of these process categories is described below. Timelines for these processes are presented in Attachment 3. A complete listing of P/S codes for special processing, their descriptions, feed materials, and inputs and outputs is found in Attachment 4. A simplified process flow diagram for special processing is found in Attachment 5.

3.4.1 Head-End Operations (P/S Codes ACD, IAM, SB, and SL)

Head-end operations involve incineration, calcination, leaching of noncombustible materials (including ash), conversion of pyrophoric metal and compounds to stable oxides, and dissolution. P/S code IAM is also classified as a head-end operation in this report because it involves inspection of scrap items from the vault to determine an appropriate disposition for them.

Combustible wastes are burned in air in a furnace prior to being calcined. Calcination uses rotary calciners to remove incompletely oxidized organic material from some types of feed prior to leaching or dissolution in nitric acid (SP-5, SP-43 [both in TWCP-3543]). This treatment step is quite advantageous for the following reasons:

- Organic materials sometimes react vigorously when treated with strong nitric acid,
- Emulsions that form when nitric acid reacts with organic material impede plutonium recovery, and
- Some of the organic materials dissolve in nitric acid to yield a dark solution that in turn poisons the ion-exchange resin.

Glovebox operations and research and development (R&D) projects routinely generate non-plutonium scrap metal, glass, high-efficiency particulate air (HEPA) filters, tools, plastics, glovebox sweepings, sand, slag, crucibles, etc. Leaching in nitric acid and hydrofluoric acid, or pickling these materials in hydrochloric acid, is a relatively easy but incomplete decontamination method (SP-1, SP-2, SP-3, and SP-4 [all in TWCP-3543]).

Conversion of pyrophoric metals and compounds to stable oxides is usually done by calcination in a controlled oxygen atmosphere and at temperatures less than 600°C. Low-fired oxides are easier to dissolve in nitric acid (TWCP-3543/SP-42).

Dissolution of oxide prepares plutonium for purification by nitrate ion exchange processing and oxalate precipitation.

Under P/S code IAM, MT42 scrap items (gloves, ash, rags and other items that may contain RCRA-listed metals) were taken from the vault, visually inspected for material type, and remeasured by non-destructive assay. If the Pu content was less than the DL, the items were discarded. Material that was not discardable, but was within specification, would be sent to P/S codes DO or SL for treatment or was returned to the vault. Out-of-specification material was sent to P/S code POSM for processing. Activities conducted under POSM are similar to those for P/S code DO (section 3.4.5).

3.4.2 Nitrate Anion Exchange (P/S code IX)

Nitrate anion exchange is the primary method used at LANL for the aqueous concentration of plutonium. The most commonly used ion exchange resin is a polyvinyl pyridine base macroporous-type resin. Information on the use of this method for processing plutonium material type MT 42 (see section 3.5.2), is provided in references SP-6, SP-7, SP-8, SP-9, SP-34 (all in TWCP-3543). Nitrate anion exchange for MT 52 is discussed in the nitrate operations process AK report (TWCP-AK-2.1-005,R.1, section 3.4.3).

Nitrate anion exchange is a very powerful technique for recovery and separation of plutonium from most elements in the periodic table. At constant acidity, the amount of plutonium absorption onto the resin increases with nitrate concentration. Aluminum nitrate is added to the column to complex with fluoride and oxalate anions, which would otherwise complex with plutonium and prevent its full absorption onto the resin. The plutonium must be in the +IV oxidation state for absorption onto the column and, because plutonium can exist in five different oxidation states in aqueous solution, the oxidation state must be adjusted by careful selection of the sequence and type of reducing and oxidizing agents.

Major reducing and oxidizing agents used in plutonium production operations include hydroxylamine nitrate ($\text{NH}_2\text{OH}\cdot\text{HNO}_3$), ferrous ammonium sulfate [$\text{Fe}(\text{SO}_4)(\text{NH}_4)_2\text{SO}_4\cdot 6\text{H}_2\text{O}$], sodium nitrite (NaNO_2), urea [$\text{CO}(\text{NH}_2)_2$] and hydrogen peroxide (H_2O_2).

Ion exchange operations are typically divided into the following steps: (1) column conditioning, (2) feed oxidation state adjustment, (3) loading plutonium in nitric acid, (4) washing with 7 molar nitric acid, (5) elution with hydroxylamine nitrate, and (6) readjustment of the column from the low-acid elution step to 7–8 molar nitric acid for the next column run.

Effluents from nitrate ion exchange, when discardable, are sent to P/S code EV (part of nitrate operations), where they are reduced in volume

by evaporation. Similar to waste from ion exchange processes in nitrate operations (e.g., P/S codes DS and LR), these wastes may be contaminated with the heavy metals cadmium (D006), chromium (D007), lead (D008), mercury (D009), and silver (D011). The evaporator salts are sent to cement fixation (P/S code CF, also part of nitrate operations). The distillate is sent to the RLWTF at TA-50.

3.4.3 Chloride Anion Exchange (P/S codes DO and POSM)

Chloride salts are an important class of residues and are by-products of pyrochemical operations that are also important to Special Processing operations. In addition, plutonium must be recovered from the hydrochloric acid leach solutions employed during pickling (also conducted under P/S code DO). Chloride anion exchange is the method of choice for recovery of plutonium from these chloride-based processes (SP-14, SP-16, SP-30, SP-33, SP-34 [all in TWCP-3543]). Chloride anion exchange is a more recent innovation in Special Processing operations. It was probably implemented sometime in the early 1990s (TWCP-3543/SP-37). Prior to that, hydroxide precipitation was used and is discussed in the chloride operations process AK report (TWCP-AK-2.1-002,R.1, section 3.4.4).

Special Processing operations use chloride anion exchange to recover plutonium from salts produced by multicycle direct oxide reduction (MCDOR), molten salt extraction (MSE), electrorefining (ER), and pyroredox operations. The general chloride anion exchange process consists of the following steps: (1) dissolution of salt in 2-4 molar hydrochloric acid, (2) adjustment of plutonium oxidation state, chloride concentrations, and pH using 12 molar hydrochloric acid and sodium nitrite, (3) loading of feed solution onto the ion exchange column, (4) washing with 8 molar hydrochloric acid, (5) elution of plutonium from the column with 0.5 molar hydrochloric acid and 0.5 molar hydroxylamine hydrochloride, and (6) precipitation of plutonium oxalate by addition of solid oxalic acid. Chloride concentrations in the column eluant were measured by titration using silver nitrate and potassium dichromate until the end of 1992 when this method was replaced with a silver electrode.

Activities conducted under P/S code POSM are similar to those described above for P/S code DO. Feed materials to P/S code POSM are provided by P/S code IAM (section 3.4.1).

3.4.4 Metal Preparation (P/S code RM and PI)

Conversion of plutonium to an oxide from scrap can be used as feed material for metal preparation (TWCP-3543/SP-17). The oxide

compound is reduced to metal, often an impure form; however, the oxide would not contribute RCRA-listed heavy metals to wastes produced during metal preparation (TWCP-3543/SP-44). In pyrochemical operations, several processes are used to convert this impure metal into high-purity metal.

3.4.4.1 Fluorides

Reactive plutonium oxides formed by calcination of oxalate or peroxide precipitates can be treated in a hydrofluorinator to form plutonium fluoride (PuF_4). In the hydrofluorination step, the oxide is treated with hydrogen fluoride (HF) or fluorine gas (F_2) to produce PuF_4 . The PuF_4 is mixed with calcium metal, which in turn is heated to form calcium fluoride (CaF_2) and plutonium metal. Quite often, a booster (in this case iodine [I_2]) is added to initiate the reaction and to provide sufficient energy to ensure the reaction goes to completion. This method of metal preparation neither purifies the product metal, nor does it introduce many impurities. However, a high-purity oxide feed can produce metal that meets purity specifications for many applications. Wastes generated from this operation include magnesium oxide (MgO) sand, CaF_2 , and MgO crucibles. These waste items are sent to leaching operations to recovery any plutonium. Subsequent wastes are discarded. Hydrofluorination at LANL was discontinued in the early 1990s. In the Special Processing operations, this activity was conducted under P/S code PI (SP-22, SP-23, SP-41 [all in TWCP-3543]).

3.4.4.2 Oxides

Metal scrap containing plutonium can be converted to plutonium oxide by burning it at elevated temperature in air. Reactive plutonium oxides can then be converted to plutonium fluoride for reduction to plutonium metal. Unreactive or high-fired plutonium oxide does not react to form plutonium fluoride; instead, the addition of a strong reducing agent in a solvent salt is required to produce plutonium metal from such oxide. The resulting impure metal forms a button in the bottom of the crucible that is covered by a fused oxide/salt layer. The button is removed mechanically from the salt. All residues containing plutonium in excess of the DL are sent to aqueous recovery.

3.4.5 Separation and Purification by Precipitation (P/S code DO)

The separation of plutonium from aqueous solutions makes use of many different precipitation reactions, the most common being reactions involving oxalate, peroxide, hydroxide, and fluoride anions (TWCP-352; SP-10, SP-11, SP-12, SP-13, SP-15, SP-16, SP-25, SP-43 [all in TWCP-3543]). Common reasons for conducting these precipitation reactions include the following:

- Relatively concentrated plutonium nitrate solutions can be largely or partially purified from many cationic impurities.
- Precipitation of plutonium (III) oxalate from very large volumes of nitrate anion-exchange eluates is a very quick and convenient concentration step.
- Calcination at 550°C can easily convert precipitated oxalates of plutonium (III) and plutonium (IV) to reactive plutonium oxide (PuO_2) suitable for hydrofluorination prior to metal preparation by calcium reduction.
- Some precipitated plutonium fluoride salts are suitable precursors for reduction to metal.
- Precipitation of plutonium and americium hydroxides from waste solutions such as oxalate or peroxide filtrates is an effective method to allow discard of the alkaline filtrate and recycle of the plutonium and americium in the separated solids. The hydroxide filtrate is discarded to the caustic waste line for treatment at the RLWTF at TA-50.

The following discussion summarizes the more important precipitation reactions and disposition paths for their filtrates (TWCP-352).

3.4.5.1 Plutonium (III) oxalate

Since the early days of the Manhattan Project, researchers have found it advantageous to produce large-particle-size precipitate because large grain sizes filter most readily. Plutonium (III) oxalate precipitation provides good separation from such impurities as aluminum (Al^{3+}), ferric iron (Fe^{3+}), and uranium oxide (UO_2^{2+}). Less separation is provided from calcium, potassium or sodium, and none from americium (III).

3.4.5.2 Plutonium (IV) oxalate

Plutonium (IV) oxalate is often quite fine-grained and gummy, but controlled addition of oxalic acid solution produces a coarse-grained precipitate that compares favorably with the best plutonium (III) oxalate precipitates. The higher acidity of plutonium (IV) oxalate gives better separation of Al^{3+} , Fe^{3+} , and UO_2^{2+} than does plutonium (III) oxalate.

3.4.5.3 Plutonium peroxide

Plutonium peroxide precipitate gives the best overall separation from cations; and, unlike the two oxalate precipitates, peroxide precipitation also gives excellent separation from Am-241. Plutonium peroxide is dissolved, reprecipitated as plutonium (III) oxalate, and calcined to provide plutonium oxide for plutonium metal production. Calcination of plutonium oxalate is more easily controlled than calcination of plutonium peroxide.

3.4.5.4 Plutonium hydroxide

Plutonium hydroxide precipitation is quite useful for producing a filtrate that can be discarded to final waste disposal. Oxalate and peroxide filtrates are frequently treated with sodium or potassium hydroxide to precipitate plutonium and Am-241 hydroxides and to destroy residual hydrogen peroxide. In addition, hydroxide precipitation is a good method for discarding spent chloride process solutions because alkaline solutions cause less corrosion of stainless steel. One potential problem with hydroxide precipitation is the generation of voluminous amounts of magnesium and calcium precipitates if pH is not carefully controlled.

3.4.5.5 Plutonium fluoride

Plutonium fluoride precipitation is not as common as precipitation of plutonium oxalate, peroxide, or hydroxide. The feedstock must be relatively pure because separation of plutonium from impurities is not as good for plutonium fluoride as for the other precipitation methods.

3.4.5.6 Disposition of oxalate and peroxide filtrates

Oxalate and peroxide filtrates cannot be sent directly to final waste management without further processing. Oxalate

filtrates cannot be directly processed by ion exchange because oxalic acid interferes with adsorption of plutonium onto the resin. LANL evaporates oxalate filtrates to destroy the oxalate ion while reducing the volume of solution to be recycled through the ion exchange column (either nitrate or chloride ion exchange).

Both oxalate and peroxide filtrates are amenable to recovery of residual plutonium by hydroxide precipitation and subsequent disposal of the filtrate. The hydroxide cake can then be recycled to recover and purify the plutonium and americium if above the discard level, or can be discarded if these radionuclide concentrations are below the discard level.

3.4.6 Pyrochemical Operations (P/S codes PX and RM)

Pyrochemical operations for MT 42 (defined in section 5.2.1) include MCDOR with in-situ regeneration and electrorefining (P/S code RM) and MSE (P/S code RM), and oxide reduction (P/S code RM) (SP-17, SP-18, SP-19, SP-20, SP-21 [all in TWCP-3543]). Pyrochemical R&D efforts for MT 52 in the Special Processing area were done under P/S code PX. This included MCDOR with in-situ regeneration, electrorefining, pyroredox, preparation of PuCl_3 using chlorine gas and carbon tetrachloride, and MSE (SP-26, SP-27, SP-28, SP-29 [all in TWCP-3543]). Cadmium and lead were used occasionally as secondary solvent metals in P/S code PX.

3.4.7 Direct Oxide Reduction (DOR) Processes (P/S codes PX and RM)

3.4.7.1 Single-Pass DOR Process

Prior to the MCDOR process, a single pass DOR process was used for plutonium oxide (TWCP-2507, PYRO-14/TWCP-3542). Plutonium oxide and calcium metal are reacted in molten calcium chloride (CaCl_2) or CaCl_2 mixed with calcium fluoride (CaF_2), to produce plutonium metal. The reaction is conducted in a magnesium oxide (MgO) crucible at 820°C to 875°C . Any arsenic, mercury or selenium present in the impure plutonium oxide would be driven off due to their volatility at this high temperature (TWCP-1258). The reaction proceeds to completion when excess calcium is present and when sufficient CaCl_2 is available to dissolve the calcium oxide (CaO) product.

After cooling, a plutonium metal button is removed by breaking the crucible. A layer of salt above the button

contains unreacted oxide and calcium metal shot, which was sometimes recovered by addition of fresh salt plus additional calcium metal. The process was then rerun. If the unreacted oxide and metal shot did not process after the second run, the material was sent to aqueous recovery. The product plutonium metal contains significant impurities, including additional metal impurities derived from the calcium metal and calcium chloride reagents. It must be further purified by ER. The salt, remaining calcium metal, and MgO crucible pieces are sufficiently low in plutonium to be discarded directly as waste under P/S codes RM or PX. Salt that cannot be discarded as waste is routed through aqueous chloride operations (P/S code DO) to recover the plutonium. After May 1987, spent salts above the DL were sent to controlled oxidation to oxidize the pyrophoric metals. In any case, all DOR salts were oxygen sparged before disposal.

The feed oxide, reagent salts and reductant are of the highest purity available because the process is non-purifying. In fact, the plutonium metal produced from this operation is always less pure than the feed material due to impurities derived from the reductant reagents. Plutonium metal from this process typically requires further processing to meet purity requirements.

3.4.7.2 MCDOR Process

To minimize the salt waste, the MCDOR process was started in 1988 (TWCP-2502, SP-25, SP-27, SP-39 [all in TWCP-3543]). In this process, the molten salt is regenerated by sparging the $\text{CaCl}_2\text{-CaO}$ mixture with chlorine gas between multiple plutonium metal production runs. After approximately five cycles of metal production, the mixture is cooled and the salt and metal phases are separated. The salt is chlorinated and reused for MCDOR. The salt is discarded under P/S codes RM or PX if the plutonium concentration is below the DL. The salts above the DL are returned to P/S code DO for dissolution and recovery. Before 1987, the salts may have been discarded under P/S codes RM or PX or routed to chloride operations. The chlorine off-gas is passed through a caustic scrubber, with the caustic solution going to the RLWTF at TA-50 for disposal if the solution meets this facility's Waste Acceptance Criteria (WAC). If the solution does not meet the WAC, it is returned to P/S code DO for additional treatment.

MCDOR process inputs are low in contaminants. Only high-purity reagent chemical salts are used in the process, and the plutonium oxide feed materials are also of high purity, with absorbed water being the main impurity. MCDOR metal feed material analytical samples were analyzed for cadmium, chromium, lead, and silver. A review of 100 analyses showed that, even in the most impure sample, these D-listed toxicity characteristic metals were well below RCRA regulatory limits (TWCP-2540), as follows:

Metal	Totals Analysis	Calculated TCLP Result	Regulatory Level
Cadmium	<10 ppm	<0.5 mg/L	1 mg/L
Chromium	30 ppm	1.5 mg/L	5 mg/L
Lead	20 ppm	1 mg/L	5 mg/L
Silver	2 ppm	0.1 mg/L	5 mg/L

All metal impurities except barium would be reduced to the metal state and remain with the plutonium metal phase rather than be transferred into the molten salt phase. Hence, the molten salt phase is purified of regulated metals except for barium. These regulated metals will be present in the waste salt at levels below the toxicity characteristic levels. Because the salts are reused, only the initial reduction in fresh salt would contain any of the salt feed impurities.

The waste salt, crucibles, and debris waste items associated with this process are discarded under P/S codes DO, PX, or RM. Asbestos gloves were also used in glovebox operations under P/S codes RM or PX, and were disposed with ceramic and glass debris.

3.4.8 Molten Salt Extraction (P/S codes ACC, PX, and RM)

MSE is used to separate the more reactive elements such as rare earth elements, alkali metals, and alkaline earth metals, and americium from plutonium metal (TWCP-352, TWCP-3543/SP-19). This process is employed only if the americium content is greater than 1000 ppm. In the original process, which operated from 1980 to 1988, magnesium chloride ($MgCl_2$) was added to the impure plutonium metal in a tantalum crucible, covered with a mixture of sodium chloride and potassium chloride (NaCl/KCl), and then heated to 750°C. Magnesium oxidized americium to americium chloride ($AmCl_3$), although some plutonium

was also converted to the chloride salt. In 1988, the MSE process was converted to use plutonium trichloride (PuCl_3) produced by in-situ chlorination. In the LANL process, 90 percent of the americium and 10 percent of the plutonium are transferred from the impure feed metal to the salt. After cooling, the salt and residual metal are mechanically separated. The salts are transferred to the aqueous chloride process under P/S code DO.

P/S code ACC was an experimental effort using ammonium chloride as a chlorinating agent to produce plutonium trichloride (SP-24/TWCP-3543).

3.4.9 Electrorefining (P/S codes PX, RM, and SBB)

The ER process was introduced in 1962 at TA-21 and was moved to TA-55 in 1979 under pyrochemical operations. This process was implemented as part of special processing in 1980. It takes impure metal from the MSE and MCDOR (DOR) processes and produces high purity plutonium metal (SP-18/TWCP-3543], TWCP-2505). Impure plutonium is cast as an anode, which is then placed in a magnesium oxide crucible with a salt mixture, a metal cathode (typically tungsten), and a seeding reagent that is MgCl_2 or PuCl_3 (TWCP-3543/SP-24, TWCP-2505). After the anode and salt melt, current is applied to the system, and plutonium at the anode is oxidized to plutonium ions, which travel to the cathode and are reduced back to the metal state. Impurities in the original plutonium anode that are less electroactive than plutonium (including cadmium, chromium, lead, and silver) remain in the anode, while impurities more electroactive than plutonium (including barium) are left in the molten salt. After cooling, the crucible is broken and the residues are physically separated from the high purity product metal. MT 42 anode heels are oxidized in P/S code RM, then are sent to aqueous recovery in P/S code DO. Salt and crucibles are sent for plutonium recovery under P/S code DO. MT 52 residues went to the vault. Salt may be stripped prior to going to P/S code DO.

In 1986 to 1989, secondary solvent metals such as cadmium, bismuth, lead, and gallium were added to experimental studies of the MT 52 electrorefining process (TWCP-3543/SP-29). The salts and crucibles from those ER runs may be contaminated with additional cadmium and lead, although those metals should have remained in the anode heels. However, these particular anode heels are retained in the vault at TA-55, with no plans to reprocess them in the near future. A pyroredox process was developed to recover plutonium from the anode heels, but it was mostly limited to demonstration runs.

The salt and crucible residues were discarded under P/S code PX when the plutonium content was sufficiently low. However, very little salt from this process met the DL. The salt typically contains up to eight percent of the feed plutonium and is treated by salt stripping to recover the plutonium under P/S code PX.

P/S code SBB was an R&D effort examining the feasibility of a DOR-like process for extracting Pu from salt before discarding the salt. Pu was chlorinated then reduced to the metal with calcium metal. The feed material for this process was salt containing plutonium MT 42.

3.4.10 Pyroredox (P/S code PX)

The pyroredox operation was developed to recover plutonium material type MT 52 from spent anode heels in the mid- to late-1980s (TWCP-2541). The anode heel was polished with calcium metal to remove surface oxide, then oxidized to plutonium (III) with zinc chloride ($ZnCl_2$) in molten KCl, forming plutonium chloride ($PuCl_3$). Elements more electroactive than zinc (including barium) were oxidized into the salt phase, and the zinc formed a metal button. Any of the residual RCRA-regulated heavy metals that may have been present in the spent anode heel (barium, cadmium, chromium, lead, and silver), with the exception of barium, would be present in the zinc button. The salt was then mixed with calcium metal in $CaCl_2$ to reduce the plutonium to the metal phase, as well as reducing all elements less electroactive than calcium. The salt phase containing small amounts of the impurity barium was mechanically separated from the metal phase and discarded under P/S code PX. The metal phase containing zinc was placed in the vault or further treated (TWCP-2540), and the plutonium eventually was routed back to electrorefining (also conducted under P/S code PX). In the electrorefining process, the RCRA-regulated metals are concentrated in the anode heel, which then may be treated in the pyroredox process to transfer these RCRA metals to the zinc button, or may be roasted in air to form metal oxides and then be dissolved in nitrate operations. Thus, only the zinc button output could contain RCRA-regulated metals above the toxicity characteristic limits.

3.4.11 Plutonium Pellet Dissolution (P/S Code PPD)

Pu-238 pellets were dissolved in a combination of nitric and hydrofluoric acid (TWCP-3543/SP-45). The plutonium was precipitated as the oxalate using either oxalic acid or sodium oxalate and after digestion was filtered to separate the solid plutonium oxalate. The oxalate was converted to the oxide by heating to 600°C to 700°C, then heated with water vapor to about 800°C to volatilize the fluoride content as HF to prepare the finished product. The oxalate filtrate was treated

with caustic to remove the plutonium by a hydroxide precipitation and subsequent filtration. The hydroxide cake was dried and sent to the vault. The hydroxide filtrate was discarded to the RLWTF at TA-50 if it met this facility's WAC or was recycled to filtration until it did meet the WAC. No solvents or heavy metals were used in the process.

3.5 Material Inputs to the Waste Generation Processes

Attachment 4 lists P/S codes for special processing at TA-55, including process descriptions, feed material, other process inputs, process outputs, and type of waste. The feed materials for special processing consist of the general types of materials listed in Table 1 that are obtained from the storage vault, as process output from other P/S codes, or from sources outside TA-55, including other DOE sites.

The remainder of this section summarizes the nature of the process waste in terms of its physical, chemical and radioisotopic characteristics.

3.5.1 Physical Waste Form Identification

Solid waste from special processing primarily consists of debris waste. Debris waste contains glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Leaded gloves may also be generated as process waste. Prior to May 1992, leaded gloves were discarded as metal debris but were not otherwise segregated from other metal wastes. Since that time, they have been routinely segregated from other metal debris although they continue to be discarded under the originating P/S code. In addition, caustic solutions from hydroxide precipitation are discarded through the waste line to the RLWTF at TA-50.

Because items from several different processes are usually combined into individual waste drums, the physical waste form of each drum must be determined independently. This information is documented on a Waste Origination and Disposition Form (WODF) by the waste generator according to controlled procedures. The P/S code for each waste item is also documented on this form. In the packaging process, a standard form, the Discardable Waste Log Sheet (DWLS), was used to list each item and record its matrix material. This form was signed by the waste packager, reviewed, and approved by quality assurance (QA) personnel. Example forms for one drum of waste generated can be viewed in record TWCP-2513.

Table 1. Process Feed Materials for Special Processing

Feed Material	Potential Presence of RCRA-Regulated Substances	P/S Codes in Special Processing
Ash from P/S code SB	Usually suspect contaminated with Ba, Cd, Cr, Pb, and Ag (D005, D006, D007, D008, D011). As, Hg, and Se may also be present although these metals are volatilized at high temperatures if present in the oxide and chloride forms.	ACD, DO, SL
Crucible pieces (tantalum, magnesium oxide)	Typically fairly pure, no RCRA substances present	ACD, SL
Hydroxide cakes	Typically contaminated with RCRA-regulated heavy metals Cd, Pb, Hg, Ag and possibly Cr (D006, D008, D009, D011, and D007)	DO
Miscellaneous materials contaminated with Pu (e.g. sand, slag, tools, crucibles, metal, glass, plastic, labware, scrap, rags, glovebox sweepings, pump oils)	Typically contaminated with RCRA-regulated heavy metals Cd, Pb, Hg, Ag and possibly Cr (D006, D008, D009, D011, and D007)	ACD, DO, SB, SL
Pu chlorides and fluorides (from P/S codes PI, PX, and RM)	Variable purity	RM
Pu metal or metal alloy	High purity, no RCRA-regulated substances, unless noted otherwise	ACC (variable purity), PI (variable purity), PPD, POSM, RM, SB
Pu oxalates	Typically fairly pure, no RCRA substances present	SL
Pu oxides	Variable purity, suspect contaminated with RCRA-regulated heavy metals Cd, Cr and Pb (D006, D007, D008)	DO, PI, PX, POSM, RM
Pyrochemical salts	Typically fairly pure, no RCRA substances other than Ba (D005) are present	DO

3.5.2 Radionuclide Content Identification

The primary plutonium material type inputs for plutonium feed materials at Building PF-4 are listed in Table 2. The designation *material type* (e.g., MT 52) is used within the DOE Complex to describe the isotopic composition of common blends of radioactive materials used within the Complex. The material type notation was developed because it is a convenient way to describe material types that have very consistent isotopic compositions. Table 2 indicates the isotopic composition of the material types at the time the waste was characterized. The material type provides the basis for estimating an upper bound for U-234, U-235, and Am-241 contents based on the rate of decay of their precursors, Pu-238, Pu-239 and Pu-241, respectively. The results of these calculations are also tabulated in Table 2, assuming (a) none of these isotopes were initially present in the material, (b) the oldest Pu material in inventory dates back to 1 January 1960, and (c) the waste was packaged on 1 January 1996, making it 36 years old (TWCP-698).

The material type used in the process generating each waste item was documented on the WODF and DWLS. However, some of the plutonium recovery processes separate plutonium and americium, or plutonium and uranium so that their relative ratios may be altered in the process outputs and wastes. Waste items may be either depleted or enriched in americium depending on whether the source of contamination is the process product or the process residues (TWCP-882).

Residues submitted for reprocessing often contain Np-237, the decay product of Am-241 (half-life, 458 yr). This radioisotope is expected to be present in minor amounts in nearly all debris waste from special processing at TA-55.

In general, uranium and its isotopes are expected to be present only at trace levels, if at all. U-238 would only be present if purposefully added to the feed material. U-235 in growth from the decay of Pu-239 (half-life, 24,120 years) would be negligible due to the long half-life of Pu-239. Uranium-234 would be present in MT 83 as a decay product of Pu-238 (half-life, 87.74 years). After 20 years, 14.6 percent of the initial Pu-238 would have decayed to U-234. For MT 83 with an initial content of 83.89 percent Pu-238, the atomic ratio U-234 to total Pu would be about 0.14. No U-236 is present.

During TWCP characterization, the contents of each waste package undergo non-destructive analysis to provide detailed radioisotopic data. These data will be used to evaluate the accuracy of AK information in accordance with *Waste Characterization Data Reconciliation with*

**Table 2. Average Isotopic Content of Plutonium Material Types and Enrichments
(Weight %)**

Material Type (MT)	Plutonium isotope and half-life						Upper limits for weight ratios		
	Pu-238 (87.74 yr)	Pu-239 (24120 yr)	Pu-240 (6564 yr)	Pu-241 (14.35 yr)	Pu-242 (376,300 yr)	Pu-244 (8.26 x 10 ⁷ yr)	U-234/ Total Pu	U-235/ Total Pu	Am-241/ Total Pu
MT 51	0.006	96.77	3.13	0.076	0.018	—	1 x 10 ⁻⁵	0.001	0.0006
MT 52	0.01	93.78	6	0.2	0.02	—	2 x 10 ⁻⁵	0.001	0.002
MT 53	0.03	91.08	8.45	0.366	0.071	—	7 x 10 ⁻⁵	0.0009	0.003
MT 54	0.046	87.42	11.5	0.81	0.22	—	0.0001	0.0009	0.007
MT 55	0.06	83.88	14.73	1.03	0.304	—	0.0002	0.0009	0.009
MT 56	0.061	81.9	16.51	1.18	0.355	—	0.0002	0.0009	0.01
MT 57	0.433	74.63	20.7	2.55	1.69	—	0.001	0.0008	0.02
MT 42									
84%	1.02	1.37	10.32	3.13	84.14	0.02	0.003	1 x 10 ⁻⁵	0.03
90%	0.72	1.26	6.4	1.86	89.77	—	0.002	1 x 10 ⁻⁵	0.02
95%	0.45	0.56	2.47	0.906	95.58	0.029	0.001	6 x 10 ⁻⁶	0.008
MT 83									
83%	83.89	13.8	1.9	0.32	0.09	—	0.26	0.0002	0.003
89%	89.26	10.07	0.633	0.021	0.015	—	0.28	0.0001	0.0002

Source: TWCP-698

Acceptable Knowledge (TWCP-DTP-1.2-064). If warranted, this AK report will be updated to incorporate the results of these comparisons.

3.5.3 Chemical Content Identification

Chemical inputs to special processing are listed in Table 3. The use of strong acids, bases, or oxidizers does not result in RCRA listings for solid debris waste from these processes because of the absence of free liquids in this waste. However, D006, D007, D008, D011, and D019 apply to some of the process wastes generated by special processing, as noted in Table 3.

4.0 ASSIGNMENT OF EPA HAZARDOUS WASTE NUMBERS

The assignment of EPA hazardous waste numbers to process wastes from special processing operations is summarized below, as well as on the process timelines in Attachment 3, and the table of process inputs and outputs in Attachment 4. These assignments take into account the possible presence of RCRA chemicals in process waste as a result of their suspected or known presence in feed materials, chemical inputs, equipment, and glovebox surfaces.

Chemical Input	P/S Codes in which RCRA-Listed Chemical Is Used	Comments on Applicability of RCRA Listing
Sodium chloride Sodium nitrite Sodium oxalate Zinc chloride		
Organic Chemicals		
Carbon tetrachloride	PX	D019. F002 does not apply because carbon tetrachloride was used as a chlorination reagent.
Urea		

4.1 F, K, and P Listings

No F, K, or P listings apply to solid wastes generated from any of the special processing because no F-listed, K-listed, or P-listed chemicals were present in the feed materials, chemicals or equipment used in these processes.

4.2 Toxicity Listings

No D001 (ignitable), D002 (corrosive), or D003 (reactive) listings apply to solid wastes from special processing because no ignitable chemicals were used in these processes and because the solid wastes do not contain any free liquids (see Section 6.0).

D005 (barium) and D008 (lead) apply to P/S code VU.

D005 (barium), D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver) apply to P/S codes ACD, IAM, SB and SL.

D006 (cadmium), D007 (chromium), D008 (lead), D009 (mercury), and D011 (silver) apply to waste generated under P/S code IX.

D006 (cadmium), D008 (lead), and D019 (carbon tetrachloride) apply to salt, crucible and debris waste generated P/S code PX.

D006 (cadmium), D007 (chromium), D008 (lead), and D011 (silver) are assigned to the zinc metal waste produced from P/S code PX. In the ER process, these RCRA-regulated heavy metals concentrate in the anode heel, which then may be treated in the pyroredox process (P/S code PX) to transfer them to the zinc button, or may be roasted in air to form metal oxides and then be dissolved in nitrate operations. Thus, only the zinc button output could contain RCRA-regulated metals above the toxicity characteristic limits.

D006 (cadmium), D008 (lead), and D019 (carbon tetrachloride) apply to P/S code PX, as the salts, crucibles, and debris waste items discarded under this code may include some RCRA-regulated metal residues above the toxicity characteristic

limits. Carbon tetrachloride was used as a chlorination reagent in this P/S code from April 1988 until July 1989.

D007 (chromium) and D011 (silver) apply to P/S codes DO and POSM. Potassium dichromate and silver nitrate were used in P/S code DO for chloride titrations until the end of 1993. Solution and precipitates were then processed by hydroxide precipitation under the same code. Hydroxide cakes (in which chromium and silver would be present) were sent to P/S code POSM. Ultimately, chromium and silver end up in the solution sent to P/S code EV, from which the residue gets sent to cement fixation.

D008 (lead) applies to metal waste from all P/S codes in special processing, except for P/S codes ACD and PPD. Before 1992, leaded gloves were segregated and discarded as metal debris. Thus, metal debris containing these gloves from chloride operations before 1992 is assigned D008. Since May 1992, however, these gloves have been routinely segregated from other metal debris although they are still discarded under the originating P/S code (TWCP-4166).

4.3 Corrosivity, Reactivity, and Ignitability

See Section 6.0.

5.0 DETERMINATION OF THE RADIOISOTOPIC COMPOSITION

See Section 3.5.2.

6.0 VERIFICATION THAT IGNITABLE, REACTIVE, AND CORROSIVE WASTES WERE EXCLUDED

According to the WIPP WAP, "The prohibition of liquids and containerized gases prevents the shipment of corrosive, ignitable, or reactive wastes." Administrative controls on waste packaging were in place at various times to ensure the absence of such items from the waste stream.

- Liquids were prohibited from solid waste streams at TA-55 when the facility opened in January 1978. A waste management procedure written to cover operations at the new facility, *TA-55 Standard Operating Procedure (SOP) 406-GEN-R00*, stated that "Liquids are not permitted in any container of solid waste materials" (TWCP-3943).
- Chemical Waste Disposal Requests introduced in June 1980 included checkboxes which the waste generator was required to check if the waste contained corrosive acids or bases, or pyrophoric, flammable, corrosive, explosive, toxic, carcinogenic or highly reactive materials.

- The Certification Plan (TWCP-697) and related Generator Attachments (TWCP-701) were implemented in 1987. Waste generators were required to sign a statement on the WODF documenting that the waste contained “no free liquids, pyrophorics, explosives, compressed gases, powders or materials other than the indicated matrix.” Checkboxes were also present for indicating the presence or absence of corrosive chemicals. Full implementation of this generator statement occurred in May 1987.
- Waste management inspectors perform visual examination of the waste prior to its initial packaging, thus allowing the inspectors to verify the generator’s WODF statement (TWCP-701, Sections 3.8.5 to 3.8.6).
- Explosives were prohibited from TA-55 until installation of the Impact Test Facility in the early 1990s. Explosives continue to be banned in the solid waste streams up to the present time. If a misfire should occur, the requirement is to destroy the unspent powder by burning.
- The Waste Profile Request Form (WPRF), which has been in use at LANL since 1991, includes a statement which must be authenticated by the waste generator, that the waste is not ignitable (flash point $>200^{\circ}\text{F}$), reactive, or corrosive.
- The TA-55 Generator Attachments to the Certification Plan were updated in 1995 (TWCP-700) but the prohibition on liquids in the solid waste, and the waste management inspection, remained in effect.

Hence, since the inception of operations at TA-55, corrosive and reactive wastes have been excluded from TA-55 solid wastes through the prohibition of liquids.

The absence of these prohibited items is verified through radiography of each waste container and visual examination of selected containers during TWCP characterization activities. These data will be used to assess the accuracy of AK information in accordance with *Reconciliation of Visual Examination and Radiography Information* (TWCP-QP-1.1-028). Any free liquids are remediated, or the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007).

7.0 VERIFICATION THAT INCOMPATIBLE CHEMICALS WERE PROHIBITED

Section 6.0 summarizes administrative controls in place at TA-55 that prohibit incompatible chemicals in the waste, and measures taken to verify their absence. In addition, all waste containers shipped from TA-55 to TA-54 for storage were evaluated for potentially incompatible chemicals in accordance with 49 *Code of Federal Regulations* (CFR) Subpart C—Segregation and separation chart of hazardous materials; Section 177.848, Segregation of hazardous materials, and were determined to be in compliance with this requirement.

8.0 VERIFICATION THAT THERE ARE NO COMPRESSED GASES, FREE LIQUIDS, NONRADIONUCLIDE PYROPHORICS, SEALED CONTAINERS GREATER THAN FOUR LITERS IN VOLUME, OR >1% RADIONUCLIDE PYROPHORICS

Most gases used at the TA-55 Plutonium Facility are stored outside the building and the gas is plumbed into the glovebox from outside the building (TWCP-4164). Occasionally, a lecture bottle may have been used for a process inside the building, but these bottles were kept outside of the glovebox with the gas plumbed into the glovebox. Consequently, compressed gas cylinders or containers are not expected to be in any of the TRU wastes generated by TA-55 operations.

Spray cans, especially WD-40, were in common use in TA-55 gloveboxes until May 1992 (TWCP-4166). These were routinely discarded as metal debris waste. From 1988 until May 1992, the protocol was to vent or puncture the spray cans inside the glovebox; venting was indicated by inserting a metal wire into the valve. After May 1992, spray cans were no longer used in gloveboxes.

For items of pyrochemical salt waste, the procedures of oxygen sparging and/or carbonate oxidation have been used since May 1987 to ensure that pyrophorics were oxidized. In addition, screening tests on similar pyrochemical salts and residues (which contain higher amounts of plutonium) at the Rocky Flats Environmental Technology Site (TWCP-2501) have shown (1) no autoignition, (2) no spontaneous combustion, (3) and no sparking. Experimental results on the reactivity of LANL DOR salt with water and the reactivity in air of heated calcium metal nodules from DOR salts indicate the absence of "dangerous when wet materials" and pyrophoricity in these salts (TWCP-3730, TWCP-3731, TWCP-3732).

Verification that individual waste drums do not contain compressed gases, free liquids, or sealed containers greater than 4 L in volume is obtained from radiography of each waste containers and visual examination of selected containers during TWCP characterization activities. Any free liquids are remediated, and any sealed containers greater than 4 L in volume, or unpunctured or unvented gas containers, are removed; or else the container is tagged as non-compliant by filing a Prohibited Waste Report in accordance with *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007). For administrative controls on the prohibition of pyrophorics, see Sections 6.0 and 7.0.

9.0 VERIFICATION THAT THERE ARE NO POLYCHLORINATED BIPHENYLS (PCBs) IN THE WASTE STREAM

No PCBs were introduced into special processing, based on documentation in TA-55 procedures reviewed during the AK investigation and summarized in the process inputs listed in Table 1, Table 3, and Attachment 4. Oils used in the reviewed processes include vacuum pump oils, and cutting fluids used for cooling purposes; none of these oils are known to contain PCBs. All transformers known to contain PCBs have been tracked from

the time of startup of TA-55 in 1978. Whenever any transformer oil is drained, it is handled by a subcontractor who is wholly responsible for its disposal (TWCP-AK-2.1-005,R.1, Section 9.0). This oil does not enter the LANL disposal operations.

10.0 VERIFICATION THAT THERE IS NO ASBESTOS IN THE WASTE

Asbestos gloves were used in glovebox operations in P/S codes OR, RM and PX (TWCP-4162, TWCP-4166), which are discussed in *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55* (TWCP-AK-2.1-006,R.1), and in this report, section 3.4.7, respectively. These gloves were disposed with ceramic and glass debris. Asbestos heating mantles were never used at TA-55. Asbestos-bearing transite was widely used until recently for thermal insulation, including as a coverplate over the furnace in glovebox wells, and as part of end plates on Lindberg furnaces (TWCP-4162, TWCP-4166). Although many Lindberg furnaces have been replaced with newer asbestos-free furnaces, some are still in use at TA-55. The transite would have been disposed either as metal or as ceramic and glass waste streams.

11.0 CITED PROCEDURES AND REQUIREMENTS DOCUMENTS

- 40 CFR Part 261, Subpart C—Characteristics of hazardous waste, Sections 261.21 (*Characteristic of ignitability*), 261.22 (*Characteristic of corrosivity*), 261.23 (*Characteristic of reactivity*), and 261.24 (*Toxicity characteristic*)
- 40 CFR Part 261, Subpart D—Lists of hazardous waste, Sections 261.31 (*Hazardous wastes from non-specific sources*), 261.32 (*Hazardous wastes from specific sources*), and 261.33 (*Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof*)
- 49 CFR Subpart C—Segregation and separation chart of hazardous materials. Section 177.848, *Segregation of hazardous materials*
- *Acceptable Knowledge Documentation* (TWCP-QP-1.1-021,R.5)
- *Los Alamos National Laboratory Transuranic Waste Characterization Sampling Plan* (TWCP-PLAN-0.2.7-001,R.3)
- *Nonconformance Reporting and Tracking* (TWCP-QP-1.1-007)
- *Process Acceptable Knowledge Summary Report for Chloride Operations at TA-55* (TWCP-AK-2.1-002,R.1)
- *Process Acceptable Knowledge Summary Report for Metal Operation Processes at TA-55* (TWCP-AK-2.1-003,R.1)
- *Process Acceptable Knowledge Summary Report for Miscellaneous Operations at TA-55* (TWCP-AK-2.1-004,R.1)

- *Process Acceptable Knowledge Summary Report for Nitrate Operations at TA-55 (TWCP-AK-2.1-005,R.1)*
- *Process Acceptable Knowledge Summary Report for Pyrochemical Processes at TA-55 (TWCP-AK-2.1-006,R.1)*
- *Reconciliation of Visual Examination and Radiography Information (TWCP-QP-1.1-028)*
- *Waste Acceptance Criteria for the Waste Isolation Pilot Plant (DOE/WIPP-069)*
- *Waste Analysis at Facilities that Generate, Treat, Store and Dispose of Hazardous Waste (EPA/OSWER 9938.4-03)*
- *Waste Analysis Plan, Attachment B to the Hazardous Waste Facility Permit Issued to the Waste Isolation Pilot Plant (EPA No. NM4890139088)*
- *Waste Characterization Data Reconciliation with Acceptable Knowledge (TWCP-DTP-1.2-064)*

ACCEPTABLE KNOWLEDGE ROADMAP

Waste Stream: P/S Codes ACC, ACD, DO, IAM, IX, PI, POSM, PPD, PX, RM, SB, SBB, SL, and VU.

Copies of these documents are in the TWCP RMDC Center.

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-352	B	Description of plutonium recovery processes	<i>Wastes from Plutonium Conversion and Scrap Recovery Operations</i> , LA-11069-MS, March 1988.	Document describes the Pu residues and the various treatment approaches used in recovering plutonium from scrap	Document does not give information about RCRA constituents introduced or present in the processes
TWCP-614	D	All TA-55 waste is defense related	Memo from Doug Sankey.	All TA-55 waste is defense related	None
TWCP-697	C	Waste management requirements to meet WIPP WAC requirements were formalized in 1984.	<i>Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , WCP-HSE7-CPL-01, R.2 (November 1984)	Waste management requirements to meet WIPP WAC requirements. Generator Attachments were used to describe and reference specific generator procedures.	Overview document - Generator Attachments provide more detailed information.
TWCP-698	B	Gives Material Type compositions	NMT Memo, NMT-7 WM/EC-96-032 Benchmark Environmental Corp. Memo, AL-7193 BEC	Gives Material Type compositions	Does not give information on how material may fractionate in TA-55 waste processes.
TWCP-700	C	<i>Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste</i> , R05	<i>NMT-7 Attachment, January 1995</i> , TRUWM-TA55-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.
TWCP-701	C	<i>TA-55 Generator Attachment to the TRU Waste Certification Plan for Newly Generated TRU Waste</i>	<i>TA-55 Attachment, 1987</i> , TRU-MST12-CPA-03,R00	Documents controls to meet WIPP WAC were implemented and how independent verification was accomplished.	Information is not extremely detailed.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-816	D	Jim Foxx Interview on Number of Layers of Packaging	C.L. Foxx, Los Alamos National Laboratory	Waste was co-mingled with room trash, and was initially boxed as low-level waste. Subsequently, some of these waste boxes were returned for disposal in drums as TRU waste when on-site radioassay results showed them exceeding the low-level DLs.	None
TWCP-882 (UCNI)	D	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste	Memo from Jim Foxx	Lists additional radionuclides and metals potentially in waste, subdivided by process status code. Covers time period from 1978 to present.	Best information available, but it is based on worker recollection because other records are not available.
TWCP-886	C	Color Flow Diagram of Pu-processes at TA-55.	Diagram from Jim Fixx	Indicates that process inputs are thermally treated and that heavy metals from process inputs end up in the nitric acid evaporator bottoms.	Does not indicate solvent input to processes.
TWCP-887	D	Co-mingling of Defense and Non-Defense TRU Waste	Memo from Jim Foxx	Wastes generated from defense and non-defense activities were not segregated at TA-55 through 1997	None
TWCP-1258	B	“Waste Determination Report for Waste Stream TA-55-43, Lot No.1”	LANL internal report	Table B-1 lists the decomposition and vaporization temperatures of Hg, Se, and As and their oxides and chlorides.	None
TWCP-2501	B	“Backlog Waste Reassessment Baseline Book, Waste Form 34”	Rocky Flats Environmental Technology Site Report 1995	Page WF34-10 contains results of tests for corrosivity	Tests were conducted on residues rather than on waste.

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-2502	D	“Acceptable Knowledge Personnel Interview Form” for Waste Stream TA-55-39 (pyrochemical salts) and P/S codes MP, OR, SS, PX, ER, and RM	Jim Foxx, NMT-7	Answers to miscellaneous questions on pyrochemical processes.	Not a good overview
TWCP-2505 (UCNI)	C	Procedure for Plutonium Electrorefining (P/S SS)	TA-55 Document, 432-MPP-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-2507 (UCNI)	C	Procedure for Direct Oxide Reduction (P/S code OR)	TA-55 Document, 426-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-2513	A	Example of Generator Reports for Drum 54856	TA-55 Records Management Center	Example of generator records including WPRF #07045 and WODF form showing the waste generator certification statement.	Older forms are often hard to read.
TWCP-2540 (UCNI)	A	Answers to Questions about pyrochemical Processes	Jim Foxx, NMT-7-WM/EC-99-118	Also contains old records of analysis of DOR salts	
TWCP-2541 (UCNI)	C	Procedure for Pyroredox Processing of Spent Electrorefining Anodes (P/S RA)	TA-55 Document, 460-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3542 (UCNI) (PYRO-14)	C	Procedure for Reduction of PuO ₂ to Metal, 700g Scale (P/S code OR)	TA-55 Document, 420-MPP-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-1) (UCNI)	C	Procedure for Pickling, Leaching, and Dissolution (P/S SL)	TA-55 Document, 209-MPP-R00-R01	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-2) (UCNI)	C	Procedure for Pickling or Surface Leaching (P/S SL)	TA-55 Document, 211-MPP-R00-R04	Contains materials used in the process	No RCRA analyses documents

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-3543 (SP-3) (UCNI)	C	Procedure for Stirred Tank Leaching of Bulk Solids (P/S SL)	TA-55 Document, 240-MPP-R00-R07	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-4) (UCNI)	C	Procedure for Distillation of Lean Plutonium Solutions (P/S SL)	TA-55 Document, 241-MPP-R01-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-5) (UCNI)	C	Procedure for Rotary Calcination of Scrap (P/S SB)	TA-55 Document, 220-MPP-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-6) (UCNI)	C	Procedure for Oxalate Precipitation of Plutonium From Nitrate Solutions (P/S IX)	TA-55 Document, 215-MPP-R01	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-7) (UCNI)	C	Procedure for Oxalate Precipitation of Ion Exchange Eluates (P/S IX)	TA-55 Document, 216-MPP-R01-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-8) (UCNI)	C	Procedure for Nitrate Ion Exchange (P/S IX)	TA-55 Document, 219-MPP-R01-R07	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-9) (UCNI)	C	Procedure for Transfer of Waste-Acid Solution (P/S IX)	TA-55 Document, 236-MPP-R00-R06	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-10) (UCNI)	C	Procedure for Dissolution of Various Residue Materials in Hot Nitric Acid or Hydrochloric Acid (P/S DO)	TA-55 Document, 212-MPP-R01-R06	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-11) (UCNI)	C	Procedure for Conversion of Plutonium Oxalate to Oxide (P/S DO)	TA-55 Document, 213-MPP-R01-R09	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-12) (UCNI)	C	Procedure for Oxalate (IV) Precipitation (P/S DO)	TA-55 Document, 214-MPP-R01-R07	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-13) (UCNI)	C	Procedure for Peroxide Precipitation (P/S DO)	TA-55 Document, 217-MPP-R01	Contains materials used in the process	No RCRA analyses documents

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-3543 (SP-14) (UCNI)	C	Procedure for Dissolving Chloride Portion of Electrorefining Residues (P/S DO)	TA-55 Document, 226-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-15) (UCNI)	C	Procedure for Hydroxide Precipitation (P/S DO)	TA-55 Document, 230-MPP-R01-R08	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-16) (UCNI)	C	Procedure for Oxalate Precipitation of Pu from Hydrochloric Acid Solutions (P/S DO)	TA-55 Document, 232-MPP-R01-R03	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-17) (UCNI)	C	Procedure for Oxidation of Plutonium Metal and Alloys (P/S RM)	TA-55 Document, 222-MPP-R00-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-18) (UCNI)	C	Procedure for Electrorefining of Plutonium Metal (P/S RM)	TA-55 Document, 258-MPP-R00-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-19) (UCNI)	C	Procedure for Molten Salt Extraction and Liquidation (P/S RM)	TA-55 Document, 262-MPP-R00-R04	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-20) (UCNI)	C	Procedure for Salt Stripping of Electrorefining Salts (P/S RM)	TA-55 Document, 264-MPP-R00-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-21) (UCNI)	C	Procedure for Spent DOR Salt Regeneration (P/S RM)	TA-55 Document, 425-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-22) (UCNI)	C	Procedure for Hydrofluorination in the Special Isotope Preparation Line (P/S PI)	TA-55 Document, 290-MPP-R02-R03	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-23) (UCNI)	C	Procedure for Small Scale Bomb Reduction (P/S PI)	TA-55 Document, 291-MPP-R00-R01	Contains materials used in the process	No RCRA analyses documents

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-3543 (SP-24) (UCNI)	C	Procedure for Chlorination of Plutonium Compounds with Ammonium Chloride (P/S ACC)	TA-55 Document, 292-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-25) (UCNI)	C	Feed Preparation for +4 Oxalate Precipitation (P/S DO)	TA-55 Document, 210-MPP-R02	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-26) (UCNI)	C	Procedure for Chlorination of Plutonium Compounds (P/S PX)	TA-55 Document, 224-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-27) (UCNI)	C	Procedure for Multiple-cycle Direct Oxide Reduction (P/S PX)	TA-55 Document, 251-MPP-R00-R05	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-28) (UCNI)	C	Procedure for Breaking Press Operation (P/S PX)	TA-55 Document, 253-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-29) (UCNI)	C	Procedure for Solvent Anode Electrorefining (P/S PX). Also referenced in Pyrochemical Processes as PYRO-15/TWCP-3542)	TA-55 Document, 434-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-30) (UCNI)	C	Purifying and Recovery of Pu by Chloride Anion Exchange (P/S DO)	TA-55 Document, 273-CLO-R02, R03, R04	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-31) (UCNI) add to Att. 4	C	Procedure for Vessel Handling (P/S VU)	TA-55 Document, 201-MPP-R01, R02, R05-R07	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-33) (UCNI)	C	Procedure for Precipitation of Plutonium (III) Oxalate in Hydrochloric Acid (P/S code DO)	TA-55 Document, 242-MPP-R00-R01	Contains materials used in the process	No RCRA analyses documents

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-3543 (SP-34) (UCNI)	C	Procedure for Leaching of Non-combustible Materials in Nitric Acid (P/S IX or NC)	TA-55 Document, 235-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-37) (UCNI)	D	Acceptable Knowledge Interview Form for Special Processing	Jim Foxx, NMT-7 1/19/00	SME review of Special Processing AK Report	Addresses specific questions
TWCP-3543 (SP-38) (UCNI)	D	Acceptable Knowledge Interview Form for Special Processing	Jim Foxx, NMT-7 2/3/00	Answers to questions about P/S code PPD and to MT42 waste volume	Addresses specific questions
TWCP-3543 (SP-39) (UCNI)	D	Procedure for Direct Oxide Reduction R&D	TA-55 Document 422-MPP-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-41) (UCNI)	C	Procedure for Generation of 242PuF6	TA-55 Document 122-LPN-R00	Contains materials used in the process	No RCRA analyses documents
TWCP-3543 (SP-42) (UCNI) – add to Section 3.4.2.1	C	Procedure for Burning of Combustibles	TA-55 Document, 221-MPP-R00	Contains materials used in the process	Contains no chemical list: no chemicals used. No P/S code
TWCP-3543 (SP-43) (UCNI)	C	Alternate Procedure for Dissolution of Oxide Derived from Calcination of Oxalate	TA-55 Document, 448-REC-R00	Contains materials used in the process, mineral acids used	No chemical list: no P/S code
TWCP-3543 (SP-44) (UCNI)	D	Acceptable Knowledge Interview Form for Special Processing	Jim Foxx, NMT-7 8/2/00	Answer to question as to whether Pu metal, pure or impure, is a contributor of RCRA-listed metals	Addresses specific questions
TWCP-3543 (SP-45) (UCNI)	D	Acceptable Knowledge Interview Form for Special Processing	Jim Foxx, NMT-7	Answer to questions regarding P/S codes PPD, RAP2, SBB and SCB	Addresses specific questions
TWCP-3730 (UCNI)	B	Pyrophoricity characterization	Characterization of Direct Oxide Salts (LA-CP-95-0098)	Hydrogen generation and pyrophoricity of DOR salts. Also gives reference for MSE, ER, and Cr-containing salts.	None

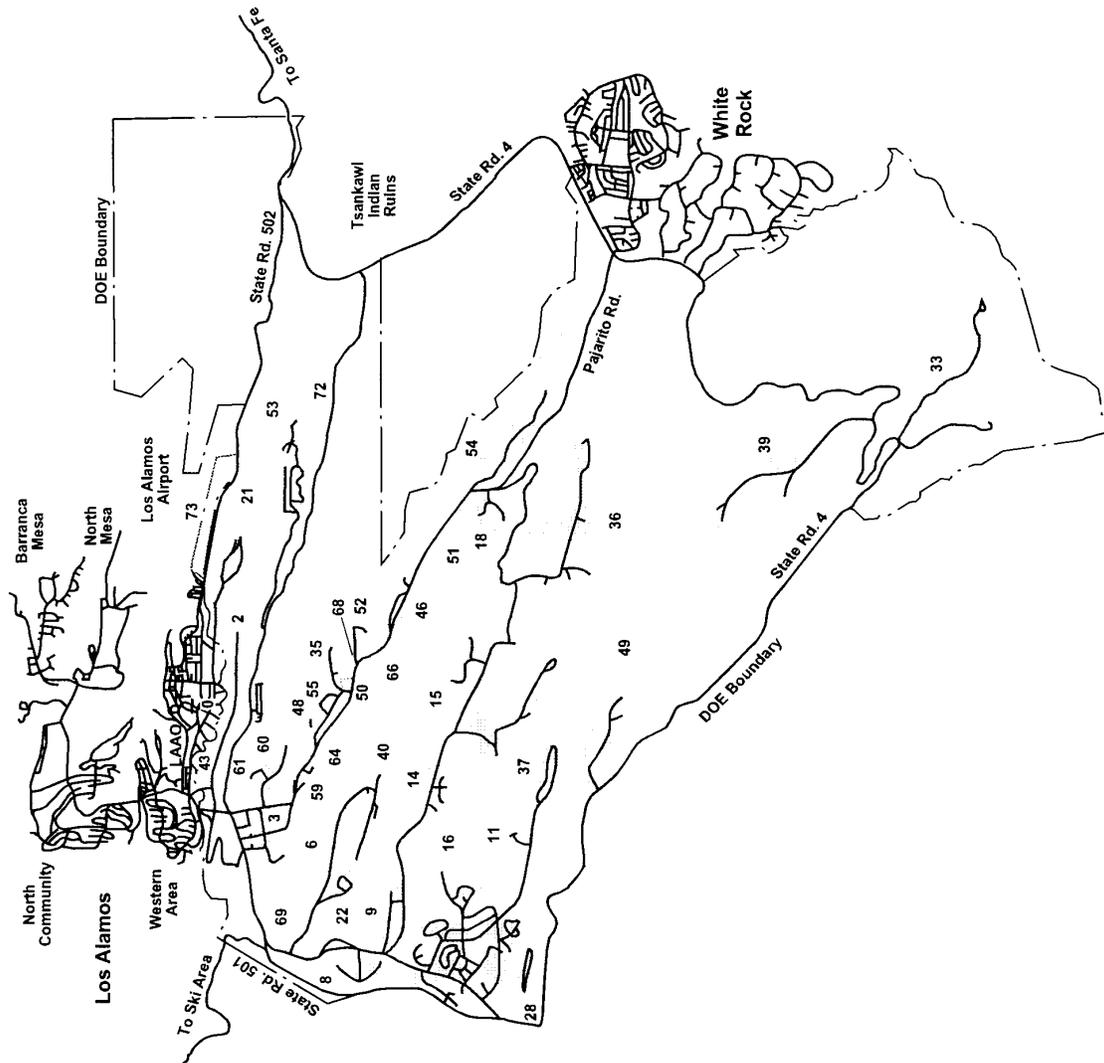
* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

TWCP Record No.	Information Category Code	Information	Source	Summary	Limitations
TWCP-3731	D	Sodium pyrophoricity in pyrochemical salts	Memo (MST-12-ARO-88-052)	Treatment of sodium in salts is effective	Sodium only
TWCP-3732	C	Experimental data on calcium pyrophoricity in salts	Memo (MST-12-ARO-88-077)	Treatment of calcium in salts is effective	Calcium only
TWCP-3943	B	Procedure for Waste Management at TA-55	TA-55 Document, 406-GEN-R00	Contains information on waste management procedures in 1978	None, but doesn't address today's waste management concerns
TWCP-4162	D	Answers to questions about P/S codes PB, PuBe, CC, MB, MS, FF, BF, and other issues	Interview with Jim Foxx, 10/12/00	Answers to questions on use of asbestos at TA-55, non-defense activities, and specific P/S codes in chloride operations.	None
TWCP-4164	D	Answers to questions about various P/S codes	Interview with Jim Foxx, 10/16/00	Answers to questions on use of Ag, disposal of ash and resins, and use of gases.	None
TWCP-4166	D	Answers to questions about P/S codes DO, EV, HP, CF, OR, RM, PY	Interview with Jim Foxx, 10/17/00	Answers to questions on use of Cr and Ag, RCRA metals in cement, asbestos in furnaces and gloves, and disposal of spray cans used in gloveboxes.	None
TWCP-4167	D	Answers to questions about segregation of non-defense wastes; leachability of Ag from ash	Interview with Jim Foxx, 10/18/00	Segregation of non-defense wastes began on 27 August 1998; analytical data show that Ag in ash is below limits of regulatory concern	None

* Information Category Codes: A = forms intended for use in waste certification, B = data from controlled databases and published documents, C = unpublished data, and D = interviews, memos, and letters

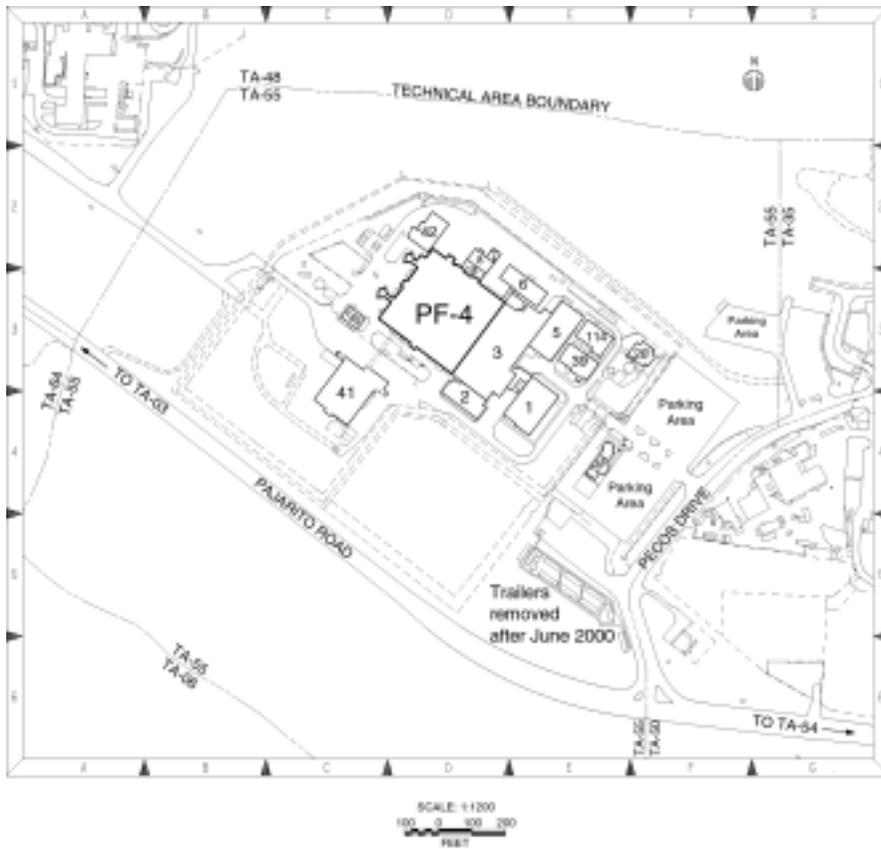
MAP OF LANL

Technical Area Locations	
TA-0	Unassigned Land Reserve
TA-2	Omega Site
TA-3	South Mesa Site
TA-5	Beta Site
TA-6	Two Mile Mesa Site
TA-8	Anchor Site West
TA-9	Anchor Site East
TA-11	K-Site
TA-14	Q-Site
TA-15	R-Site
TA-16	S-Site
TA-18	Pajarito Laboratory
TA-21	DP-Site
TA-22	TD-Site
TA-28	Magazine Area A
TA-33	HP-Site
TA-35	Ten Site
TA-36	Kappa Site
TA-37	Magazine Area C
TA-39	Ancho Canyon Site
TA-40	DF-Site
TA-41	W-Site
TA-43	Health Research Lab & DOE Headquarters
TA-46	WA-Site
TA-48	Radiochemistry Site
TA-49	Frijoles Mesa Site
TA-50	Waste Management Site
TA-51	Radiation Exposure Facility
TA-52	Reactor Development Site
TA-53	Meson Physics Facility
TA-54	Waste Disposal Site
TA-55	Plutonium Facility Site
TA-57	Fenton Hill Site
TA-58	Two Mile North Site
TA-59	OH-Site

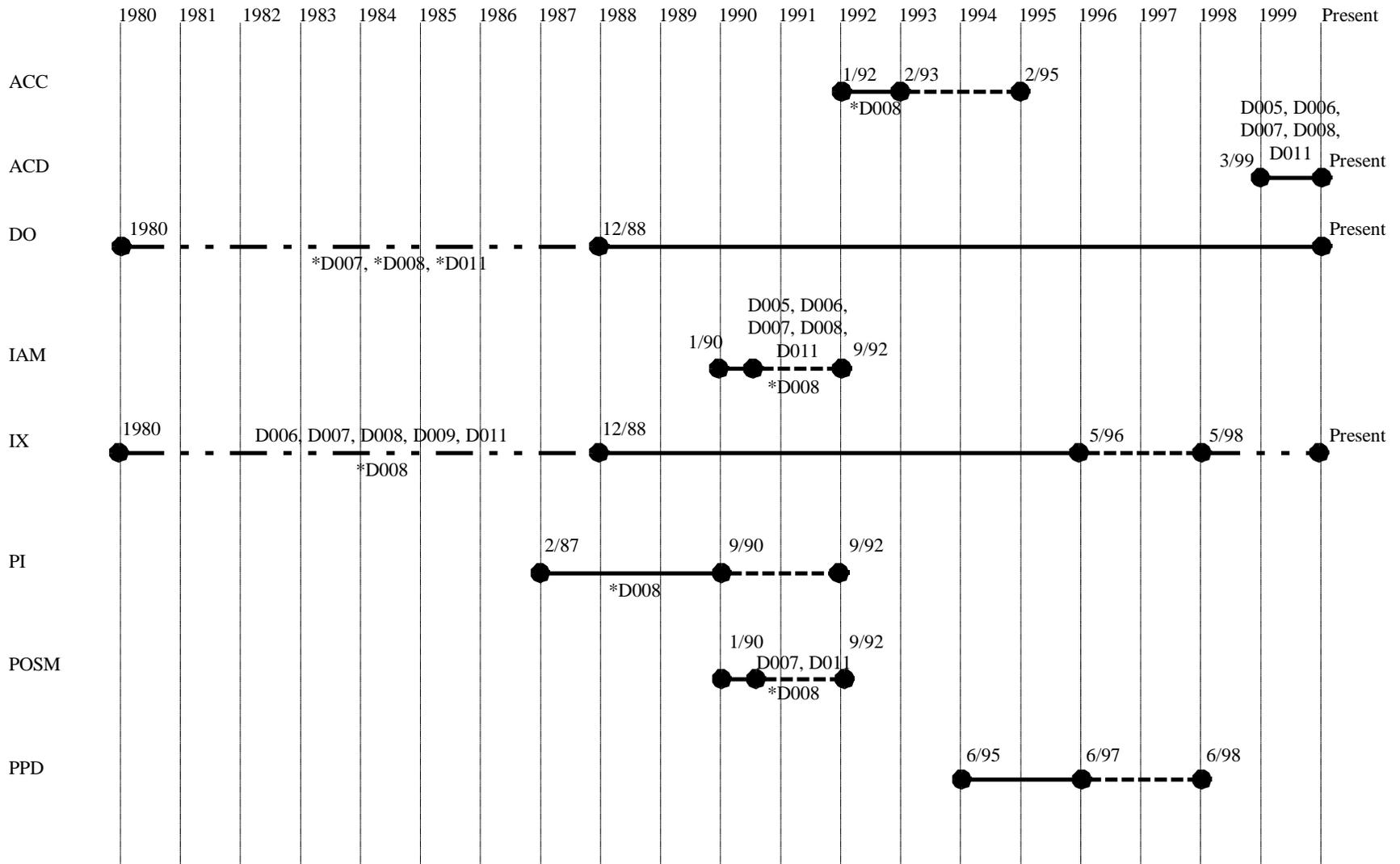


MAP OF TA-55

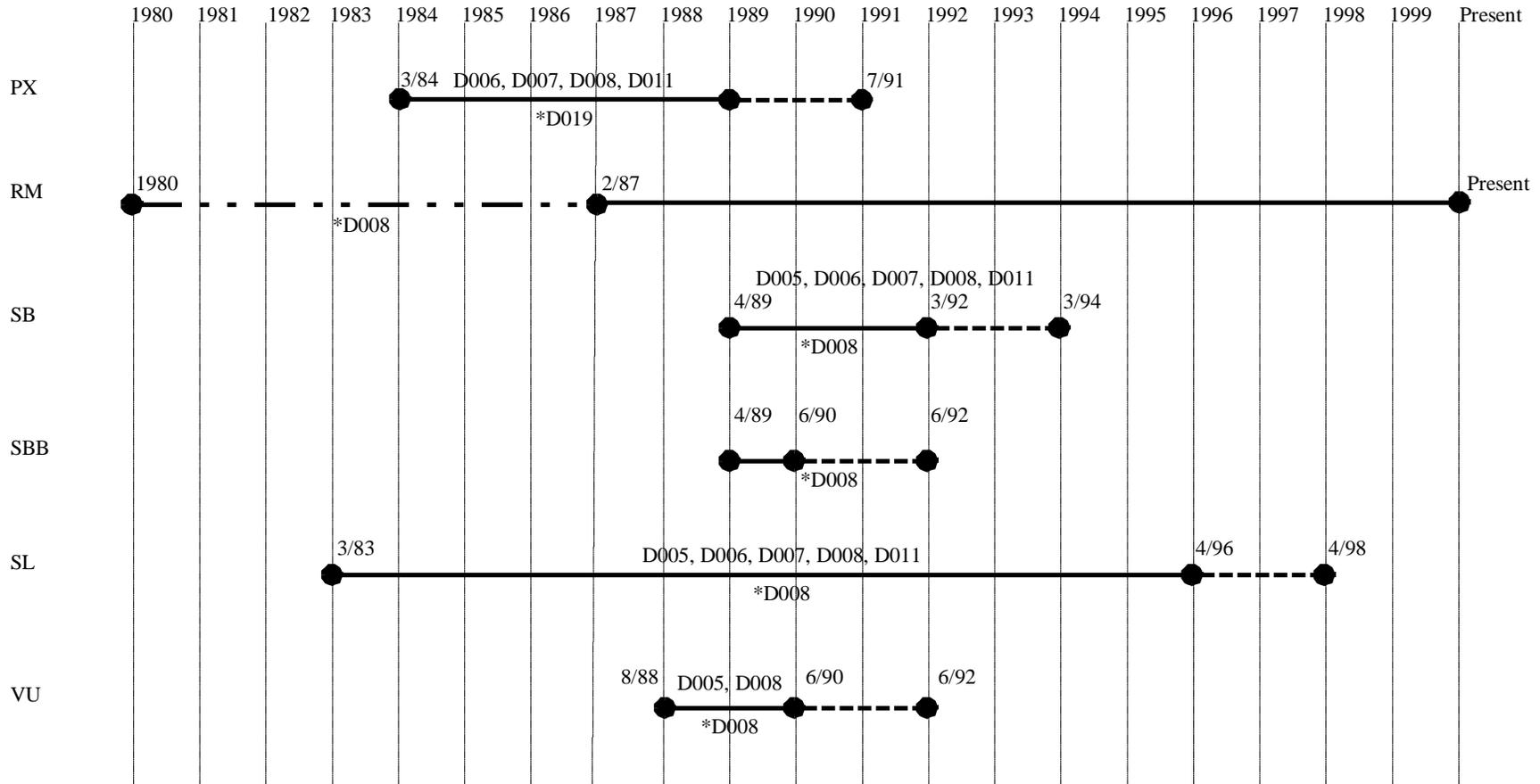
Note: The Plutonium Facility, Building PF-4, is labeled PF-4 on this map



TIMELINE FOR SPECIAL PROCESSING



TIMELINE FOR SPECIAL PROCESSING (continued)



*Notes on time-dependence of RCRA codes

D006 = applies to P/S code PX from 2/87 - 7/89

D007 = applies to P/S codes DO and POSM until the end of 1993

D008 = applies to leaded gloves which were discarded in a separate waste stream after 1992, still under the originating P/S code

D011 = applies to P/S codes DO and POSM until the end of 1993

D019 = applies to P/S code PX from 4/88 to 7/89

TIMELINE EXPLANATION



The P/S code is established either in the P/S diagrams and/or in the procedures designating the start and end dates.



Extrapolate out two (2) years beyond the last revision date for the procedure to next possible review date.



Dates for which a process is known to have been in operation based on Subject Matter Expert input, but no procedures exist nor is there a P/S code for this time period.

PROCESS INPUTS AND OUTPUTS

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
ACC	Ammonium Chloride Conversion	plutonium metal (varying purity)	Ammonium chloride	plutonium trichloride to P/S RM	rags, tools, labware, gloves	D008	TWCP-3543 (SP-24)
ACD	Cascade Dissolver	plutonium scrap; plutonium contaminated tools, crucibles, metal items, and labware; labware; tools	Hydrofluoric acid, hydrochloric acid, nitric acid	plutonium lean leach solution to P/S IX, some material to vault	leached tools, crucibles, metal items, and labware to discard	D005, D006, D007, D008, D011	None
DO	Dissolution of Oxide	plutonium oxide (varying purity); plutonium scrap; plutonium contaminated tools, crucibles, salt, metal items, and labware, filtrates from oxalate precip in P/S IX, hydroxide cake from DO, solutions with solids	Nitric acid, hydrochloric acid, sodium hydroxide, potassium hydroxide, calcium fluoride, hydrofluoric acid, oxalic acid, hydroxylamine hydrochloride	Some material to vault. Hydroxide precip filtrate to caustic waste line. Hydroxide cake to DO or vault. Isotopically out-of-spec material to P/S code IAM or POSM. Plutonium lean leach solution to P/S IX.	Leached tools, crucibles, salt, metal, labware, spent ion exchange resins to discard.	D007, D008, D011	TWCP-3543 (SP-10, SP-11, SP-12, SP-13, SP-14, SP-15, SP-16, SP-25, SP-30, SP-33, SP-37, SP-43)
IAM	Inspection and Measurement	Material from P/S code DO, RM, other P/S codes.	No chemicals used.	Out-of-spec material to P/S code POSM. In-spec material to P/S DO, SL, or vault.	Discardable items to WM	D005, D006, D007, D008, D011	None
IX	Ion Exchange	Leach solutions from P/S codes DO and SL.	Nitric acid, hydroxylamine nitrate, sodium nitrite, aluminum nitrate, calcium fluoride, hydrofluoric acid, oxalic acid, ferrous ammonium sulfate, urea, hydrogen peroxide	Plutonium dioxide to P/S code RM. Filtrates to P/S DO. Washes and effluents off ion exchange columns DL to P/S code EVDL back through IX	Labware. Spent ion exchange resins to discard	D006, D007, D008, D009, D011	TWCP-3543 (SP-6, SP-7, SP-8, SP-9, SP-34)

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
PI	Preparation of Isotopes	Plutonium dioxide, impure Pu metal	Fluorine gas, hydrogen fluoride gas, calcium metal, iodine	Pu metal to originating P/S code	Slag and crucible to vault or discard. Tools, labware, rags, gloves to discard	D008	TWCP-3543 (SP-22, SP-23, SP-41)
POSM	Processing Out-of-Specification Material	Out-of-spec plutonium scrap	Nitric acid, sodium hydroxide, potassium hydroxide	Plutonium to vault	Ion exchange resins, hydroxide filtrate to caustic waste; labware, gloves, tools, rags to discard	D007, D008, D011	None
PPD	Pu Pellet Dissolution	Pu pellet	Nitric acid, hydrofluoric acid, oxalic acid, sodium oxalate, sodium hydroxide, potassium hydroxide	Pu oxide to 238-Pu operations; Hydroxide cake to vault	Labware, gloves, rags to discard	None	TWCP-3543 (SP-38)
PX	Multiple DOR with in-situ Regeneration and Electrorefining	Pu oxide feed	Calcium metal, MgO crucibles, mineral acids, calcium chloride, sodium chloride, potassium chloride, carbon tetrachloride, cadmium metal, lead metal, gallium metal, bismuth metal	Pu metal to P/S CA, salts and crucible to vault or discard, anode residue to vault, spent hardware leach solution to P/S code SE.	Labware, gloves, rags to discard	D006, D007, D008, D011, D019	TWCP-3543 (SP-26, SP-27, SP-28, SP-29)
RM	Reduction to Metal	Pu oxide or metal from various P/S's DO, CA, MA, vault.	Calcium metal, calcium chloride, sodium chloride, potassium chloride, chlorine gas	Pu metal (high purity) to P/S CA. Out-of-spec to P/S POSM or vault. Reprocess material to P/S DO. Salt and crucibles to P/S DO or discard. Labware, tools to P/S DO if >DL or to discard if <DL.	Covered in column to right	D008	TWCP-3543 (SP-17, SP-18, SP-19, SP-20, SP-21, SP-44)

P/S Code	P/S Title	Process Inputs		Process Outputs		EPA Codes ²	References ³
		Feed Stream(s)	Chemicals/Reagents	Product	Waste Stream ¹		
SB	Scrap Burning	Pu scrap from various P/S codes.	No chemicals used	Calcined scrap to P/S code SL.	Gloves <DL to discard	D005, D006, D007, D008, D011	TWCP-3543 (SP-5, SP-43)
SBB	Ca/Al Scrubbing RD&D	Pu samples from P/S codes OR or SS	Calcium metal, aluminum metal, calcium chloride, sodium chloride, potassium chloride, chlorine gas	Vault. Salt, crucibles > discard limit to vault.	Salt, crucibles <DL discard. Tools labware, rags, and gloves to discard.	D008	None
SL	Scrap Leaching	Pu scrap, other scrap metals, labware, gloves	Nitric acid, hydrofluoric acid, hydrochloric acid	Lean leach solution to P/S IX.	Leached items to discard	D005, D006, D007, D008, D011	TWCP-3543 (SP-1, SP-2, SP-3, SP-4)
VU	Vessel Unloading	Vessels	WD-40 Vacuum grease Silicon adhesive Pneumatic tool oil	Vessels Residues	Metal and wire debris	D005, D008	TWCP-3543 (SP-31)

¹All P/S codes generate routine laboratory debris waste. For those P/S codes that generate only debris waste, this column is left blank. The debris waste may consist of glassware, plastics, ceramic materials, paper, rags, HEPA filters, metal containers, brushes, and small tools. Leaded gloves may also be generated and are segregated.

²The EPA hazardous waste codes listed apply to the solid TRU waste only and not to any other waste forms that may undergo further treatment or processing (e.g., evaporation or cement fixation). The resulting treated waste stream is evaluated for hazardous waste constituents and assigned the applicable EPA hazardous waste codes. All P/S codes have the potential to generate leaded gloves. The gloves are segregated from other debris waste and are assigned EPA hazardous waste code D008. The D008 code is assigned to the leaded gloves waste stream rather than to each P/S code waste stream.

³Refer to the Acceptable Knowledge Roadmap in Attachment 1.

**SIMPLIFIED PROCESS FLOW DIAGRAM
FOR SPECIAL PROCESSING**

