

Attachment 2 – CCP Waste Stream Profile Form

(1) Waste Stream Profile Number: LA-MIN02-V.001	
(2) Generator site name: Los Alamos National Laboratory	(3) Generator site EPA ID: NM0890010515
(4) Technical contact: Veronica Waldram	(5) Technical contact phone number: 575-234-7187
(6) Date of audit report approval by New Mexico Environment Department (NMED): April 18, 2013	
(7) Title, version number, and date of documents used for WIPP-WAP Certification: CCP-PO-001, CCP Transuranic Waste Characterization Quality Assurance Project Plan, Revision 21, May 31, 2013; CCP-PO-002, CCP Transuranic Waste Certification Plan, Revision 27, May 31, 2013; CCP-PO-012, CCP/Los Alamos National Laboratory (LANL) Interface Document, Revision 13, June 25, 2013	
(8) Did your facility generate this waste? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
(9) If no, provide the name and EPA ID of the original generator: NA	
Waste Stream Information	
(10) WIPP ID: LA-MIN02-V.001	(11) Summary Category Group: S3000 – Homogeneous Solids
(12) Waste Matrix Code Group: Solidified Inorganics	(13) Waste Stream Name: Absorbed Waste from TA-55
(14) Description from the ATWIR: Inorganic particulate waste generated during TA-55 R&D/fabrication and associated recovery, facility and equipment maintenance, D&D, waste repackaging, and below-grade retrieval operations.	
(15) Defense TRU Waste: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	
(16) Check One: CH <input checked="" type="checkbox"/> RH <input type="checkbox"/>	
(17) Number of SWBs: 1 (17a) Number of SLB2 : NA	(18) Number of Drums ¹ Current – 377 55-gallon drums Projected – 1 55-gallon drum/year
	(19) Number of Canisters NA
(20) Batch Data Report numbers supporting this waste stream characterization: See Characterization Information Summary (CIS) Correlation of Container Identification Numbers to Batch Data Report Numbers.	
(21) List applicable EPA Hazardous Waste Numbers: ² D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D021, D022, D035, D038, D039, D040, F001, F002 and F005	
(22) Applicable TRUCON Content Numbers: LA 212, LA 226, SQ 212, SQ 213, SQ 229	
(23) Acceptable Knowledge Information	
(For the following, enter the supporting documentation used [i.e., references and dates])	
Required Program Information	
(23A) Map of site: CCP-AK-LANL-006, Revision 12, December 12, 2012, Figures 1 and 2	
(23B) Facility mission description: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 4.2.2	
(23C) Description of operations that generate waste: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 4.4	
(23D) Waste identification/categorization schemes: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 4.3.1	
(23E) Types and quantities of waste generated: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 4.3.6	
(23F) Correlation of waste streams generated from the same building and process, as applicable: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 4.3.7	
(24) Waste certification procedures: CCP CH TRU Waste Certification and WWIS/WDS Data Entry, CCP-TP-030, Revision 32, June 20, 2013	

(25) Required Waste Stream Information		
(25A) Area(s) and building(s) from which the waste stream was generated: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 7.1		
(25B) Waste stream volume and time period of generation: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 7.2		
(25C) Waste generating process description for each building: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 7.3		
(25D) Waste Process flow diagrams: CCP-AK-LANL-006, Revision 12, December 12, 2012, Figures 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22		
(25E) Material inputs or other information identifying chemical/radionuclide content and physical waste form: CCP-AK-LANL-006, Revision 12, December 12, 2012, Section 7.4		
(25F) Waste Material Parameter Weight Estimates Per Unit of Waste: See table entitled "Waste Stream LA-MIN02-V.001 Waste Material Parameter Estimates" in Summation of Aspects of AK Summary Report: LA-MIN02-V.001		
(26) Which Defense Activity generated the waste:		
	Weapons activities including defense inertial confinement fusion	Naval Reactors development
	Verification and control technology	X Defense research and development
X	Defense nuclear waste and material by products management	X Defense nuclear material production
	Defense nuclear waste and materials security and safeguards and security investigations	
(27) Supplemental Documentation:		
(27A) Process design documents: NA		
(27B) Standard operating procedures: See D058, M012, M014, M024, M028, M029, M030, M074, M076, M085, M086, M088, M089, M090, M095, M096, M097, M098, M103, M137, M180, M181, M182, M184, M185, M186, M189, M200, M202, M206, M212, P001, P005, P008, P011, P012, P014, P028, P029, P033, P034, P036, P069, P080, P094, P095, P096, P097, P098, P104, P105, P154, P155, P156, P157, P158, P159, P160, P161, P162, P163, P164, P165, P166, P167, P168, P169 and P170 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27C) Safety Analysis Reports: See D014, D068, P147 and P148 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27D) Waste packaging logs: See M018, M019 and M219 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27E) Test plans/research project reports: See C186 and D028 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27F) Site databases: See C101, M222 and U004 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27G) Information from site personnel: See C001, C002, C005, C007, C010, C011, C014, C017, C018, C019, C020, C023, C031, C033, C035, C037, C038, C039, C040, C041, C047, C057, C061, C062, C064, C066, C067, C068, C069, C073, C082, C083, C085, C092, C098, C102, C104, C105, C108, C113, C117, C121, C129, C130, C131, C188, P109 and P110 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27H) Standard industry documents: See D055 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27I) Previous analytical data: See C113 and M002 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27J) Material safety data sheets: See C009, C121 and M154 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		
(27K) Sampling and analysis data from comparable/surrogate Waste: NA		
(27L) Laboratory notebooks: See M281 in the Summation of Aspects of AK Summary Report: LA-MIN02-V.001, Source Documents		

CCP-TP-002, Rev. 26
CCP Reconciliation of DQOs and
Reporting Characterization Data

Effective Date: 06/19/2013

Page 3 of 3

Confirmation Information			
<i>For the following, when applicable, enter procedure title(s), number(s) and date(s)</i>			
(28)	Radiography: CCP Standard Real-Time Radiography (RTR) Inspection Procedure, CCP-TP-053, Revision 13, May 14, 2013		
	Visual Examination: NA		
(29) Comments: For a list of the waste characterization procedures used and date of respective procedures see the list of procedures on the attached CIS.			
Reviewed by AK Expert:	YES	<input checked="" type="checkbox"/>	Date: <u>6/26/2013</u>
Reviewed by STR (if necessary):	YES	<input checked="" type="checkbox"/>	N/A <input type="checkbox"/> Date: <u>6/26/2013</u>
Waste Stream Profile Form Certification:			
I hereby certify that I have reviewed the information in this Waste Stream Profile Form, and it is complete and accurate to the best of my knowledge. I understand that this information will be made available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.			
<u>Veronica Waldram</u>	<u>Veronica Waldram</u>		<u>8/12/2013</u>
Signature of Site Project Manager	Printed Name		Date
<p>NOTE: (1) This waste stream currently consists of 266 55-gallon drums (includes pipe overpack containers) and 73 85-gallon drums, totaling an estimated 79.2 cubic meters of waste, which is equivalent to approximately 377 55-gallon drums.</p> <p>(2) If radiography or visual examination were used to confirm EPA Hazardous Waste Numbers, attach signed Characterization Information Summary documenting this determination.</p>			

CHARACTERIZATION INFORMATION SUMMARY

WSPF # LA-MIN02-V.001

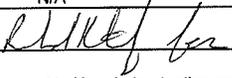
Lot 1

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CIS001

CCP Characterization Information Summary Cover Page

Waste Stream # LA-MIN02-V.001 Lot #: 1
 AK Expert Review: N/A Date: N/A
 SPM Review: Jim Eastham  Date: 7/5/2013

SPM signature certifies that through Acceptable Knowledge testing and/or analysis that the waste identified in this summary is not corrosive, ignitable, reactive, or incompatible with the TSDF.

A summary of the Acceptable Knowledge regarding this waste stream containing specific information about the corrosivity, reactivity, and ignitability of the waste stream is included as an attachment to the Waste Stream Profile Form. By reference, that information is included in this lot.

List of procedures used:

Radiography (RTR/NDE):

CCP-TP-053	Rev. 13	05/14/13	CCP Standard Real-Time Radiography (RTR) Inspection Procedure
CCP-TP-053	Rev. 12	08/22/12	CCP Standard Real-Time Radiography (RTR) Inspection Procedure
CCP-TP-053	Rev. 11	07/20/11	CCP Standard Real-Time Radiography (RTR) Inspection Procedure
CCP-TP-053	Rev. 10	03/04/11	CCP Standard Real-Time Radiography (RTR) Inspection Procedure
CCP-TP-053	Rev. 9	09/30/10	CCP Standard Real-Time Radiography (RTR) Inspection Procedure
CCP-TP-053	Rev. 8	06/30/10	CCP Standard Real-Time Radiography (RTR) Inspection Procedure
CCP-TP-053	Rev. 7	10/21/09	CCP Standard Real-Time Radiography (RTR) Inspection Procedure

Non Destructive Assay (NDA):

CCP-TP-063	Rev. 14	08/01/12	CCP Operating the High Efficiency Neutron Counter Using NDA2000
CCP-TP-063	Rev. 13	04/11/11	CCP Operating the High Efficiency Neutron Counter Using NDA2000
CCP-TP-063	Rev. 12	11/17/10	CCP Operating the High Efficiency Neutron Counter Using NDA2000
CCP-TP-103	Rev. 11	05/16/13	CCP Data Reviewing, Validating and Reporting Procedure for the High Efficiency Neutron Counter and the Super High Efficiency Neutron Counter Using NDA2000
CCP-TP-103	Rev. 10	08/30/11	CCP Data Reviewing, Validating and Reporting Procedure for the High Efficiency Neutron Counter and the Super High Efficiency Neutron Counter Using NDA2000
CCP-TP-103	Rev. 9	03/14/11	CCP Data Reviewing, Validating and Reporting Procedure for the High Efficiency Neutron Counter and the Super High Efficiency Neutron Counter Using NDA2000
CCP-TP-103	Rev. 8	07/12/10	CCP Data Reviewing, Validating and Reporting Procedure for the High Efficiency Neutron Counter Using NDA2000

Project Level Data Validation / DQO Reconciliation:

CCP-TP-001	Rev. 21	06/06/13	CCP Project Level Data Validation and Verification
CCP-TP-001	Rev. 20	09/27/12	CCP Project Level Data Validation and Verification
CCP-TP-001	Rev. 19	12/29/10	CCP Project Level Data Validation and Verification
CCP-TP-001	Rev. 18	08/09/10	CCP Project Level Data Validation and Verification
CCP-TP-002	Rev. 26	06/19/13	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 25	02/11/13	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 24	12/28/11	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 23	12/29/10	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 22	06/30/10	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-002	Rev. 21	08/04/09	CCP Reconciliation of DQOs and Reporting Characterization Data
CCP-TP-003	Rev. 19	11/02/12	CCP Data Analysis for S3000, S4000, and S5000 Characterization
CCP-TP-003	Rev. 18	12/29/10	CCP Data Analysis for S3000, S4000, and S5000 Characterization
CCP-TP-003	Rev. 17	11/09/09	CCP Data Analysis for S3000, S4000, and S5000 Characterization
CCP-TP-003	Rev. 16	10/02/07	CCP Data Analysis for S3000, S4000, and S5000 Characterization
CCP-TP-030	Rev. 32	06/20/13	CCP CH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-030	Rev. 31	11/19/12	CCP CH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-030	Rev. 30	05/21/12	CCP CH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-030	Rev. 29	04/26/11	CCP CH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-030	Rev. 28	05/12/10	CCP CH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-030	Rev. 27	12/14/09	CCP CH TRU Waste Certification and WWIS/WDS Data Entry
CCP-TP-030	Rev. 26	05/27/09	CCP CH TRU Waste Certification and WWIS Data Entry
CCP-TP-030	Rev. 25	01/22/09	CCP CH TRU Waste Certification and WWIS Data Entry

WAP Certification:

CCP-PO-001	Rev. 21	05/31/13	CCP Transuranic Waste Characterization Quality Assurance Project Plan
CCP-PO-001	Rev. 20	06/16/11	CCP Transuranic Waste Characterization Quality Assurance Project Plan
CCP-PO-001	Rev. 19	12/29/10	CCP Transuranic Waste Characterization Quality Assurance Project Plan
CCP-PO-001	Rev. 18	06/30/10	CCP Transuranic Waste Characterization Quality Assurance Project Plan
CCP-PO-001	Rev. 17	06/23/09	CCP Transuranic Waste Characterization Quality Assurance Project Plan

CIS002

CCP Characterization Information Summary Cover Page

CCP-PO-002	Rev. 27	05/31/13	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 26	07/14/11	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 25	12/29/10	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 24	06/30/10	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 23	04/07/10	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 22	01/12/10	CCP Transuranic Waste Certification Plan
CCP-PO-002	Rev. 21	01/26/09	CCP Transuranic Waste Certification Plan
CCP-PO-012	Rev. 13	06/25/13	CCP/Los Alamos National Laboratory (LANL) Interface Document
CCP-PO-012	Rev. 12	11/05/12	CCP/Los Alamos National Laboratory (LANL) Interface Document
CCP-PO-012	Rev. 11	10/01/12	CCP/Los Alamos National Laboratory (LANL) Interface Document
CCP-PO-012	Rev. 10	07/09/12	CCP/Los Alamos National Laboratory (LANL) Interface Document
CCP-PO-012	Rev. 9	01/04/12	CCP/Los Alamos National Laboratory (LANL) Interface Document
CCP-PO-012	Rev. 8	12/29/10	CCP/Los Alamos National Laboratory (LANL) Interface Document

CIS003

CCP Correlation of Container Identification Numbers to Batch Data Report Numbers

Waste Stream: # LA-MIN02-V.001 1

Container ID Number	NDA BDR	RTR BDR	VE BDR	Load Management/ Overpack Yes	Transportation Headspace Gas BDR
93588	1LANDA1767	LA-RTR2-13-0067	N/A	No	LA13FG2054
93589	1LANDA1767	LA-RTR2-13-0067	N/A	No	LA13FG2054
93593	1LANDA1767	LA-RTR2-13-0067	N/A	No	LA13FG2054
93597	1LANDA1767	LA-RTR2-13-0067	N/A	No	LA13FG2056
93598	1LANDA1767	LA-RTR2-13-0067	N/A	No	LA13FG2055


 Signature of Site Project Manager

Jim Eastham 7/5/2013
 Printed Name Date

CIS004

CCP RTR/VE Summary of Prohibited Items and AK Confirmation

Vaste Stream Number: LA-MIN02-V.001

Lot #: 1

Container Number	RTR Prohibited Items ^{a,b}	Visual Examination Prohibited Items ^{a,b}	Does the Physical Form of the Waste Match the Waste Stream Description as Determined by AK
See correlation of container ID numbers for list of remaining drum numbers in this Lot.	None of the containers in this lot had prohibited items identified during RTR.	VE was not used to certify any containers in this Lot.	The physical form of the waste matches the waste stream description as determined by AK.
a. See Batch Data Reports b. If AK has assigned U134 to this waste stream, then any liquids in these containers are prohibited items (not acceptable by the TSDF).			
Justification for the selection of RTR and/or VE: Containers in this waste stream were characterized using RTR. RTR was selected as the characterization method for the containers because the waste was previously packaged and RTR meets all the Data Quality Objectives for NDE for waste stream LA-MIN02-V.001.			


 Site Project Manager Signature

Jim Eastham
 Printed Name

7/5/2013
 Date

CIS005

CCP Reconciliation with Data Quality Objectives

WSPF# LA-MIN02-V.001

Lot # 1

Sampling Completeness

RTR/VE:

Number of Valid Samples: 5 Number of Total Samples Analyzed: 5
 Percent Complete: 100 (QAO is 100%)

NDA

Number of Valid Samples: 5 Number of Total Samples Analyzed: 5
 Percent Complete: 100 (QAO is 100%)

	Y/N/NA	Reconciliation Parameter
1	Y	Waste Matrix Code.
2	Y	Waste Material Parameter Weights.
3	Y	The Transuranic (TRU) activity reported in the BDRs for each container demonstrates with a 95% probability that the container of waste contains TRU radioactive waste.
4	N	<u>AK Sufficiency</u> . Is there an approved AK sufficiency Determination for this waste stream?
5	Y	The data demonstrates whether the waste stream exhibits a toxicity characteristic under Title 40 <i>Code of Federal Regulations</i> (CFR), Part 261, <i>Identification and Listing of Hazardous Waste</i> , Subpart C, <i>Characteristics of Hazardous Waste</i> .
6	Y	Does the waste stream contain listed waste found in 20.4.1.200 NMAC incorporating 40 CFR Part 261, Subpart D, <i>Lists of Hazardous Wastes</i> .
7	Y	Waste stream can be classified as hazardous or nonhazardous.
8		The overall completeness, comparability, and representativeness quality assurance objectives (QAOs) were met for each of the analytical and testing procedures as specified in the Sections C3-1 through C3-2 prior to submittal of a waste stream profile form for a waste stream or waste stream lot.
		Completeness
		Comparability
		Representativeness
	Radiography	Y
	VE	NA
Comments: None		


 Signature of Site Project Manager

Jim Eastham
 Printed Name

7/5/2013
 Date

CIS006

SUMMATION OF ASPECTS OF AK SUMMARY REPORT: LA-MIN02-V.001

Overview

Waste stream LA-MIN02-V.001 consists primarily of inorganic particulate waste generated in TA-55. The waste is largely comprised of Transuranic (TRU) waste such as liquids and solids absorbed or mixed with absorbent (e.g., Ascarite, diatomaceous earth, kitty litter, vermiculite, Waste Lock 770, and/or zeolite). Examples of absorbed liquids include acids (e.g., hydrochloric acid, hydrofluoric acid, and nitric acid); carbon tetrachloride; ethylene glycol; kerosene; methanol; methylene chloride; silicone based liquids (e.g., silicone oil); tetrachloroethylene; tributyl phosphate; trichloroethylene; and various types of oils including hydraulic, vacuum pump, grinding, and lapping (mixture of mineral oil and lard). Solids mixed with absorbents are typically evaporator salts (i.e., nitrate salts). The waste is also expected to contain heavy metals such as cadmium, chromium, and lead. Liquids and solids not absorbed or mixed with absorbent are often cemented and disposed of separately in waste stream LA-CIN01.001. A small fraction of debris waste (mainly plastic packaging, metal packaging, personnel protection equipment [PPE], and secondary waste from repackaging) and metal fines may also be present. Any payload container consisting of more than 50 percent by volume of heterogeneous debris will be excluded from this waste stream.

Based on a review of the AK, waste containers LA-MIN02-V.001 meet the WIPP-WAC definition of TRU defense waste and can be categorized as items D, E, and G of the activities listed in Section 10101(3) of the NWPAA, and detailed in the *Interim Guidance on Ensuring that Waste Qualifies for Disposal at the Waste Isolation Pilot Plant* :

- Defense nuclear waste and materials by-products management
- Defense nuclear materials production
- Defense research and development

On a waste stream basis, the two predominant isotopes by mass for waste stream LA MIN02-V.001 are Pu-239 and U-238 while over 95 percent of the total activity is from Pu-239, Pu-240, and Pu-241.

The waste stream contains RCRA-regulated constituents and is assigned the following EPA HWNs: F001, F002, F005, D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D021, D022, D035, D038, D039, and D040. This waste stream does not include wastes containing or contaminated with PCBs.

Based on the review of container documentation and documented waste management practices, no prohibited items are specifically identified in the waste stream. However, the presence of prohibited quantities of liquid due to dewatering or incomplete absorption is possible. Procedures also allowed containers greater than four liters, sealed with tape, to be used for waste packaging until Los Alamos National Laboratory (LANL) Waste Isolation Pilot Plant(WIPP)-approved procedures were implemented. Lead shielding is often used to increase handling safety, and thick shielding can obscure real-time radiography (RTR) observations. Additionally, based on interviews with site personnel performing visual examination (VE) and prohibited item disposition repackaging, internal cans (both shielded and unshielded) have been measured for dose rate during repackaging and found to contain waste with radiation levels

exceeding 200 mrem/hr. Waste packages containing prohibited items identified during characterization activities will be segregated then dispositioned appropriately and/or repackaged to remove the items prior to certification and shipment.

Waste packaging procedures for LANL waste streams have been modified several times since the beginning of recovery operations and containers in this waste stream include a variety of configurations with up to four layers of confinement. RTR will confirm TRUCON code LA212. However, TRUCON codes LA226, SQ212, SQ213, and SQ229 have been identified as suitable for individual containers in this waste stream.

Waste stream LA-MIN02-V.001 meets the definition of waste materials that have common physical form, that contain similar hazardous constituents, and that are generated from a single process or activity. This waste stream was generated during TA-55 Research & Development (R&D)/fabrication and associated recovery, facility and equipment maintenance, decontamination and decommissioning (D&D), waste repackaging, and below-grade retrieval operations.

This Summation of the AK Summary Report includes information to support Waste Stream Profile Form (WSPF) number LA-MIN02-V.001 for mixed absorbed waste. The primary source of information for this Summation is CCP-AK-LANL-006, *Central Characterization Program Acceptable Knowledge Summary Report For Los Alamos National Laboratory TA-55 Mixed Transuranic Waste, Waste Streams: LA-MHD01.001, LA-CIN01.001, LA-MIN02-V.001, LA-MIN04-S.001*, Revision 12, December 12, 2012.

Waste Stream Identification Summary

Waste Stream Name:	Absorbed Wastefrom TA-55
Waste Stream Number:	LA-MIN02-V.001
Dates of Waste Generation:	1979 to present
Waste Stream Volume – Current:	377 55-gallon drums ¹ 1 standard waste box (SWB)
Waste Stream Volume – Projected:	1 55-gallon drum per year
Summary Category Group:	S3000 – Homogeneous Solids
Waste Matrix Code Group:	Solidified Inorganics
Waste Matrix Code:	S3110, Inorganic Particulate Waste
TRUCON Content Number:	LA212, LA226, SQ212, SQ213, SQ229
Annual Transuranic Waste Inventory Report Identification Numbers:	LA-MIN02-V.001

¹This waste stream currently consists of 266 55-gallons drums (includes pipe overpack containers [POCs]) and 73 85-gallon drums, totaling an estimated 79.2 cubic meters of waste, which is equivalent to approximately 377 55-gallon drums.

Waste Stream Description and Physical Form

Waste stream LA-MIN02-V.001 consists primarily of inorganic particulate waste generated in TA-55. The waste is largely comprised of TRU waste such as liquids and solids absorbed or mixed with absorbent (e.g., Ascarite [carbon dioxide], diatomaceous earth [silica, quartz], kitty litter [clay], vermiculite [hydrated magnesium aluminum iron silicate], Waste Lock 770 [sodium polyacrylate] and/or zeolite [aluminosilicate mineral]). Examples of absorbed liquids include acids (e.g., hydrochloric acid, hydrofluoric acid, and nitric acid); carbon tetrachloride; ethylene glycol; kerosene; methanol; methylene chloride; silicone based liquids (e.g., silicone oil); tetrachloroethylene; tributyl phosphate; trichloroethylene; and various types of oils including hydraulic, vacuum pump, grinding, and lapping (mixture of mineral oil and lard). Solids mixed with absorbents are typically evaporator salts (i.e., nitrate salts). The waste is also expected to contain heavy metals such as cadmium, chromium, and lead. Liquids and solids not absorbed or mixed with absorbent are often cemented and disposed of separately in waste stream LA-CIN01.001. A small fraction of debris waste (mainly plastic packaging, metal packaging, PPE, and secondary waste from repackaging) and metal fines may also be present. Any payload container consisting of more than 50 percent by volume of heterogeneous debris will be excluded from this waste stream (References C005, C035, C080, C094, C232, D007, D025, D032, D036, D041, D080, D083, M064, M142, M242, and M286).

The waste stream meets the definition of waste materials that have common physical form, that contain similar hazardous constituents, and that are generated from a single process or activity.

This waste stream was generated during TA-55 R&D/fabrication and associated recovery, facility and equipment maintenance, D&D, waste repackaging, and below-grade retrieval operations.

Point of Generation

Location

Waste stream LA-MIN02-V.001 was generated at LANL in Los Alamos, New Mexico. The waste is stored at the TA-54 Material Disposal Area G (Area G).

Area and/or Buildings of Generation

All of the absorbed waste covered by this report originated from TA-55 R&D/fabrication and associated recovery, facility and equipment maintenance, D&D, waste repackaging, and below-grade retrieval operations. Container-specific records are reviewed for each container to verify the physical composition and origin of the waste stream inventory (References C154, C181, M222, and M242).

Generating Processes

Description of Waste Generating Processes

Absorbed waste is generated by or originated from materials used during TA-55 R&D/fabrication and associated recovery, facility and equipment maintenance, D&D, waste repackaging, and below-grade retrieval operations described in detail below and includes (References D041 and D083):

- Preparing ultra-pure plutonium metals, alloys, and compounds
- Preparing (on a large scale) specific alloys, including casting and machining these materials into specific shapes
- Determining high-temperature thermodynamic properties of plutonium
- Reclaiming plutonium from scrap and residues produced by numerous feed sources
- Disassembling components for inspection and analysis
- Manufacturing of parts on a limited basis
- Processing mixtures of plutonium and uranium oxides for reactor fuels
- Pu-238 generator and heat source R&D, fabrication, testing, and recycling

Sections 1 through 6, in the following discussion, correspond to the six operational areas. Each section describes the operations that generated waste assigned to the homogeneous waste stream.

Sections 7 and 8 correspond to facility and equipment maintenance and D&D operations which are commonly performed in TA-55. These operations originate in the same areas and generate waste and materials that contain the same chemical and radiological contaminants described in Sections 1 through 6.

1. Nitrate Operations

The overall goal of the nitrate operations is to recover plutonium from scrap and residues, and produce a purified plutonium oxide product, or for conversion into metal. The primary feed sources for the nitrate operations are plutonium residues from other recovery operations (e.g., chloride operations), metal preparation, metal fabrication, analytical laboratory operations, and residues from other DOE facilities. Nitrate operations can be broken down into the following six steps (References C129, D008, and D036):

- Pretreatment
- Dissolution
- Purification and Oxide Conversion/Refinement
- Americium Oxide Production
- Evaporation
- Cement Fixation

Pretreatment primarily includes physical methods used to separate scrap and residues for the next step—dissolution. It may include burning metal, thermal decomposition, crushing and pulverizing, incineration, scraping, or sorting. Historically, it also may have included calcination, caustic leaching, chemical separation (hydroxide or oxalate precipitation), distillation, filtering of liquids or oils, magnetic separation or passivation. The filtering of liquids or oils was performed under *Oil Recovery* from 1979 to 1989. Vacuum pump oils and other contaminated liquids from various operations were analyzed for nuclear material content. If they met the discard limit (DL) for plutonium, they were mixed with vermiculite and packaged in a drum for disposal. If the

liquids 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 was used as a diluent to reduce the viscosity of vacuum pump oil. Heavy metals were not used in the process but were expected to be present from equipment wear (References C130, D008, D036, and M057). After pretreatment, solids are sent to dissolution if plutonium concentrations are above the DL. If concentrations are below the DL, solids are sent to solid waste packaging. Plutonium bearing solutions are sent to purification if plutonium concentrations are above the DL. If concentrations are below the DL, solutions are sent to solid waste packaging (References D008 and D036).

Dissolution includes various steps that generate plutonium nitrate solutions for feed into the purification step. Primary chemicals used in dissolution are nitric acid, calcium fluoride, and/or hydrofluoric acid. Filtered solids are either returned to the dissolution operation until plutonium concentrations are below the DL or sent to the vault for storage. Processed solids with plutonium concentrations below the DL are sent to solid waste packaging for disposal. Debris items are disposed after removal of plutonium contamination above the DL. Non-acidic plutonium-bearing solutions are sent to purification. Acid solutions are sent to the evaporator (References D008 and D036).

The *Advanced Testing Line for Actinide Separations (ATLAS)* facility is a technology development operation performed in the dissolution process. The mission of the ATLAS facility is to research, develop, and demonstrate state-of-the art methods to reclaim and purify actinides from contaminated scrap. The facility has the capability to recover actinides from a wide range of feed types including oxides, ash, pyrochemical salts, metal conversion residues, and other items such as metal, alloys, and sources. This line employs dissolution, feed treatment for anion exchange, eluate precipitation, purification precipitation, calcinations, and waste treatment technologies. Chemicals used in this process include aluminum nitrate, calcium fluoride, diethyl oxalate, ferrous ammonium sulfate, formamide, hydrogen peroxide, hydroxylamine nitrate, sodium hydroxide, sodium nitrite, urea, and ascorbic, formic, hydrochloric, hydrofluoric, nitric, and sulfuric acids (References C200, D071, and P190).

Purification and Oxide Conversion/Refinement consists of ion exchange, precipitation, calcination, and roasting and blending operations. The ion exchange operations use resin-filled columns to collect plutonium, which binds to the resin while impurities flow through the columns; an eluting agent (nitric acid and hydroxylamine nitrate) is then used to release purified plutonium in solution. The enriched solutions are then sent to oxalate precipitation. Calcination of the oxalate converts the plutonium to oxide form. The oxide is then screened and blended. The depleted liquids are sent to the evaporator after hydroxide precipitation. An alternative purification process involves peroxide precipitation to eliminate a select set of metallic impurities. The plutonium peroxide is then separated by filtration, redissolved in nitric acid and precipitated again as the oxalate. The calcined plutonium oxides are sent to the vault (References C129, D008, and D036).

Americium Oxide Production begins with hydroxide precipitation of americium from the filtrate of the plutonium peroxide precipitation. The americium hydroxide then goes through dissolution, purification and packaging much like the plutonium nitrate operations, but without the refinement step. The processed material is sent to the vault for storage (References C129 and D036).

The *Evaporator* processes plutonium-poor liquids in order to re-concentrate plutonium, if possible, or to reduce the volume of liquid waste. These solutions are collected in tanks and sent to the evaporators in batches of up to 600 liters. The solution batches are then

concentrated to approximately 25 liter volumes called "bottoms." As the bottoms cool, salts (i.e., nitrate 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 if concentrations are below the DL. Attempts are made to re-dissolve settled salts, but if this is not readily achievable, the salts are sent to dissolution if plutonium concentrations are above the DL or sent to cement fixation if concentrations are below the DL. Nitric acid is used in the evaporator to wash nitrate salts having a plutonium concentration above the DL. Spent acid waste is sent to the Radioactive Liquid Waste Treatment Facility (RLWTF). Heavy metals that might be present are concentrated in this operation (References C130, D008, and D036).

Prior to 1992, some nitrate salts below the DL were not sent to cement fixation for immobilization but were packaged as waste. These salts were washed, vacuum dried (to reduce, but not eliminate, moisture content), double- (or triple-) bagged, and placed in 55-gallon drums. These salts are being remediated/repackaged in the Waste Characterization Reduction and Repackaging (WCRR) Facility with an inert absorbent material (e.g., zeolite, kitty litter). The minimum inert absorbent material to nitrate salts mixture ratio is 1.5 to 1. Containers of nitrate salt waste mixed with inert absorbent material are included in the mixed absorbent waste stream (References C230, C231, D089, D090, D091, and P198).

The *Cement Fixation* process immobilizes aqueous and organic liquids with low plutonium concentrations and solids (e.g., evaporator bottoms, salts) from the six operational areas (e.g., nitrate operations) in cement. Historically, filtered solids and fines were also sometimes sent to cement fixation, but this is no longer done. Prior to 1988, the cement fixation process was performed throughout TA-55 using available glovebox space. Since 1988, the process has been performed in a dedicated glovebox. Liquids and solids are typically transferred to cement fixation in containers. Reagents used during this operation include cement accelerator, gypsum cement, nitric acid (pH adjustment), organic liquid emulsifier, Portland cement, silicone defoamer, sodium citrate retarder, sodium hydroxide, and phthalate and phosphate buffer solutions for pH meter calibration. The waste materials are commonly adjusted to a specific pH prior to mixing with gypsum or Portland cement. In the past, the cement was mixed in plastic bags or in various sized containers. Waste is now mixed directly into a 55-gallon drum attached to the glovebox. Any particulate matter is added during the stirring operation. Based on the review of the AK sources, contaminants of incoming materials may include chromium, lead, mercury, silver, acetone, benzene, butanol, carbon tetrachloride, chlorobenzene, chloroform, tetrachloroethylene, methylene chloride, methanol, pyridine, and xylene. Most of the wastes generated under this operation are classified as cemented wastes; although a small amount of debris waste is also generated (References C132, C171, C200, D008, D036, D050, D077, D078, and U005).

2. Miscellaneous Operations

R&D projects involve applied techniques and methods designed to study and improve operations associated with the purification, separation, extraction, recovery, and characterization of actinides (primarily plutonium). General types of these miscellaneous operations are described below.

Actinide Chemistry R&D. Several small-scale R&D efforts utilizing analytical instrumentation, wet chemistry, and other miscellaneous laboratory techniques primarily focus on plutonium recovery. Examples of some of these efforts include:

- Fluoride sintering of plutonium oxide takes advantage of the presence of fluoride to aid the formation of a sintered mass of plutonium oxide powder at temperatures above 700°C.
- Chlorination of plutonium oxides involves oxides with tantalum chips from the former Rocky Flats Environmental Technology Site. Chlorination is used to recover plutonium from potassium chloride and sodium chloride matrices.
- Processing of molten-salt extraction (MSE) salts generated at LANL and the former Rocky Flats Environmental Technology Site.
- Recovery of plutonium from ash involving plutonium/thorium oxide mixtures.
- Processing of neptunium oxide and metal to remove the protactinium (Pa) daughter in order to use the neptunium for Nondestructive Assay (NDA) standards.

Process outputs from these operations may be sent to the vault, aqueous recovery, or cement fixation based on the DL (References D009 and D032)

Experimental Oxide Characterization is conducted in Room 208 of PF-4 as an experiment designed to calculate the surface area and pore size distribution of a sample and to analyze the surface characteristics of the sample. Mixtures of helium and nitrogen are passed through a V-shaped cell to analyze the sample inside. With the exception of nitrogen and helium, no solvents or chemicals are used in this process. Process outputs from this operation may be sent to the vault, returned to the originating process/status (P/S) Code, transferred to aqueous recovery, or cement fixation based on the DL (References D009 and D032).

The *Analytical Chemistry Laboratory* includes all analytical techniques performed in Room 124 of the PF-4. Operations involve the analysis of plutonium and americium, Resource Conservation and Recovery Act (RCRA) metals, and trace metals. Originators provide samples, which are prepared for further analyses, such as inductively-coupled plasma (ICP) and x-ray energy spectroscopy (XES). Unused liquid samples are returned to the originator, sent to radiochemistry for counting, sent to aqueous recovery operations, cement fixation, or sent to the RLWTF (References D008, D009 and D032).

Laser Induced Breakdown Spectroscopy is a technique that uses a powerful laser beam which, when focused on a sample, vaporizes a portion of the sample and forms a plasma. The light emitted by the plasma is analyzed in an optical spectrometer and the elemental composition and concentration of the sample can be determined. The advantages of this technique include analysis without sample preparation or dilution and portability. In this operation, originators provide plutonium containing solids or solutions which are analyzed. After analysis, the remaining sample is returned to the originator (Reference D032).

Actinide Processing Demonstration is a hydrothermal processing technique that involves the reaction of aqueous/organic mixtures, pure organic liquids, or contaminated combustible solids (e.g., ion exchange resins, plastic filters, and cellulose rags) with water under supercritical or near supercritical (elevated temperature and/or pressure) conditions. Feed streams may be contaminated with acetone, butanol, carbon tetrachloride, chlorobenzene, chromium, dihexyl N, N-diethylcarbamoylmethylphosphonate, diisopropyl benzene, lead, methanol, methylene chloride, octylphenyl di isobutyl carbamoylmethyl phosphine oxide, and xylene. Effluents are

liquids, oxides, 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. 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 (References C199, D032, D077, and M223).

Electrochemistry operations examine the electrochemical behavior of actinide or actinide contaminated metal samples and compounds in aqueous and non-aqueous solutions. A wire is attached to the sample with conductive paint and the sample is mounted in epoxy. The surface is polished and then cleaned with ethanol. An electrochemical cell is assembled, including a reference electrode (such as saturated calomel), a counter electrode, the desired solutions, and a gas dispersion tube. The electrodes are attached to a potentiostat and the sample is polarized by the application of voltage to the working electrode. The residual solution is made more basic to precipitate the actinide. After settling, the liquid is decanted and the precipitate is filtered and dried. The filtrate is sent to Aqueous Recovery or to the RLWTF. After drying, the residue is scraped into a storage container and sent to the vault. The remaining samples are returned to the originating P/S Code (Reference C131).

Material Identification and Surveillance involves the preparation of batches of plutonium oxide with well-established characteristics, and non-special nuclear material (SNM) impurities as desired to determine how these materials will interact with water in long-term storage. The preparation of the batches uses any combination of milling, blending, screening, calcining, and splitting to produce the desired plutonium oxide powders. Impurities such as alkaline, alkaline earth, uranium chlorides, metal oxides, hydroxides, fluorides, carbonates, nitrates, and sulfates are added as desired and the material is sent to the vault or other operations as needed (Reference C131).

Long Term Storage and Compatibility Testing is an operation used to measure the chemical and physical changes that occur when plutonium metal or compounds (such as oxides) are placed in various storage configurations, in various gaseous environments, or in contact with process or commercial materials. Small Material Inventory Studies involve the loading of up to 10 grams of plutonium dioxide as well as non-special nuclear material impurities into containers. The containers are monitored for temperature, pressure and gas composition over time. The capability also exists to modify the gas composition at any given time. The containers are heated in a furnace to a temperature corresponding to self-heating of a normal storage container loaded with nuclear material. The plutonium oxide is supplied by the vault or the Material Identification and Surveillance (MIS) process. The purpose of this process is to understand any changes or reactions that might occur in long-term storage of nuclear material. The gas monitoring is accomplished using mass spectrometry or gas chromatography. At the conclusion of testing, the containers and materials are submitted for analysis, returned to MIS, or sent to the vault (References C131 and D009).

Compatibility tests, which are no longer performed, were similar to the long term storage tests, except that (1) tests were prepared with process or commercial materials in contact with the plutonium metal or compounds and stored in the glovebox, (2) the storage containers didn't have a thermocouple, (3) the container may not have been monitored by an automated data acquisition system, and (4) the container had a volume up to 1.3 liters. Materials involved include plutonium metal, alloys or compounds, process or commercial materials (including liquid solder [gallium, indium, and tin], glycol, silicone grease, Sylgard 184 (a silicone encapsulant), or

cellular silicone), and the following gases which were used as atmospheres in the storage containers: helium, hydrogen, or the constituents of air. The test materials were sent out for analysis after the tests.

Gas cylinders were attached to a manifold through a two-stage regulator and not used in the gloveboxes (References C131 and D009).

Standard Fabrication originated as Pyrochemical Matrix Studies conducted from 1986-1992 involving rod milling prior to screening. This operation had two objectives: (1) blending large batches of homogeneous plutonium oxide for pyrochemical operations, and (2) blending similar batches for dissolution in nitrate operations. The operation changed in August 1992 when a need developed to blend oxides to provide feed material for making NDA standards. From February 1995 to the present, the operation changed again, with the objective of determining the effect of high purity oxide, salt, and metal matrices on the accuracy of NDA measurements. Operations involve crushing, pulverizing, blending, roasting, and sieving. The results are used to determine protocols for handling and processing the matrices and to correct bias measurements. The product material consists of high-purity oxide standards for use at LANL and throughout the DOE complex (References D009 and D032).

Metallography Operations characterize the microstructure of metallic or ceramic pieces and establish the quality and effectiveness of welds. Materials examined 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 and metal pieces are subjected to grinding with standard metal grinding media (e.g., papers impregnated with silicon carbides and diamond). The materials are cleaned, polished, and etched with several different chemical compounds. The spent chemicals are sent to aqueous recovery, to the RLWTF, or mixed with absorbent. The plutonium and uranium carbides, nitrides, and oxides are returned to the vault (References D009 and D032).

Electrolytic Decontamination conducts various electrochemistry R&D experiments in Rooms 105, 106, 112, 208, 209, and 210. Electrochemistry methodologies are designed to decontaminate items, replace operations that produce large amounts of waste, or enhance chemical reactions. Process inputs are from the vault. The process involves uranium decontamination of disassembled weapon components from various sites with various levels of surface contamination with plutonium. The operation is strictly an aqueous process in which an alkaline solution is reacted with the components to precipitate uranium. A stainless-steel cathode is used; therefore, corrosion is not an issue and the electrolyte is not degraded. Significant amounts of metal could be stripped in a short period of time. The precipitated solution comprises either uranyl hydroxide or uranyl sulfate, which is then dried for mass balance. The distillate contains small amounts of uranium. Rinse water is discarded to the RLWTF. Outputs from the process are directed to the vault or cement fixation (References D009 and D032).

Waste Management Operations (P/S Code WM) is currently limited to waste generated from the TRU solid waste management operation in Room 432. This practice has been in place since the beginning of 1993. Room trash boxes from PF-4 have always been handled as low-level waste (LLW). However, when the boxes were assayed to verify contamination levels, some were determined to be TRU waste. These boxes of room trash were diverted to Room 432 for repackaging as TRU waste. From May 1987 through 1992, these boxes were tracked using P/S

Code XO or X0 (Inactive or unspecified P/S material) and ultimately designated as having originated in P/S Code WM. These codes were changed to P/S Code WM after 1992 (References D009, D032, and D077).

Additional controls were placed on room trash after 1992 and continue to the present. Trash is assayed with the Multiple Energy Gamma Assay System (MEGAS). When a container is rejected because of MEGAS data, the rejected container is returned to the originator for removal of any "hot" item(s). This operation also allows greater control to prevent discarding regulated materials (e.g., RCRA constituents) in room trash. P/S Code XO indicates waste materials contaminated with RCRA constituents that are generated within specific rooms but cannot be associated with an individual P/S Code in that room. P/S Code X0 is designated for waste materials that cannot be associated with a specific room, such as a hallway, mezzanine offices, restrooms, change rooms, basement, pump rooms, and trolleys. The waste from all these areas, except the pump rooms and trolleys, would be LLW and no RCRA constituents are associated with the waste. P/S Codes XO and X0 are considered interchangeable because of the difficulty in distinguishing them on container paperwork and their inconsistent use by waste generators (References C037, D009, and D077).

Material Management Operations (P/S Codes M1, M2, MM, and M4) are used to introduce and remove items from the glovebox line. TRU waste typically associated with bag-out operations (e.g., stubs, tape) is packaged with other waste items and assigned Hazardous Waste Numbers (HWNs) based on the P/S Code from which the waste originated. Waste generated in the material management rooms is associated with glovebox maintenance operations. No other operations are conducted in these rooms (Reference D009).

The *Non-Confirming Drums* operation occurred from April 1989–April 1991 in Room 432. This operation was established to provide a mechanism for dealing with TRU drums that did not confirm TA-55 characterization information (e.g., recorded weight or nuclear material content). Non-confirming drums were temporarily set aside until such time as personnel could reprocess them under waste management operations to correct the non-confirming condition. After April 1991, non-confirming drums were dealt with immediately, and this operation was no longer needed (Reference D032).

Extraction/Separation Studies is no longer active, but involved the processing of actinide hydroxide cakes generated from chloride and nitrate operations. Research in this area also contributed to the development of sensors and instrumentation for online chemical analysis, and improvements in the purification operation. The R&D operations were non-routine and developmental in nature. The operations involved research, process development, small scale trouble-shooting, and occasionally preparation of various isotopes and isotopic mixtures of plutonium, uranium, americium, and neptunium (Reference D032).

Non-Aqueous Dissolution/Extraction Operations is no longer active, but involved the dissolution of actinide compounds and actinide-containing matrices in superacid media. The superacid solutions were evaporated to leave solid products that were analyzed by a variety of methods. The study of the organometallic chemistry of uranium and thorium in non-aqueous solvents consisted of a variety of small-scale organoactinide operations. The organoactinide operations were designed to study the synthesis of new actinide compounds in non-aqueous media. These operations also examined the characterization and reaction chemistry, and considered applications to existing actinide processing technology. Other non-aqueous operations supported fundamental and applied actinide chemistry research, by preparing solvents and

reagents for the synthesis of new compounds, and characterization and analysis of new chemical compounds using wet chemistry methods and analytical instrumentation(Reference D032).

Measurement/Detection Operations and Studies is no longer active, but involved the inspection of oxides and metals. Materials were retrieved from the vault, brought to the glovebox, inspected, assayed by a non-destructive method, and sampled if necessary, then repackaged and returned to the vault. Assay methods included XES, laser-based, Raman and high resolution emission spectroscopy as well as other spectroscopic techniques. In addition to elemental and isotopic analyses, other measurement studies were designed to determine the surface area and pore size distribution of a sample and to analyze its surface characteristics. These studies produced only standard glovebox waste (References C131, D009, and D032).

Halogenation Studies is no longer active, but involved the fluorination of samples containing plutonium residues. 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 plutonium tetrafluoride or gaseous plutonium hexafluoride. Gaseous plutonium hexafluoride was trapped in a cold trap, distilled, and reduced to plutonium tetrafluoride. Separation operations involving experimental chlorination operations were similar to the fluorination procedures. A gas loop was used to flow carbon tetrachloride and perchlorocarbons through a gas-solid reactor to chlorinate plutonium oxides to form recoverable plutonium compounds. These studies produced only legacy waste (References D009 and D032).

3. Special Processing Operations

Special Processing includes operations for material type(MT) 42 and R&D for MT 52. Because processing MT 42 is a smaller-scale version of the recovery operations used for MT 52, MT 42 processing has four main recovery steps (References D010 and D030):

- Head-end operations
- Nitrate ion exchange operations
- Chloride ion exchange operations
- Pyrochemical operations

Only head-end operations are covered here. Nitrate ion exchange operations are covered in Section 1. Chloride ion exchange operations and pyrochemical operations (Direct Oxide Reduction, Molten Salt Extraction, and Electrorefining) are covered in Section 5 (References C131, D010, and D030).

Head-end Operations includes pretreatment which may include sorting, crushing, and/or pulverizing feed materials prior to being fed into later operations. A separate pretreatment procedure is the decladding of plutonium-beryllium (Pu-Be) sources. The Pu-Be metal alloy is removed from the sources, which are then entered into the chloride line for plutonium recovery along with other materials (References D007 and D028). The next operation is to leach or pickle items such as tools, labware, crucibles, and ash in nitric, hydrochloric, or hydrofluoric acids to remove recoverable plutonium. Plutonium oxide is typically calcined in nitrate and chloride operations to oxidize any metallic plutonium prior to dissolution. Combustible wastes are burned and the ash sent through the rotary calciners to remove incompletely oxidized organic material (References D010 and D030).

All wastes generated by MT 52 R&D operations are replicated for MT 42, but carry different P/S Codes to differentiate and identify the radionuclide content of the waste. Outputs from Special Processing include high purity metal for casting and machining (References D010 and D030).

4. Metal Operations

The main goal of metal operations is to transform the high purity metal produced primarily by pyrochemical operations into alloyed metal shapes. On-going metal operations include metal casting, machining/metal work on various metals, extrusion, surface preparation, oxidizing, surveillance machining, accelerated aging, impact testing, fuel fabrication, assembly, recovery and extraction, physical property testing, burst testing, special recovery, thermal hydride/dehydride, research alloy preparation, and welding (References C131, D011, and D029).

Casting is a process that receives plutonium metal from pyrochemical operations or Special Processing Operations depending on material type, or from other sources. 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. Shapes generated by this process are sent to machining, various P/S Codes for testing, plutonium standards extrusion, reduction to metal or salt stripping. Plutonium oxide byproduct is sent to aqueous recovery (References D011 and D029).

Machining involves a variety of operations on cast parts obtained from Casting. Machining operations include turning, milling, grinding, and boring. The objective of the machining operations is to bring the parts to their formal dimensional specifications. Operations within machining use dry machining techniques. Cleaning solvents were used in machining operations in the past, and still are occasionally used, although with less-hazardous substitutes. Freon TF is used to remove oil from turnings (degreasing) before they are sent to recovery. Tetrachloroethylene is used to degrease metal parts after they are machined. Machined parts are sent to assembly operations or the vault. Scrap metal and turnings are sent to salt stripping and casting for recovery/reuse (References D011 and D029).

Plutonium Standards Extrusion uses high purity metal ingots from casting or machining which are placed in an extruder. The extruder is operated to produce a metallic wire that is cut into 1 gram pieces. Each 100 gram lot of wire pieces is sealed in a stainless-steel storage container for later packaging and shipment as required. The extrusion system consists of a hydraulic press and a microprocessor controlled hydraulic pumping system including a 0.156 inch diameter extruding die. The entire operation is performed in an inert glovebox to prevent oxidation of the metal. Plutonium standards are sent to the vault for storage (Reference C131).

Plutonium Surfaces studies receive samples from other operations and characterize them by the Sievert's Equilibrium System, x-ray, and other physical examinations. These methods can determine pressure-composition-temperature curves for actinide hydride/deuteride compounds or prepare samples of these compounds. These techniques also determine structures of actinide samples and measure helium release in aged plutonium. The samples may require mounting prior to characterization. Samples are returned to the originating P/S Code or to the vault (Reference C131).

Uranium Conversion involves the oxidation of uranium metal in air or a controlled oxygen environment at temperatures up to 1,100° C in a glovebox environment. The uranium pieces are usually received from the vault. The metal may be cut into pieces to fit into the crucible, which is then placed in the furnace and heated to the desired temperature in a slow flow of oxidizing gas. The oxide powder is then rod- or ball-milled to reduce particle size. It is then placed in a bottle before being removed from the glovebox line and transferred to the vault (References C131 and D011).

Surveillance Machining focuses on receiving metal shapes and machining the required metallic samples for a variety of analyses that can document what changes may or may not have occurred in the shaped item over its lifetime. The turnings are ultimately oxidized, while classified shapes and miscellaneous metal go to a variety of operations or to the vault (Reference C131).

Accelerated Aging of Plutonium is similar to casting and machining. Plutonium and other actinide based metals and materials are cast, machined, and inspected in the Actinide Research Machining Glovebox in the 300 wing of PF-4. This program employs Pu-238 to rapidly age weapons-grade plutonium, permitting accelerated self-irradiation induced changes in the material as a function of time. The Pu-238 enrichment level of weapons grade plutonium is performed at approximately 5 to 7.5 percent by weight. The Pu-238 is blended with the weapons-grade plutonium during the casting operation. Machining operations include turning, milling, grinding, and boring. Unlike machining, Freon TF is not used to degrease metal chips and turnings. However, trichloroethylene is used to clean machined parts. Machined parts are sent to metallography for testing. Plutonium scrap and turnings are sent to Casting and Salt Stripping for reuse/recovery. Oxide from casting is sent to Roasting and Blending for further processing (References C131, D011, D081, and P189).

The Impact Test Facility uses a 7-inch gas gun and a 40-millimeter (mm) powder gun. 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 elsewhere in PF-4. No TRU waste is generated from the 7-inch gun experiments under normal circumstances. The 40-mm gun enables the experimenter to generate data on materials in high stress environments. During the test, a projectile propelled to hypervelocity 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 are reused (References D011 and D029).

The Kolsky Bar Test Facility is a gas gun operation for physical property testing. 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 plutonium. 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. Wastes include rags, HEPA filters, and gloves. The rags generated by this process may contain some lead/lead oxide from cleaning operations. The barrel is cleaned with a cotton swab. No solvents are used. Residual plutonium is returned to the originating P/S Code (References D011 and D029).

Fuel Fabrication entails the development of reactor fuel. Enriched uranium oxide, depleted uranium, and/or plutonium oxide is blended and mixed with graphite and stearic acid. The blended mixed oxide is then pressed into briquettes. The briquettes are heated, size reduced, and pressed into pellets. The pellets are heated/sintered and inspected. Grinding may be necessary to meet specifications. The accepted mixed oxide fuel pellets are transferred into the cladding glovebox. The cladding tube is held in a lathe while the pellets are pushed into the cladding with a pushrod. A stainless-steel shroud tube is placed in the cladding tube prior to insertion of the pellets. A spring and end cap is placed in the open end of the cladding tube, and a tungsten inert gas (TIG) weld is made at the joint between the end cap and the cladding. Cladding, spring, and end cap are stainless-steel. Bonding of the fuel is done with either helium or sodium. Any excess sodium is reacted with Dowanol 80 (a long chain alcohol) to form a stable sodium salt, which prevents metallic sodium from entering the waste streams. As a result of the current effort in mixed oxide fuel development, the issue of gallium removal becomes important. Completed fuel rods are sent to the vault for storage prior to distribution. Oxides and rejected pellets are sent to aqueous recovery or the vault (References D011 and D029).

Assembly Operations involves bringing nuclear material out of the glovebox and encapsulating it in a cold container. This outer container can be a bolted assembly or a welded assembly using electron beam, pressurized inert-gas metal arc, TIG, or laser welding techniques. No solvents are used. Wastes include aluminum foil, plastic bags, and gloves. The waste generated from this process is nearly always LLW, but some TRU waste may be generated. The assembled containers are sent to the vault for storage (References D011 and D029).

The *Advanced Recovery and Integrated Extraction System (ARIES)* is a demonstration operation, which receives and disassembles pits, plutonium hydrides and metallic plutonium, from which it produces plutonium metal or oxide powder. The product is canned for long-term storage. Wastes include plutonium-contaminated debris waste. Operation of the ARIES Electrolytic Can Decontamination System decontaminates the external surfaces of canned plutonium using an electrolytic decontamination system. An electrolyte (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 plutonium. This liquid waste is sent either to cement fixation or to the RLWTF at TA-50. The plutonium metal and oxide powder is sent to the vault (References D011 and D029).

Physical Properties 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 from various operations. 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 G 187. The actinide metals, alloys, and compounds are returned to the originating P/S Code (References D011 and D029).

Burst Testing involves the placement of hemi-shells on a test stand. A buffered test solution is pumped into the shell, pressurizing it until it bursts. 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. Strain gauges have electrical contact points that are tin-lead solder. No solvents are used. The tested hemi-shells are sent to the vault for storage (References D011 and D029).

The *Special Recovery Line* (SRL) conducts pit disassembly on pits which are contaminated with tritium. Tritium is recovered if it 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 zeolite absorbent for disposal. Small-scale decontamination of tritium-contaminated plutonium 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. Plutonium, uranium, and tritium are sent to the vault for storage. Plutonium metal is also sent to casting, machining, or salt stripping for reuse/recovery (References D011 and D029).

Thermal Hydride/Dehydride:

a) Plutonium Hydriding System. The plutonium hydriding process studies the reactions of plutonium alloys and other actinides with hydrogen and other gases. The process takes place in Room 114, glovebox 110, and uses no chemicals other than the gases. The plutonium alloys and actinides are returned to the originating P/S Code (Reference D029).

b) Operating the Hydride-Dehydride Systems. The hydride-dehydride operating procedure describes how to safely form plutonium hydride, and then to decompose it to plutonium metal. Three phases are involved: phase one uses hydrogen gas in large amounts and dehydriding is done in a separate reactor. 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. The plutonium metal is sent to the vault for storage (Reference D029).

Welding operations fall into two categories: encapsulation of radioactive isotopes and other welding operations. Two methods of welding are employed: a gas tungsten arc welder and an electron beam 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 plutonium 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. The welded parts are either returned to the originating P/S Code or sent to the vault for storage (Reference D029).

5. Pyrochemical and Chloride Operations

Pyrochemical operations include metal preparation, metal purification, and ancillary metal production operations (chloride operations and metal oxidation). Pyrochemical outputs are most often high-purity metal feed materials for metal operations (References D011 and D028).

Metal preparation includes the following:

In the single pass *Direct Oxide Reduction* (DOR) operation, plutonium oxide and calcium metal are reacted in molten calcium chloride (CaCl_2) to produce plutonium metal. The reaction is

conducted in a magnesium oxide (MgO) crucible. 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 is sometimes recovered by heating with addition of fresh salt plus calcium metal (Reference D028).

Multiple-Cycle Direct Oxide Reduction (MCDOR) is used to minimize the salt waste. During the MCDOR operation, the molten salt is regenerated by sparging the calcium chloride-calcium Oxide ($\text{CaCl}_2\text{-CaO}$) 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 plutonium metal is sent to casting or electrorefining. Impure plutonium metal is sent to molten salt extraction. Salts and crucibles above the DL are sent to chloride operations or the vault. Salts and crucibles below the DL are sent to solid waste packaging for disposal. Caustic solution from the chlorine off-gas scrubber is sent to chloride operations or the RLWTF (References D011 and D028).

Metal Preparation Line is no longer active, but produced plutonium metal from fluoride salts. Hydrogen fluoride gas was reacted with plutonium oxides obtained from calcination of oxalate or peroxide precipitates from the aqueous nitrate or chloride process lines. The plutonium fluoride was further reacted with calcium metal to produce plutonium metal, which could then be recovered as a small globule, or button, by breaking the crucible. This operation generated only legacy waste (References D011 and D028).

Metal purification operations include the following:

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 (Reference D048). This operation is employed only if the americium content is greater than 1,000 parts per million (ppm). In the original operation (from 1979 to 1988), magnesium chloride (MgCl_2) was added to the impure plutonium metal in a eutectic mixture of sodium chloride (NaCl) and potassium chloride (KCl), contained in a MgO crucible, and heated to 750°C . The MgCl_2 oxidized americium to americium chloride although some plutonium was also converted to the chloride salt form. In 1988 and continuing to the present, the MSE operation uses CaCl_2 , NaCl, KCl, and plutonium chloride (PuCl_3) produced by in-situ chlorination in a tantalum or MgO crucible. Ninety percent of the americium and ten percent of the plutonium are transferred from the feed metal to the salt. After cooling, the salt and metal are mechanically separated. The salts and crucibles above the DL are transferred to the vault or chloride operations. Salts and crucibles below the DL are sent to solid waste packaging for disposal. The plutonium metal is sent to electrorefining or metal oxidation. Caustic solution from the chlorine off-gas scrubber is sent to chloride operation or the RLWTF (References D011 and D028).

The *Electrorefining (ER)* operation takes impure metal from the MSE and DOR/MCDOR operations and produces high purity plutonium metal. Impure plutonium is cast as an anode, which is then placed in a MgO crucible with a salt mixture, a metal cathode (typically tungsten), and a seeding reagent that is MgCl_2 , NaCl, or KCl. After the anode and salt are melted, current is applied to the system, and plutonium at the anode is oxidized to plutonium ions that travel to the cathode and are reduced back to the metal state. Impurities in the original plutonium anode that are more electropositive or have a greater negative free energy of formation than plutonium (including barium and americium) dissolve and remain in the salt, while impurities more electronegative than plutonium (including cadmium, chromium, lead, and silver) remain in the anode. After cooling, the crucible is broken and the residues are physically separated from the high purity product metal. Anode heels were sent to pyroredox from 1984 to 1986. Currently,

salts and crucibles above the DL are sent to chloride operations or the vault. Salts and crucibles below the DL are sent to solid waste packaging for disposal. Purified plutonium is sent to casting and the vault. Caustic solution from the chlorine off-gas scrubber is sent to chloride operation or the RLWTF (References D011 and D028).

Ingot Casting is included in the Electrorefining section of pyrochemical operations. Metal is melted in a MgO crucible to cast the ingot (References D011 and D028).

From 1987 to 1989, secondary solvent metals such as cadmium, bismuth, lead, and gallium were added to experimental studies of the ER operation (References D011 and D028).

Ancillary metal production operations include the following:

Chloride Operations:

The overall goal of chloride operations is to recover plutonium from scrap and residues and produce a purified plutonium oxide for conversion to metal. The feed sources have included plutonium residues from pyrochemical operations, Pu-Be neutron sources, analytical chemistry laboratory solutions, and residues from other DOE facilities. Chloride operations can be broken down into the following four steps (Reference D007):

- Pretreatment
- Dissolution
- Purification
- Hydroxide precipitation

Pretreatment for chloride operations is discussed in the *Head-end Operations* section of special operations (refer to Section 3).

Dissolution uses hydrochloric acid to leach and dissolve plutonium from salts, scrap, crucibles, residues, and various solutions, including solutions from the analytical chemistry laboratory. Enriched solutions undergo further purification and solid wastes are discarded as debris waste or sent to cement fixation in nitrate operations (refer to Section 1) (Reference D007).

Purification includes solvent extraction, ion exchange and oxalate precipitation, depending on the chemical nature of the material to be purified. Ion exchange columns are used to collect plutonium and to separate plutonium from impurities. Enriched solutions may be further treated with oxalic acid to precipitate plutonium oxalate. The resulting plutonium precipitate is sent to nitrate operations to be calcined and eventually to the vault. The liquid solution (filtrate) goes to hydroxide precipitation for further processing. Solid wastes are discarded as debris waste or sent to cement fixation for immobilization. Tetrachloroethylene, which was used in the solvent extraction process until 1992, contaminated the debris waste and the liquid waste absorbed in vermiculite (Reference D007).

Hydroxide Precipitation takes plutonium in filtrate solutions from the purification steps and precipitates it with potassium or sodium hydroxide. Heavy metals are concentrated in the plutonium-rich hydroxide cakes. The sources of heavy metals vary but may include one or more of the following: (a) feed materials that consist of or contain these metals; (b) leaching of chromium from stainless-steel equipment components; or (c) the use of silver salt (until 1994) in the measurement of chloride content. The resulting plutonium-enriched hydroxide cakes may become feed material for nitrate operations, be returned to the dissolution step for re-

processing, may be sent to cement fixation for immobilization, or may be discarded as solid waste if they meet the approved DLs. Liquid meeting the TA-50 Waste Acceptance Criteria (WAC) is sent to the TA-50 RLWTF using the caustic waste line (Reference D007).

In *Metal Oxidation* small pieces of metal remaining on furnace or crucible surfaces are collected for conversion to the oxide phase. These metal pieces are placed in a furnace for the conversion process. The oxide is then transferred to the vault (References D011 and D028).

Salt Stripping is no longer an active operation, but the MSE and ER salts were further treated by salt stripping, oxygen sparging or carbonate oxidation, and salt distillation. The salt stripping operation treated the residue by melting and stirring the salt with calcium metal in a MgO crucible at 850°C. This treatment reduced the plutonium in the salt to metal and allowed the metal to coalesce for physical removal and recovery. After cooling, the crucible was broken and the metal physically separated and recycled to the ER operation or burned to oxide and sent back through aqueous recovery. The crucible shards were leached in hydrochloric acid, and then discarded (References D011 and D028).

Oxygen sparging and carbonate oxidation (since 1996) were used to ensure that any plutonium, americium, or metallic sodium or potassium left in the salts was converted to nonpyrophoric oxide forms (References D011 and D028). Vanadium pentoxide was used in place of carbonate to convert metals to oxide as part of the salt stripping operation from February to June 1998. Wastes that potentially contain residual vanadium pentoxide were, at one time, assigned the EPA HWN P120. However, this assignment has been rescinded (Reference D028).

Salt Distillation is no longer an active process, but allowed for the recovery of plutonium oxide from the chloride salt and produced purified chloride salt for reuse (References D011 and D028).

The *Pyroredox* operation was used to recover plutonium from spent anode heels in the mid- to late 1980s. The anode heel was polished with calcium metal to remove surface oxide, and then oxidized to plutonium (III) with zinc chloride in molten KCl, forming PuCl_3 . Elements more electropositive than zinc (including barium) were oxidized into the salt phase, and the zinc formed a metal button. The salt was then mixed with calcium metal in CaCl_2 to reduce the plutonium to the metal phase, as well as to reduce all elements more electronegative than calcium. The salt phase containing small amounts of the impurity barium was mechanically separated from the metal phase and discarded. The metal phase containing zinc was placed in the vault or further treated, and the plutonium eventually was routed back to ER. This operation generated only legacy waste (References D011 and D028).

The *Metal Coalescence* operation is no longer active. Metal coalescence was used for plutonium turnings to coalesce the turnings into a metal button. Calcium metal and CaCl_2 were added to a MgO crucible along with the turnings and melted. Salts and crucibles above the DL were sent to chloride operations for recovery. Salts and crucibles below the DL were sent to solid waste packaging for disposal. Plutonium metal was sent to ER or the vault (References C131, D011, and D028).

The *Neptunium* operation processed neptunium contaminated residues from the vault in 1993. This operation generated only legacy waste (Reference D028).

Plutonium Trichloride Preparation was accomplished by bubbling a carrier gas (such as chlorine) 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. In this operation (January 1987–June 1989) the carbon tetrachloride was broken down into phosgene, carbon monoxide, and carbon dioxide gases. In June 1989 the operation switched to the use of phosgene gas as the carrier gas until the operation ended in May 1991. Feed material was high purity oxides from the vault or from other P/S Codes. The product plutonium trichloride was reduced to metal by the MSE or ER operations. This operation only generated legacy waste (Reference D028).

6. Pu-238 Operations

Heat Source Fabrication:

As described in Section 1, Pu-238 heat sources fabricated at TA-55 included the General Purpose Heat Source (GPHS), Light Weight Radioisotope Heater Unit (LWRHU), and Milliwatt Generator (MWG) sources. Current heat source production involves fuel fabrication and scrap and process residues processing. The primary P/S Code associated with heat source fabrication operations described in this section is P1 (routine Pu-238 heat source). Pellet production and welding and decontamination operations were also part of heat source fabrication but they are no longer active (References C198 and C220).

Fuel Fabrication:

The source of all feed material for Pu-238 fuel fabrication is oxide, originating directly or indirectly from the Savannah River Site (SRS) K Reactor. The feed material selected for fabrication is weighed then prepared using splitting, ball milling, slugging and screening, and granule seasoning. The material also undergoes oxygen isotopic exchange, involving the replacement of oxygen-17 and oxygen-18 with oxygen-16 by heating the feed material in a furnace (750°C). In GPHS processing prior to its inactivation and LWRHU processing, oxygen exchange is followed by heating to 1,000°C to release alpha-decay helium from the plutonium oxide crystal structure. The fuels are further heated or “seasoned” at temperatures ranging from 1,100 to 1,600°C and the resulting oxides are sent to be hot pressed into fuel pellets (References C192, C194, C212, C220, D080, and M285).

During the fuel fabrication process, analytical samples are frequently required for both Pu-238 oxide feed material and product specimens either to characterize the material or to determine whether the material meets current production specifications. The primary sampling capsules containing the oxide samples are cleaned in an ultrasonic bath with ethanol and allowed to air-dry before being placed into a secondary plastic container. Sampling tools are wiped down with cheesecloth containing ethanol (References C195 and P180).

The oxide samples are taken to perform particle size analysis. Ethylene glycol is used to suspend the Pu-238 oxide powder in a disposable polystyrene cuvette. The cuvette is sealed with a polystyrene cap coated with Duco cement. After the glue has set, the cuvette is ultrasonically cleaned in a water bath containing a high-purity soap (e.g., Alconox), is cleaned a second time in a bath of distilled water, and is wiped down with a cheesecloth pad soaked in Fantastik (nonhazardous) cleaning solution. The cuvette is then transferred to another hood for final decontamination with Fantastik-soaked cheesecloth. This process of cleaning and transferring the cuvette occurred up to 1994. From early 1994 onward, the water bath does not contain soap and Fantastik is not used because all work is performed in the same glovebox line and there is no need to decontaminate the cuvette. Before 1994, if the water was radioactively contaminated, it was discarded to the TA-50 RLWTF. Since 1994, the water has been evaporated (References C197 and M286).

Upon completion of the analysis, the ethylene glycol containing the Pu-238 oxide is poured through a coarse sieve and collected in a polyethylene bottle. When 200 - 500 milliliters of ethylene glycol has accumulated in the bottle, the contents are poured through a filter. The residue and filter paper are allowed to dry and are sent to a plutonium recovery process. The contaminated ethylene glycol is collected until a sufficient amount is available to discard, and then it is poured onto a bed of vermiculite for absorption (References C194 and M286).

The *Scrap and Process Residues Processing* operation receives materials from the vault and various other operations, such as fuel fabrication, pellet production, calorimetry, and metallography. This is a physical process consisting of weighing, sorting, segregating, and loading into a shipping container. The product from this process either goes to the vault or feeds into calorimetry operations (References D080 and M285).

The *Metallography* process began in 1992 and is still active. It receives feed material from P/S Code P1 operations in the form of Pu-238 oxide fuel recovered from encapsulated heat sources, impacted heat sources, fuel pellets, or other sources. The metallography process is a physical process involving cutting, mounting, grinding, polishing, photography, and etching of Pu-238 fuel specimens (References C194 and M287).

An epoxy-based mounting resin, hardener, and mount filler is used to mount the Pu-238 oxide. The epoxy resin, hardener, and mount filler consist of diethylenetriamine, Epon Resin 8132 (nonhazardous), and a Citofix/Durofix liquid (nonhazardous). Epon Resin 8132 is a liquid that polymerizes when mixed with an amine (e.g., diethylenetriamine). The Citofix/Durofix liquid is also a polymer. One end of a phenolic ring is covered with aluminum tape. The Pu-238 oxide sample is placed in the center of the interior surface of the tape. The mixture of epoxy resin, hardener, and filler is poured into the mount ring. The mounted sample is placed in a small aluminum film can, which is placed in a pressure bomb. The bomb is pressurized for a minimum of ten hours, vented, and the sample is removed. The mounted Pu-238 oxide sample then undergoes grinding and polishing (References C197 and P181).

Manual grinding and polishing involves moving the mounted sample across wet silicon carbide grinding papers of varying grits that are laid over a glass plate. Between each grinding step and after the last grinding step, the sample is ultrasonically cleaned in distilled water. The mounted sample is polished using aqueous suspensions of aluminum oxide or diamond powder. After polishing, the sample is cleaned in distilled water. Automated grinding and polishing involves using programmable equipment. The grinding process uses a metal or cloth plate that has been coated with an abrasive slurry. This process also involves cleaning the polished sample in distilled water (Reference P181).

Whenever there is a requirement to examine and/or document the Pu-238 oxide grain boundaries, the surface of the polished sample is etched using a solution consisting of hydrobromic, hydrochloric, and hydrofluoric acids. The sample is rinsed with distilled water and allowed to dry (Reference P181).

Residues from the metallography process feed into the P/S Code P1 process. Before 1994, the Pu-238 oxide was physically removed from the plastic mount (no solvent or chemical was used), and the mount was bagged out with other plastic debris. The Pu-238 oxide sample removed from the mount was sent to the P1 scrap and process residue processing operation for plutonium recovery. However, since 1994, the Pu-238 oxide has been left on the mount and archived (stored) in the glovebox line (References C197 and M287).

The waste generated from the metallography process includes aluminum tape, grinding papers and polishing cloths, aqueous abrasive slurries, acid etching solutions, and aqueous washing and cleaning solutions. The grinding papers and polishing cloths are dried and discarded as debris waste, as is the aluminum tape. The aqueous abrasive slurries are feed material for the Pu-238 waste solidification process. Any etching solution remaining on the Pu-238 oxide sample is rinsed off using distilled water and is collected with the aqueous wash solutions. These solutions are also sent to the waste solidification process (Reference P181).

The *Routine Pu-238 Waste Solidification* process of precipitating Pu-238 in waste solutions (P/S R8) has been conducted since 1979 and is still active. The feed material for this process comes from analytical operations, Pu-238 heat source fabrication operations, metallography operations, and other LANL groups. The feed solutions are strongly acidic, contain heavy metals, and have Pu-238 concentrations that are orders of magnitude above the DL for radioactive waste solutions. The solidification process uses sodium hydroxide, ferric nitrate, and phenolphthalein in ethanol to precipitate the Pu-238 (References C194, C196, M293, and P182).

Ferric nitrate solids are dissolved into the feed solutions to act as a flocculent. Concentrated sodium hydroxide solution is then added to convert the acidic solutions into caustic solutions, and cause the ferric ions and the Pu-238 ions in the solutions to co-precipitate as hydroxides. Phenolphthalein solution is used to indicate when the solution is basic. After sedimentation and vacuum filtration, the liquid portion (filtrate) is sampled and alpha-assayed to determine the residual Pu-238 concentration. The sludge is heated (calcined) to oxidize the hydroxides for disposal. This procedure is repeated as necessary for the filtrate until the Pu-238 concentration in the filtrate is below the DL (References P155 and P182).

The waste generated by this process consists of calcined ferric oxide solids containing Pu-238, a caustic solution containing Pu-238 below the DL, and solid debris. The oxide solids are sent to the vault or disposed as waste, depending on the Pu-238 concentration. Waste containers that are predominantly debris may contain small quantities of the oxide solids. The caustic solution is discarded into the caustic drain to the pretreatment plant at the RLWTF (TA-50, Building 1, Room 60) (References P155 and P182).

Aqueous Scrap Processing involves the purification of Pu-238 oxide in a nitric acid stream, similar to the recovery operations already established for Pu-239 as part of TA-55 nitrate operations (Reference C210).

During comminution, the weighed Pu-238 solid is ground to a particle size less than five microns. After the comminution, all or a portion of the ground material is put into a dissolution vessel. The Pu-238 solid is dissolved in a mixture of refluxing concentrated nitric acid and hydrofluoric acid for up to eight hours. After dissolution is performed, the Pu-238-rich solution is filtered through a five micron Teflon membrane. A portion of the filtrate may be processed through ion exchange, or the entire filtrate may be treated for oxalate precipitation (References C210 and D080).

Oxalate precipitation involves an acid adjustment of the filtrate with nitric acid while the solution is continuously stirred using the mechanical stir bar. Urea is added to scavenge nitrite salt that could interfere with further chemical pretreatment. Hydroxylamine nitrate is added to adjust the valence of the plutonium to (III). Oxalic acid is added to form a plutonium-oxalate precipitate.

The precipitate is filtered, and calcination converts the Pu-238 oxalate to Pu-238 oxide product. The solid product is cooled, weighed, and stored (Reference D080).

The dissolution Pu-238 filtrate destined for ion exchange may undergo an aluminum nitrate treatment. The dissolution Pu-238-filtrate is added to aluminum nitrate dissolved in dilute nitric acid, followed by a filtration step to collect any formed solids (typically, the aluminum nitrate treatment is not performed). The filtrate then undergoes a pretreatment involving urea, sodium nitrite, and ferric salt prior to ion exchange. The plutonium-rich eluate is collected and undergoes oxalate precipitation as described above. The plutonium-lean effluent, which contains impurity metal ions, as well as the aluminum from the aluminum nitrate treatment, is neutralized to pH 10-12 with sodium hydroxide. Under these neutralization conditions, the majority of the impurity ions and Pu-238 (not precipitated as an oxalate precipitate) will precipitate as metal hydroxides (References C210, C213, D079, and D080).

The hydroxide precipitate is calcined then stored, and the hydroxide filtrate is sampled to determine the radioactivity level. Waste containers that are predominantly debris may contain small quantities of the metal hydroxides. If above the DL, the hydroxide filtrates are transferred to the residue solidification process. In this process, soluble Pu-238 is recovered with ferric nitrate and sodium hydroxide, and the filtrate resulting from the solidification process is sent to the TA-50 RLWTF through the caustic waste line. The Pu-238 in the hydroxide filtrates can also be recovered by an ultrafiltration/polymer filtration process operated by NMT-11 personnel. The Pu-238 oxide product is sent to P/S Code P1. The hydroxide cakes are stored either in the vault or in the glovebox line under P/S Codes MM for disposal or ASP for recovery (References C210 and D080).

Induction Heating and Levitation is a technique used to achieve minimal contamination of conductive material. This technique uses Pu-238 metal from various operations and produces small quantities of uncontaminated metal by suspending and then melting the material inside of an induction coil with induction heating. Once the material has melted, the power is shut off, and the molten mass can be dropped or forced into a mold for forming. This process was designed to drive off impurities from the metal by melting it in a vacuum and not reintroducing impurities from a container during the time the material is in the molten state. The purified Pu-238 metal is sent to the vault (References C220 and M306).

Pu-238 Direct Oxide Reduction was an activity that was performed in October 1998 and October 1999 to produce Pu-238 metal for the accelerated plutonium aging program. There are no current plans to perform this operation again, but the code is still active. In this process, plutonium oxide and calcium metal are reacted in molten calcium chloride to produce plutonium metal. The reaction is conducted in a MgO crucible at 820° to 875°C. The reaction proceeds to completion when excess calcium is present and when sufficient calcium chloride is available to dissolve the calcium oxide product. After cooling, a plutonium metal button is removed by breaking the crucible. The salts are exposed to air to oxidize pyrophoric metals that might be present. The salt is then either routed through aqueous recovery operations to recover the plutonium or discarded as waste with the crucible pieces. The plutonium button is sent to the vault (References C211, C221, D080, and P189).

Traditionally, the *Thermal Decomposition of Cellulose* process incinerated organic-based materials contaminated with plutonium to ash to reduce the volume of waste generated or to recover the plutonium using a nitrate dissolution process. Due to increasingly stringent regulations governing the combustion products associated with incineration, the incinerator process was modified to thermally decompose organic-based materials in an argon atmosphere

in 1995. The thermal decomposition unit is also referenced in nitrate operations. It consists of a pyrolysis or passivation chamber, a caustic scrubber (potassium hydroxide) unit, and vacuum system. Organic-based materials designated for passivation have been limited to rags (cheesecloth) contaminated with nitric acid solution (References C200, D071, M299, and P156).

During processing, oil contaminated rags are separated from nitrated rags. The nitrated rags are moistened with water to reduce reactivity and excess water is removed using a filtration screen. The rags are then combined, placed in a furnace can, and reduced to ash in an argon atmosphere in the furnace. The ash, rinse water, filter residues, and caustic solution are further processed to recover the plutonium, if these materials are determined to exceed the DL. These materials are sent for disposal, if below the DL. Liquid waste below the DL is sent to the RLWTF at TA-50 (References C200, D071, M299 and P156).

The *Routine Scrap Processing*, which operated from 1988 to 1996, received Pu-238 feed materials (Pu-238 oxide) from calorimetry operations, heat source operations (P/S Codes P1 and GPHS), and the vault. The scrap processing operation involved opening, weighing, sorting, and segregating the Pu-238 oxide that arrived in a stainless-steel inner shipping container (EP-60). The Pu-238 oxide was then transferred into an outer shipping container (EP-61) and sent to the calorimetry process, and then to the vault (References C194, M288, and M289).

The *Recovery of Pu-238 Oxide from Contaminated Iridium* process occurred from 1990 to 1992. The feed material for this process came from metal items in the iridium inventory in PF-4 or in the CMR Facility at TA-3. This process used both molten magnesium chloride and electrochemical dissolution to remove Pu-238 from iridium (References M290 and M291).

The first step in this process involved immersing the Pu-238 oxide-contaminated iridium metal in molten magnesium chloride. The magnesium chloride was melted in a MgO crucible. The same salt was used for subsequent runs until it had lost its effectiveness. The iridium shells were placed into a tantalum basket and immersed in the molten salt. At the end of the treatment, the iridium metal was removed from the salt and the salt coating on the metal was removed with a water wash. This water wash was sent to the Pu-238 solidification process. The spent salt and crucibles were bagged out and assayed before being discarded as Pu-238 contaminated TRU solid waste. The iridium metal was sent to the vault unless additional treatment was necessary (References C194 and C197).

If further treatment was required, the iridium metal underwent electrochemical dissolution. The electrolyte solution consisted of a dilute mineral acid (nitric acid, hydrochloric acid, or sulfuric acid) with optional salt. The iridium metal was immersed in the solution, and a current was passed between the iridium metal and a graphite reference electrode. At the end of the run, the iridium metal was washed with water and allowed to dry. The clean iridium metal was sent to the vault. The spent electrolyte solution, which was acidic and contaminated with small amounts of iridium and Pu-238, and the water wash were sent to the Pu-238 solidification process (References C197, M290, and M292).

The *Recovery of Pu-238 from Sucrose Solutions* occurred from 1979 to 1988. The feed material for this process consisted of a 35 percent sucrose solution composed of sodium pyrophosphate, water, and sucrose. Sucrose solutions were used as a dispersive medium in particle size analysis of Pu-238 oxide; therefore, the feed solutions contained recoverable amounts of Pu-238 oxide (References D080 and M294).

The Pu-238 was recovered from these sucrose suspensions by filtering out the Pu-238 oxide in a ceramic filter boat and evaporating the solution to dryness over low heat. The Pu-238 oxide residue was scraped off the filter paper and calcined, then sent off-site for reprocessing. The residue from the evaporated solution was calcined and sent for discard if the Pu-238 content was below the DL (References D080 and M294).

The *Pellet Production* process is no longer active. The original feed material for the pellet production process consisted of Pu-238 oxide from fuel fabrication. This material underwent the physical operations of screening and weighing, die loading, hot pressing, sintering, and dimensioning. The product was sent to the vault and any residues were sent to the scrap and process residues processing operation (References C220, D074, D080, and M285).

The *Welding and Decontamination* process is no longer active. Heat source capsules were welded and a solution of nitric and hydrofluoric acid was used for decontaminating the fuel clads. The clad heat sources were immersed in the solution a minimum of three times to allow the acids to dissolve any plutonium oxide particles on the clad surface. Each time, the heat sources were removed from the acid solution and placed on a rag dampened with water. A rubbing action removed contamination while the heat of the source caused the acid solution and water on the rag to evaporate at a fairly rapid rate. The TRU acid solutions generated by the decontamination steps were neutralized to precipitate plutonium, and the filtrate was discarded into the caustic waste line to the RLWTF at TA-50. The plutonium precipitate was discarded if it met the DL. The only other process chemical, UCAR C-34, was an epoxy for sealing the graphite aeroshell of the LWRHU heat source assembly. The epoxy was not RCRA-regulated (References C220, D080, and M284).

The *Material Reclamation* process is no longer active. The process was used to remove specially identified Pu-238/beryllium (Be) neutron source material from its packaging and place it into packaging authorized for shipment to the Waste Isolation Pilot Plant (WIPP). Waste disposal was chosen over reclaiming the source material because there was no capability for purifying and reclaiming the Pu-238. This process involved the disassembly of source materials retrieved from the vault, crushing and sieving the source material, and packaging the products and byproducts as waste. The original packaging was also disposed of as waste (References C156, D060, and P170).

7. Facility and Equipment Maintenance Operations

Facility and equipment maintenance operations conducted in TA-55 involve cleaning and decontamination, equipment inspection and replacement, modification and repair of facilities, and general housekeeping. Cleaning and decontamination operations include physical wiping and the use of cleaning solutions (e.g., Fantastik, water) to remove potential contamination and to restore work areas and equipment to their original condition. Paper, plastic, and rags with a cleaning solution are used to remove or contain the spread of contamination. Equipment inspection, calibration, and replacement operations are performed to ensure continued operability and process efficiency. Solid wastes generated from these operations may include paper and plastic wastes, glass, small equipment (e.g., labware, motors, pumps), and small tools. Modification of facilities include plumbing; electrical fixtures and equipment installation; and installation or removal of gloveboxes, ventilation ductwork, and windows. General housekeeping includes cleaning, repair, and organization of the facility/infrastructure. Solid wastes generated from these operations may include HEPA filters, glass, glovebox gloves, paper, plastic, and rags. Solid waste generated from these operations is disposed of as TRU or LLW waste. General facility maintenance solutions (e.g., wet vacuum water, mop water) are

sent to the evaporator or the RLWTF (References D002, D008, D009, D011, D013, D014, D017, D023, D024, D026, D032, D045, M011, P001, P102, and P155).

8. Decontamination and Decommissioning (D&D) Operations

D&D operations are commonly performed at PF-4 in TA-55 to reduce the amount of floor space posted as radiological controlled areas and to support upgrades to existing facilities and equipment. These efforts assist in contamination control and result in a decrease in the amount of radiological waste generated at TA-55. These radiological controlled areas house the equipment and material used to perform the above listed operations and the waste generated during D&D operations contain the same chemical and radiological contaminants. No hazardous chemicals are added to the waste during the D&D operations. Commercially available, non-hazardous cleaning products, such as Fantastik, are used to remove loose contaminants. The goal of the D&D is to reduce the amount of TRU waste generated as much as possible through decontamination and size reduction (References D002, D013, D014, D026, D034, and D041).

Decontamination operations are used to accomplish several goals, such as reducing occupational exposures, limiting potential releases of radioactive materials, permitting the reuse of components, and reducing the amount of TRU waste generated. Decontamination operations included the use of mechanical and chemical cleaning techniques such as brushing, stripping, washing, and wiping to remove contamination. In addition, physical isolation and draining of equipment are performed when necessary. Based on the radiological contamination, drained liquids are either further treated or solidified. Decommissioning operations included the physical removal of contaminated gloveboxes, equipment, machinery, furnishings, and support systems. This included the removal and size reduction of glovebox internals, process piping and supports, tanks and ancillary equipment, and other fixed equipment such as ducting, wires, conduits, electrical panels, and cabinets. Gloveboxes and equipment are size reduced as necessary and packaged for disposal. Size reduction operations are sometimes performed in other facilities as discussed in the repackaging and prohibited item disposition section. Secondary waste such as combustibles, metal, and plastic generated during D&D is expected to be part of the waste. D&D operations also included the removal of stored radiological and hazardous materials and other related actions (References D002, D013, D014, D026, D034, and D041).

Waste Stream Material and Chemical Inputs

The following table identifies the Resource Conservation and Recovery Act (RCRA) toxicity characteristic and listed constituents identified in this waste stream.

Toxicity Characteristic and Listed Constituents in Waste Stream LA-MIN02-V.001

Chemical/Product	Use/Source	Document Source(s)	EPA HWN(s)
1,1,1-Trichloroethane	Metallographic sample cleaning (<1992) and contaminant of hydroxide solids. Degreasing solvent and component of Tap Magic.	C019, C020, C089, C194, C195, M154, M160	F001, F002
Arsenic	Contaminant of liquids, filtrates, ash, hydroxide cake, and analytical solutions. Evaporator sludge contaminant and sputter coating reagent.	C010, C196, C197, C207, D078, D080, M153	D004
Barium	Contaminant of plutonium feed, hydroxide cake, ash, actinide separation waste, pyrochemical salts, and analytical solutions.	C038, C087, C192, C197, D075, D078, D080, M153	D005
Benzene	Cement fixation input and actinide chemistry R&D operations reagent.	C027, D009, D032, D077, P080, P081	D018, F005,
Cadmium	Contaminant of plutonium feed, hydroxide cake, anode heels, ash, actinide separation waste, and analytical solutions. Solvent metal used in electrorefining.	C038, C039, C192, C196, C197, C200, D073, D075, D076, D080, M061, M153	D006
Carbon tetrachloride	Contaminant of cement fixation process and hydroxide solids. Used in PTP between 1/87 and 6/89. Chlorination of plutonium oxide and CLS reagent	C092, C121, C194, C200, D078, M112, M129, P067	D019, F001
Chlorobenzene	Contaminant of cement fixation process and hydroxide solids. CLS reagent.	C092, C095, C200, D007, D077, D078	D021, F002
Chloroform	Contaminant of cement fixation and miscellaneous processing (P/S XO/X0). CLS reagent.	C027, C092, C102, C117, C194, D077, D078	D022
Chromium	Contaminant of plutonium feed, anode heels, hydroxide cake, ash, actinide separation waste, and analytical solutions. Potentially leached from stainless-steel materials.	C038, C039, C192, C196, C197, C200, C205, D073, D074, D075, D078, D080, M061, M153	D007
Freon TF (1,1,2-trichloro, 1,2,2-trifluoroethane)	Miscellaneous processing contaminant and recovery operations reagent. Cleaning, cooling, and ultrasonic degreasing operations solvent.	C011, C017, C019, C085, C102, C104, C105, D029, D077 M026, M032, M041, M123, M212, P044, P046, P049	F001, F002

Toxicity Characteristic and Listed Constituents in Waste Stream LA-MIN02-V.001

Chemical/Product	Use/Source	Document Source(s)	EPA HWN(s)
Lead	Leaded gloves (<1992), shielding, sheeting, and discs. Contaminant of actinide separation waste, analytical solutions, ash, hydroxide cake, plutonium feed, and solder. Solvent metal used in electrorefining.	C039, C041, C192, C196, C197, C200, D002, D011, D073, D074, D075, D076, D078, D080, M061, M153, P183, P186	D008
Lead hydroxide, oxide, and nitrate	Actinide R&D reagents.	D032, M050	D008
Mercuric nitrate	Catalyst used in nitrate operations.	M064, D078	D009
Mercury	Contaminant of actinide separation waste, analytical solutions, ash, evaporator sludge, hydroxide cake, and plutonium feed. Component of fluorescent bulbs.	C023, C095, C176, C196, C197, C200, C207, D029, D078, D080, M153, P109	D009
Methylene chloride	Paint stripper, contaminant of cement fixation, hydroxide cake, and miscellaneous processing (P/S XO/XO). CLS and organoactinide R&D reagent. Component of REZ-N-Bond.	C027, C092, C200, C214, D007, D032, D077, D078, M174, P080	F001, F002
Methyl ethyl ketone	Degreasing solvent. Detected in headspace gas of Pu-238 waste.	D032, D076, D077	D035, F005
Potassium chromate	Dissolution and chloride anion exchange reagent.	C098, M131, M185	D007
Potassium dichromate	Silver nitrate titrations and hydroxide precipitation reagent.	C082, D002, D007, D032, M076	D007
Pyridine	Uranium triiodide reagent, R&D solvent, and contaminate in cement fixation process.	D077, P080	D038, F005
REZ-N-Bond	Solvent bonding (contains methylene chloride).	M154, M174	F002
Selenium	Contaminant of liquids, filtrates, ash, hydroxide cake, and analytical solutions.	C196, C197, C207, D045, D080, M153	D010
Silver	Contaminant of plutonium feed, hydroxide cake, ash, actinide separation waste, cement fixation inputs, and laboratory reagent.	C027, C038, C039, C192, C196, C197, C207, D075, D078, D080, M086, M153	D011
Silver nitrate	Leaching, solvent extraction, and laboratory reagent.	D007, C200, D078, M054, M080, M086, M093, M131	D011
Sodium chromate	Plutonium dissolution and precipitation.	D078, P103	D007
Tap Magic	Machining coolant (contains 1,1,1-trichloroethane).	C009, C019, C020, M154	F002
Tetrachloroethylene	Degreasing, cleaning solvent, diluent, contaminant of cement fixation process and hydroxide solids. CLS reagent.	C092, C200, D007, D032, D078, P067	D039, F001, F002
Toluene	Actinide and organoactinide R&D reagent. Detected in headspace gas of Pu-238 waste.	C027, D032, D076, P080,	F005

Toxicity Characteristic and Listed Constituents in Waste Stream LA-MIN02-V.001

Chemical/Product	Use/Source	Document Source(s)	EPA HWN(s)
Trichloroethylene	Clean and polish machined parts. Miscellaneous process and hydroxide cake contaminant. Hydrothermal processing and solvent extraction reagent.	C009, C019, C035, C102, C200, D077, D081, M223, P071, P085	D040, F001, F002

RCRA Determinations**Historical Waste Management**

Waste stream LA-MIN02-V.001 has historically been managed in accordance with the generator site requirements and in compliance with the requirements of the New Mexico Environment Department. Based on historical waste management and LANL's TRU Program, the containers in this waste stream were managed as hazardous and assigned the same EPA HWNs as the debris waste stream including arsenic (D004), barium (D005), cadmium (D006), chromium (D007), lead (D008), mercury (D009), selenium (D010), silver (D011), benzene (D018), carbon tetrachloride (D019), chlorobenzene (D021), chloroform (D022), 1,2-dichloroethane (D028), methyl ethyl ketone (D035), pyridine (D038), tetrachloroethylene (D039), trichloroethylene (D040), and F-listed solvents (F001, F002, F003, and F005). A review of available AK documentation has determined that this waste is hazardous for the above constituents, and with the exception of D028 and F003, the HWNs were retained. An evaluation was performed of existing TA-55 AK source documentation and no use of 1,2-dichloroethane (D028) was identified. This HWN is also not assigned to any other TA-55 waste streams. The original LANL waste stream included containers from the CMR Facility at TA-3 and HWN D028 is believed to be associated with this facility only. HWN F003 was not assigned because the waste stream does not exhibit the characteristic of ignitability. The following sections describe the characterization rationale for the assignment of EPA HWNs. The table above, Toxicity Characteristic and Listed Constituents in Waste Stream LA-MIN02-V.001, summarizes the EPA HWNs assigned to this waste stream. The HWN assignments have been applied on a waste stream basis; individual containers may not contain all of the hazardous material listed for the waste stream as a whole (Reference C121, C155, and D083).

Hazardous Waste Determinations**Ignitability, Corrosivity, Reactivity**

The homogeneous waste in waste stream LA-MIN02-V.001 does not meet the definition of ignitability as defined in 40 CFR 261.21. Ignitable chemicals (e.g., acetone, hexane) are used or present in the facility and operations potentially contaminating this waste stream. However, D001 (ignitability) does not apply because: (a) the solid waste is not liquid, and verification that there are no prohibited liquids in the waste is performed prior to certification; (b) the solid waste does not spontaneously ignite at standard pressure and temperature through friction, absorption of moisture, or spontaneous chemical changes; (c) the solid waste is not an ignitable compressed gas; and (d) there are no oxidizers present that can stimulate combustion. Prior to 1992, some nitrate salts below the DL were not sent to cement fixation for immobilization but were packaged as waste. LANL has determined that these salts do not meet the definition of a DOT oxidizer (i.e., they would not stimulate combustion). However, the salts are being remediated/repackaged in the WCRR Facility with an inert absorbent material (e.g., zeolite, kitty

litter). The minimum inert absorbent material to nitrate salts mixture ratio is 1.5 to 1. LANL has determined that nitrate salts, when mixed with inert absorbent material, would further support the managing of the waste as non-ignitable. This determination is based on the results of oxidizing solids testing performed by the Energetic Materials Research and Testing Center. The materials in the waste stream are therefore not ignitable wastes (D001) (References C121, C155, C201, C203, C230, C231, D071, D083, D089, D090, D091, P096, P102, P187, and P198).

The homogeneous material in waste stream LA-MIN02-V.001 is not liquid and does not contain unreactive corrosive chemicals; therefore, it does not meet the definition of corrosivity as defined in 40 CFR 261.22. Corrosive chemicals (e.g., hydrofluoric acid, nitric acid, potassium hydroxide, sodium hydroxide) are used or present in the facility and operations potentially contaminating this waste stream. However, D002 (corrosivity) does not apply because the solid waste is not a liquid, and verification that there are no prohibited liquids in the waste is performed prior to certification. The materials in the waste stream are therefore not corrosive wastes (D002) (References C121, C155, C194, D071, D083, P096, and P102).

The homogeneous waste in waste stream LA-MIN02-V.001 does not meet the definition of reactivity as defined in 40 CFR 261.23. Reactive chemicals (e.g., perchloric acid, sodium metal) are used or present in the facility and operations potentially contaminating this waste stream. However, D003 (reactivity) does not apply because the waste is stable and will not undergo violent chemical change without detonating. The waste will not react violently with water, form potentially explosive mixtures with water, or generate toxic gases, vapors, or fumes when mixed with water. The waste does not contain reactive cyanide or sulfide compounds. There is no indication that the waste contains explosive materials, and it is not capable of detonation or explosive reaction. The materials in the waste stream are therefore not reactive wastes (D003) (References C121, C155, C201, C202, D071, and D083).

Controls have also been in place to ensure the exclusion of ignitable, corrosive, and reactive constituents. In addition, the absence of prohibited items is verified through RTR of each waste container (References D037, D041, D049, D083, P090, P096, P097, P102, and P165).

Toxicity Characteristic

Based on review of AK relative to chemicals used or present in the facility and operations potentially contaminating the absorbed waste, LA-MIN02-V.001 may be contaminated with toxicity characteristic compounds as defined in 40 CFR 261.24 as summarized in the table above, Toxicity Characteristic and Listed Constituents in Waste Stream LA-MIN02-V.001. Where a constituent is identified and there is no quantitative data available to demonstrate that the concentration of a constituent is below regulatory threshold levels, the applicable EPA HWN is added to the waste stream. The AK also identified the potential presence of organic toxicity characteristic compounds that are assigned the more specific F-listed EPA HWNs. Although these organic characteristic compounds are covered by the assignment of the F-listed EPA HWNs, the toxicity characteristic EPA HWNs are also assigned to the waste stream for consistency with historical site waste coding. Waste stream LA-MIN02-V.001 is assigned the following toxicity characteristic HWNs: D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D021, D022, D035, D038, D039, and D040 (References C121, C155, and D083).

Listed Waste

F-Listed Waste

Based on review of AK relative to chemicals used or present in the facility and operations potentially contaminating the absorbed waste, LA-MIN02-V.001 may contain or be mixed with F-listed hazardous wastes from non-specific sources listed in 40 CFR 261.31. Toxicity Characteristic and Listed Constituents in Waste Stream LA-MIN02-V.001, F001, F002, F003, and F005 listed solvents are utilized and potentially contaminate the waste. F003 constituents, including acetone, n-butyl alcohol, ethyl ether, methanol, and xylene, are listed solely because these solvents are ignitable in the liquid form. The waste stream does not exhibit the characteristic of ignitability and therefore F003 is not assigned. Waste stream LA MIN02-V.001 is assigned F-listed EPA HWNs F001, F002, and F005 for potential 1,1,1-trichloroethane, benzene, carbon tetrachloride, chlorobenzene, Freon TF (1,1,2 trichloro, 1,2,2-trifluoroethane), methylene chloride, methyl ethyl ketone, pyridine, tetrachloroethylene, toluene, and trichloroethylene contamination (References C121, C155, and D083).

K-Listed Waste

The material in this waste stream is not hazardous from specific sources since it is not generated from any of the processes listed in 40 CFR 261.32.

P- and U-Listed Wastes

At one time, HWN P120 was applied to certain TRU drums generated in 1998 because of the temporary use of vanadium pentoxide for about six months in that year. Based upon investigation into the way the material was handled, this code is not assigned to this waste stream. A P120 assignment would be used only if waste resulted from spillage of this material or from disposal of un-reacted/unspent material. No unreacted/unspent material was disposed of in TRU waste drums. In addition, no documented spill of this material occurred. If a spill had occurred, suitable records would exist (e.g., incident reports, waste profile forms). The absence of such documentation, coupled with information obtained through interviews of people who worked with the material, indicates that a P120 assignment is not necessary (References C061, C155, and D083).

Beryllium may be present in the waste stream, but does not meet the definition of a P015-listed waste. Available AK did not identify beryllium powder as a constituent of this waste stream. During processing within P/S Codes PU and PUB, beryllium from Pu-Be sources is dissolved with the plutonium in acid, and after dissolution, the beryllium is either precipitated or the contaminated solution is sent to the RLWTF at TA-50. The precipitate is not included in this waste stream. Beryllium from metal operations, in general, would be in the form of classified shapes and would therefore not be in this waste stream. In some cases, beryllium turnings are generated during machining operations. However, these turnings are not expected to be in this homogeneous waste stream. The beryllium contaminated waste from the material reclamation process was debris and would also not be in this waste stream (References C121, C122, C155, C156, and M283).

Although hydrofluoric acid was used in the processes creating the waste in this waste stream, a U134 HWN assignment would be used only if waste resulted from spillage of this material or

from disposal of unused/unspent material. There is no record of unused/unspent hydrofluoric acid disposed in this waste stream. In addition, no documented spill of this material occurred (References C121, C155, D002, and D025).

Waste stream LA-MIN02-V.001 does not contain and is not mixed with a discarded commercial chemical product, an off-specification commercial chemical product, or a container residue or spill residue thereof. Constituents identified were further researched and a determination was made that waste does not meet the definition of a listed waste in 40 CFR 261.33. The material in this waste stream is not hazardous from specific sources since it is not generated from any of the processes listed in 40 CFR 261.32. Therefore, this waste stream is not a K-, P-, or U-listed waste stream (References C121 and C155).

Polychlorinated Biphenyls (PCBs)

Based on documentation in procedures reviewed during the AK investigation and summarized in lists of inputs documented in the TA-55 process reports, no sources of PCBs are introduced into waste stream LA-MIN02-V.001. In the cement fixation operation (P/S Codes CF and HP), oils are sometimes added to drums of cemented waste. They are added to the 55-gallon drums of cement in small quantities (maximum of six liters). The oils are primarily vacuum pump oils, along with some oils used in heat-treating (cooking or silicone oils) or in grinding. None of these oils are known to contain PCBs. All transformers known to contain PCBs have been tracked from initiation of recovery operations. When any transformer oil is drained, the oil is handled by a subcontractor who is wholly responsible for its disposal; this oil does not enter the LANL disposal operations. Therefore, this waste stream is not regulated as a TSCA waste under 40 CFR 761 (References C096, C155, C201, D080, D083, P012, and P162).

Prohibited Items

Prohibited items are not expected to be present. However, the presence of prohibited quantities of liquid due to dewatering or incomplete absorption is possible. Procedures also allowed containers greater than four liters, sealed with tape, to be used for waste packaging until WIPP certification procedures were implemented. Lead shielding was used to increase handling safety, and thick shielding can obscure RTR observations (References D025 and D083).

Prohibited items are detected by RTR and reported with the characterization results. Waste containers with prohibited items are segregated then dispositioned appropriately and/or repackaged, during which time sealed containers greater than four liters are opened, and other items removed and segregated if necessary prior to certification and shipment. Some secondary waste generated during remediation and repackaging operations may be added to the waste containers, including but not limited to: absorbent (e.g., Waste Lock 770), Fantastik bottles used during decontamination, miscellaneous hand tools, paper/plastic tags and labels, plastic/metal wire ties, PPE, plastic sheeting used for contamination control, rags and wipes (Kimwipes), and original packaging material (e.g., plastic bags, plywood sheathing, rigid liner lids cut into pieces) (References C150, C177, D083, P154, and P158).

Method for Determining Waste Material Parameters (WMPs) Weights per Unit of Waste

The WMPs for waste stream LA-MIN02-V.001 were based on the descriptions of waste packaged into 339 containers. This waste stream is greater than 50 percent by volume of absorbed waste (References C154, C232, D041, D083, M222, and M242).

The WMPs for 49 containers were calculated assuming that approximately one gallon of absorbed waste was placed into either a 5-mil plastic bag or a one-gallon can, and subsequently placed in a bag-out bag prior to being placed in a drum. A conservative approach was taken with respect to the absorbed liquid. Unless specified otherwise, the liquid absorbed was assumed to be an organic matrix. Vermiculite, for example, is known to absorb approximately 250 percent of its weight in liquid; therefore, the vermiculite/organic matrix would be considered to be greater than 50 percent organic matrix. The WMPs for 290 containers were calculated assuming a 1 to 1.5 ratio of evaporator salts (i.e., nitrate salts) mixed with an inorganic absorbent material (e.g., zeolite, kitty litter). The average weights of absorbed waste, metal cans, and bag-out bags were used in the calculations. Average, minimum, and maximum WMP weight percentages were calculated using this data. These calculations conclude that the relative waste weight percentages for organic waste materials (primarily absorbed organic liquids and plastic bags) and inorganic waste materials (primarily absorbed inorganic solids and steel cans for waste stream LA-MIN02 V.001) are 15.13 percent and 84.87 percent, respectively. The results of the assessment are presented in the table below, Waste Stream LA-MIN02-V.001 Waste Material Parameter Estimates.

Waste Stream LA-MIN02-V.001 Waste Material Parameter Estimates

Waste Material Parameter	Avg. Weight Percent	WeightPercentRange
Iron-based Metals/Alloys	4.65%	0.00% – 9.17%
Aluminum-based Metals/Alloys	0.00%	0.00%– 0.00%
Other Metals	0.00%	0.00%–0.00%
Other Inorganic Materials	0.00%	0.00% – 0.00%
Cellulosics	0.00%	0.00%– 0.00%
Rubber	0.00%	0.00%– 0.00%
Plastics (waste materials)	4.57%	2.90% – 14.37%
Organic Matrix	10.56%	0.00% – 73.09%
Inorganic Matrix	80.22%	0.00%– 93.20%
Soils/Gravel	0.00%	0.00%– 0.00%
Total Organic Waste Avg.	15.13%	
Total Inorganic Waste Avg.	84.87%	

List of AK Sufficiency Determinations Requested for the Waste Stream

No AK Sufficiency Determinations were requested for this waste stream.

Transportation

This waste stream and its chemical constituents have been reviewed for consistency with the listed TRUCON code and they are consistent.

Each payload container shipped to the WIPP will be certified in accordance with CCP PO-002, CCP Transuranic Waste Certification Plan, as containing more than 100 nanocuries per gram (nCi/g) of alpha emitting isotopes with half-lives greater than 20 years.

Beryllium

During processing within P/S Codes PU and PUB, beryllium from Pu-Be sources is dissolved with the plutonium in acid, and after dissolution, the beryllium is either precipitated or the contaminated solution is sent to the RLWTF at TA-50. The precipitate is not included in this waste stream. Beryllium from metal operations, in general, would be in the form of classified shapes and would therefore not be in this waste stream. In some cases, beryllium turnings are generated during machining operations. However, these turnings are not expected to be in this homogeneous waste stream. The beryllium contaminated waste from the material reclamation process was debris and would also not be in this waste stream. Individual containers in waste stream LA MIN02 V.001 will contain less than one weight percent beryllium (References C121, C122, C155, C156, and M283).

Radionuclide Information

Radionuclide data established by the PF-4 waste generator on a container basis and container data from the Area G waste storage records were evaluated to determine the relative radionuclide weight and activity for waste stream LA-MIN02-V.001. This evaluation was performed using the data for the containers in this waste stream (if a container was repackaged, then the data from the parent container was used). From this evaluation, the two predominant isotopes for the waste stream are Pu-239 and U-238 while over 95 percent of the total activity is from Pu-239, Pu-240, and Pu-241. It should be noted that although U-238 is the most prevalent radionuclide by mass in the waste stream, U-238 was reported in only 12 containers. The table below, Estimated Radionuclide Distribution in LA-MIN02-V.001, identifies the relative radionuclide weight and activity percent of expected radionuclides over the entire waste stream based on the container data evaluated. Radiological data was available for all of the waste in this waste stream. However, some of the containers list "zero" assay values. It is not known why the zero assay values are listed. This could indicate that assay was not performed on these containers although they were managed as TRU waste. It could also indicate low assay containers that did not contain activity levels above the lower limit of detection. Finally, it could indicate measured or estimated plutonium mass values below 0.5 grams. As illustrated in the table below, Estimated Radionuclide Distribution in LA-MIN02-V.001, the radionuclide weight percent of individual radionuclides varies on a container by container basis (References C154, C181, C232, D041, M242, and M307).

Estimated Radionuclide Distribution in LA-MIN02-V.001

Radionuclide	Total Nuclide Weight% ^{1,5}	Total Nuclide Curie% ^{2,5}	Nuclide Wt% Range for Individual Containers ^{3,5}	Nuclide Ci% Range for Individual Containers ^{4,5}	Expected Present
WIPP Required Radionuclides					
Am-241	0.01%	0.24%	0 - 7.79%	0 - 50.90%	Yes
Pu-238	0.01%	1.38%	0 - 83.75%	0 - 97.63%	Yes
Pu-239	23.21%	17.65%	0 - 95.29%	0 - 23.08%	Yes
Pu-240	1.61%	4.48%	0 - 16.49%	0 - 4.88%	Yes
Pu-242	0.04%	Trace	0 - 35.97%	0 - 0.17%	Yes
U-233	Trace	Trace	0 - 2.39%	0 - 0.08%	Yes
U-234	Trace	Trace	0 - 0.12%	0 - Trace	Yes
U-238	74.72%	Trace	0 - 99.32%	0 - Trace	Yes
Sr-90 ⁶	Not Reported				Yes
Cs-137 ⁶	Not Reported				Yes
Additional Radionuclides					
Np-237	Trace	Trace	0 - 1.45%	0 - Trace	Yes
Pu-241	0.06%	76.24%	0 - 1.18%	0 - 92.46%	Yes
Pu-244	Trace	Trace	0 - Trace	0 - Trace	Yes
U-235	0.35%	Trace	0 - 21.07%	0 - Trace	Yes
U-236	Trace	Trace	0 - 0.02%	0 - Trace	Yes

1. This listing indicates the total weight percent of each radionuclide over the entire waste stream.
2. This listing indicates the total activity (curie) percent of each radionuclide over the entire waste stream.
3. This listing is the weight percent range of each radionuclide on a container-by-container basis.
4. This listing is the curie percent range of each radionuclide on a container-by-container basis.
5. "Trace" indicates <0.01 weight or activity percent for that radionuclide.
6. Radionuclides not reported but suspected present from secondary radionuclides or decay.

Payload management will not be utilized for this waste stream.

Source Documents

Source Document Tracking Number	Title
C001	Assay of U-234
C002	Vent and Closure dates for TWISP containers submitted to WWIS
C005	TA-55 Pu-238 Processes Issues and SMEs (Acceptable Knowledge Personnel Interview Form)
C007	Segregation of Pu-238 Processing
C009	Electronic Communication from the Author
C010	Interview with R. Gutierrez, SME, re: P/S Code PE
C011	Interview with Dale Soderquist, SME Re: P/S Code DA
C014	Interview with J. Milewski, SME, re: P/S Code ELW
C017	Interview with B. Martinez, SME, re: P/S Codes RAP, RAP2, FSPF, PF, JA, and BC
C018	Interview with J. Simpson, SME, re: P/S Code RL
C019	Interview with G. Zaker, SME, re: P/S Code MA and Chemicals Used in Machining
C020	Interview with G. Zaker, SME, re: P/S Code CA
C023	Interview with G. Jarvinen re: P/S Codes AD, APD
C026	Interview with L. Avens re: P/S Codes MAS, SA
C027	Interview with B. Zwick and J. Byrd Re: P/S Codes AC1 and AC2
C031	Interview with C. Davis re: P/S Code SMP
C033	Interview with J. Foxx re: P/S Codes RD, NCD, WM, and XO/XO
C035	Interview with R. Masen re: P/S Code ME
C037	Interview with D. Wulff re: P/S Code XO/XO
C038	Interview with John Musgrave – TA-55 Miscellaneous Operations, RD&D Processes
C039	Interview with J. Foxx re: Process inputs to P/S Code AD
C040	Interview with J. Foxx re: P/S Codes PB, PuBe, CC, MB, MS, FF, BF, and other issues
C041	Interview with J. Foxx re: Use of Lead in P/S Codes DOP
C047	Interview with F. Hampel re: Metal Operations Process AK; Information on Chemical Use in P/S Code FF
C054	Air Sparging to Eliminate Pyrophoric Sodium
C056	Layers of Packaging in TA-55 Combustible TRU Waste
C057	Commingling of Defense and Nondefense TRU Waste
C061	Interview with J. Foxx re: Vanadium, Vanadium Pentoxide, TA-55-19, TA-55-30
C062	Wire Twist-Tie and Plastic Electrical Tie Bag Closure
C064	Air Sparging to Eliminate Pyrophoric Sodium
C065	WACCC Audit Finding #1 (April 27-May 1, 1987)
C066	Interview with F. Hampel re:Information on Chemical Use in P/S Code FF
C067	Interview with J. Foxx re:Sources of Cs-137, Pa-231, and Cm-244 in TA-55 waste
C068	Interview with J. Foxx re:Timeline for disposal of TA-55 waste with P120
C069	Ac-227 Drums
C073	Interview of J. Foxx re: Sources of Cs-137 and Pa-231 in TA-55 Waste

Source Document Tracking Number	Title
C076	Memo to P. Rogers re: "Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste"
C079	Interview of J. Foxx re: P/S Codes PPD, UA, VD, IN, and WE
C080	Collection of Correspondence, Comments, and AK Summaries
C081	Interview with J. Foxx re: P/S Code DO
C082	Interview with J. Foxx and Supporting Documentation re: Defense Relationship of TA-55 Waste
C083	Interview with J. Foxx, SME re: P/S Codes
C085	Interview with M. West of NMT-2 and G. Bird of NMT-2 re: P/S Codes SBB and SCB
C087	Answers to Questions About Pyrochemical Processes
C089	Interview with J. Foxx re: Pu-238 and Effluent to TA-50
C092	Interview with J. Foxx re: CLS-1 Solvents
C094	Interview with T. Hayes of TA-55 Nitrate Operations re: Draft AK Summary for TA-55 Nitrate Operations, 12-19-99 (attached)
C095	Comments from T. Hayes and J. Foxx on the Acceptable Knowledge Summary for TA-55 Nitrate Operations
C096	Response to comments on the AK Summary for TA-55 Nitrate Operations
C098	Interview with J. Foxx re: P/S Code PY
C100	Memo with Attachments to K. Dziejewski re: Material Type Isotopic Compositions
C101	AK Isotopic Files for Input to NDA Radioassay Spreadsheets
C102	Interview with R. Simpson re: P/S Codes CN, CO, CT, EL, FF, ID, OB, OM, MOX, RS
C104	Interview with J. Foxx re: P/S UA
C105	Interview with J. Foxx re: P/S Codes AO, EVAC and WLT
C108	Interview with J. Foxx re: Secondary radionuclides used in P/S Code PI
C113	AK Interview with Jim Foxx re: P/S Code FF, Use of Kynar, Portland Cement, Code HRA, 40 mm Gun
C117	A Few Issues
C121	Detailed Chemical Evaluation MHD01.001
C122	Be Contamination
C124	Interview with Jim Fox Regarding Material Type 83 used at TA-55
C125	Decay Corrected Values for LANL Heat Source Plutonium
C129	Jim Foxx's Review and Comments on CCP-AK-LANL-006
C130	Jim Foxx's Review and Comments on Nitrate and Pyrochemical/Chloride Operations Process Flow Diagrams
C131	Jim Foxx's Review and Comments on Draft Process Flow Diagrams
C132	Pu-239 Operations Detailed Process Flow Diagrams
C133	Radiological Evaluation of Waste Stream LA-MHD01.001 Based on the Addition of Waste Stream LA-MHD02.01

Source Document Tracking Number	Title
C135	Interview with Site Personal Performing VE and PID Repackaging Regarding Potential for High Dose Rate Waste from TA-55
C136	Interview with Dennis Wulff Regarding Potential for High Dose Rate Waste from TA-55
C138	Addition of Mixed Inorganic and Organic Process Solids (Waste Stream # LA-CIN01.001) to Acceptable Knowledge Report AK6
C139	Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream # LA-CIN01.001
C140	Interview with Gerry Veazey Regarding the TA-55 Cement Fixation Process
C142	Opening of Drum (#8260) of Retrieved TA-55 Cement Waste
C143	Documentation Re Evaluation of TRU Waste Can Drums Retrieved from TA-54, Area G
C144	Interview with Dennis Wulff Regarding the Packaging of Pu-238 Waste at TA-55
C145	Evaluation of LANL Pu-238 Waste Management Practices
C147	RCRA and Chemical Evaluation for LANL Waste Streams LA-MHD01.001 and LA-CIN01.001
C149	Fiberboard Drum Liners Used During Repackaging
C150	Secondary Waste Discussions to be Added to AK4 and AK6
C152	Interview with J. Foxx re: Future Waste Generation for Waste Streams LA-MHD01.001 and LA-MIN02-V.001
C153	Evaluation of Volume, Period Generation, and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MHD01.001
C154	Evaluation of Volume, Period Generation, and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MIN02-V.001
C155	RCRA and Chemical Evaluation for LANL Waste Stream LA-MIN02-V.001
C156	Email to M. J. Papp re: Material Reclamation Project
C157	Prohibition on PCB waste lifted from LANL
C163	Change of LA Waste Stream Designation For TRU Oversize Crates at TA-54
C164	Information on Packaging Changes
C165	Decontamination and Volume Reduction System (DVRS) Information
C171	Homogeneity of LANL Waste Stream LA-CIN01.001
C172	Evaluation of Volume, Period Generation, and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MIN04-S.001
C173	RCRA and Chemical Evaluation for LANL Waste Stream LA-MIN04-S.001
C174	Projected Future Waste Generation for Waste Stream LA-MIN04-S.001

Source Document Tracking Number	Title
C175	Evaluation of Volume, Period Generation, and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MHD01.001
C176	Email from Kapil Goyal Regarding Compact Fluorescent Bulbs
C177	Secondary Waste Generated by the Remediation/Repackaging Processes at Dome 231 and WCRRF
C178	Drum Washing of Drums Retrieved from Below-Grade
C179	Evaluation of Volume and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MHD01.001
C180	Evaluation of Volume and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-CIN01.001
C181	Evaluation of Volume and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MIN02-V.001
C182	Evaluation of Volume and Calculation of Individual and Total Radionuclide Masses and Activities for Waste Stream LA-MIN04-S.001
C184	Determination of Flammable VOCs For LANLTA-55 Mixed Transuranic Waste, Waste Stream LA-CIN01.001
C185	TA-54 Building 412 vs. DVRS Facility
C186	Letter on Material Type Isotopic Composition
C187	Memorandum to Pamela Rogers, Transuranic Database Modifications
C188	Memorandum to Pam Rogers; Layers of Packaging in TA-55 Combustible TRU Waste
C189	Secondary Radionuclides and Toxic Metals in TA-55 TRU Waste
C190	Memo to TWCP Records Center: Commingling of Defense and Nondefense TRU Waste
C191	Segregation of Pu-238 Processing
C192	Memorandum to Pamela Rogers; Acceptable Knowledge of Pu-238 Waste Generated at the Los Alamos Plutonium Facility, TA-55
C194	Comments from Jim Foxx on the Draft Pu-238 AK Summary Report (dated November 1999)
C195	Interview with Jim Foxx: Pu-238 and Effluent to TA-50
C196	Email from Jim Foxx: RCRA Codes for Pu-238
C197	Interview with Jim Foxx and Gary Rinehart Relating to the RCRA Characterization and Management of Pu-238 Liquids and P/S Code Operations
C198	Interview with Jim Foxx Regarding P/S Code PI
C199	Interview with Gordon Jarvinen Regarding TA-55 Miscellaneous Operations – RD&D Processes
C200	Jim Foxx's comments on Draft Acceptable Knowledge Summary for TA-55 Nitrate Operations

Source Document Tracking Number	Title
C201	Comment Resolution for Nitrates AK Summary Report (dated 2/25/00)
C202	Memorandum to B.T. Reich : Air Sparging to Eliminate Pyrophoric Sodium
C203	Memorandum to B.T. Reich: xperimental data on calcium pyrophoricity in salts
C204	Interview with Jim Foxx; Segregation of non-defense wastes from defense wastes
C205	Interview with Jim Foxx; Answers to questions of use of Ag, disposal of ash and resins, and use of gases
C206	Acceptable Knowledge Personnel Interview with Jim Foxx: Disposal of Spray Cans Used in Gloveboxes
C207	Interview with Jim Foxx re: Volatile RCRA-Listed Metals
C208	Acceptable Knowledge Personnel Interview with Jim Foxx: Sources of Cs-137 and Pa-231 in TA-55 TRU Waste
C209	Interview with J. Foxx re: Sources of Cs-137, Pa-231, and Cm-244 in TA-55 TRU Waste
C210	AK Personnel Interview of Lisa Pansoy-Hjelvik, Description of P/S Code ASP
C211	Interview with Gary Rinehart regarding P/S code WS Operations
C212	Memorandum to Ed Wilmont, Pu-238 Waste at TA-55
C213	AK Personnel Interview with Jim Foxx: Information on P/S Codes PPD, UA, VD, IN, and WE
C214	AK Personnel Interview with Jim Foxx: RD&D Processes (RD, NCD, WM)
C215	Email From Wayne Punjak to Pamela Rogers: Ac-227 Drums
C216	Memorandum to RMDC; Vent and Closure dates for TWISP containers submitted to WWIS
C219	Interview with Jim Foxx: Material Type 83 used at TA-55
C220	Jim Foxx's Review and Comments on Draft Process Flow Diagrams
C221	Detailed Pu-238 Operations Process Flow Diagrams
C222	Decay Corrected Values for LANL Heat Source Plutonium
C223	Record of Communication for interview with Jim Foxx: All Process Wastes
C224	Addition of 7 Containers to Waste Stream LA-MIN04-S.001
C225	Evaluation of Additional Containers for waste stream LA-MHD01.001
C226	Waste Packaging Issues with CCP-AK-LANL-006, Waste Stream LA-CIN01.001 (TA-55 cemented waste packaged in cans and monoliths)
C228	Evaluation of Los Alamos National Laboratory Circumferentially Taped Slip-Lid Cans (>4 Liters)
C230	Memo: Legacy TA-55 Nitrate Salt Wastes at TA-54 - Potential Applicability of RCRA D001/D002/D003 Waste Codes

Source Document Tracking Number	Title
C231	Email RE: Nitrate Salt Processing Guidance
C232	Evaluation of Volumes and Calculations of Individual and Total Radionuclide Masses and Activities for Waste Streams LA-MHD01.001, LA-CIN01.001, LA-MIN02-V.01, and LA-MIN04-S.001
D002	Acceptable Knowledge Report for Legacy Debris TA-55 Waste Streams Containing Pu-239
D003	Hazardous Waste Facility Contract with DOE, University of California & Summary of Modifications
D004	Attachment A (Waste Analysis Plan) of the LANL Hazardous Waste Permit
D007	Process Acceptable Knowledge Report for Chloride Operations at TA-55
D008	Acceptable Knowledge Report for Newly Generated Waste from Nitrate Operations at TA-55
D009	Acceptable Knowledge Report for Newly Generated Waste from Miscellaneous Operations at TA-55
D010	Acceptable Knowledge Report for Newly Generated Waste from Special Processing Operations at TA-55
D011	Acceptable Knowledge Report for Newly Generated Waste from Metal/Pyrochemical Operations at TA-55
D013	Los Alamos National Laboratory Transuranic Waste Characterization Acceptable Knowledge Information Summary (AKIS)
D014	TA-55 Facility Safety Analysis Report (FSAR), Excerpt (Chapter 1 missing)
D017	Draft Acceptable Knowledge (Report) for TA-55 Nitrate Operations (and Interview comments from Tim Hayes)
D018	Transuranic Waste Interface Document for the Waste Characterization, Reduction, and Repackaging Facility and the Radioactive Materials Research, Operations, and Demonstration Facility
D019	Waste Management Plan for the 40-mm Powder Breach Project
D023	TA-55 Plutonium Facility Acceptable Knowledge Report
D024	TA-55 Transuranic Waste Interface Document
D025	Acceptable Knowledge Report for Debris Waste Streams Containing Pu-239
D026	Acceptable Knowledge Information Summary For LANL Transuranic Waste Streams
D028	Process Acceptable Knowledge Report for Pyrochemical Processes at TA-55
D029	Process Acceptable Knowledge Report for Metal Operation Processes at TA-55
D030	Process Acceptable Knowledge Report for Special Processing at TA-55
D032	Process Acceptable Knowledge Report for Miscellaneous Operations at TA-55
D034	Waste Management Site Plan

Source Document Tracking Number	Title
D036	Process Knowledge Report for Nitrate Operations at TA-55
D037	Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste
D041	Acceptable Knowledge Information Summary for LANL Transuranic Waste Streams
D044	Lightweight Radioisotope Heater Unit (LWRHU) Production for the Cassini Mission
D045	Final Safety Analysis Report for TA-55 NMT
D048	Wastes from Plutonium Conversion and Scrap Recovery Operations
D049	40-mm Powder Breech Project, TA-55 Bldg PF-4, Waste Management Plan
D050	Waste-form Development for Conversion to Portland Cement at LANL Technical Area 55
D055	Rocky Flats Environmental Technology Site Backlog Waste Reassessment Baseline Book – Waste Form 34 Pyrochemical Salts
D056	TWISP Final Report
D057	Processing Waste Acceptance Criteria Exception Forms
D058	Review and Completion of the TWSR
D059	Environmental Protection: Managing Waste; Air Quality; Ecological and Cultural Resources...
D060	Repackaging Plutonium-238 High Dose Rate Material for Waste Disposal
D062	Upgrade and Performance Testing for the LINC Systems at TA-54 Area G
D063	Project Management Objectives for Pit 9 TRU Waste Retrieval
D064	Retrieval Plan for TA-54, Area G TRU Waste for Pit 9
D065	TA-54, Area G Pit 9 Waste Description
D066	TA-54, Area G Pit 9 Waste Description
D067	TA-54, Area G Trenches A-D Waste Description
D068	TA-54 Area G Documented Safety Analysis
D070	Wastes from Plutonium Conversion and Scrap Recovery Operations
D071	Final Safety Analysis Report for TA-55 NMT
D073	Lightweight Radioisotope Heater Unit (LWRHU) Production for the Galileo Mission
D074	Lightweight Radioisotope Heater Unit (LWRHU) Production for the Cassini Mission
D075	Sampling and Analysis Project Validates Acceptable Knowledge on TA-55-43, Lot No. 01
D076	Acceptable Knowledge Summary Report for Waste Streams TA-55-43, TA-55-44, TA-55-45, TA-55-46, TA-55-47
D077	Process Acceptable Knowledge Report for Miscellaneous Operations at TA-55
D078	Process Acceptable Knowledge Report for Nitrate Operations at TA-55
D079	Process Acceptable Knowledge Report for Special Processing at TA-55
D080	Process Acceptable Knowledge Summary Report for Plutonium-238 Operations at TA-55
D081	AK Report for NG Waste from Metal/Pyrochemical Operations at TA-55
D082	Institutional Plan FY2002-FY2007
D083	Acceptable Knowledge Information Summary for LANL Transuranic Waste Streams
D084	Acceptable Knowledge Report for Debris Waste Streams Containing Pu-239
D085	Determination of H2 Diffusion Rates through Various Closure on TRU Waste Bag-Out Bags

Source Document Tracking Number	Title
D089	Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts
D090	Results of Oxidizing Solids Testing - EMRTC Report FR 10-13
D091	Solution Package Scope Definition REPORT-72, Salt Waste (SP #72) Rev 1
DR001	Discrepancy Resolution Waste Stream Assignment
DR004	Discrepancy Resolution Non-Mixed TA-55 Pu-239 Debris Drums
DR005	Acceptable Knowledge Source Document Discrepancy Resolution - Homogeneous Solids in Containers S818280, S818308, S822622, S818309, S832485, S862359, S802994, and S811632
DR007	Acceptable Knowledge Source Document Discrepancy Resolution – Layers of Confinement
DR008	Acceptable Knowledge Source Document Discrepancy Resolution – TA-55 Homogeneous Solids Containing Greater Than 50% Heterogeneous Debris
DR029	Acceptable Knowledge Source Document Discrepancy Resolution – Drum No. 86309 Contained a Small Lighter Fluid Can with ~65 ml of liquid
DR043	Miscellaneous Debris Items in LA-CIN01.001 (cemented) Container No. 53706
DR044	Removal of 114 Heterogeneous Drums from Cemented Waste Stream (LA-CIN01.001)
DR048	Acceptable Knowledge Source Document Discrepancy Resolution – Waste Stream LA-MHD01.001 Radiological Characterization
M002	Review of Headspace Gas Data from Pre-WAP Analyses for Additions to AK
M006	Pit Production
M011	Waste Determination Report for Waste Stream TA-55-43 Lot No. 01
M012	Waste Profile Form Guidance
M013	Waste Generator Guidance for Completing the TRU Waste Storage Record (TWSR)
M014	General Waste Management Requirements
M015	Managing Radioactive Waste
M016	Hazardous and Mixed Waste
M017	Final Documentation for RadWaste ORACLE Database's List of Acceptable Radioisotopes, Specific Activities, Categories and Regulatory Limits
M018	Los Alamos National Laboratory Waste Profile System Forms
M019	Generator Documentation
M023	Procedure Review Sheets for 410-MPP, "Electrorefining of Plutonium Metal-Crac Cell"
M024	Procedure Review Sheets for 435-MPP, "Reverse Cell Electrorefining (R&D Project)"
M026	Coalescence of Plutonium Metal (Excerpts) and Procedure Review Sheets
M028	Procedure Review Sheets and Excerpts from Salt Stripping of Electrorefining Salts Using Oxygen/Argon
M029	Procedure Review Sheets and Excerpts from Electrorefining of Plutonium Metal, Nominal Six Kilogram Scale
M030	Measuring Physical Properties (Excerpt)
M032	Acceptable Knowledge Personnel Interview Form - Metal Operations

Source Document Tracking Number	Title
M037	Multiple-Cycle Direct Oxide Reduction
M041	Procedure Review Sheets for Revs 0-5 of "Electrorefining of Plutonium Metal," Doc. # 258-MPP-R00
M043	Procedure Review Sheet for Procedure 290-MPP-R02
M044	Procedure Review Sheets for Procedure 216-MPP-R01 "Oxalate Precipitation of Ion-Exchange Eluates"
M045	Procedure Review Sheets for Procedure 215-MPP-R01, "Oxalate Precipitation of Plutonium from Nitrate Solutions"
M048	Procedure Review Sheets for Procedure 230-MPP-R01, "Hydroxide Precipitation for Oxalate Filtrates"
M050	Procedure Review Sheet for 474-REC-R01, "Process Research and Development Facilities"
M053	Procedure Review Sheet for 426-REC-R00, "Residue Leaching"
M054	Procedure Review Sheet for 461-REC-R00, "Nitrate Anion Exchange"
M057	Procedure Review Sheet for 431-REC, "Procedure for Disposal of Oils Containing Recoverable Amounts of Pu in the Form of (U, Pu) Carbides"
M061	Process Review Sheet for RAB-MS-2000, "Carbothermic Process Material Specification for Uranium Oxide Powder (Depleted)"
M064	Process Accountability Flow Documents for Various Nitrate Processes
M067	Procedure Review Sheet for 430-REC, "Recovery of Contaminated Platinum"
M069	Procedure Review Sheet for 420-REC, "Processing of Contaminated Solids"
M072	Procedure Review Sheets for 444-REC, "Dissolving Chloride Melt Portion of Electrorefining Residues"
M074	Procedure 474-CLO, Hydroxide Precipitation of Chloride Waste Streams
M076	Hydroxide Precipitation of the Plutonium in Chloride Waste Streams
M080	Interview with J. Foxx re: Solvent Extraction Developmental Work
M084	Procedure 437-REC, "Polystyrene Cube Processing"
M085	Procedure 445-REC, "Preferential Dissolution of Uranium Oxides from a Uranium-Plutonium Oxide Mixture"
M086	Procedure 490-REC, "Catalyzed Electrochemical Plutonium Oxide Dissolver (CEPOD)"
M088	Procedure 423-REC, "Ash Leaching"
M089	Procedure 431-REC, "Leaching of Contaminated Metals in Nitric Acid"
M090	Procedure 421-REC, "Pickling or Surface Leaching" and "Leaching of Noncombustible Materials in Nitric Acid"
M092	Procedure 490-REC, "Mediated Electro-Oxidation of Low-Level Organic Waste" and "Catalyzed Electrochemical Plutonium Oxide Dissolver"
M093	Procedure 427-REC, "Incinerator Ash R&D Facility"

Source Document Tracking Number	Title
M095	Procedure 447-REC, "Dissolution of Impure Plutonium Dioxides, Filter Residues, and Glovebox Sweepings in Hot HNO ₃ -HF"
M096	Procedure 472-REC, "Nitrate Anion Exchange for the Rich Column Material System"
M097	Procedure 471-REC, "Nitrate Anion Exchange for the Lean Residue System"
M098	Procedure 470-REC, "Nitrate Anion Exchange for the Rich Residues Ion Exchange Column"
M099	Procedure 473-REC, "Nitrate Anion Exchange for the Dissolved Solids (DS) System"
M103	Procedure 480-REC, "Peroxide Precipitation"
M112	Procedure 407-MPP, Chlorination of Plutonium Compounds
M113	Procedure 420-MPP, Reduction of PuO ₂ to metal
M116	Review Sheet for Procedure 445-MPP, "Coalescence of Plutonium Metal"
M118	Review Sheet for Procedure 209-MPP, "Pickling, Leaching, and Dissolution"
M123	Procedure 213-MPP, Conversion of Plutonium Oxalate to Oxide using heat lamp and hot plate
M125	Procedure 217-MPP, Peroxide precipitation
M126	Procedure 226-MPP, Dissolving Chloride Melt Portion of Electrorefining Residues
M127	Procedure 232-MPP, Oxalate Precipitation of Pu from Hydrochloric solutions
M129	Procedure 224-MPP, Chlorination of Plutonium Compounds
M130	Procedure 251-MPP, Multiple-cycle Direct Oxide Reduction
M131	Procedure 273-CLO, Purifying and Recovering Pu by Chloride anion exchange
M132	Procedure 242-MPP, Precipitation of Plutonium Oxalate in Hydrochloric Acid
M134	Direct Oxide Reduction R&D
M137	Procedure HS-NMT9-PP-42, "Particle Size Analysis of Oxide Powders Procedure"
M142	Procedure 435-REC, "Processing Lapping Oil and Similar Organics"
M144	Procedure 491-REC, "Advanced Testing Line for Actinide Separations (ATLAS) Unit Operations"
M151	Procedure 464-Rec, "Peroxide Precipitation"
M153	Development of Control Charts for the Evaporator Bottoms Newly Generated Waste Stream from TA-55
M154	Miscellaneous MSDSs
M156	Project 2010 Container Specific Database Information for LA-MHD01.001
M157	Project 2010 Database Summary of Waste Codes from LA-MHD01.001
M158	Project 2010 Database Information Waste Item Descriptions Summary
M159	Project 2010 Container Specific Database Information - Area G Reported Radionuclides
M160	LANL Project 2010 Summary of AK Discrepancies

Source Document Tracking Number	Title
M164	Procedure Review Sheet for Identification of Potential Hazards Associated with Metallographic Operations in Rooms G104 and G107
M169	Procedure Review Sheet - Comminution and Nickel Addition Procedures for Uranium Carbide or Uranium-Plutonium Carbide
M172	Procedure Review Sheet for Manual Pellet Pressing Procedure for Uranium Carbide or Uranium-Plutonium Carbide Powders
M174	Procedure Review Sheet for Procedure for Measuring the Density of Sintered Fuel or Insulator Pellets by a Water Immersion Technique
M180	Procedure Review Sheet - Hydroxide Precipitation of Chloride Solutions Containing Organic Chemicals
M181	Procedure Review Sheet - Oxalate Precipitation of Plutonium from Chloride Solutions
M182	Procedure Review Sheet - Purification and Recovery of Plutonium by Chloride Anion Exchange
M184	Procedure Review Sheet - DicesiumHexachloroPlutonate (DCHP)
M185	Procedure Review Sheet - Head End Processing of Aqueous Chloride Plutonium
M186	Procedure Review Sheet - Plutonium Recovery from Chloride Solutions by Oxalate
M189	Procedure Review Sheet - Vessel Handling and Unloading
M200	Plutonium Electrorefining
M202	Preparation of Pu Metal by the Fluoride Reduction Process
M206	Procedure Review Sheet - Salt Stripping of Electrorefining Salts
M212	Procedure Review Sheet - Six Foot Sphere Handling and Unloading
M215	LANL Hard Copy TWSRs for LA-MHD01 and LA-MHD02 from 2500 Set
M216	LANL Hard Copy TWSRs for LA-MHD01 and LA-MHD02 from AK6 Remaining Set
M217	LANL Hard Copy TWSRs for LA-MHD01 and LA-MHD02 from AK7 Remaining Set
M218	LANL Hard Copy TWSRs for LA-MHD01 and LA-MHD02 from Imagic Printout Set
M219	Electronic image of TWSRs and RSWD Forms from Imagic Software
M220	Vent Date Information Sources
M222	CONCERT Database
M223	Design of Hydrothermal Waste Treatment Units for Operation at Pressures from 1 to 1,000 Bar
M224	LANL Hard Copy RSWDs and TWSRs for LA-MHD01 and LA-MHD02
M226	LANL Hard Copy RSWDs and TWSRs for LA-MHD01 and LA-MHD02
M236	TA-55 Cemented RSWDs/TWSRs
M238	NUGEN Drum TWSRs
M241	Drum Spreadsheet for Additional LA-MHD01.001 Containers
M242	TA-55 Waste Stream LA-MIN02-V.001 RSWDs/TWSRs and Drum Spreadsheet
M252	TA-55 Cement Fixation Drum Logbook
M273	LA-MHD01.001 TWSRs

Source Document Tracking Number	Title
M274	TWSRs for Containers 8000 Series
M275	TA-55 NUGEN TWSRs
M276	TA-55 VE NUGEN TWSRs
M279	TA-55 Waste Stream LA-MIN04-S.001 RSWDs/TWSRs, Drum Spreadsheet, and BDRs
M280	Pit 9 Waste Information
M281	Trenches A-D logbook
M283	Assembled Tables taken from Milliwatt Generator Project Progress Reports
M284	MSDSs for Pu-238 Operations
M285	Process Flow Diagram for Routine Pu-238 Heat Source Production - Fuel Fabrication
M286	Particle Size Analysis of Oxide Powders
M287	Process Flow Diagram for Metallography
M288	Process Flow Diagram for Pu-238 Scrap Processing
M289	Introductory Glovebox Transfer of an EP-60 into and EP-61
M290	Decontamination of Ir Using Molten MgCl ₂
M291	Process Flow Diagram for Recovery of Pu-238 Oxide from Contaminated Iridium
M292	Dissolution of Ir by Electrochemical Methods
M293	Process Flow Diagram for Pu-238 Waste Solidification
M294	Recovery of Plutonium-238 from Sucrose Solutions
M295	Documentation for RadWaste ORACLE Database's List of Acceptable Radioisotopes, Specific Activities, Categories and Regulatory Limits
M296	Generator Documentation (RSWD/TWSRs)
M298	Concert Database Query, Physical Parameter Inventory Analysis for Waste Stream LA-MHD02.002
M299	Thermal Decomposition of Cellulose Items
M300	General Waste Management Requirements
M301	Hazardous and Mixed Waste
M302	Managing Radioactive Waste
M303	Waste Profile Form Guidance
M304	Waste Generator Guidance for Completing the TRU Waste Storage Record (TWSR)
M306	The Actinide Research Quarterly, Magnetic Levitation Results in High-Purity Plutonium Metal.
M307	Acceptable Knowledge Isotopic Ratios (AKIR) database, Versions 2.0 and 2.1
M308	Pu-238 Defense Determination Resolution
M309	Radiological Discrepancy Report
M310	RCRA EPA Hazardous Waste Code Assignment Discrepancy Report
M312	CCP-AK-LANL-007 Document Conversion To CCP-AK-LANL-006 Source Documents
P001	Nitric Acid Process Evaporator
P005	Thorium Fluoride Precipitation
P008	Cement Fixation of Process Residues in 55-Gallon Drums (Excerpts)
P011	Cement Fixation of Process Residues in One-Gallon Cans (Excerpts)

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P012	Organic Liquid Emulsification
P014	Casing Enriched Plutonium
P024	Nitrate Anion Exchange
P025	Dissolution and/or Leaching of Various Materials in Hydrochloric Acid
P026	Oxalate Precipitation of Plutonium from Hydrochloric Acid Solutions
P027	Purification and Recovery of Plutonium by Chloride Anion Exchange
P028	Hydroxide Precipitation
P029	Procedure for Pyroredox Processing of Spent Electrorefining Anodes (P/S RA)
P033	Procedure "Cleaning Requirements for Large Components" P/S EL
P034	Procedure "Cleaning for Small Components"
P036	Procedure "Fabrication and Inspection of He-Bonded Fuel Elements" P/S EL
P042	Procedure "Sodium Bonding" P/S EL
P044	Procedure "Encapsulation of Radioactive Isotopes" P/S WE
P045	Procedure "Plasma Chemical Reactor" P/S PCH
P046	Procedure "Safe Operating Procedure for Pit Disassembly" P/S MW, PD, SRL
P049	Procedure "Ultrasonic Degreaser" P/S MA
P051	Procedure "Operating the Autoclave Hot Isostatic Press" P/S BA
P052	Procedure "Cleaning of SP-100 Fuel Pin Components"
P053	Procedure "Pit Disassembly" P/S SRL
P056	Procedure "Heat Treatment of SP-100 Components"
P064	Procedure "Hydrothermal Processing"
P065	Procedure "Superacid Research and Development"
P067	Procedure "Room 208 Purification Process Development"
P069	Procedure "Super Oxidizer Fluorination of Ash"
P070	Procedure "Operation of the Plutonium FOOF Loop"
P071	Procedure "Operation of the Plutonium Fluorination Loop"
P076	Procedure "Research, Development, and Demonstration Facilities"
P077	Procedure "Research, Development, and Demonstration Facilities"
P078	Procedure "Sensors and Instrumentation Development"
P080	Procedure "Organoactinide R&D"
P081	Procedure "Actinide Chemistry Research and Development"
P083	Procedure "Plutonium Chlorination"
P085	Procedure "Developmental Chloride Solvent Extraction Process"
P090	TA-55 Generator Attachment to the Los Alamos TRU Waste Certification Plan

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P091	Attachment 3 to the TRU Waste Certification Plan, R05
P092	TA-55 Transuranic Waste Interface Document for Debris Waste
P094	Documenting Acceptable Knowledge For Legacy Waste Items
P095	Inspecting, Packaging, Rejecting, and Remediating Transuranic Waste for WIPP and for TA-54 Safe Storage
P096	TA-55 Waste Management, TWCP-351
P097	Performing Visual Inspections of TRU Waste
P098	Packing TRU Waste Containers
P102	Procedure 406-GEN, "Standard Operating Procedure for the Waste Management at TA-55, CMB-11 Facility"; also LA-UR-01-6170
P103	Thorium Fluoride Precipitation
P104	Electrorefining of Plutonium Metal, Nominal Six Kg Scale
P105	Chloride Melt Preparation for Electrorefining and Fused Salt Extraction
P109	Acceptable Knowledge Personnel Interview Form re: Pyrochemical waste stream
P110	Acceptable Knowledge Personnel Interview Form re: Pyrochemical waste stream
P117	Waste Visual Examination and Packaging
P118	Acceptable Knowledge Documentation
P125	Characterization of Direct Oxide Salts
P147	Electrochemical Systems Operations, NMT-15 Hazard Control Plan
P148	Machining of Special Nuclear Materials in Glovebox Enclosures, NMT-15 Hazard Control Plan
P152	Cement Fixation of Process Residues in One-Gallon Cans
P153	Cement Fixation of Process Residues in 55-Gallon Drums
P154	Standard Waste Visual Examination and Prohibited Item Disposition
P155	Pu-238 Residue Solidification
P156	Thermal Decomposition of Cellulose Items Contaminated with Plutonium-238
P157	Direct Oxide Reduction of Pu-238 Oxide
P158	Prohibited Items Disposition Dome 231 Permacon
P159	Processing Waste in the Waste Characterization Glovebox
P160	Introducing and Removing Items and Samples from the Glovebox Systems in PF-4
P161	TA-55 Waste Management
P162	TA-55 Waste Management Requirements
P163	Nuclear Materials Packaging
P164	Inspecting, Labeling, and Preparing TRU Waste Containers

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P165	Performing Visual Inspections of TRU Waste
P166	Packing TRU Waste Containers
P167	Packing TRU Waste Containers
P168	Sealing TRU Waste Containers
P169	Sealing TRU Waste Containers
P170	Material Reclamation
P171	Inspecting and Preparing a Drum
P172	Inspecting the Cement and Performing the Drum-in and Drum-out
P173	Waste Generating Instruction for Heat-Source Plutonium Solid TRU Waste
P174	Trenches A – D Retrieval Operations
P175	Sort, Segregate, Size Reduction, and Repackaging Activities
P177	TA-55 Waste Management
P178	Attachment 3 to the Los Alamos TRU Waste Certification Plan for Newly Generated TRU Waste
P179	TA-55 Generator Attachment to the Los Alamos TRU Waste Certification Plan
P180	Sampling PuO ₂ Procedure
P181	Ceramography of 238 PuO ₂ Fuel Samples
P182	238 Pu Waste Solidification
P183	Cement Fixation of Process Residues in 55-Gallon Drums
P185	Cement Fixation of Process Residues in One-Gallon Cans
P186	Organic Liquid Emulsification
P187	Characterization of Direct Oxide Salts
P188	Standard Operating Procedure for the Waste Management at TA-55
P189	Direct Oxide Reduction of 238PuO ₂
P190	Advanced Testing Line for Actinide Separations (ATLAS) Unit Operations
P192	TA-54 Area G TRU Crate SSSR Activities
P194	TA-54-231 PermaCon Upgrades
P195	Sort, Segregate, Size Reduction, and Repackaging Activities
P196	TA-54 Area G Sludge Remediation Activities
P197	TA-54 Area G TRU Crate SSSR Activities
P198	WCRRF Waste Characterization Glovebox Operations
P199	TA-54-375 TRU Oversized Box Processing Capability Project
U002	Review of RTR Data From Pre-WAP Analysis For AK

Source Document Tracking Number	Title
U004	Process Status Data from Area 55 WMD & Cert. Database
U005	Twenty-Five Years of Radioactive Waste Cementation at Los Alamos National Laboratory
U007	Review of RTR Data From Pre-WAP Analysis for AK