Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221
March 28, 2002

ENTERED

2002

Mr. Steve Zappe
Hazardous Waste Permits Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2905 E. Rodeo Park Drive, Bldg. 1
Santa Fe, NM 87505

RE: Transmittal of the Approved Waste Stream Profile Form Number SR-W027-221F-HETA for the Central Characterization Project at the Savannah River Site

Dear Mr. Zappe:

The Carlsbad Field Office (CBFO) has evaluated the Waste Stream Profile Form (WSPF) SR-W027-221F-HETA for contact handled mixed transuranic debris waste from FB-LINE and concluded that the WSPF is complete and that the waste stream determinations made were made in accordance with CBFO procedures and guidance. The CBFO therefore approves the WSPF for waste characterized at Savannah River Site (SRS) through the use of the Central Characterization Project (CCP) process line.

Using the methods demonstrated in audit A-02-09 at the SRS, the CBFO has authorized the CCP to enter the data into the certification and shipping modules of the WIPP Waste Information System. This approval does not extend to activities conducted by SRS as their approval is limited to waste stream SR-T001-221F-HET.

If you have any questions on this matter, please contact me at (505) 234-7357 or (505) 361-0265.

Sincerely,

Kerry W. Watson
Assistant Manager
Office of National TRU Program

Enclosure

cc: w/o enclosure
J. Kieling, NMED
C. Walker, TechLaw
J. Cotton, WTS
P. Roush, WTS
S. Calvert, CTAC

CBFO:NTP:KWW:VW:02-2193:UFC:5822

020328

Waste Stream Profile Number: SR-W027-221F-HETA

Generator site name:	Savannah River	Technical contact:	Adela M. Cantu
Generator site EPA ID:	SC1890008989	Technical contact phone number:	1-505-234-7498
Date of audit report approval by NMED:	February 27, 2002		

Title, version number, and date of documents used for WAP Certification:

CCP-PO-001, rev. 3, CCP Transuranic Waste Characterization Quality Assurance Project Plan, January 14, 2002
CCP-PO-001, rev. 2, CCP Transuranic Waste Characterization Quality Assurance Project Plan, July 23, 2001
CCP-PO-002, rev. 3, CCP Transuranic Waste Certification Plan, January 21, 2002
CCP-PO-002, rev. 2, CCP Transuranic Waste Certification Plan, July 27, 2001
CCP-PO-004, rev. 8, CCP/SRS Interface Document, February 8, 2002
CCP-PO-004, rev. 7, CCP/SRS Interface Document, November 2, 2001
CCP-PO-004, rev. 6, CCP/SRS Interface Document, October 18, 2001
CCP-PO-004, rev. 5, CCP/SRS Interface Document, September 17, 2001.

DOE/WIPP-069, rev. 7, Waste Acceptance Criteria for the Waste Isolation Pilot Plant, November 8, 1999.

WSRC-RP-99-01097, SRS WIPP Disposal Program QAPjP, September 5, 2000.
WSRC-RP-99-01095, SRS WIPP Disposal Program Waste Certification Plan (U), August 3, 2000.

Did your facility generate this waste? ☐Yes ☒No — If no, provide the name and EPA ID of the original generator: Savannah River , SC1890008989

Waste Stream Information[1]

WIPP ID:	SRW027-221F-Het A	Summary Category Group:	S 5000
Waste Matrix Code Group:	Heterogeneous Debris	Waste Stream Name:	Contact Handled Mixed Transuranic Debris Waste from FB-Line

Description from the TWBIR: Defense related, contact handled transuranic debris waste. Heterogeneous Process Waste (MWIR: SR-W027)

Defense TRU Waste: ☒Yes ☐No   Check One: ☒CH ☐RH

Number of SWBs: 0   Number of Drums: 5,666   Number of Canisters: 0

Batch Data report numbers supporting this waste stream characterization: See attachment 4 Table 1 (CIS)

List applicable EPA Hazardous Waste Codes:[2] F001, F002, F003, F005 , D008

Applicable TRUCON Content Codes: SRS 225 A (or SRS 225 C for repackaged containers)

Acceptable Knowledge Information[1]

[For the following, enter supporting the documentation used (i.e., references and dates)]

Required Program Information

- Map of site: CCP-AK-SRS-1, March 14, 2002, Attachment 2
- Facility mission description: CCP-AK-SRS-1, March 14, 2002, Section 4.1.4
- Description of operations that generate waste: CCP-AK-SRS-1, March 14, 2002, Section 4.3
- Waste identification/categorization schemes: CCP-AK-SRS-1, March 14, 2002, Section 4.4
- Types and quantities of waste generated: CCP-AK-SRS-1, March 14, 2002, Section 4.2.1
- Correlation of waste streams generated from the same building and process, as appropriate: CCP-AK-SRS-1, March 14, 2002, Section 4.2.2

Waste Stream Profile Number: SR-W027-221F-HETA

Waste certification procedures:
CCP-PO-001, rev. 3, CCP Transuranic Waste Characterization Quality Assurance Project Plan, January 14, 2002
CCP-PO-002, rev. 3, CCP Transuranic Waste Certification Plan, January 21, 2002
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, March 7, 2002
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, February, 18, 2002
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, January 21, 2002
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, October 4, 2001
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, September 13, 2001
CCP-TP-003, CCP Sampling Design and Data Analysis for RCRA Characterization, March 18, 2002
CCP-TP-003, CCP Sampling Design and Data Analysis for RCRA Characterization, January 17, 2002
CCP-TP-003, CCP Sampling Design and Data Analysis for RCRA Characterization, November 1, 2001
CCP-TP-003, CCP Sampling Design and Data Analysis for RCRA Characterization, October 4, 2001
CCP-TP-003, CCP Sampling Design and Data Analysis for RCRA Characterization, August 1, 2001
CCP-TP-030, rev. 3, CCP WWIS Data Entry and TRU Waste Certification, October 24, 2001.
CCP-TP-030, rev. 3, CCP WWIS Data Entry and TRU Waste Certification, October 10, 2001.
CCP-TP-030, rev. 3, CCP WWIS Data Entry and TRU Waste Certification, September 5, 2001.
CCP-TP-057, CCP Project Level Data Validation and Verification for Headspace Gas Sampling and Analysis, September 9, 2001

Required Waste Stream Information

Area(s) and building(s) from which the waste stream was generated: CCP-AK-SRS-1, March 14, 2002, Section 5.1

Waste stream volume and time period of generation: CCP-AK-SRS-1, March 14, 2002, Section 5.2

Waste generating process description for each building: CCP-AK-SRS-1, March 14, 2002, Section 4.3

Process flow diagrams: CCP-AK-SRS-1, March 14, 2002, Section 4.3, Figures 4-1 & 4-2

Material inputs or other information identifying chemical/radionuclide content and physical waste form: CCP-AK-SRS-1, March 14, 2002, Section 5.4

Which Defense Activity generated the waste: (check one)

- ☐ Weapons activities including defense inertial confinement fusion
- ☐ Naval Reactors development
- ☐ Verification and control technology
- ☐ Defense research and development
- ☐ Defense nuclear waste and material by products management
- ☒ Defense nuclear material production
- ☐ Defense nuclear waste and materials security and safeguards and security investigations

Supplemental Documentation (from CCP-AK-SRS-1, March 14, 2002, Attachment 1 reference numbers)

Process design documents:	None Compiled
Standard operating procedures:	C11, P1, P10 and P11
Safety Analysis Reports:	D4
Waste packaging logs:	M2
Test plans/research project reports:	C12 and D5
Site databases:	None Compiled
Information from site personnel:	C4, C6, C7, C10, C13, C14, C20, and M4
Standard industry documents:	C18 and D15
Previous analytical data:	C12 and M3
Material safety data sheets:	M1
Sampling and analysis data from comparable/surrogate Waste:	None compiled
Laboratory notebooks:	None Compiled

Waste Stream Profile Number: SR-W027-221F-HETA

Sampling and Analysis Information[2]

For the following, when applicable, enter procedure title(s), number(s) and date(s))

Radiography:

CCP-TP-011, CCP Radiography Inspection Operating Procedures, October 18, 2001

CCP-TP-011, CCP Radiography Inspection Operating Procedures, August 29, 2001

CCP-TP-011, CCP Radiography Inspection Operating Procedures, August 01, 2001

CCP-TP-011, CCP Radiography Inspection Operating Procedures, July 02, 2001

CCP-TP-011, CCP Radiography Inspection Operating Procedures, June 01, 2001

CCP-TP-011, CCP Radiography Inspection Operating Procedures, May 21, 2001

CCP-TP-011, CCP Radiography Inspection Operating Procedures, April 27, 2001

Visual Examination:

SW15.7-SOP-TVEF-01, TVEF Operations, April 11, 2001

SW15.7-SOP-TVEF-01, TVEF Operations, October 30, 2001

WP-AP-0016, WIPP Disposal Program Data Generation Level Review for Visual Examination, February 21, 2001

Headspace Gas Analysis

VOCs:

CCP-TP-007, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Procedure, January 28, 2002

CCP-TP-007, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Procedure, December 7, 2001

CCP-TP-007, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Procedure, August 30, 2001

CCP-TP-009, CCP Single Sample Manifold Data Handling Procedure, January 30, 2002

CCP-TP-009, CCP Single Sample Manifold Data Handling Procedure, September 4, 2001

CCP-TP-009, CCP Single Sample Manifold Data Handling Procedure, August 28, 2001

CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration, January 30, 2002

CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration, October 09, 2001

CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration, August 28, 2001

CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration, July 30, 2001

CCP-TP-032, CCP Single Sample Manifold Data Validation Procedure, January 29, 2002

CCP-TP-032, CCP Single Sample Manifold Data Validation Procedure, August 28, 2001

CCP-TP-032, CCP Single Sample Manifold Data Validation Procedure, July 22, 2001

SW 15.7-SOP-HSGS-01, Headspace Gas Sampling (U), June 28, 2001

SW 15.7-SOP-HSGA-01, Headspace Gas Analysis Operations (U), June 28, 2001

SW 15.7-SOP-HSGR-01, Headspace Gas Analysis Data Review (U), June 7, 2001

WP-AP-0014, WIPP Disposal Program Data Generation Level Review for Headspace Gas Sampling, February 21, 2001

WP-AP-0015, WIPP Disposal Program Data Generation Level Review for Headspace Gas Analysis, February 21, 2001.

Flammable: See above

Other gases (specify): NA

Homogeneous Solids/Soils/Gravel Sample Analysis

Total metals: NA

PCBs: NA

VOCs: NA

Nonhalogenated VOCs: NA

Semi-VOCs: NA

Other (specify): NA

Waste Stream Profile Number: SR-W027-221F-HETA

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.

Beverly A. Crawford	BEVERLY A. CRAWFORD CCP SPM	3/27/02
Signature of Site Project Manager	Printed Name and Title	Date

NOTE: (1) Use back of sheet or continuation sheets, if required.

(2) If radiography, visual examination, headspace gas analysis, and/or homogeneous solids/soils/gravel sample analysis were used to determine EPA Hazardous Waste Codes, attach signed Characterization Information Summary documenting this determination.

CHARACTERIZATION INFORMATION SUMMARY
Lot 1

03/27/2002

TABLE OF CONTENTS

ATTACHMENT 4 - Characterization Information Summary Cover Page

Waste Stream Lot Number: SR-W027-221F-HETA Lot 1

SPQAO Reviewer: A.J. Fisher Date: 3/27/02

SPM Reviewer: Adele M. Martin Date: 3/27/02

SPQAO signature indicates that the information presented in this package is consistent with analytical batch reports.

SPM signature indicates concurrence with all information presented in this report.

List of procedures used:

Radiography:
CCP-TP-011, CCP Radiography Inspection Operating Procedures, October 18,2001
CCP-TP-011, CCP Radiography Inspection Operating Procedures, August 29,2001
CCP-TP-011, CCP Radiography Inspection Operating Procedures, August 1, 2001
CCP-TP-011, CCP Radiography Inspection Operating Procedures, July 2, 2001
CCP-TP-011, CCP Radiography Inspection Operating Procedures, June 1, 2001
CCP-TP-011, CCP Radiography Inspection Operating Procedures, May 21, 2001
CCP-TP-011, CCP Radiography Inspection Operating Procedures, April 27,2001

Visual Examination:
SW15.7-SOP-TVEF-01, TVEF Operations, April 11, 2001
SW15.7-SOP-TVEF-01, TVEF Operations,October 30, 2001

Headspace Gas Analysis:
CCP-TP-007, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Procedure, January 28, 2002
CCP-TP-007, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Procedure, December 7, 2001
CCP-TP-007, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Procedure, August 30, 2001
CCP-TP-009, CCP Single Sample Manifold Data Handling Procedure, January 30, 2002
CCP-TP-009, CCP Single Sample Manifold Data Handling Procedure, September 4, 2001
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CCP-TP-029, CCP Single Sample Manifold Headspace Gas Sampling and Analysis Methods and Equipment Calibration, July 30, 2001
CCP-TP-032, CCP Single Sample Manifold Data Validation Procedure, January 29, 2002
CCP-TP-032, CCP Single Sample Manifold Data Validation Procedure, August 28, 2001
CCP-TP-032, CCP Single Sample Manifold Data Validation Procedure, July 22, 2001
SW 15.7-SOP-HSGS-01, Headspace Gas Sampling (U), June 28, 2001
SW 15.7-SOP-HSGA-01, Headspace Gas Analysis Operations (U), June 28, 2001
SW 15.7-SOP-HSGR-01, Headspace Gas Analysis Data Review (U), June 7, 2001

Data Generation Review (SRS):
WP-AP-0014, WIPP Disposal Program Data Generation Level Review for Headspace Gas Sampling, February 21, 2001
WP-AP-0015, WIPP Disposal Program Data Generation Level Review for Headspace Gas Analysis, February 21, 2001
WP-AP-0016, WIPP Disposal Program Data Generation Level Review for Visual Examination, February 21, 2001

Project Level Data Validation/DQO Reconciliation:

CCP-TP-001, CCP Project Level Data Validation and Verification, March 8, 2002
CCP-TP-001, CCP Project Level Data Validation and Verification, December 14, 2001
CCP-TP-001, CCP Project Level Data Validation and Verification, August 27, 2001
CCP-TP-001, CCP Project Level Data Validation and Verification, July 23, 2001
CCP-TP-001, CCP Project Level Data Validation and Verification, May 25, 2001
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, March 7, 2002
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, February 18, 2002
CCP-TP-002, CCP Reconciliation of DQOs and Reporting Characterization Data, January 21, 2002
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CCP-TP-030, CCP WWIS Data Entry and TRU Waste Certification, September 5, 2001
CCP-TP-057, CCP Project Level Data Validation and Verification for Headspace Gas Sampling and Analysis, September 9,2001

WAP Certification:

CCP-PO-001 CCPTransuranic Waste Characterization Quality Assurance Project Plan, January 14, 2002
CCP-PO-001 CCPTransuranic Waste Characterization Quality Assurance Project Plan, July 27, 2001
CCP-PO-002 CCPTransuranic Waste Certification Plan, January 21, 2002
CCP-PO-002 CCPTransuranic Waste Certification Plan, July 27, 2001
CCP-PO-004 CCP/SRS Interface Document, February 8, 2002
CCP-PO-004 CCP/SRS Interface Document, November 2, 2001
CCP-PO-004 CCP/SRS Interface Document, October 18, 2001
CCP-PO-004 CCP/SRS Interface Document, September 17,2001

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ATTACHMENT 4 TABLE 1 - Correlation of Container Identification Numbers to Batch Data Report Numbers

Container ID Number	On-Line Headspace Gas BDR	NDA BDR	RTR BDR	VE BDR	Solids Sampling BDR	Solids Analytical BDR
214541	101001B	SRS-NDA-010822	SRRTR0043	02-VECCP-003		
214684	01-HSGA-059	SRS-NDA-010821	SRRTR0040	01-VECCP-029		
214694	101001B	SRS-NDA-010821	SRRTR0041	01-VECCP-045		
226377	01-HSGA-055	SRS-NDA-010815	SRRTR0039	01-VECCP-021		
226424	01-HSGA-055	SRS-NDA-010815	SRRTR0039	01-VECCP-023		
226436	101001B	SRS-NDA-010821	SRRTR0042	01-VECCP-038		
226446	101001B	SRS-NDA-010822	SRRTR0042	01-VECCP-042		
226760	01-HSGA-054	SRS-NDA-010815	SRRTR0039	01-VECCP-026		
226815	101001B	SRS-NDA-010821	SRRTR0040	01-VECCP-040		
226828	01-HSGA-056	SRS-NDA-010806	SRRTR0024	01-VECCP-027		
226871	01-HSGA-053	SRS-NDA-010730	SRRTR0025	01-VECCP-002		
226886	01-HSGA-058	SRS-NDA-010823	SRRTR0044	02-VECCP-001		
226929	01-HSGA-058	SRS-NDA-010821	SRRTR0040	01-VECCP-030		
226932	01-HSGA-053	SRS-NDA-010724	SRRTR0026	01-VECCP-003		
226938	01-HSGA-056	SRS-NDA-010806	SRRTR0024	01-VECCP-018		
226964	01-HSGA-054	SRS-NDA-010723	SRRTR0028	01-VECCP-007		
226972	01-HSGA-055	SRS-NDA-010815	SRRTR0039	01-VECCP-019		
235339	01-HSGA-053	SRS-NDA-010723	SRRTR0028	01-VECCP-006		
236610	01-HSGA-055	SRS-NDA-010730	SRRTR0025	01-VECCP-010		
237282	01-HSGA-055	SRS-NDA-010806	SRRTR0024	01-VECCP-011		
237293	01-HSGA-054	SRS-NDA-010723	SRRTR0028	01-VECCP-008		
237416	01-HSGA-057	SRS-NDA-010820	SRRTR0040	01-VECCP-024		
237422	01-HSGA-059	SRS-NDA-010823	SRRTR0044	01-VECCP-031		
246602	01-HSGA-055	SRS-NDA-010815	SRRTR0038	02-VECCP-002		
246675	01-HSGA-054	SRS-NDA-010806	SRRTR0025	01-VECCP-009		
252836	01-HSGA-057	SRS-NDA-010803	SRRTR0025	01-VECCP-035		
252918	01-HSGA-058	SRS-NDA-010815	SRRTR0039	01-VECCP-043		
252943	01-HSGA-057	SRS-NDA-010803	SRRTR0038	01-VECCP-025		
257059	01-HSGA-059	SRS-NDA-010823	SRRTR0044	01-VECCP-036		
257125	01-HSGA-056	SRS-NDA-010802	SRRTR0024	01-VECCP-022		
257850	01-HSGA-055	SRS-NDA-010806	SRRTR0024	01-VECCP-012		
542539	01-HSGA-055	SRS-NDA-010815	SRRTR0039	01-VECCP-020		
542558	101001B	SRS-NDA-010822	SRRTR0043	01-VECCP-037		
543718	01-HSGA-054	SRS-NDA-010806	SRRTR0024	01-VECCP-017		
543805	01-HSGA-055	SRS-NDA-010806	SRRTR0025	01-VECCP-044		
543859	01-HSGA-057	SRS-NDA-010820	SRRTR0040	01-VECCP-032		
543873	101001B	SRS-NDA-010821	SRRTR0041	01-VECCP-039		
543890	01-HSGA-053	SRS-NDA-010723	SRRTR0026	02-VECCP-004		
544811	01-HSGA-056	SRS-NDA-010803	SRRTR0025	01-VECCP-028		
544831	01-HSGA-053	SRS-NDA-010723	SRRTR0029	01-VECCP-004		
548224	01-HSGA-056	SRS-NDA-010803	SRRTR0024	01-VECCP-033		
548853	01-HSGA-053	SRS-NDA-010723	SRRTR0028	01-VECCP-005		

Beverly A. Crawford
Signature of Site Project Manager

BEVERLY A. CRAWFORD 3/7/02
Printed Name Date

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ATTACHMENT 4 TABLE 2 - Headspace Gas Summary Data

NOTE

Refer to UCL_{90} Evaluation Form CCP-TP-003, *CCP Sampling Design and Data Analysis for RCRA Characterization* (Attachment 2) for analyte and sample information.

WSPF #:SR-W027-221F-HETA **Waste Stream Lot Number: 1**

ANALYTE	# Samples	# Samples above MDL	Maximum (ppmv)	Mean (ppmv)	SD (ppmv)	UCL_{90} (ppmv)	PRQL (ppmv)	EPA Code
Benzene	42	14	8.48	0.81	1.82	1.18	10	
Bromoform	42	0	2.61	0.34	---	---	10	
Carbon tetrachloride	42	0	3.98	0.71	---	---	10	
Chlorobenzene	42	0	4.53	0.53	---	---	10	
Chloroform	42	1	2.05	0.22	0.37	0.29	10	
1,1-Dichloroethane	42	4	3.88	0.41	0.65	0.54	10	
1,2-Dichloroethane	42	4	1.87	0.21	0.33	0.27	10	
1,1-Dichloroethylene	42	0	2.08	0.50	---	---	10	
cis-1,2-Dichloroethylene	42	0	4.90	0.62	---	---	10	
trans-1,2-Dichloroethylene [1]	0	---	---	---	---	---	10	
Ethyl benzene	42	6	3.52	0.38	0.66	0.51	10	
Ethyl ether	42	0	3.33	0.57	---	---	10	
Formaldehyde [2]	0	---	---	---	---	---	10	
Hydrazine [3]	0	---	---	---	---	---		
Methylene chloride	42	2	3.79	0.46	0.67	0.60	10	
1,1,2, 2 –Tetrachloroethane	42	0	6.16	0.70	---	---	10	
Tetrachloroethylene	42	7	10.9	1.84	4.04	2.65	10	
Toluene	42	23	41.6	2.00	6.30	3.30	10	
1,1,1 –Trichloroethane	42	33	29.8	3.22	5.78	4.39	10	
Trichloroethylene	42	0	3.85	0.49	---	---	10	
1,1,2-Trichloro-1,2,2-trifluoroethane	42	0	2.61	0.38	---	---	10	
m-Xylene	42	7	5.16	0.54	0.95	0.73	10	
p-Xylene	42	7	5.16	0.54	0.95	0.73	10	
o-Xylene	42	3	5.33	0.51	0.98	0.71	10	
Acetone	42	29	26.1	5.68	6.79	7.04	100	
Butanol	42	14	32.1	5.02	7.90	6.61	100	
Methanol	42	20	40.6	6.10	7.30	7.57	100	
Methyl ethyl ketone	42	14	14.8	1.55	2.65	2.08	100	
Methyl isobutyl ketone	42	2	10.2	1.15	1.92	1.54	100	

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ATTACHMENT 4 TABLE 2 - Headspace Gas Summary Data (Continued)

Data Confirms Acceptable Knowledge? Yes_X_____ No_______

If no, describe the basis for assigning theEPA Hazardous Waste Codes.________________________________

1. Headspace gas samples were obtained before January 9, 2002. Addition of trans 1,2-dichloroethylene to the target analyte list was not completed until after January 9, 2002 per the implementation schedule in the July 18, 2001 letter from CBFO to the NMED and corresponding letter to generator sites from the CBFO.

2. Required only for homogenous solids and soil/gravel waste from Los Alamos National Laboratory and Savannah River Site.

3. Required only for homogenous solids and soil/gravel waste from Oak Ridge National Laboratory and Savannah River Site.

SPM Signature: Adele McCarter Date: 3/27/02

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AMC 3/27/02

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ATTACHMENT 4 TABLE 2 - Headspace Gas Summary Data (continued)

Tentatively Identified Compound	Maximum Observed Estimated Concentrations (ppmv)	# Samples Containing TIC	% Detected
2-Methyl, 2 propanol[4]	75.6	12	29
1,3,5-Trimethyl benzene[4]	0.57	12	29
1,2,4-Trimethyl benzene[4]	0.74	18	43
cyclohexane	0.33	5	12
Isopropyl Alcohol	16.9	2	5
Butanol	3.40	2	5
1-ethyl-3-methyl-benzene	0.86	1	2
Hexane	0.50	1	2
Isopropylidene cyclopropyl methyl ketone	0.60	1	2
Tetrahydro furan	3.30	1	2
Carbon disulfide	0.50	1	2

Data confirms Acceptable Knowledge? Yes X No ______

If no, describe the basis for assigning the EPA Hazardous Waste Codes: ______

4. TICs that were found in individual container headspace gas samples, met the SW-846 TIC identification criteria, and reported in 25 percent of all waste containers sampled in this waste stream were compared to 20.4.1.200 NMAC (incorporating 40 CFR §261) Appendix VIII list. None of the TICs detected in containers at 25% or greater were found in Appendix VIII and therefore will not be added to the target analyte list.

SPM Signature: Beverly A. Crawford

Date: 3/27/02

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ATTACHMENT 4 TABLE 3 - Acceptable Knowledge Summary Data

Waste Stream Name:	Contacted Handled Mixed Transuranic Debris Waste From FB-Line
Waste Stream Number:	SR-W027-221F-HETA Documented in the following attached sections of CCP-AK-SRS-1: Waste Stream Description, Sec. 5.3
Point of Generation:	Savannah River Site 221-F, FB-Line Documented in the following attached sections of CCP-AK-SRS-1: •Location Sec. 4.1.1 •Area and Building of Generation Sec. 5.1
Waste Stream Volume:	5,666 55-gallon drums
Generation Dates:	March 1986 to January 1990
TRUCON Codes:	SR 225 A
TWBIR No.:	SR-W027-221F-HET
MWIR No.:	SR-W027
Generating Processes:	Documented in the following attached sections of CCP-AK-SRS-1: •Description of Waste Generating Process Sec 4.3 •Maintenance and Housekeeping Sec. 4.3.7
RCRA Determinations:	Documented in the following attached sections: • Hazardous Waste Determinations • Polychlorinated Biphenyls • Physical Form • Prohibited Items
Radionuclide Information:	Documented in the following attached section of CCP-AK-SRS-1: Radiological Characterization Sec. 5.4.2
Layers of Confinement:	Up to 5 layers
Filter Model #:	• NucFil®-DVS3 installed during HSG sampling
Hydrogen Diffusivity:	9.5E-06 m/s/mf
Shipping Category:	30 0340 0839

SPM Signature: [signature]

Date: 3/27/02

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Waste Stream SR-W027-221-HETA AK Summary Data

Waste Stream Description (from section 5.3, CCP-AK-SRS-1)

The process by which the waste streams under consideration were generated is described in detail in CCP-AK-SRS-1 Section 4.3 with detailed process flow diagrams. Much of the work performed in FB-Line took place within areas contaminated with radioactive material. Waste materials and items contained in this stream result from various activities that took place in these areas. Routine operational activities (housekeeping/cleaning, process equipment adjustments, radiological surveys, etc.) and preventive and corrective maintenance were the major waste producers. Other contributing activities included facility modifications, decontamination, sump cleanout, absorption of liquids, glove replacement on process cabinets and gloveboxes, various mechanical and electrical repairs, maintenance, and changeouts of process equipment, piping, cabinet panels, and other equipment.

Example Waste Materials (from CCP-AK-SRS-1 table 5-1)

Plastic Bags	Plastic Suit (PPE)	Breathing Air Hose	Metal Cans
Absorbent	Scissors	Pipe	Flashlight
Flashlight Battery(s)	Sheet Metal	Aerosol Cans	Paint Can
Pipe Flange	Electric Drill	Electric Grinder	Electrical Wire
Cloth Coveralls (PPE)	Scaffold Hardware	Nuts, Bolts & Washers	Saw Blade
Plastic Sheeting	Wrench	Rolls of Tape	Light Bulb
Hammer	Plastic Bottles	Ladder (cut up)	Tape Measure
Safety Harness (PPE)	Metal Bucket	Wood/Nails	Wire Mesh
Hack Saw	Respirator (PPE)	Plastic Tubing	Drill Bits

Point of Generation

Location (from Section 4.1.1, CCP-AK-SRS-1)

The SRS is located in South Carolina on approximately 310 square miles. It is bounded on the southwest by the Savannah River and occupies parts of Aiken, Barnwell, and Allendale counties. The FB-Line facility is located inside the 221-F Canyon Building in the 200-F Separations Area of the SRS.

Area and Building of Generation (from Section 5.1, CCP-AK-SRS-1)

All waste from this waste steam described in the Ak Summary Report (CCP-AK-SRS-1) were generated by the FB-Line facility located inside the 221-F Canyon Building. FB-Line occupies several floors of Building 221-F. Waste was generated from areas inside process cabinets or gloveboxes, huts erected around glovebox entry ports, or areas contaminated with radioactive material adjacent to the process cabinets/gloveboxes (such as rooms).

Generating Processes

Description of Waste Generating Process (from Section 4.3, CCP-AK-SRS-1)

The waste streams under consideration were generated in FB-Line in a process involving concentration and refinement of dilute Pu solutions to solid Pu buttons usable in weapons production.

Primary Processes

Pu isotopes were separated from uranium, fission products (primarily ^{137}Cs, ^{90}Sr, ^{95}Zr, ^{95}Nb, ^{103}Ru and ^{106}Ru) and chemical impurities (primarily Fe^{+3}, Al^{+3}, Na^{+}, SO_4^{-2} and sometimes F^{-}) in the 221-F Building processes. Purified Pu isotopes contained in a dilute nitric acid and hydroxylamine nitrate solution were transferred to the FB-Line where it was processed to either Pu metal or

plutonium oxide form. Underlying principles of FB-Line finishing processes are explained in terms of extractive metallurgy. The initial unit operations (i.e., concentration of plutonium nitrate by cation exchange, precipitation of Pu as a trifluoride, filtration, and washing) are best described as hydrometallurgical operations. The remaining unit operations (i.e., warm air drying, oxidation, and reduction with calcium metal to purified Pu metal form) are pyrometallurgical operations.

Maintenance/Housekeeping Activities (from Section 4.3.7, CCP-AK-SRS-1)

Maintenance activities conducted on FB-Line included the following

- lead-lined glove replacements (periodically and as needed)
- Repair of leaks on a weekly or more frequent basis
- Filter changeouts (including changing plastic frits on precipitation filters)
- Changing panels on cabinets and huts
- Equipment repair (valve replacement, etc.)
- Inspection and cleaning of exhaust ducts to remove any Pu accumulation (during January 1990 shutdown)

Routine housekeeping activities conducted by operators included the following:

- Sump cleanout of Pu and calcium residues
- Calcium disposal
- Absorption of liquids
- Construction, breakdown, and disposal of huts adjacent to cabinets
- Bagging trash out of gloveboxes and cabinets

All of these activities generated TRU and/or low-level waste during the late 1980s. Some examples of waste-generating maintenance and housekeeping activities are provided below.

<u>Hydraulic Sump Cleanup</u>

Mechanical Line sumps located outside of process cabinets were periodically cleaned out. These cleanout activities typically generated over 20 red pails of waste. Operators placed plastic and absorbent paper in front of the sumps and pumped any collected liquid oil into one-gallon containers filled to 66% capacity with oil dry or other absorbent materials. Bottles were agitated until all oil was absorbed. Procedures mandated "No free liquid can be sent to the burial ground". When all of the liquid oil was removed, the sump was wiped clean. Operators then placed strips of clean paper over the sump, reinstalled the panels, and restarted the pump to check for leaks that would drip onto the paper. When all leaks were repaired, the paper, absorbed oil, panels, and other waste was collected and removed. Wet cabinet sumps were cleaned in a similar manner.

<u>Floor Sweeping Cleanup</u>

In the Mechanical Line, powder spilled in dry cabinets was collected by sweeping. In addition to sieving sweepings to remove trash, trash was inspected to remove Pu-bearing material. Sweepings exposed to liquid were handled separately. Both trash and collected material were also inspected for calcium, which was placed in a separate "calcium waste container". Up to 1,000 grams of sweepings could be bagged out of the line as waste in an S&C can. Calcium waste (oxidized or loose) was segregated from other trash, placed in a one-gallon metal pail, and covered with Celite or sand.

RCRA Determinations

Hazardous Waste Determinations

Ignitability

Only WIPP WAC compliant drums will be shipped to WIPP (ie. Less than or equal to 1 inch of liquid in internal containers and less than or equal to 0.55 gallons (2082 mL) total volume.

The solids in the drums will not ignite through friction, moisture adsorption, or chemical changes.

Corrosivity

Under 40 CFR 261.22, a solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

- It is aqueous with a pH less than or equal to 2, or greater than or equal to 12.5, as determined by a pH meter using Method 9040 in "Test Methods for Evaluation Solid Waste, Physical and Chemical Methods," EPA Publication SW-846.
- It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55 degrees Celsius (130 degrees Fahrenheit) as determined by its test method specified in National Association of Corrosion Engineer (NACE) Standard TM-01-69 as standardized in SW-846.

FB-Line operating procedures direct that residual acids in TRU waste be neutralized, thus removing any corrosive characteristic through neutralization before waste is packaged and transported to the solid waste storage facility.

This waste is not an aqueous liquid. As determined by radiography and visual examination, none of the drums to be shipped contained greater than 1 volume percent liquid (present as residual liquid). Since 20% liquid by volume is required in order to measure pH, the corrosive characteristics characteristic (D002) does not apply to the waste.

Reactivity

The waste stream does not meet the characteristic of reactivity as defined under RCRA 40 CFR 261.23. The waste materials are stable based on procedures used during FB-line processing (CCP-AK-SRS-1) and will not react violently with water, form potentially explosive mixtures with water, or generate toxic gases, vapors or fumes when mixed with water.

The materials do not contain sulfides and are not capable of detonation or explosive reaction. Further, this waste does not present a compatibility hazard due to the chemicals identified with each other with the packaging of the waste. Therefore, the waste code for reactivity (D003) is not assigned to this waste stream.

Calcium metal was managed separately from this waste stream. Oxidized calcium from the Mechanical Line was placed in special metal 1-gallon waste calcium pails, taped shut, and placed in five-gallon metal containers, which were themselves covered with Celite (CCP-AK-SRS-1). Sweepings that might have contained calcium were placed in a "calcium waste container," an S&C can, covered with sand, and sealed with a taped-on lid. These wastes were segregated and managed separately from the drums that are included in waste stream SR-W027-221F-HETA.

Toxicity

An evaluation was completed of toxicity characteristic metals in FB-Line waste including: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. Drum specific TRU Waste Package Data forms specify D008 for 160 drums generated between March 7, 1986, and January 23, 1990. Acceptable Knowledge (CCP-AK-SRS-1) also indicates the potential

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presence of lead in this waste stream. No other metals have been determined to be present in this waste stream.

Chromium was found in a composite sample of various waste streams including the FB-line waste stream. This composite sample included a laboratory waste stream that was known to contain chromium. No other source documents could be found to determine chromium was present in this waste stream. Therefore the waste designation for chromium (D007) has not been applied to this waste stream.

Radiography characterization has indicated the presence of batteries in containers in waste stream SR-W027-221F-HETA. In many cases, the batteries found during radiography were found in flashlights. These alkaline batteries had been detected in the non-hazardous waste stream SR-T001-221F-HET by Savannah River. These batteries were not managed as hazardous waste by the generator. MSDS information on typical alkaline batteries describes mercury content as less than 0.025 wt % mercury. The regulatory level for mercury for the toxicity characteristic is 0.2 mg/L based on the amount leachable using TCLP. Alkaline batteries are unlikely to leach mercury because this constituent and other electrolytic constituents are sealed within the battery casing. This casing would not deteriorate sufficiently under conditions of the TCLP test (pH = 2.9 and 4.9 for 18 hours) to corrode and release its contents. Therefore the EPA designation of D009 has not been applied to this waste stream.

Drum specific TRU Waste Package Data forms (CCP-AK-SRS-1) do not apply "D" organic toxicity characteristic EPA hazardous waste numbers to any of the drums from FB-Line generated between March 7, 1986, and January 25, 1990, nor are the names of any D-listed chemicals or commercial chemical products containing these chemicals part of the detailed waste descriptions. Other reviewed documentation indicate no source for any toxic organic compounds or the presence of these compounds in the waste.

Spent halogenated organic compounds commonly used for their solvent properties for cleaning and degreasing were included in the waste as reported in the Acceptable Knowledge Report (CCP-AK-SRS-1). Methyl Ethyl Ketone (D035) was also listed as commonly used as a spent solvent at lower than 200.0 mg/L concentration. The appropriate F-listed codes for these solvents has been applied to this waste (see Listed Waste). The toxicity characteristic codes associated with these compounds will not be assigned.

Listed Waste

Acetone, methanol, methylene chloride, 1,1,1-trichloroethane and Freon were used on the FB-line for housekeeping (CCP-AK-SRS-1). PVC solvent (which contains methyl ethyl ketone) was used during maintenance in the FB-Line cabinets. MSDS information for chemicals approved for use in FB-Line processes identified the presence of toluene, methanol, and cyclohexanone used as solvents. EPA hazardous waste numbers F001, F002, F003, and F005 will be applied to these waste steams as follows:

- F001 – Freon, which may have been used for degreasing of panels and other surfaces inside cabinets
- F002 – Freon, methylene chloride, 1,1,1-trichloroethane, and trichloroethylene
- F003 – acetone, methanol, ethyl acetate, n-butyl acetate, xylene, cyclohexanone, and n-butanol
- F005 – toluene and methyl ethyl ketone

Headspace gas analyses indicate that benzene, tetrachloroethylene, toluene, 1,1,1-trichloroethane, acetone, butanol, methanol, methyl ethyl ketone and methyl isobutyl ketone are present in the waste below reportable concentrations (PRQL). Trace amounts (below 1 ppmv) of chloroform, 1,1-dichloroethane, 1,2-dichloroethane, ethyl benzene, methylene chloride, and xylene were also found to be present in the waste stream. Benzene, tetrachloroethylene and chloroform were listed in the 1992 draft RCRA Part B permit application for the TRU storage pads. Therefore, the applicable waste codes F001, F002, F003 and F005 apply to the waste stream.

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DMC 3/27

The waste stream does not meet the 40CFR 261.33 definition of U coded waste of:

a) Any commercial chemical product, or manufacturing chemical intermediate having the generic name listed in paragraph (f).
b) Any off-specification commercial chemical product or manufacturing chemical intermediate, which, if it met specifications, would have the generic name, listed paragraph (f) of this section.
c) Any residue remaining in a container or in an inner liner removed from a container that has held any commercial chemical product or manufacturing chemical intermediate having the generic listed in paragraphs (f) of this section, unless the container is empty as defined in 261.7(b) of this chapter.

No P or U listed wastes were identified on the drum-specific TRU Waste Package Data forms (CCP-AK-SRS-1) for the FB-Line waste generated between March 7, 1986, and January 24, 1990. No source was identified for any of the P-listed chemicals in Acceptable Knowledge source documents (CCP-AK-SRS-1).

On July 20, 2001, the DOE required that trans (1,2)-Dichloroethylene be added as a target analyte for headspace gas sampling and analysis by January 9, 2002. Only trans 1,2-Dichloroethylene was added to the target analyte list as part of the New Mexico Environment Department (NMED) approval of a class 2 permit modification[1]. This compound is reported for all analytical results obtained after January 9, 2002. Formaldehyde and hydrazine were not analyzed for this waste stream per Table B-1 and B-3 of the Waste Analysis Plan, as the analysis pertains only to S3000 Homogeneous Solids and S4000 Soils/Gravel and this waste stream contains only S5000 Heterogeneous Debris.

Conclusion

The following EPA hazardous waste numbers are assigned to waste stream SR-W027-221F-HETA constituents: F001, F002, F003, F005, and D008.

Polychlorinated Biphenyls

There are no polychlorinate biphenyls in the SR-W027-221F-HETA waste stream. Waste in this waste stream was generated after 1985, more than six years after PCB production in the United States was halted. Electrical capacitors were the only potential source of PCB contamination for these waste streams identified during the AK investigation. In 1981, the SRS PCB Committee identified several capacitors containing PCBs inside the FB-Line facility. Extensive efforts were undertaken during the early- to mid-1980s to replace or retro-fill electrical equipment containing PCB material. The annual PCB Inventory Change Report (CCP-AK-SRS-1) for calendar year 1984 stated that no large capacitors were in service at the SRS. In addition, no evidence was found of fluorescent bulb ballasts in container inventory information provided by generators. Therefore, by the end of 1984, the potential for PCB contamination of TRU waste from the FB-Line no longer existed. Since this waste stream was generated after March 7, 1986, there is no potential for PCB contamination.

Physical Form

In the late 1980's the physical form of waste was investigated during collection of data describing the waste. An effort conducted in 1988 resulted in the following estimate of the average mass distribution by drum/box of waste forms in the waste: 19.4 kg (30.1%) combustible, 17 kg. (25.4%) metals, 10 kg. (15.5%) glass, 7 kg. (10.9%) filters, 5 kg. (7.8%) graphite, 4 kg. (6.2%) inorganic solids (such as ash, concrete, lead, and slag), 1.2 kg. (1.9%) organic waste (such as oils and solvents), and 1 kg. (1.2%) resins.

Further information from the TRU Waste Package Data form provided additional information about the physical form and is included in Table 5-2 from the Acceptable Knowledge Summary Report.

[1] Dr. Inez R. Triay of Carlsbad Field Office to Mr. Steve Zappe, New Mexico Environment Department, Implementation Schedule for the Class 2 Hazardous Waste Facility Permit Modification Requiring Addition of trans-1,2-dichloroethylene and formaldehyde as Target Analytes, July 18, 2001, Carlsbad, New Mexico.

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Physical Form Information from TRU Waste Package Data Forms (Table 5-2 of CCP-AK-SRS-1)

Waste Form	% of Containers	Waste Form	% of Containers
Plastics	85.6	Tools	21.4
Tape	54.9	Cans	8.2
Gloves	54.8	Sump crud	4.9
Wipes	35.8	Celite (absorbent)	6.4
Paper	21.2	Motors	0.2

Based on various collection of data, waste packaging forms, procedures and document on waste generating activities, and audit reports, a delineation of the heterogeneous waste resulted in a waste matrix code assignment. The waste matrix code for SR-W027-221F-HETA is designated as S5440, Predominantly Organic Debris. The matrix code is defined in the AK Summary Report as follows: "This specific-detailed category includes waste streams that are estimated to contain a greater amount of organic debris materials than any other type of material. The balance of the matrix may be inorganic debris materials (i.e., inorganic nonmetal), soil, or homogeneous solids."

Waste Package Data forms for this waste provided information on waste material parameters on a container basis. The AK Summary Report states that the presence or absence of these parameters can be estimated using volume percent organic information, but not the estimated weights.

Prohibited Items

Approximately 142 drums have been rejected for shipment at this time due to the presence of prohibited items. These items include water above the WIPP WAC required limits, sealed containers greater than 4 liters, and presence of aerosol (pressurized) cans. These items are detected during radiography and visual examination and dispositioned as non-conforming items that are rejected from the waste stream. Therefore, no containers with prohibited items will be shipped to WIPP.

(SEE TABLE 7, PAGE 016) JRB 3-28-02

Visual Examination identified two drums that contained prohibited items in this waste stream. One drum SR582539 contained water that was obscured from radiography detection by dense floor tiles. The water was removed during visual examination and the container was returned to process on NCR-SRS-0212-01. Drum SR226871 contained lead gloves and was found prior to designation of D008 for this waste stream (NCR-CCP-0005-01). The discovery of this glove and the inability of acceptable knowledge to definitively determine whether a drum contained lead-lined gloves or other types of gloves led to assignment of the lead (D008) waste code to the SR-W027-221F-HETA waste stream.

Radionuclide Information

Radiological Characterization (from Section 5.4.2, CCP-AK-SRS-1)

Radiological quantities were entered on burial slips attached to TRU Waste Package Data forms for each container (CCP-AK-SRS-1). Generators assayed each red pail to determine the total grams of Pu and recorded the information on Red Pail Waste Identification Records, as well as waste identification slips. Drums into which waste was directly packaged were also assayed by the generator. The generator used this information to complete the Burial Ground Record after packaging waste. Some problems with these assay results were noted in 1989 and 1992, resulting in the re-assay of some containers and update of the COBRA database in which container-specific data was compiled in the early 1990s. Generators were directed by procedures to enter "50" in the "Isotope1" field on the Burial Ground Record to indicate weapons-grade Pu material. Generators often entered "0" in the "Total Quantity" and "Quantity1" fields if the total quantity was known or suspected to be below the accountability threshold. Hut waste and other waste from outside of the cabinets was often labeled on the Burial Ground Records as "0 g" for Pu quantity. Inventory adjustments would have been submitted for

accountability tracking purposes, but may not have been submitted to Waste Management. Waste Management also assayed drums by passive-active neutron assay upon receipt to determine the TRU activity concentration (nCi/g).

In June 1996, a change in the radioisotopic composition of the material processed in FB-Line occurred. The "old" distribution shown in Table 5-3 is applicable to the 1986-1990 TRU waste streams and is consistent with the specification for weapons-grade Pu acceptable at Rocky Flats and operation basis documents. This specification requires that the Pu-240 content of each Pu button must be between 5.00 and 6.50 weight percent and the average Pu-241 content for each shipment "shall not exceed 1.00 weight percent". Americium-241 is also present in the waste as a result of in-growth from the beta decay of ^{241}Pu. At the time of generation, Pu isotopes contributed greater than 99.99% of the radioactivity in the waste stream.

Generators interviewed recalled processing only weapons-grade Pu during the 1986-1990 time period, particularly because new Special Recovery operations were shut down at this time. However, accountability information suggests that some material from other U.S. Department of Energy sites was processed at FB-Line during the time period in which the waste under consideration was generated. Table 5-4 summarizes material that was processed in FB-Line and may also be present in the waste. The material received from Rocky Flats appears to be consistent with the weapons grade material routinely processed through FB-Line. However, the material from Hanford appears to be relatively depleted with respect to Pu-239. It is thought that this is related to a longer burn time in the Hanford reactor, which was also used for power production. Intermediate burn-up fuels such as this may have ^{239}Pu isotopic composition as low as 82.5%. This lower Pu-239 material was co-mingled with weapons-grade-contaminated waste and is present throughout the population of waste under consideration. ^{238}Pu concentrations were not provided for this material, but are expected to be < 2% based on the available composition data.

General 221FB-Line Plutonium Isotopic Distribution (from Table 5-3, CCP-AK-SRS-1)

Isotope	Isotopic Range (References C8, C21, D20, and D22) (wt%)
^{238}Pu	0-0.21
^{239}Pu	93.05-95.00
^{240}Pu	5.70-5.96 (weighted average)
^{241}Pu	0-0.75 (weighted average)
^{242}Pu	0-0.10
^{233}U	Trace
^{234}U	Trace
^{238}U	0-0.01
^{90}Sr	0-6.3 x 10^{-4}
^{137}Cs	0-1.3 x 10^{-3}
^{241}Am	0-0.11 (weighted average)

Isotopic Distribution for Offsite Material Processed at FB-Line (from Table 5-4, CCP-AK-SRS-1)

Date	Site/Transfer #	^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu
8/85-8/89	Rockwell Intl (Rocky Flats)/ARF243	NR	5.34-6.12	NR	NR
9/89-11/89	Rockwell Intl (Rocky Flats)/ARF243	NR	5.7-6.24	NR	NR
3/86-5/86	Hanford HRA37	84.13-85.93	11.92-13.41	1.67-2.00	NR
10/87-12/87	Hanford HRA41	85.69-88.91	10.01-12.85	0.79-1.72	0.2
3/88-7/88	Hanford HUD1	87.24-88.05	10.31-11.11	1.37-1.38	0.2
10/88-2/89	Hanford HUD3	86.19-86.20	11.98-12.08	1.41-1.52	0.2

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For the preparation of this document, the ratio of ^{239}Pu ("Quantity1" on the Burial Ground Record) to total Pu ("Total Quantity") was calculated on the AK tracking spreadsheet based on the assay data provided by generators on Burial Ground Records. A survey of the 3,087 containers included on the AK tracking spreadsheet revealed the following breakdown of ^{239}Pu ratios for drums with nonzero entries:

- 0.860 $\leq$ ^{239}Pu ratio $<$ 0.900 – 174 drums
- 0.910 $\leq$ ^{239}Pu ratio $<$ 0.9401 – 870 drums
- 0.9401 $\leq$ ^{239}Pu ratio $<$ 1 – 106 drums.

The containers for which the ^{239}Pu ratio is between 0.86 and 0.90 are consistent with the isotopic distributions of offsite waste processed through FB-Line, rather than the normal weapons-grade material. Note that the remainder of the 3,086 containers have assay results of "0" (e.g., may be "non-cabinet" waste or were not thought to hold accountable quantities of material) and thus, were not included in the calculation of the ^{239}Pu ratio. Considering the information described previously and measurement uncertainties in reported values, the range of the major radiological constituents anticipated for the subject waste is as follows: ^{238}Pu (0-0.2); ^{239}Pu (80-96); ^{240}Pu (4-18); ^{241}Pu (0-2.0); and ^{242}Pu (0-0.2).

ATTACHMENT 4 TABLE 7 - RTR/VE Summary of Prohibited Items and AK Confirmation

542539	N/A	2001-CDF-26-0384 >1in liquid in bottom of internal container. Sum of liquid > 2liters. Drum had excessive liquid not identified in RTR, the liquid was not identified because the drum contained flooring tiles (dense) that masked the liquid. (NCR-SRS-0212-01)Prohibited item removed, drum returned for processing	Y
226871	N/A	2001-CDF-26-0381, 2001-PIR-26-036, NCR-CCP-0005-01, Drum contained Lead.	Y

a. See Batch Data Reports
b. Attachment 10 of CCP-TP-005, *CCP Acceptable Knowledge Documentation*

Adela M. Cantu (signature) — Site Project Manager Signature
Adela M. Cantu — Printed Name
3/27/02 — Date

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AMC 3/27/02

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ATTACHMENT 2B - Reconciliation with Data Quality Objectives

SPQAO Sampling Completeness

RTR:
Number of valid samples: 42 Number of total samples analyzed: 42
Percent Complete: 100 (QAO is ≥90%)
NDA:
Number of valid samples: 42 Number of total samples analyzed: 42
Percent Complete: 100 (QAO is ≥90%)
HSG:
Number of valid samples: 42 Number of total samples collected: 42
Percent Complete: 100 QAO is ≥90%)
Number of valid samples: 42 Number of total samples analyzed: 42
Percent Complete: 100 (QAO is ≥90%)

SPQAO Signature and Date: [signature] 3/27/2002

I certify that sufficient data have been collected to determine the following Program-required waste parameters:

WSPF# SR-W027-221F-HETA

	YN/NA	Reconciliation Parameter
1.	Y	Waste Matrix Code.
2.	Y*	Waste Material Parameter Weights.
3.	Y	The waste matrix code identified is consistent with the type of sampling and analysis used to characterize the waste.
4.	Y	The TRU activity reported in WWIS demonstrates with a 95% probability that the waste is TRU waste and not low-level radioactive waste.
5.	Y	Potential Flammability. Is there sufficient AK or analytical data to demonstrate that the waste meets the potential flammability limits (Headspace Gas, BDR and Summary Sheet)?
6.	Y	Mean concentrations, upper 90% confidence limit (UCL_{90}) values for the mean concentration, standard deviations, and the number of samples collected for each **VOC** in the headspace gas of each container were calculated and compared with the program required quantitation limits, as reported in the Characterization Information Summary Table 2, and additional EPA Hazardous Waste codes were assigned as required. Samples were randomly collected (when appropriate).

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ATTACHMENT 2B - Reconciliation with Data Quality Objectives (continued)

7a.	N/A**	Mean concentrations, UCL_{90} values for the mean concentration, standard deviations, and the number of samples collected for total **VOCs** were calculated and compared with the program required quantitation limits and regulatory thresholds, as reported in the Characterization Information Summary Table 3, and additional EPA Hazardous Waste codes were assigned as required. Samples were randomly collected.
7b.	N/A**	Mean concentrations, upper 90% confidence limit (UCL_{90}) values for the mean concentration, standard deviations, and the number of samples collected for **total SVOCs** were calculated and compared with the program required quantitation limits and regulatory thresholds, as reported in the Characterization Information Summary Table 4, and additional EPA Hazardous Waste codes were assigned as required. Samples were randomly collected.
7c.	N/A**	Mean concentrations, upper 90% confidence limit (UCL_{90}) values for the mean concentration, standard deviations, and the number of samples collected for **total metals** were calculated and compared with the program required quantitation limits and regulatory thresholds, as reported in the Characterization Information Summary Table 5, and additional EPA hazardous Waste codes were assigned as required. Samples were randomly collected.
8.	Y	The data demonstrates whether the waste stream exhibits a toxicity characteristic under 40 CFR 261, Subpart C.
9.	Y	Waste stream can be classified as hazardous or nonhazardous at the 90-percent confidence level.
10.	Y	Sufficient number of waste containers have been visually examined to determine the UCL_{90} for the miscertification rate is less than 14%.
11.	Y	TICs were appropriately identified and reported in accordance with the requirements of Section B3-1 of the QAPjP.
12.	Y***	The PRQLs for headspace gas VOCs, were met for all analyses as evidenced by the analytical batch data reports.
		The overall completeness, comparability, and representativeness QAOs were met for each of the analytical and testing procedures as specified in the WAP Sections B3-2 through B3-9 prior to submittal of a waste stream profile form for a waste stream or waste stream lot.

	Completeness	Comparability	Representativeness
Radiography	Y	Y	Y(100%)
Headspace Gas Sampling and Analysis	Y	Y	Y

ATTACHMENT 2B - Reconciliation with Data Quality Objectives (continued)

		Headspace Gas Analysis	Y	Y	Y
		Solids Sampling	N/A**	N/A**	N/A**
		Total VOCs	N/A**	N/A**	N/A**
		Total SVOCs	N/A**	N/A**	N/A**
13.		Total Metals	N/A**	N/A**	N/A**

[signature]
Signature of Site Project Manager

BEVERLY A. CRAWFORD
Printed Name

3/07/02
Date

*RTR and VE weight comparisons for total organic and total inorganic materials were within acceptable limits. RTR experienced difficulties determining sorbents within multiple bags, differences between plastics and cellulosics and weights of rubber and metal parameters.
**Not analyzing homogenous waste
***On-column detection limit for tetrachloroethylene (BDR101001B) was 8ng. Recalculation after spreadsheet change produced MDL of 10.87 ppmv. (NCR - SRS - 0296-01)

019

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CCP-AK-SRS-1

Central Characterization Project

Acceptable Knowledge Summary Report For Savannah River Site Waste Steams: SRW027-221F-Het-A, Het-C-D, Het-E

REVISION 07
March 28, 2002

Beverly Crawford

Printed Name

APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
5	01/19/2002	Revised to update TRUCON Content Code, layers of packaging, and reference numbers. Clarified layers of confinement, and added detail for additional clarification.
6	03/14/2002	Deleted Average Wt% column in Table 5-3. Deleted sentence in 5.4.1[A] and made other minor editorial changes. The Pu238 value (in Table 5-3, Isotopic Range column) has been revised to 0.21 in accordance with source documentation.
7	03/28/2002	Sections 2.0 and 5.4 - clarified discussion of the waste description and matrix code; Section 5.4.1 - clarified the physical form discussion to reflect mass values which resulted in the addition of reference C11; Section 5.4.4 - clarified the units reported for Ba, and Cd, also clarified the As discussion; Section 5.4.1[A] - clarified that the Waste Matrix Code is applied to the waste stream(s); Changed the citation for Reference 7; and added reference D22; other minor editorial changes. Clarified Section 5.4.4 on Chromium by adding an additional source document, C25 and by clarifying text.

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List of Acronyms and Abbreviations

AK	acceptable knowledge
Am	americium
cm^2	square centimeters
CCP	Central Characterization Project
CH	contact-handled
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
FSN	File Sequence Number
kg	kilogram
µg/L	micrograms per liter
mrem/hr	millirem per hour
MSDS	Materials Safety Data Sheet
nCi/g	nanocuries per gram (activity concentration unit)
PCB	polychlorinated biphenyl
pCi	picocuries
PE-Ci	plutonium equivalent curies
ppm	parts per million
Pu	plutonium
PVC	polyvinyl chloride (polymer)
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
S&C	slag and crucible
SRS	Savannah River Site
TRU	transuranic
TWBIR	Transuranic Waste Baseline Inventory Report
WAC	waste acceptance criteria
WIPP WAP	WIPP Hazardous Waste Facility Permit Waste Analysis Plan
WIPP	Waste Isolation Pilot Plant
WMC	Waste Matrix Code
wt %	weight percent

1.0 Executive Summary

This document has been prepared for the Waste Isolation Pilot Plant (WIPP) Central Characterization Project (CCP) for contact-handled (CH) transuranic (TRU) waste generated and managed by Savannah River Site (SRS). The CCP is tasked with certification of CH-TRU waste for transportation to and disposal at the WIPP. The procedure CCP-TP-005, *CCP Acceptable Knowledge Documentation* (Reference 1), describes how acceptable knowledge (AK) is compiled and confirmed by the CCP. The CCP is responsible for the direction of the SRS AK development effort in accordance with CCP procedures and will review and approve this SRS Acceptable Knowledge Summary Report and maintain this document and supporting AK source documentation as CCP quality assurance (QA) records. All referenced documentation are stored at the WIPP Records Facility in Building 642-E at the SRS. In addition, copies of source documents are available at the CCP office in Carlsbad, New Mexico.

Beginning in 1954, the SRS FB-Line facility conducted atomic energy defense activities consistent with Section 10101(3) of the Nuclear Waste Policy Act of 1982 (Reference 2). Waste generated from these activities is consistent with guidance from the Carlsbad Field Office (Reference 7) for waste disposal at the WIPP. Specifically, the FB-Line was a defense nuclear materials production facility. The facility mission was to process and convert dilute plutonium (Pu) solution into highly purified weapons grade Pu metal. As a result of various activities conducted in support of the mission (e.g., operation, maintenance, repair, cleaning, and facility modifications), the facility generated TRU waste. There is no indication of non-defense-related material being generated by these activities at SRS.

This document, along with referenced supporting documents, provides a defensible and auditable record of AK for designated waste streams from the FB-Line. All documentation used to derive AK information for this report is denoted by alphanumeric designations corresponding to the Source Document Tracking Number (where applicable). References are provided in Attachment 1.

This AK report includes information relating to the facility's history, configuration, equipment, process operations, and waste management practices. Information contained in this report was obtained from numerous sources, including facility safety basis documentation, historical document archives, generator and storage facility waste records and documents, and interviews with cognizant personnel. A search was made for both classified and unclassified documentation, but no classified documentation was located. However, some unclassified nuclear information (UCNI) was investigated, including several procedures. These heterogeneous debris TRU waste streams were generated from March 1986 to January 1990. The waste was packaged in 55-gallon drums, then shipped to the TRU waste storage facility in "E" area of the SRS.

This report complies with the requirements of Section B4, "Acceptable Knowledge," of the Hazardous Waste Facility Permit issued to WIPP Waste Isolation Pilot Plant" (Reference 3), and provides an auditable characterization that satisfies WIPP criteria for AK.

2.0 Waste Stream Identification Summary

Site Where TRU Waste Was Generated: Savannah River Site, Post Office Box 616, Aiken, South Carolina, 29802

Facility Where TRU Waste Was Generated: 221-F, FB-Line

Facility Mission: The Building 221-F FB-Line facility was a defense nuclear materials production facility in which dilute Pu solutions were concentrated and purified into Pu metal for weapons use.

Summary Category Group: S5000 – Debris Waste

Waste Matrix Code Group: Heterogeneous Debris Waste

Waste Matrix Code: S5440 –Predominantly Organic Debris.* This debris waste (Summary Category Group S5000) is predominantly organic in these waste streams. See Section 5.4.1[A].

TRUPACT-II Content Code (TRUCON): SR 225A

Shipper and Generator Site Identification: SR

Waste Type Code: MTRU

Waste Stream TWBIR Identification: SR-W027-221F-HET

Waste Stream MWIR Identification: SR-W027

IDC Code: 001 (Job control waste)

Layers of Confinement: Maximum of five layers. See detail on packaging in section5.5.2.

Waste Stream Description: The waste streams listed below are CH-TRU waste resulting from glovebox operations, decontamination, housekeeping, maintenance, and construction activities. The waste consists mostly of dry heterogeneous organic debris by volume with the balance being mainly comprised of inorganic debris. Organic debris constituents include plastic, personnel

protective equipment (e.g., shoe covers, lab coats, plastic suits), wipes, labware, wood, absorbed oil, paper, and other job control type waste. The waste also includes inorganic debris such as metal components (e.g., hand tools, motors, small equipment), glass, floor sweepings, and absorbent materials.

Waste from these streams is contaminated primarily with weapons-grade Pu consisting of the following radioisotopes and corresponding nominal relative weight percent (wt %) distribution (References C8, C19, and C9): ^{238}Pu (0-0.2), ^{239}Pu (80-96), ^{240}Pu (4-18), ^{241}Pu (0-2.0), and ^{242}Pu (0-0.2). Some americium-241 (^{241}Am) is present as a result of in-growth from beta decay of ^{241}Pu, and other radionuclides are present in trace (<1 wt %) quantities. Further radiological characterization information is described in Section 5.4.2.

As described in Section 5.4, hazardous constituents vary by waste stream and include spent solvents, lead, cadmium, and mercury. Three waste streams have been delineated based on chemical content from the population of FB-Line waste considered:

<u>SR-W027-221F-Het-A</u>:
The stream is assigned hazardous waste numbers F001, F002, F003, and F005 for solvent contamination, as well as D008 for lead. Lead items such as gloves and shielding may be present in containers, as described in Section 5.4.4.

<u>SR-W027-221F-Het-C-D</u>:
In addition to the codes listed for SR-W027-221F-Het-A, the stream is assigned D006 for cadmium due to the inclusion of cadmium shielding in containers, as described in Section 5.4.4.

<u>SR-W027-221F-Het-E</u>:
In addition to the codes listed for SR-W027-221F-Het-A, the stream is assigned D009 for mercury due to the inclusion of mercury-filled items such as thermometers and manometers in containers, as described in Section 5.4.4.

*In Revision 0 of this document, the Waste Matrix Code (WMC) was S5900, described as Unknown/Other Debris. The code was changed to S5440, Predominantly Organic Debris, in order to designate a more definitive WMC. The change to a different WMC was not based on results from characterization activities.

3.0 Acceptable Knowledge Data and Information

TRU waste destined for disposal at the WIPP must be characterized prior to shipment. The WIPP Hazardous Waste Facility Permit Waste Analysis Plan (WIPP WAP) (Reference 3) permits use of knowledge of the materials and processes that generate and control the waste for this purpose, provided a clear and convincing argument about the characteristics of the waste is achieved. The AK characterization documented herein complies with the requirements of the WIPP WAP and was developed in accordance with Section B4 of CCP-PO-001, *CCP TRU Waste Characterization Quality Assurance Project Plan* (Reference 4), and CCP-TP-005, *CCP Acceptable Knowledge Documentation* (Reference 1).

This waste stream was characterized using AK from a variety of sources. Controlled FB-Line facility and SRS TRU Waste Certification Program documentation effective during the period of waste generation was used as the basis for this characterization. Examples include facility specific safety analysis reports, facility operating procedures, TRU Waste Package Data forms, Materials Safety Data Sheets (MSDSs), and completed burial ground records. Specific revisions of controlling documentation in effect during generation and processing of waste from this stream were obtained and used where available. Some of the documents reviewed during this effort were UCNI, but no classified documents were located.

The CCP investigated a population of 6,178 waste containers generated at FB-Line in Building 221-F at SRS between January 2, 1986, and January 25, 1990. Other FB-Line-generated containers from the same time period may also be included in one of the waste streams described in this document, provided that they have physical, radiological, and chemical characteristics consistent with those described herein. SRS began to implement elements of its TRU Waste Certification Program in early 1986, including storage of uncovered waste containers on concrete pads above grade and completion of packaging logs called TRU Waste Package Data forms by generators. SRS certified its first TRU waste container by June 1986. On January 25, 1990, SRS began to segregate solvent rag waste from other TRU waste, generating non-mixed TRU waste streams for the first time. Following a review of TRU Waste Package Data forms for these containers, an AK tracking spreadsheet was created in Microsoft Excel software to capture relevant data. The spreadsheet was used as a tool to identify TRU waste containers generated at FB-Line during the period of interest that are most likely to be certifiable to the current WIPP Waste Acceptance Criteria (WAC). It was not used for quantitative determinations. While 6,178 containers were investigated, only approximately 5,670 were considered for possible inclusion in the waste streams under consideration as discussed in Section 5.2. The AK tracking spreadsheet may be used by the CCP to track containers suitable for inclusion in the waste streams described in this document.

The following information from TRU Waste Package Data forms and Burial Ground Records was reviewed to support the preparation of this document:

- FSN (File Sequence Number, a container-specific designation)
- Date generated
- Isotope1 (usually a designation for weapons-grade Pu, coded 50)
- ^{239}Pu ratio
- Total quantity (for all isotopes in grams)
- Quantity1 (quantity of ^{239}Pu)
- Waste weight
- WIPP U.S. Environmental Protection Agency (EPA) hazard codes (hazardous waste numbers)
- Other hazard codes (usually used for the state-imposed code for oil, 8888)
- Prohibited items (considered under the 1986-90 SRS TRU Waste Certification Program to include free liquid, pyrophorics, explosives, compressed gases, and particulates below a certain particle size)
- Content code
- Volume % organic
- Reason not certified (under the 1986-90 SRS TRU Waste Certification Program)
- Radiography (yes/no field)
- Reason for failure (applicable only if a prohibited item was located during radiography)
- Waste descriptions
- Comments
- <100 nanocuries per gram (nCi/g) (yes/no field)
- Activity concentration (nCi/g).

The procedure *CCP Acceptable Knowledge Documentation* (Reference 1) requires the completion of several forms that were used for tracking information during the AK collection effort. Attachment 2 of this procedure (Record of Communication) was used to document personnel interviews conducted to collect waste generation and management information. Attachment 3 of the procedure (Acceptable Knowledge Source Document Summary) was used to compile relevant information from source documents such that it is traceable to required AK elements. Attachment 4 was completed to provide a road map of AK information presented in this document to source documentation. Source Document Discrepancies (Attachment 13 of the procedure) were completed to summarize the approach for including information based on conflicting source documents. In addition, other attachments (5, 6, 7, and 14) were completed to summarize information presented herein.

4.0 Required Program Information

Attachment 1 of the procedure *CCP Acceptable Knowledge Documentation* (Reference 1) provides a list of TRU waste management program information required to be developed as AK. Most of the information provided in this section was derived from References D7 and D8.

4.1 Facility Location, Description, and Mission

4.1.1 Location

The SRS is located in South Carolina on approximately 310 square miles. It is bounded on the southwest by the Savannah River and occupies parts of Aiken, Barnwell, and Allendale counties. The FB-Line facility is located inside the 221-F Canyon Building in the 200-F Separations Area of the SRS. Maps denoting the location of the site, the 200-F Separations Area within the site boundary, the waste generating facility within F-Area, and the TRU waste storage areas (Reference D7) are included as Attachment 2.

4.1.2 Facility Description and Site Operations

The original facility was constructed in 1951-1953 and later upgraded during 1957-1958 (Reference D8). The 221-F Canyon Building, which houses the FB-Line facility, is a large reinforced concrete structure approximately 850 feet long, 122 feet wide, and 66 feet tall. The FB-Line is located in Sections One through Five and the third through sixth levels of the 221-F Canyon Building. Processing equipment in the facility is enclosed in either cabinets or gloveboxes to minimize the spread of radiological contamination. The enclosures are constructed of stainless steel with welded joints, although some older enclosures use gasketed joints. To further minimize the spread of contamination, the FB-Line is designed to provide an operating side and a maintenance side. Major pieces of equipment are located near the maintenance side of the process enclosure. In some cases, equipment is located inside of enclosures called "wing cabinets" which protrude into the maintenance room. Any breach of radiological containment for maintenance is conducted from the maintenance side of the line. When such a breach is necessary, a temporary enclosure (hut) is made of sheet plastic material to surround the cabinet or glovebox panel to be removed. The hut permits ingress/egress to the process enclosure while still confining radiological contamination. Airflow patterns are cascaded to direct flow from uncontaminated areas of the facility to those progressively more contaminated. For example, air moves from personnel corridors to operations areas to maintenance rooms to process enclosures (cabinets/gloveboxes), and finally through the facility's filtered exhaust system.

4.1.3 Process Equipment Description

Primary operating equipment within the FB-Line is designed and fabricated of corrosion-resistant material depending on the operation and corrosives being contacted. Most materials of construction are Type 304L stainless steel. Plastics, metals, and special alloys such as Hastelloy®C and Inconel® are used in locations where warranted by service conditions. A description of individual pieces of major process equipment is presented below.

Cation Exchange Vessels

The primary cation exchange equipment consists of 14 tanks, four exchange columns, and four filters. Each vessel is constructed of Type 304L stainless steel. The tanks range in capacity from 30 to 2,500 liters.

Cation Exchange Columns

The four cation exchange columns each consist of two cylindrical segments connected in series. Each segment is approximately ten inches in diameter with a resin bed five inches high. A neutron-absorbing shield is located between the two segments of each column and on top of each segment. The shield is fabricated of thin sheets of cadmium in a polyethylene envelope. Each segment is also shielded with two-inch-thick lead.

Precipitation and Filtration

Precipitation and filtration is accomplished using four precipitator systems. Each system is housed in a separate wet-chemical glovebox that contains a two-stage precipitator and a filtration run tank.

Precipitation Equipment: Each first-stage precipitator is cylindrical. Two of the precipitators are constructed of polyethylene and two of Kynar® (a polyvinylidene fluoride material). Each precipitator is held to specified dimensions by metal supports fabricated from Hastelloy® C. Inlet and outlet tubing is constructed of a plastic material called SYGEF®. Second-stage precipitators are slab designs fabricated from polyethylene and Kynar® materials (two each, respectively). The dimensional shape for these precipitators is also secured using Hastelloy® C support structures.

Filtration Equipment: Pu product solution is drawn by vacuum from the second-stage precipitator through a filter boat where the Pu product material is captured on filter media. Filter boats are cylindrical and fabricated from 304L stainless steel with a platinum liner. Filter media is made from Kynar® material. The filtration head and piping are constructed of either polyvinyl chloride or Kynar®

materials. Outlet tubing is Nylobraid® material. The filter station sump is fabricated using 304L stainless steel lined with Hypalon®.

Drying and Conversion (Roasting)

Drying Station: Pu product (in the form of filter cake) contained in a filter boat is transferred to one of four drying stations where warm, dry air is drawn through the cake. Each drying station is fabricated using Hastelloy® C material.

Conversion (Roasting) Station: After drying, Pu product is dumped from the filter boat into a roasting pan. Roasting pans are cylindrical, open-topped vessels constructed of Hastelloy® C. The roasting pan is then transferred to one of four roasting furnaces. Each furnace is heated by three 5,000-watt heaters.

Reduction and Finishing

In the reduction step, a roasted mixture of plutonium tetrafluoride and plutonium oxide is dumped from the roasting pan into a mixing container. The material is weighed, calcium metal is added, and materials are mixed in a mixer-dumper. The mixture is then dumped into a pressure chamber containing a magnesium oxide crucible nested in magnesium oxide sand. The crucible is covered with a stainless steel lid and the reduction vessel is sealed and placed in one of two reduction furnaces. After reduction and cooling, the regulus is dumped from the reduction vessel, marked for identification, pickled, drilled to obtain an analytical sample, weighed, and packaged for storage. All of these operations are conducted in gloveboxes that make up the Mechanical Line.

Dumping Stations: Three dumping stations are used in the Mechanical Line to dump intermediate powders from one container to another:

- "Boat Dumper" dumps from the filter boat to the roasting pan.
- "Pan Dumper" dumps from the roasting pan to the mix-and-weigh station.
- "Mixer-Dumper" mixes the reactants in the mix-and-weigh vessel.

The Boat Dumper and Pan Dumper are similar. The Mixer-Dumper is essentially the same as the other two except that it is equipped with a chain-drive system for rotating the equipment to mix the reactants in the reduction charge. Each dumper has a set of latches to engage the boat or pan and hold it to the frame. Additionally, each has a funnel with a drop valve assembly, a vibrator, and a hand wheel for rotating the dumper.

Weighing Station: A weighing station is located in the roasting pan dumping glovebox. The device uses a pressure-sensitive transducer sandwiched in the head of a hydraulic lift. The hydraulic lift raises the load cell to support the weighing vessel.

Reduction Vessel (Pressure Chamber): The pressure chamber is cylindrical and fabricated of Type 316 stainless steel. The chamber is sized to receive a magnesium oxide crucible. After placement in the chamber, the crucible is covered with a stainless steel lid fabricated with Type 304L stainless steel. The pressure chamber seals to the reduction furnace with a copper gasket. A stainless steel diaphragm is attached to the gasket to protect the furnace head during firing.

Reduction Furnace: Two reduction furnaces in the Mechanical Line heat the charge contained in the reduction vessel. The furnace heating units are water-cooled induction coils with power supplied by a common 30-kilowatt, 10-kilohertz motor generator set. Induction coils are fabricated from copper. The reduction vessel is placed inside an induction coil and is sealed against the furnace head by a hydraulic lift. The lift system is powered with high-pressure nitrogen. During the operation, the reduction vessel is pressurized with argon. The furnace head is constructed of Hastelloy® C.

4.1.4 Mission

Beginning in 1954, the FB-Line mission was to produce weapons-grade Pu used in the assembly of atomic weapons (References D5, D6, and D8). This mission meets all criteria as an atomic energy defense activity (i.e., defense nuclear materials production) as listed in Section 10101(3) of the Nuclear Waste Policy Act of 1982 (Reference 2). The facility had two functions: 1) to convert dilute Pu solution received from the 221-F Canyon Building into highly purified Pu metal; and 2) to recover weapons-grade Pu from scrap materials produced during FB-Line operation and from scrap material shipped to the SRS from other off-site facilities. Process operations were discontinued in January 1990 for routine maintenance and project upgrades.

4.2 TRU Waste Management

TRU waste generated between March 7, 1986, and January 25, 1990, was managed within the SRS TRU Waste Certification Program (Reference D12), which was in place until 1991. Under the program, waste generators were required to complete waste identification slips (Form OSR 7-38) and TRU Waste Package Data forms for each pail of waste packaged in accordance with operating procedures (References P1, P3, P11, P13, P14, and P15). Generators began to complete TRU Waste Package Data forms in March 1986 as part of the new SRS TRU Waste Certification Program. The SRS TRU Waste Certification Program

ensured that waste met the WIPP WAC (Reference D11) that was in place during the period of generation, as well as WIPP QA requirements defined in "Quality Assurance Requirements for Certification of TRU Waste for Shipment to the Waste Isolation Pilot Plant" (WIPP-DOE-120, Revs. 1 and 2) (Reference D13). The SRS TRU Waste Certification Program was implemented by SRS' certification plan, "Savannah River Certification Plan for Newly Generated, Contact-Handled Transuranic Waste" (DPSP 84-17-1, Revisions 3 and 4) (Reference D15). The waste under consideration is now retrievably stored, but was considered newly generated under the SRS TRU Waste Certification Program at the time of generation.

During the generation of this waste stream, TRU waste certification activities conducted under the SRS TRU Waste Certification Program were audited by the Albuquerque Operations Office WIPP Waste Acceptance Criteria Certification Committee in 1986, February 1988, and September 1989 (References D11 and D12). Each of these audits determined that the SRS TRU Waste Certification Program in place was "effective and well managed" (Reference D12) and that SRS was approved to certify TRU waste to WIPP requirements (References D11 and D12). In particular, the auditors found that the certification plan was "implemented in an excellent manner," "effective," and "well managed," and that findings from previous audits were adequately addressed.

Waste Acceptance Criteria

As previously described, the WAC applicable to WIPP waste during the 1986-1990 period were defined by the WIPP WAC Revisions 2 and 3 (Reference D14) and the QA requirements documents (Reference D13) published at the time. Table 4-1 summarizes Revision 3 of the WAC. Containers in storage have been vented in accordance with current WIPP WAC standards (Reference C18). Any further characterization efforts should consider that waste was managed according to WIPP WAC Revision 2 or 3 at the time of packaging. Revision 3 of the WIPP WAC did not contain standards for radionuclide composition, sealed containers, chemical compatibility, or polychlorinated biphenyl (PCB) compounds.

Table 4-1 1989 Waste Acceptance Criteria (WIPP WAC Revision 3)

Container Property	WAC Revision 3 Requirement
Payload Container Description	• Noncombustible U.S. Department of Transportation (DOT) Type A • Design life of 20 years • Overpack bulging or damaged containers • Separate criteria for remote-handled waste
Waste Package Size	Packages and assemblies shall not exceed 12 x 8 x 8.5 feet (length x width x height)
Waste Package Handling	All waste packages shall be provided with handling devices (cleats, skids, etc). Lifting devices, if present, shall be attached in a manner that does not inhibit stacking of packages.
Container Weight, Center of Gravity	Maximum payload container weight of 21,000 pounds. No center of gravity requirement.
Removable Surface Contamination	$\alpha \leq 50$ picocuries (pCi)/100 square centimeters (cm^2) $\beta/\gamma \leq 450$ pCi/100 cm^2
Container Identification/Labeling	• Label in one location • Meet DOT labeling requirements • Label must be legible for 10 years
Filter Vents	Requires an "appropriate method of pressure relief" – no filter required
Fissile Material Quantity	55-gallon drum ^{239}Pu fissile gram equivalents $\leq$ 200
TRU Alpha Activity Concentration	100 nCi/g lower limit
^{239}Pu Equivalent Activity	Plutonium equivalent curies (PE-Ci) $\leq$ 1,000 for payload containers
Radiation Dose Rate	• Dose rate $\leq$ 200 millirem per hour (mrem/hr) • Neutron dose rate > 20 mrem/hr to be reported. • No limit at 2 meters.
Immobilization	Waste with particulate below certain sizes is prohibited
Liquids	• No free liquids • Minor residues remaining in well-drained containers are acceptable
Pyrophoric Materials	Prohibited
Hazardous Waste	Corrosive materials shall be neutralized.
Explosives, Corrosives, and Compressed Gases	Explosives and compressed gases are prohibited. Corrosives must be neutralized.
Combustibility	No criterion for combustibility
Headspace Gas Volatile Organic Carbon Concentrations	No mixture of gases or vapors in any package that could Significantly reduce the effectiveness of the packaging

4.2.1 Types and Quantity of TRU Waste Generated

The following three TRU waste streams have been delineated from the initial population of 6,178 FB- Line waste 55-gallon drums investigated:

- SR-W027-221F-Het-A: ~5,666 (3,086 likely to be TRU)
- SR-W027-221F-Het-C-D: ~2 drums
- SR-W027-221F-Het-E: ~1 drum

The total number of containers estimated for the waste streams under consideration in this report is ~5,670 55-gallon drums. This number reflects the exclusion of ~500 containers with missing TRU Waste Package Data Forms or other problems, such as 101 drums that may contain prohibited items or be part of a different Summary Category Group physical form. SRS staff was notified of containers with suspected prohibited items. Other FB-Line-generated containers from the same time period should also be considered part of one of the waste streams described by this document, provided that they have physical, radiological, and chemical characteristics consistent with those described herein.

4.2.2 Correlation of Waste Streams Generated from the Same Building and Process

The waste streams discussed in this document are mixed counterparts of the waste stream SR-T001-221F-HET, for which SRS published an Acceptable Knowledge Summary Report in August 2000 (Reference 5), although the T001 stream was generated later (throughout the 1990s). The correlation between waste streams with regard to time of generation, waste processing, and site-specific facilities are delineated in the SRS chapter of the Transuranic Waste Baseline Inventory Report (TWBIR) (Reference D6). This delineation is based on a technical report titled "SRS Data Preparation For The 1995 TRU Waste Baseline Inventory Report, Mixed Waste Inventory Report, and Integrated Database" (Reference D3).

The waste stream number SR-T001-221F-HET was created from TWBIR Site Waste Stream Number SR-T001 and Building 221-F at SRS. The "HET" indicates that the final waste form consists of heterogeneous debris. Similarly, the waste stream numbers for the streams described in this document are "SR-W027" from the TWBIR, "221-F" for the generating facility, and "Het" for heterogeneous debris. The TWBIR waste stream number SR WO26-221F-HET was a mixed waste stream also generated at Building 221-F but not contaminated with F-listed solvents.

The streams under consideration herein were generated between March 7, 1986, and January 25, 1990. On the latter date, a program to segregate waste

containing F-listed solvents and cleaning agents such as trichloroethylene, methylene chloride, and carbon tetrachloride, was implemented. In short, the TWBIR waste stream SR-W027-221F-HET was generated before the solvent rag segregation program was implemented, whereas SR-T001-221F-HET and W026-221F-HET were generated afterwards and T001 is considered non-mixed. Waste generated at SRS before January 25, 1990, is thus managed under the Resource Conservation and Recovery Act (RCRA) as F-Listed solvent waste (Reference C5). The SRS decision to manage waste stream SR-W027-221F-HET under RCRA as F-Listed solvent waste was based on the rationale that containers holding solvent rags were not identifiable or separable from the remainder of the waste containers or stream.

The SRS internal waste stream designation W027 applies to waste generated at several different SRS facilities, including HB-Line, and is not unique to FB-Line. Stream SR-W027-221F-HET used in the TWBIR, however, has the unique 221F identifier for the 221-F Canyon Building in which FB-Line is located. Some of this waste was emplaced below grade (on Pads 2-6) prior to 1986, although most of it has since been unearthed and moved to covered storage for weather protection. Because SRS did not have a TRU Waste Certification Program prior to 1986 when this waste was generated, and generators did not indicate contaminants in waste, this W027 waste was conservatively managed with a much larger number of RCRA hazardous waste numbers than are applied for 1986-1990 waste.

Drums are correlated to FB-Line and the time of generation on the TRU Waste Package Data forms. Each form is numbered with a unique "Package ID No." (FSN number) that matches the container it describes. The FSN is also recorded on the AK tracking spreadsheet developed during the preparation of this document. In addition to the FSN number, the TRU Waste Package Data form lists the generating facility ("Bldg. Generated By") and "Date Drum Closed." The FSN is also listed on the burial record, which is attached to the TRU Waste Package Data form for most of the containers in the inventory.

4.3 Description of Waste Generating Process

The waste streams under consideration were generated in FB-Line in a process involving concentration and refinement of dilute Pu solutions to solid Pu buttons usable in weapons production.

Primary Processes

Pu isotopes were separated from uranium, fission products (primarily ^{137}Cs, ^{90}Sr, ^{95}Zr, ^{95}Nb, ^{103}Ru and ^{106}Ru) and chemical impurities (primarily Fe^{+3}, Al^{+3}, Na^{+}, SO_4^{-2} and sometimes F^{-}) in the 221-F Building processes. Purified Pu isotopes contained in a dilute nitric acid and hydroxylamine nitrate solution were transferred

to the FB-Line where it was processed to either Pu metal or plutonium oxide form. Underlying principles of FB-Line finishing processes are explained in terms of extractive metallurgy. The initial unit operations (i.e., concentration of plutonium nitrate by cation exchange, precipitation of Pu as a trifluoride, filtration, and washing) are best described as hydrometallurgical operations. The remaining unit operations (i.e., warm air drying, oxidation, and reduction with calcium metal to purified Pu metal form) are pyrometallurgical operations.

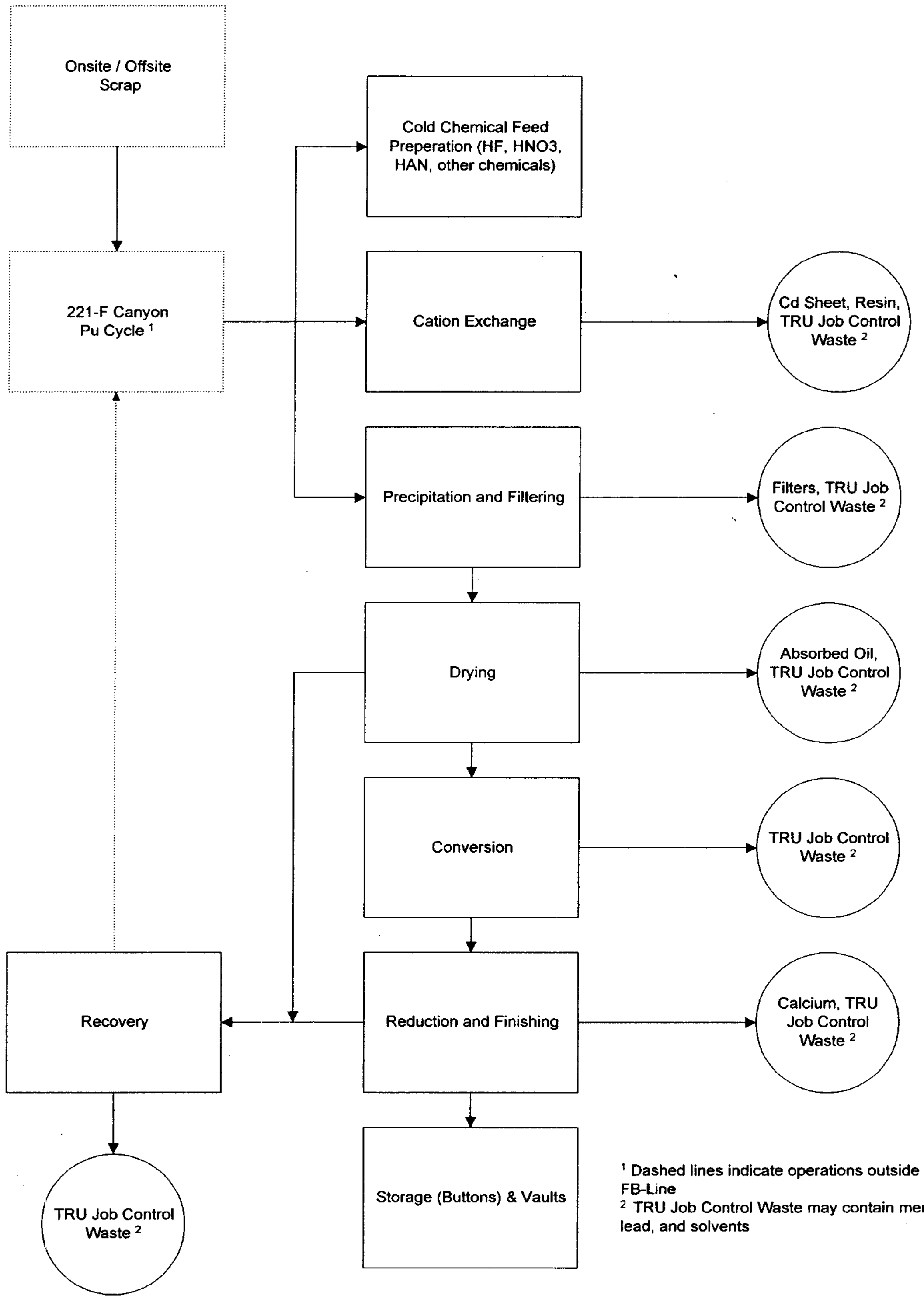
Figure 4-1 shows the general process flow diagram for FB-Line facility operations. The operations are divided into the process steps listed below. A detailed discussion for each step follows in the sections indicated below.

4.3.1 Cation Exchange

The purpose of cation exchange (coupling) is to concentrate Pu product solution (2BP) from the warm canyon second Pu solvent extraction cycle. Before receiving the solution, the FB-Line operator verifies that analytical results for the canyon Pu solution are within specified chemical and isotopic composition range and that the Pu concentration is less than an established value. Solutions containing greater than the established Pu concentration may be processed by special procedure.

Bulk chemicals used include the following: dilute plutonium-hydroxylamine nitrate solution (additional hydroxylamine nitrate may be used for additional reduction); n-paraffin hydrocarbon used for diluent washing; dilute sulfuric acid-hydroxylamine nitrate solution for additional purification to remove cationic impurities (+2 charge and lower); dilute nitric acid-hydroxylamine nitrate solution to displace residual sulfuric acid from columns; strong nitric/sulfamic acid solution to elute Pu from columns; and dilute nitric acid/hydroxylamine nitrate solution to recondition the cation exchange columns. The eluted Pu solution is transferred to a product hold tank C-7 for sampling and analysis. After analysis, the Pu is transferred to a concentrate feed tank for subsequent precipitation.

The resin may contain gases (NO_x) generated by nitric acid decomposition. These gases normally escape through the process vent system. Sometimes it is necessary to remove the gases by passing a refrigerated solution of dilute nitric acid and hydroxylamine nitrate down through the column.



[1] Dashed lines indicate operations outside of FB-Line
[2] TRU Job Control Waste may contain mercury, lead, and solvents

Figure 4-1 General FB-Line Process Flow Diagram

4.3.2 Precipitation and Filtering

Precipitation and filtration are the unit operations that bridge the gap between hydrometallurgical and pyrometallurgical operations. Precipitation and filtration produce plutonium trifluoride cake from the Pu solution eluted from the cation exchange columns.

Bulk chemical use includes the following: sulfamic and ascorbic acid solutions to reduce any tetravalent Pu; ascorbic acid to reduce Pu (and limit oxidation) in the precipitator feedstock if the precipitation stage does not immediately follow cation exchange; dilute hydrofluoric acid for precipitation of plutonium trifluoride; dilute hydrofluoric acid solution for removing excess nitrate; aluminum nitrate/nitric acid solution to dissolve plutonium trifluoride solids in filtrate and wash solutions and to clean precipitation equipment; and sodium hydroxide solution to neutralize waste solutions.

The precipitator filtrate and washes are sampled and analyzed for Pu in the liquid and solid form to determine the total Pu concentration. If the Pu content exceeds an established value, the filtrate is treated and transferred to recovery. If the Pu content is less than the established value, the filtrate and wash solution are neutralized and disposed as waste.

4.3.3 Drying and Conversion

The plutonium trifluoride filter cake from the precipitation stage is transferred to the Mechanical Line air drying station. Warm, dry air is drawn through the cake to remove residual moisture. Air drying of the cake ensures conversion without excessive hydrolysis during the subsequent roasting step. The dried cakes from two filtrations are then combined in a roasting pan and charged in a roasting furnace, where residual water and other volatile materials are removed and the plutonium trifluoride powder is oxidized to a mixture of plutonium tetrafluoride and plutonium oxide powder.

The atmosphere of the Mechanical Line is kept dry to prevent sorption of moisture into the cake and subsequent hydrolysis of calcium metal during the reduction step. The cake is exposed to the Mechanical Line atmosphere while being transferred to the reduction furnace.

4.3.4 Reduction

In this step, the plutonium tetrafluoride/plutonium oxide mixture is reduced to yield Pu metal, followed by the physical separation of the reduced metal from the residue. The prepared powder is mixed with metallic calcium and placed in a reduction vessel (stainless steel pressure chamber containing a magnesium

oxide crucible). The void space between the pressure chamber walls and the crucible is filled with magnesium oxide sand.

Heating the plutonium tetrafluoride/plutonium oxide/calcium metal mixture initiates exothermic reactions. The mixture separates into a more dense Pu liquid and a calcium fluoride/calcium oxide mixture that forms a "slag." The Pu metal product is physically separated from the slag and crucible (S&C) waste. Slag remaining after the reduction step is largely composed of calcium fluoride, calcium oxide, unreacted calcium metal, unreduced plutonium fluoride and oxide, and small Pu metal droplets. Because the molten Pu penetrates several millimeters into the wall of the magnesium oxide crucible, both slag and used crucibles are packaged, stored, and reprocessed in recovery. The pressure chamber and magnesium oxide sand are reused.

4.3.5 Plutonium Metal Finishing

The Pu metal product from the reduction step is pickled to remove any adhering slag and then rinsed in water to remove the acid. The nitric acid pickling step dissolves the slag. After water rinsing, the Pu metal is allowed to air dry and then sampled using a drill press. After sampling and weighing, the Pu metal is placed inside a tinned steel can that is subsequently crimp-sealed. The sealed can is marked for identification and removed from the glovebox in a polyethylene bag. The can is pushed to the sealed end of the bag that is attached to the glovebox. Then the bag is sealed with a portable bag sealer. Canned Pu metal product is placed inside a shipping container. The loaded shipping containers are stored in the vaults until needed. If the product purity and isotopic specifications are satisfied, the product is later shipped offsite for defense program use (i.e., fabrication into weapons shapes). Any product not meeting the specifications would be recovered.

4.3.6 Recovery

Recovery includes dissolution (e.g., of S&C waste, metal turnings, floor sweepings), filtration, anion exchange feed adjustment, and anion exchange processing (Figure 4-2 – Recovery Flow Diagram). Pu is purified and concentrated by anion exchange after dissolving and filtering FB-Line solid scrap materials. An early special recovery campaign was conducted at FB-Line prior to 1986. A second special recovery phase using hydrazine was planned for FB-Line but was never initiated.

The three processing steps (solid scrap dissolution, feed adjustment, and anion exchange) used in the Recovery process are discussed below. Recovered Pu solution is transferred to the 221-F Canyon Building for recycling.

[A] Solid Scrap Dissolution

Solid scrap consists of S&C waste, Mechanical Line cabinet/glovebox floor sweepings, and metal turnings (from analytical samples).

Slag and Crucible

Aluminum nitrate nonahydrate and nitric acid are used with heat to dissolve S&C and other solids (see Figure 4-2). The solution is then digested and passed through primary filters. The filters are cleaned by back-flushing with hot caustic sodium hydroxide.

Mechanical Line Cabinet / Glovebox Floor Sweepings

Pu powders are handled inside the Mechanical Line in preparation for reduction with calcium. In the process of handling these powders, some are spilled onto process equipment and the floor of the glovebox. These powders (plutonium fluoride and oxide compounds) are collected using a brush and scoop or hand-held vacuum cleaner, screened, and placed into a standard S&C stainless steel container. S&C containers (maximum of four) are removed from the glovebox and stored in five-gallon pails.

Metal Turnings from Pu Metal Product Sampling

Analytical samples consist of drill turnings removed from finished Pu metal product. Sample material not consumed in the analyses is collected and returned to the FB-Line for recovery. Returned sample material is partially oxidized to plutonium oxide. Returned sample material is similar to S&C residue (i.e., unreduced plutonium oxide and uncoalesced Pu metal shot). For this reason, unused sample material is dissolved along with S&C material.

[B] Solution Recycle

Solutions are generated in various FB-Line unit operations that contain Pu concentrations in excess of discard limits. These solutions are transferred to the recovery process and adjusted as necessary to prepare them as feed to the anion exchange columns.

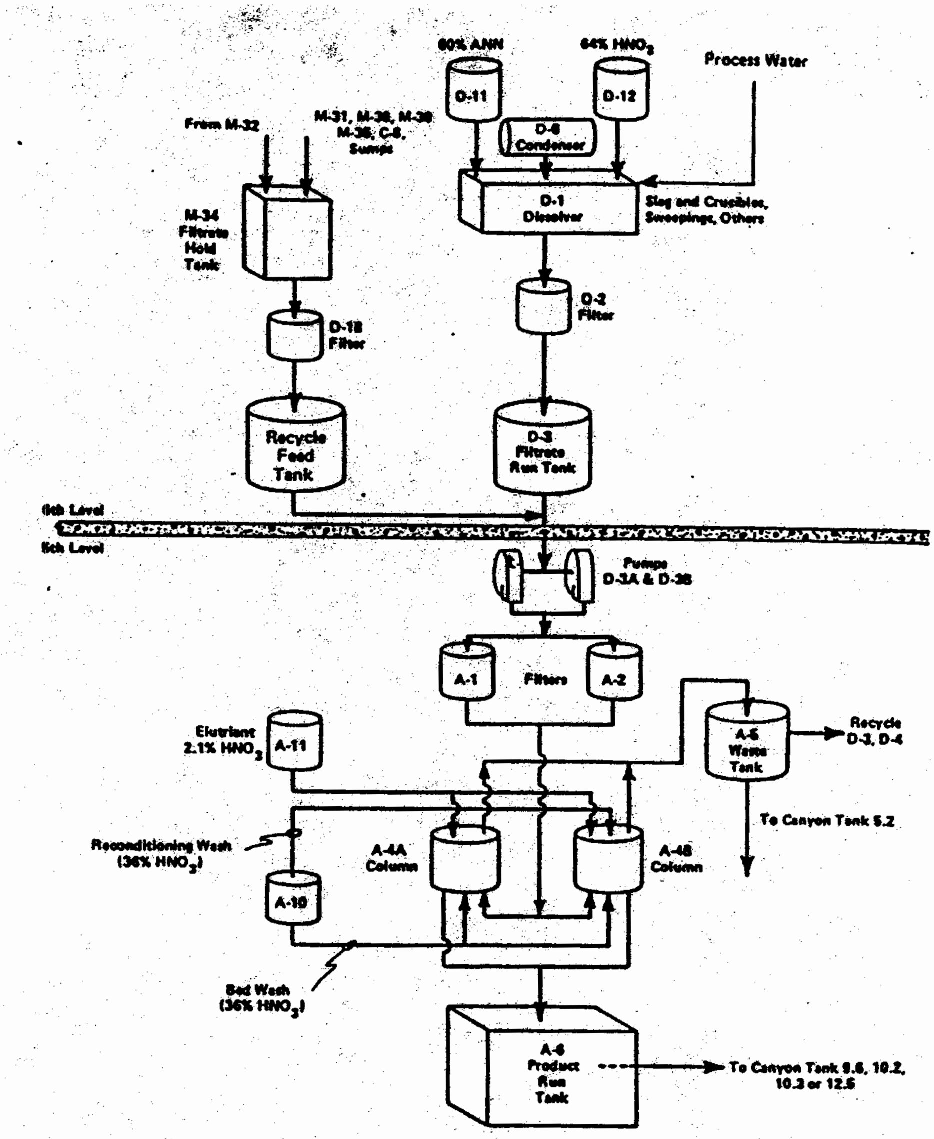


Figure 4-2 Recovery Flow Diagram

Boat Flush Solution

After air drying, the contents of filter boats are dumped into roasting pans. Residual plutonium trifluoride is removed by dissolution with a flush of aluminum nitrate and nitric acid. Following the flush, boats are thoroughly rinsed with hydrofluoric acid to prevent possible contamination of future product with aluminum. Both solutions are returned to the recovery process for recycle.

Precipitator Flush Solution

Precipitators are flushed on a routine basis with a mixture of aluminum nitrate and nitric acid to remove plated plutonium trifluoride deposits. This flush is followed by nitric acid and water rinses. Used precipitator flush solutions are routed to the anion column feed adjustment tank.

Sump Solutions

Sumps are provided under each process tank to catch and contain any overflow solution leaking from the tank or process lines. When solution is found in sumps, it is sampled for the presence of solids and analyzed for Pu content, pH, and other chemical constituents. Depending upon sample analysis results, the solution is routed to either waste or anion feed adjustment tanks. If solids are present, they are either dissolved or removed and stored until a procedure is developed for dissolution.

Process Vessel Vent System Solution

All process vessels are vented through a system designed to prevent carryover of entrained liquids. Scrub tanks are periodically drained and the solutions sampled and routed to waste collection as appropriate based on sample results.

Plutonium Metal Pickling and Rinse Water Solution

After being separated from S&C residues, Pu metal is pickled in nitric acid to remove any slag. Following pickling, the metal is rinsed with water to remove residual acid.

Recycle Solutions

Solutions containing recoverable Pu are generated during both laboratory quality control and research and development activities. Solutions are handled on an individual basis depending on their constituents. In general, solutions that do not contain any of the halogens (chlorine, bromine, or

iodine) can be dissolved during an S&C dissolution cycle. Solutions containing halogens other than fluoride must have the halogen removed prior to processing in the recovery process.

[C] Solution Collection

In general, all liquid solutions generated within FB-Line that require anion exchange processing are sampled, analyzed, and transferred to the recovery process. The solutions are adjusted as necessary to prepare them as feed for anion exchange purification and recovery. S&C dissolution solutions are also processed through anion exchange.

<u>Feed Adjustment for Anion Exchange Processing</u>

Filtrate solutions may be chemically adjusted by adding ferrous sulfamate to reduce any hexavalent or tetravalent Pu. This adjustment would be followed by the addition of sodium nitrite to reoxidize all of the Pu as needed for anion exchange, without the addition of ferrous sulfamate. Normal operation does not require this adjustment step. The solution is filtered and then transferred to the ion exchange columns.

<u>Operation of the Anion Exchange System</u>

Anion exchange is a separation process used to separate desirable from undesirable anions. In the FB-Line, the desirable anion is hexanitratoplutonium nitrate complex ion; the undesirable anions are the numerous metallic anion and cation impurities. In the recovery process, dissolver solution is fed to the anion exchange columns cycle. After any solution adjustment (as described above), a Pu solution batch is pumped through filters to the anion exchange columns, where the plutonium nitrate anion complex is absorbed on the resin. Column effluent is sampled and analyzed to determine whether the Pu concentration is within discard limits; if so, the effluent is managed as waste. For additional purification, remaining impurities are washed from the column using a wash solution of nitric acid. This solution is also managed as waste.

Pu is eluted from the column by a downward flow of weak nitric acid followed by a strong nitric acid reconditioning wash.

Spent resin to be discarded is treated to convert any remaining nitrate to sulfate form. The conversion is accomplished by treating the used resin with sodium sulfate solution so that the nitrate ion is replaced by the sulfate ion. Following the sulfate wash, the resin is washed with water to remove residual sulfate and packaged as waste. Resin that is not mixed with other job control waste is not part of this waste stream.

4.3.7 Maintenance/Housekeeping Activities

Maintenance activities conducted on FB-Line included the following (Reference C7):

- Lead-lined glove replacements (periodically and as needed)
- Repair of leaks on a weekly or more frequent basis
- Filter changeouts (including changing plastic frits on precipitation filters) (Reference P3)
- Changing panels on cabinets and huts
- Equipment repair (valve replacement, etc.)
- Inspection and cleaning of exhaust ducts to remove any Pu accumulation (during January 1990 shutdown)

Routine housekeeping activities conducted by operators included the following:

- Sump clean out (Reference P7)
- Floor sweeping, including separation of Pu and calcium residues (Reference P8)
- Calcium disposal (Reference P9)
- Absorption of liquids
- Construction, breakdown, and disposal of huts adjacent to cabinets (Reference P10)
- Bagging trash out of gloveboxes and cabinets (Reference P5).

All of these activities generated TRU and/or low-level waste during the late 1980s. Some examples of waste-generating maintenance and housekeeping activities are provided below.

<u>Hydraulic Sump Cleanup</u>

Mechanical Line sumps located outside of process cabinets were periodically cleaned out. These clean out activities typically generated over 20 red pails of waste. Operators placed plastic and absorbent paper in front of the sumps and pumped any collected liquid oil into one-gallon containers filled to 66% capacity with oil dry or other absorbent materials. Containers with predominantly absorbed liquid contents are excluded from the AK tracking spreadsheet (Reference M5). Bottles were agitated until all oil was absorbed. Procedures governing this activity noted that "No free liquid can be sent to the burial ground" (Reference P7). When all of the liquid oil was removed, the sump was wiped

clean. Operators then placed strips of clean paper over the sump, reinstalled the panels, and restarted the pump to check for leaks that would drip onto the paper. When all leaks were repaired, the paper, absorbed oil, panels, and other waste was collected and removed. Wet cabinet sumps were cleaned in a similar manner.

Floor Sweeping Cleanup

In the Mechanical Line, powder spilled in dry cabinets was collected by sweeping. In addition to sieving sweepings to remove trash, trash was inspected to remove Pu-bearing material. Sweepings exposed to liquid were handled separately. Both trash and collected material were also inspected for calcium, which was placed in a separate "calcium waste container" if located. Up to 1,000 grams of sweepings could be bagged out of the line as waste in an S&C can. Calcium waste (oxidized or loose) was segregated from other trash, placed in a one-gallon metal pail, and covered with Elite or sand.

4.4 Waste Identification and Characterization

As described in Section 4.2, management of TRU waste from the FB-Line facility was/is achieved as directed by procedures (References P1 – P15) designed to ensure accurate characterization and identification of the waste at the point of generation. The procedures used during generation of this stream direct facility personnel to ensure storage in accordance with the SRS Solid Waste Division WAC and WIPP WAC (Reference D14) in effect at the time of waste packaging. Waste was examined for physical content against criteria listed in the procedures (References P1, P3, P11, P13, P14, and P15) to determine and assign the appropriate site-specific content code (001-Job Control [Section 5.4], 002-Sludge, 003- Resin, 004-Filters, etc.). Certifiable waste was restricted to job control waste (site-specific content code 001) with no prohibited items (References P1 and P11). Procedures also contained directions for generator site and waste management personnel to complete TRU Waste Package Data forms (Form OSR 7-872) and Radioactive Solid Waste Burial Ground Records (Form OSR 7-375A), on which volume, isotopic quantity, container weight, waste description, and hazardous constituent information was entered (References P1 and P11). Procedures provided a definition of what was certifiable and examples of job control waste, organic materials, and inorganic materials (Reference P11). All "certifiable" drums were required to be labeled, X-rayed, and assayed. Waste was required to be visually inspected for special nuclear material, and job control waste and certifiable waste were to be segregated from other waste forms. Facility personnel also determined whether waste was hazardous under RCRA. Personnel responsible for identification and packaging of waste were RCRA trained. Using procedures and knowledge from the training, the waste category and applicable hazardous/nonhazardous determinations were recorded by FB-Line personnel on a waste identification slip for each waste pail or drum

generated. The waste slip was an internal worksheet that captured information necessary for completion of the two forms described above. These forms were completed at the time the waste was placed in a drum liner or pail. Each form, which contains a statement attesting to the accuracy of the information, accompanied waste containers (drums) when they were transported from the FB-Line to the Solid Waste Division storage facility.

Waste drums were labeled (paint stenciled) to reflect whether they were WIPP certifiable (i.e., 001-Job Control waste containing no sludge, resin or filters) and whether they contained hazardous constituents. This labeling provided a visual indicator to aid personnel moving and storing the drums. Each drum is traceable to its respective generating facility and characterization via the unique FSN that appears on each of the OSR forms and on each waste drum and inner liner. Each drum and liner is identified with its FSN using a die-stamped stainless steel tag attached with wire.

4.5 Waste Certification Procedures

Over the period of waste generation described in Section 5.2, FB-Line personnel used procedures (listed below) to package, identify, and document TRU waste generated from the FB-Line. Through adherence to the procedures, personnel ensured that waste contents were documented and that the container was labeled appropriately. Waste containers were identified as "certifiable" or "non-certifiable" in accordance with previous versions of WIPP WAC (i.e., Revisions 2 and 3). At the SRS, the designation of "certifiable" denoted that the waste/container was "job control waste" that contained no WIPP prohibited items/materials and that the waste was suitable for later certification and shipment to the WIPP. The procedures provided personnel with specific information and instructions concerning hazardous materials that might be encountered, WIPP prohibited items/materials, and acceptable methods for absorption of liquids and neutralization of acids and bases. Each TRU Waste Package Data form (OSR 7-872) (Reference P11) contains a statement signed by the generator that the waste is "certifiable" or "non-certifiable" in accordance with the WIPP WAC in place at the time. FB-Line personnel used the following procedures to manage TRU waste generated in the facility. Every effort has been made to locate revisions of these procedures that were current during the time period of waste generation.

- *Packaging General and Cabinet Waste Into Red Pails* (References P1 and P13)
- *Packaging and Handling HEPA Filter Waste (Reference P3)*
- *Transporting, Assaying, and Storing Red-Pail Waste (Reference P6)*
- *Drumming Red Waste Pails and Shipment to the Burial Ground (Reference P15)*

- *Packaging TRU (Process Cabinet) Waste Into A TRU Drum Liner (Reference P14)*
- *Packaging TRU Waste (Excluding Process Cabinet Waste) Into A TRU Drum Liner (Reference P11)*
- *Waste Tracking Procedure (Reference P2).*

5.0 Required Waste Stream Information

The three waste streams delineated in this document are summarized in Chapter 2.0. Although different in chemical contaminants, all were generated in the same time period by the same process in the same building.

5.1 Area and Building of Generation

All waste from the three streams described in this document were generated by the FB-Line facility located inside the 221-F Canyon Building shown in Attachment 2. FB-Line occupies several floors of Building 221-F. Waste was generated from areas inside process cabinets or gloveboxes, huts erected around glovebox entry ports, or areas contaminated with radioactive material adjacent to the process cabinets/gloveboxes (such as rooms).

5.2 Waste Stream Volume and Period of Generation

As previously discussed, approximately 5,670 drums were considered for inclusion in the three waste streams described in this document. The volume of each stream is listed in Section 4.2.1. Approximately 3,000 of the drums investigated may be excluded at assay and radiography confirmation activities as (1) low-level waste, (2) containing prohibited items, or (3) belonging to a different Summary Category Group (physical form). Exclusion of some containers as low-level waste is expected because SRS managed all containers with activity concentrations greater than 10 nCi/g as TRU (References P3 and P11) and because other records indicate activity concentrations below 100 nCi/g for some containers. The waste streams comprise waste generated between March 1986 and January 1990 (References C14 and M2), when the SRS TRU Waste Certification Program was being developed and the above-grade covering of TRU waste containers with earth ceased (Reference D11). The AK tracking spreadsheet developed for this effort (Reference M5) lists the 3,086 containers found during this investigation that were most likely to be certifiable to current WIPP WAC standards.

5.3 Waste Generating Activities

The process by which the waste streams under consideration were generated is described in detail in Section 4.3 with detailed process flow diagrams. Much of the work performed in FB-Line took place within areas contaminated with radioactive material. Waste materials and items contained in this stream result from various activities that took place in these areas. Routine operational activities (housekeeping/cleaning, process equipment adjustments, radiological surveys, etc.) and preventive and corrective maintenance were the major waste producers. Other contributing activities included facility modifications, decontamination, sump clean out, absorption of liquids, glove replacement on

process cabinets and gloveboxes, various mechanical and electrical repairs, maintenance, and changeouts of process equipment, piping, cabinet panels, and other equipment.

5.4 Type of Waste Generated

Waste contained in drums from the waste streams under consideration is a heterogeneous, hazardous combination of mostly dry organic debris by volume, with the balance being mainly comprised of inorganic debris. At the SRS, this is known as "Job Control Waste" (site-specific content code 001). Job control waste could contain any item/material that was discarded because it was no longer useable or needed, and

- Was not identified as sludge, resin, or filters (content codes 002, 003, and 004, respectively), and
- Met SRS and WIPP WAC (Revision 2 or 3).

Filters have been included in the waste under consideration because they are consistent with the physical form of job control waste, unlike sledges and resins.

Examples of materials observed in FB-Line low-level waste containers by radiography performed for the Container Evaluation and Examination Program (CEEP) include the following:

Table 5-1 Example Waste Materials

Plastic Bags	Plastic Suit (PPE)	Breathing Air Hose	Metal Cans
Absorbent	Scissors	Pipe	Flashlight
Flashlight Battery(s)	Sheet Metal	Aerosol Cans	Paint Can
Pipe Flange	Electric Drill	Electric Grinder	Electrical Wire
Cloth Coveralls (PPE)	Scaffold Hardware	Nuts, Bolts & Washers	Saw Blade
Plastic Sheeting	Wrench	Rolls of Tape	Light Bulb
Hammer	Plastic Bottles	Ladder (cut up)	Tape Measure
Safety Harness (PPE)	Metal Bucket	Wood/Nails	Wire Mesh
Hack Saw	Respirator (PPE)	Plastic Tubing	Drill Bits

5.4.1 Material Inputs Related to Physical Form

The following descriptions, which are included in the FB-Line procedure "Packaging TRU Waste (Excluding Process Cabinet Waste) Into A TRU Drum Liner" (Reference P11), are related to waste that was shipped to the solid waste storage facility as "certifiable" TRU job-control waste. Several other procedures have similar descriptions (References P1, P2, P13, P14, and P15).

Because some of the materials shown are considered hazardous under RCRA, they were managed as mixed TRU waste.

"Job control (001) – paper, wipes, cloth rags, uniforms, cartons, gloves, miscellaneous wood, plastic film, sheeting, bottles, drum liners, windows, labware, sponges, miscellaneous rubber, Plexiglas, leather, firebrick, glassware, ceramic, small tools, miscellaneous metal cans, miscellaneous metal hardware, crucibles, pipe, tubing and fittings, instruments, motors, scales, hot plates, shipping containers, carver press" (Reference P11).

Procedures also directed generators to provide "volume percent organic" information. To assist generators in making this determination, the following descriptions were provided:

"Organic – PVC [polyvinyl chloride] bags, poly bags, carboy bottles, Elite, BH-38 cleaner, bleach, plastic shoecovers, paper, wipes, cloth rags, uniforms, dry box gloves, surgeons gloves, plastic suit gloves, fresh air hoods, plastic suits, breathing air hose, Isoclean, welders jacket, mop heads, spray paint, craft paper, plastic tape, masking tape, nylon-filled tape, electric tape, cartons, miscellaneous wood, plastic film, drum liners, sponges, miscellaneous rubber, hut plastic, tape, Plexiglas, and oil (Reference P11).

Inorganic – tools, miscellaneous metal cans, metal hardware, pipe, metal tubing and fittings, instruments, motors, scales, hot plates, shipping containers, agitators, valves and valve handles, button cans, oxide cans, spray cans, glass, ceramic, metal and glass beakers, S&C cans, lead aprons and bricks, cadmium sheet, mercury thermometers, offplant oxide containers, agitator motors" (Reference P11).

Finally, procedures addressed prohibited items in the following definition:

"Certifiable – [Reference P1] TRU job control waste that does not contain the following: free liquid; explosives, compressed gases, or aerosol cans; > 1 wt % [weight percent] particles less than 10 mm in size; > 15 wt% particles < 200 mm [micrometers] in size; pyrophoric materials; or hazardous waste that is not radiologically contaminated."

The physical form of waste certified in the late 1980s was further investigated during data calls for the WIPP Performance Assessment, the TWBIR (Reference D6), RCRA Part B permit applications (Reference D1), and other documents describing the waste (References D2 and D10). One such effort (Reference C11) conducted in 1988 resulted in the following estimate of the average mass distribution by drum/box of waste forms in the waste: 19.4 kg (30.1%) combustible, 17kg (26.4%) metals, 10 kg (15.5%) glass, 7 kg (10.9%) filters, 5 kg (7.8%) graphite, 4 kg (6.2%) inorganic solids (such as ash, concrete,

lead, and slag), 2 kg (1.9%) organic waste (such as oils and solvents), and 1 kg (1.2%) resins. Note that the figures in parenthesis are in weight percent, rather than volume percent. The TWBIR (Reference D6) describes the W027 waste as Heterogeneous Debris (S5400 Waste Matrix Code), but the TWBIR W027 stream includes waste generated prior to 1986 that is not well characterized as to physical form and chemical constituents.

Waste descriptions and volume percent organic information entered on the TRU Waste Package Data form for each container also provide some information about the physical form of the waste (Reference M2). Table 5-2 summarizes the percent of containers in the AK tracking spreadsheet (Reference M5) that have the material listed in their waste description. Numerous other items are also listed, including soda ash and other absorbents, valves, carts, ladders, pipes, tubing, shielding (leaded and plastic), wire, nuts, and bolts. Volume percent organic estimates provided by generators vary from 0% to 100% for the containers under consideration, but generators did not estimate volume % organics for the different materials listed in their descriptions.

Table 5-2 Physical Form Information from TRU Waste Package Data Forms

Waste Form	% of Containers	Waste Form	% of Containers
Plastics	85.6	Tools	21.4
Tape	54.9	Cans	8.2
Gloves	54.8	Sump crud	4.9
Wipes	35.8	Elite (absorbent)	6.4
Paper	21.2	Motors	0.2

[A] Waste Matrix Code

The Waste Matrix Code assignment for this stream is based on sources (including those described above) that provide information about the physical form of the waste, such as waste packaging procedures, documents describing waste-generating activities, audit reports, and the TRU Waste Package Data forms completed by generators. The WIPP WAP defines a waste stream as "waste material generated from a single process or from an activity that is similar in material, physical form, and hazardous constituents" (Reference 3). Generators are to delineate waste streams based on AK. Section B-1b of the WIPP WAP states "Once a waste stream has been delineated, generator/storage sites will assign a Waste Matrix Code to the waste stream based on the physical form of the waste." Therefore, AK regarding the physical form of the FB-Line heterogeneous waste under consideration has been used to determine appropriate Waste Matrix Codes that describe the waste population. Note that the waste stream delineation is also affected by chemical content. For instance,

containers for which generators recorded D008 on TRU Waste Package Data forms for lead are delineated into separate waste streams.

FB-Line waste was not segregated beyond the waste categories of job control waste, sludge, resin, and filters. In particular, job control waste was not segregated for organic or inorganic constituents (References P1, P11, P14, and P15). The waste meets the definition for the Summary Category Group S5000 as defined in DOE/LLW-217, DOE Waste Treatability Group Guidance (Reference 6). The physical form of the waste is well defined by physical descriptions provided on the TRU Waste Package Data forms, but the volume percent of organic material in the waste stream on a container basis is highly variable and may range from 0% to 100% (References M5 and M2). However, physical descriptions provided by generators are reliable for determining whether inorganic material was packaged in a particular container. These descriptions provide information about the presence of different constituents in the containers, but not about their absolute or relative quantities. Some packaging logs that do provide such information were attached to source documents (Reference M2), but only for a small percentage of the containers under consideration.

Based on the information presented above, the waste stream is assigned Waste Matrix Code 5440, "Predominantly Organic Debris." This Waste Matrix Code is defined as follows:

> This specific-detailed category includes waste streams that are estimated to contain a greater amount of organic debris materials than any other type of material. The balance of the matrix may be inorganic debris materials (i.e., metal, inorganic nonmetal), soil, or homogeneous solids.

[B] Waste Material Parameters

Waste material parameters include iron-based metals, aluminum-based metals, other metals, other inorganic materials, cellulosics, rubber, plastics, organic matrix, steel (packaging), and plastics (packaging). The presence or absence of these parameters may be estimated on a container basis using the volume percent organic information and container descriptions provided on the TRU Waste Package Data forms. However, the available descriptions do not allow differentiation among iron-based, aluminum-based, or other metals. The presence or absence of other waste material parameters may also be verified by information from TRU Waste Package Data forms, but not their estimated weights.

5.4.2 Radiological Characterization

Radiological quantities were entered on burial slips attached to TRU Waste Package Data forms for each container (Reference P11). Generators assayed each red pail (References P1 and P6) to determine the total grams of Pu and recorded the information on Red Pail Waste Identification Records, as well as waste identification slips (OSR 7-38). Drums into which waste was directly packaged were also assayed by the generator (Reference P11). The generator used this information to complete the Burial Ground Record after packaging waste (References D9, P6, and P11). Some problems with these assay results were noted in 1989 and 1992 (Reference D17), resulting in the re-assay of some containers and update of the COBRA database in which container-specific data was compiled in the early 1990s. Generators were directed by procedures to enter "50" in the "Isotope1" field on the Burial Ground Record (OSR 7-375) (References P11, P13, and C10) to indicate weapons-grade Pu material. Generators often entered "0" in the "Total Quantity" and "Quantity1" fields if the total quantity was known or suspected to be below the accountability threshold. Hut waste and other waste from outside of the cabinets was often labeled on the Burial Ground Records as "0 g" for Pu quantity. Inventory adjustments would have been submitted for accountability tracking purposes, but may not have been submitted to Waste Management (Reference C10). Waste Management also assayed drums by passive-active neutron assay upon receipt to determine the TRU activity concentration (nCi/g).

In June 1996, a change in the radioisotopic composition of the material processed in FB-Line occurred (Reference C9). The "old" distribution shown in Table 5-3 is applicable to the 1986-1990 TRU waste streams and is consistent with the specification for weapons-grade Pu acceptable at Rocky Flats (Reference C8) and operation basis documents (Reference D21). This specification requires that the Pu-240 content of each Pu button must be between 5.00 and 6.50 weight percent and the average Pu-241 content for each shipment "shall not exceed 1.00 weight percent" (Reference C8). Americium-241 is also present in the waste as a result of in-growth from the beta decay of ^{241}Pu. At the time of generation, Pu isotopes contributed greater than 99.99% of the radioactivity in the waste stream.

Generators interviewed recalled processing only weapons-grade Pu during the 1986-1990 time period, particularly because new Special Recovery operations were shut down at this time (Reference C7). However, accountability information suggests that some material from other U.S. Department of Energy sites was processed at FB-Line during the time period in which the waste under consideration was generated (Reference C19 and C20). Table 5-4 summarizes material that was processed in FB-Line and may also be present in the waste. The material received from Rocky Flats appears to be consistent with the weapons grade material routinely processed through FB-Line.

However, the material from Hanford appears to be relatively depleted with respect to Pu-239. It is thought that this is related to a longer burn time in the Hanford reactor, which was also used for power production (Reference C20). Intermediate burnup fuels such as this may have ^{239}Pu isotopic composition as low as 82.5% (Reference D20). This lower Pu-239 material was co-mingled with weapons-grade-contaminated waste and is present throughout the population of waste under consideration. ^{238}Pu concentrations were not provided for this material, but are expected to be < 2% based on the available composition data.

Table 5-3 General 221FB-Line Plutonium Isotopic Distribution

Isotope	Isotopic Range (References C8, C21, D20, and D22) (wt%)
^{238}Pu	0- 0.21
^{239}Pu	93.05-95.00
^{240}Pu	5.70-5.96 (weighted average)
^{241}Pu	0-0.75 (weighted average)
^{242}Pu	0-0.10
^{233}U	Trace
^{234}U	Trace
^{238}U	0-0.01
^{90}Sr	0-6.3 x 10^{-4}
^{137}Cs	0-1.3 x 10^{-3}
^{241}Am	0-0.11 (weighted average)

Table 5-4 Isotopic Distribution for Offsite Material Processed at FB-Line

Date	Site/Transfer #	^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu
8/85-8/89	Rockwell Intl (Rocky Flats)/ARF243	NR	5.34-6.12	NR	NR
9/89-11/89	Rockwell Intl (Rocky Flats)/ARF243	NR	5.7-6.24	NR	NR
3/86-5/86	Hanford HRA37	84.13-85.93	11.92-13.41	1.67-2.00	NR
10/87-12/87	Hanford HRA41	85.69-88.91	10.01-12.85	0.79-1.72	0.2
3/88-7/88	Hanford HUD1	87.24-88.05	10.31-11.11	1.37-1.38	0.2
10/88-2/89	Hanford HUD3	86.19-86.20	11.98-12.08	1.41-1.52	0.2

NR = Not Reported

For the preparation of this document, the ratio of ^{239}Pu ("Quantity1" on the Burial Ground Record) to total Pu ("Total Quantity") was calculated on the AK tracking spreadsheet based on the assay data provided by generators on Burial Ground Records (References M2 and M5). A survey of the 3,087 containers included on the AK tracking spreadsheet revealed the following breakdown of ^{239}Pu ratios for drums with nonzero entries:

- 0.860 $\leq$ ^{239}Pu ratio < 0.900 – 174 drums
- 0.910 $\leq$ ^{239}Pu ratio < 0.9401 – 870 drums
- 0.9401 $\leq$ ^{239}Pu ratio < 1 – 106 drums.

The containers for which the ^{239}Pu ratio is between 0.86 and 0.90 are consistent with the isotopic distributions of offsite waste processed through FB-Line, rather than the normal weapons-grade material. Note that the remainder of the 3,086 containers have assay results of "0" (e.g., may be "non-cabinet" waste or were not thought to hold accountable quantities of material) and thus, were not included in the calculation of the ^{239}Pu ratio. Considering the information described previously and measurement uncertainties in reported values, the range of the major radiological constituents anticipated for the subject waste is as follows: ^{238}Pu (0-0.2); ^{239}Pu (80-96); ^{240}Pu (4-18); ^{241}Pu (0-2.0); and ^{242}Pu (0-0.2).

5.4.3 Chemical Content Identification

Chemicals used in the FB-Line Pu-processing cabinets included hydrofluoric acid, nitric and sulfuric acids, hydroxylamine nitrate, calcium, sodium hydroxide, sulfamic acid, ascorbic acid, aluminum nitrate, and di- and tri-butyl phosphates. Most of these chemicals were either piped in or brought into FB-Line in bulk amounts. Because spent chemicals were neutralized and/or absorbed, waste associated with these chemicals is not considered corrosive (D002) or ignitable (D001) for oxidizers under RCRA. Hydrazine is not known to have been used in FB-Line during the 1986-1990 time period of waste generation (Reference C7). It was planned for use in a special recovery campaign that never occurred (Reference C6) and was also used prior to 1985 (Reference C7).

Procedures and correspondence suggest that other chemicals were used in FB-Line in small amounts. Procedures covering the entire time period of generation could not be located in all cases, but available procedures (listed below) from the 1987-1989 time period provide guidance for generators to determine whether certain hazardous materials might be present in their waste. Oil was considered hazardous under state regulations during this time period, and the state-specific hazardous waste code 8888 was procedurally applied as directed to waste containing absorbed oil on TRU Waste Package Data forms (Reference M2). In addition, the following materials were listed in waste

packaging and management procedures during the late 1980s with codes that should be applied if they were known to be present in the waste:

- Isopropanol (D001) (References C1, P11, P14, and P15)
- Cadmium (D006) (References C1, D11, P1, P2, P11, P14, and P15)
- Lead (D008) (References C1, D11, P1, P2, P11, P14, and P15)
- Freon (F001) (References C1, P11, P14, and P15)
- Calcium (D003, D001) (References D11, P1, P9, P11, P14, and P15)
- Mercury (D009) (References P1, P2, P11, P14, and P15)
- 1,1,1-Trichloroethane (F002) (Reference P1) (Note: Procedure actually lists 1,1,1- trichloroethylene, which does not exist.)
- Acetone (F003) (Reference P5)
- Polyvinyl chloride (PVC) solvents (see MSDSs – F003, F005) (Reference P5).

In 1990, the procurement and use of chemicals containing hazardous constituents began to be administratively controlled by procedure. Under the procedure "Controlled Procurement and Handling of Chemical and Blue Dot Products" (Reference P4), blue circular labels were affixed to chemical containers that, if disposed in an untreated or partially-filled condition, might constitute hazardous or mixed (if radiologically contaminated) waste. This procedure was not approved until 1990, but it contained a list of all chemicals approved for use in the FB-Line that were likely to have been used during the period of waste generation. MSDSs in SRS' Shrine database were reviewed to determine what hazardous chemicals were present in the chemicals approved for FB-Line (Reference M1). This information may underestimate the presence or amount of hazardous constituents because most of the MSDSs were published in the early 1990s. As a result of increasing awareness of hazardous chemicals during this time period, these MSDSs may not reflect potentially more hazardous product compositions in the late 1980s. Also, some chemicals listed as potential hazardous waste in procedures were not identified in the later "blue dot" procedure (Reference P4). However, the following F-listed and D-coded hazardous constituents for chemical products listed in this procedure were described by available MSDSs (Reference M1):

1. Toluene (Imron Enamel, Anchor Adhesive, and others) – F005
2. Methanol (Clear Tile Adhesive, Ceilcote adhesive, and others) – F003

3. 1,1,1-Trichloroethane (Weldwood Contact Cement, Raycohesive, and others) – F002
4. Trichloroethylene (Slide Cutting Oil Aerosol) – F002
5. Methylene chloride (Wrinkle Finish Spray) – F002
6. Ethyl acetate (Spotcheck Developer and Crack Check Developer) – F003
7. n-Butyl acetate (Ceilcote EJ-11 Elastomer) – F003
8. Acetone (Spotcheck Developer) – F003
9. Xylene (Felt tip markers and others) – F003
10. Cyclohexanone (Armstrong Seam Sealing Adhesive, PVC adhesive and solvents) – F003
11. Methyl ethyl ketone (Imron Enamel, PVC adhesive and solvents) – F005
12. n-Butyl alcohol (Imron Enamel) – F003
13. Chromium/lead pigments (Imron Enamel) – D007, D008
14. Freon 12 – F001
15. Silver (Cool-Amp, Swagelok Silver Goop) – D011.

Another source of chemical information is wastewater sampling results from a dewatering campaign conducted during the mid-1990s (1993-1995). The DOE notified all sites in July 1988 that filter vents allowed water to enter TRU waste storage containers (Reference C12). At SRS, a program plan and safety evaluation for the dewatering effort were in place by early 1991. Drums were found to contain water, possibly due to in-drum condensation and drum submerging during a burial ground flooding event, as well as rainwater intrusion (Reference C12). Because any liquids present were noted by radiography during the original processing of the containers, it is unlikely that the source of liquids found during the dewatering campaign was hazardous chemical waste present at the time of packaging.

During the dewatering effort, 60% of the drums dewatered were from FB-Line (Reference C12). The remaining 40% of the drums were from other SRS waste-generating facilities that may have used some of the detected contaminants, particularly those for which no potential FB-Line sources have been identified during the AK investigation. Water removed from drums was composited over several containers and sampled for radiological contamination (Reference C14). If no such contamination was found, the water was assumed not to have contacted the waste and was land disposed. If radiological contamination was found, the water was sampled for chemical constituents including F-listed solvents and D-listed metals. Table 5-5 summarizes the sampling results (Reference M3). This information is used in conjunction with other sources to support the presence of certain contaminants in FB-Line waste.

Table 5-5 Drum Dewatering Wastewater Sampling Results (µg/l)

Sample #	MEK	CH_3OH (mg/l)	Acetone	CH_2Cl_2	1,1,1-TCA	Ba	Cd	Cr	Pb
96359-18A	1,670	308	17,800	U	U	124	232	56.5	6,350
96359-18B	1,870	288	20,000	98.8	U	300	494	93.4	1.67×10^4
96359-7B	U	307	262	147	U	J	J	J	1,760
96359-7A	J	290	547	147	U	J	J	J	116
96359-12A	U	333	102	91.5	U	107	108	J	588
96359-12B	U	331	116	U	U	J	J	J	159
96359-112A	1,880	337	18,400	335	J	J	52.2	J	879
96359-112B	1,840	304	20,000	333	U	361	356	192	1.24×10^4
96359-89A	296	187	1,560	J	44.2	J	63.5	177	508
96359-89B	417	164	1,440	J	50.3	J	69.4	198	695
96359-110B	129	196	555	357	28.5	322	644	1.03×10^5	1.51×10^4
96359-110A	131	193	490	354	U	223	273	3.42×10^4	4,390

MEK – Methyl Ethyl Ketone (2-Butanone); CH_3OH – Methanol; CH_2Cl_2 - Methylene Chloride; 1,1,1-TCA – 1,1,1-Trichloroethane; Ba – Barium; Cd – Cadmium; Cr – Chromium; Pb – Lead
U = Not detected
J = Detected but not quantifiable
All units are micrograms/liter except methanol which is in milligrams/liter

Other sources that provide chemical information on the waste streams under consideration include the 1992 draft RCRA Part B permit application for the TRU Pads (Reference D1), the SRS Site Treatment Plan (Reference D2), the TWBIR list (although this does not differentiate waste streams by generation date but by pad storage location) (Reference D6), the Technical Standard for Management of Radioactive Waste (Reference D4), the Safety Analysis for FB-Line (Reference D8), Job Control Waste Characterization (Reference D10), and interviews with FB-Line and Solid Waste Management personnel.

[A] F-Listed and Other Solvents

TRU waste generated prior to January 25, 1990, is managed as mixed-TRU waste for F-Listed solvents (Reference C5). As stated in Chapter 2.0, the subject waste stream was generated before January 25, 1990. After this date, SRS generators segregated solvent-contaminated F-Listed debris (i.e., solvent-contaminated rags and wipes) from other debris waste.

Normal process operations on FB-Line did not use organic solvents, but housekeeping activities likely used some hazardous solvents, including acetone (References C7, C13, and P5), methylene chloride (Reference C6),

1,1,1-trichloroethane (References C6, M1, and P1), and Freon (References C1, P11, P13, P14, and P15). One procedure (Reference P5) authorized the use of acetone and PVC solvent (which often contains methyl ethyl ketone and cyclohexanone, Reference M1) in the FB-Line cabinets. Most of the source documentation that identified solvents does not indicate how they were used, but rather that they might be present in waste. However, information from interviews (References C6, C7, and C13) identified how acetone, Freon, 1,1,1-trichloroethane, methylene chloride, and xylene may have been used. Also, MSDS information (Reference M1) for chemicals approved for use in FB-Line (Reference P5) identified the presence of toluene, methanol, cyclohexanone, methyl ethyl ketone, and other hazardous chemicals listed in Section 5.4.3 as solvents. Finally, analysis of wastewater from the dewatering effort suggests that the following chemicals might be present in FB-Line waste: methyl ethyl ketone; methanol; methylene chloride; and 1,1,1-trichloroethane. Based on the above information, EPA hazardous waste numbers F001, F002, F003, and F005 will be applied to these waste steams as follows:

- F001 – Freon, which may have been used for degreasing of panels and other surfaces inside cabinets
- F002 – Freon, methylene chloride, 1,1,1-trichloroethane, and trichloroethylene
- F003 – acetone, methanol, ethyl acetate, n-butyl acetate, xylene, cyclohexanone, and n-butanol
- F005 – toluene and methyl ethyl ketone

Acceptable Knowledge Source Document Discrepancy Forms have been prepared for the various source documents that have contributed to this characterization. The following chemicals were listed in the 1992 draft RCRA Part B permit application for the TRU storage pads, but because no potential sources were identified, they are not assumed to be part of the waste stream: benzene, carbon tetrachloride, chloroform, 1,1-dichloroethene, 1,2-dichloroethene, 1,4-dioxane, 1,1,2,2-tetrachloroethane, and tetrachloroethylene.

[B] Toxicity Characteristic Organic Solvents

The waste-stream specific TWBIR (Reference D6) identifies D018, D019, and D022 – D026 for the entire waste stream SR-W027-221F-HET. However, this waste stream designation includes drums buried on TRU Pad 6 early in 1986 that were not subject to the SRS Certification Plan or associated procedures. Until they can complete characterization efforts,

SRS has chosen to manage these containers assuming that every RCRA-listed chemical may be present. The TRU Waste Package Data forms (Reference M2) are drum-specific and do not apply "D" organic toxicity characteristic EPA hazardous waste numbers to any of the drums from FB-Line generated between March 7, 1986, and January 25, 1990, nor are the names of any D-listed chemicals or commercial chemical products containing these chemicals part of the detailed waste descriptions. Most of the other available source documents are specific to FB-Line, but not necessarily to this waste stream.

The source documentation (TWBIR and draft Part B permit application) that identifies these EPA hazardous waste numbers does not specify how they were used or in what product they may be present. Other reviewed documentation indicates no source for any of these organic compounds or the presence of these compounds in the waste. Therefore, D018, D019, and D022 – D026 will not be assigned to this waste. Discrepancies among source documents as to the applicability of toxicity characteristic hazardous waste numbers that may apply to this waste stream have been documented on an Acceptable Knowledge Source Document Discrepancy Form.

[C] U- and P-Listed Chemicals

There is no indication of P- or U-listed wastes. The following was evaluated:

Discrepancies regarding the applicability of RCRA P- and U-listed EPA hazardous waste numbers to these waste streams are addressed on an Acceptable Knowledge Source Document Discrepancy Form. The stream-specific TWBIR (Reference D6) identifies many U and P numbers, but as has previously been stated, these apply to wastes generated prior to 1986 that were buried on TRU Pad 6. The drum-specific TRU Waste Package Data forms (Reference M2) do not list any P- or U-listed EPA hazardous waste numbers for the FB-Line waste generated between March 7, 1986, and January 24, 1990. The Permit Application (Reference D1) and the Site Treatment Plan (Reference D2) list all of the possible EPA hazardous waste numbers for a particular chemical (e.g., carbon tetrachloride is D019, F001, and U211), without considering how the chemical may have been used. Also, the Site Treatment Plan is not FB-Line specific, so chemicals listed could be from any SRS facility. No source was identified for any of the P-listed chemicals in these source documents. Chemical control procedures (References P4 and P12) and other documents (Reference P5) indicate that the amount of chemicals to be taken into the cabinets was limited to the minimum amount required to complete a task, and that attempts were always made to use the entire amount of the chemical. Therefore, it is most likely that chemicals present in FB-Line waste were spent (F-listed) rather than unused commercial chemical products (U-listed).

The U-listed chemicals hydrazine (U133) and hydrofluoric acid (U134) were identified in other documentation (References C6, C7, and D5) as well as in References D1 and D2. The absence of hydrazine from FB-Line in the 1986 to 1990 time period is discussed in Section 5.4.3. Hydrofluoric acid solution was piped into the cabinets for use in the precipitation process but, based on its use, would not meet the definition of a U-listed waste (i.e., be a discarded commercial chemical product, off-specification product, container residue, or spill residue).

On July 20, 2001, the DOE required that trans (1,2)-Dichloroethylene be added as a target analyte for headspace gas sampling and analysis by January 9, 2002. In addition, the DOE required that formaldehyde be added for only S3000 and S4000 waste as an analyte if Acceptable Knowledge documentation indicated that it could be present in the waste stream. A review of the source documentation found no mention of the use of formaldehyde in the FB line process (References M1, M2, M3, and P5). The finding was supported by cognizant FB Line technical personnel (Reference C23). Based on this documentation, formaldehyde is not expected to be present in the waste stream, and is not required to be added to the target analyte list.

Based on the information provided, P- and U-listed EPA hazardous waste numbers identified in References D1 and D2 will not be applied to the waste streams under consideration.

5.4.4 Metals

The presence of the following RCRA toxicity characteristic metals in FB-Line waste was investigated: arsenic, barium, cadmium, chromium, lead, mercury, silver and selenium . No evidence of selenium was identified in the FB-Line. Waste management procedures used by FB-Line personnel ensure that these metals were managed and disposed appropriately as mixed TRU waste. Generators documented metals that were present in the waste on each container's TRU Waste Package Data Form for each drum. This information was included on the AK tracking spreadsheet.

The TWBIR (Reference D6) identifies D004, D006 – D009, and D011 for the entire waste stream SR-W027-221F-HET, but this designation accounts for pre-1986 drums covered on TRU Pads 2-6, which TWBIR W027 includes. The draft RCRA Part B permit application (Reference D1) is specific to FB-Line, but not to a particular waste stream. It identifies barium, cadmium, chromium, lead, mercury, and silver. The TRU Waste Package Data forms (Reference M2) are drum-specific and specify D008 for 160 drums, D006 on 3 drums, and D009 on 1 drum for FB-Line waste generated between March 7, 1986, and January 23, 1990.

Arsenic (D004)

The waste was found not to exhibit the toxicity characteristic for arsenic. The following information was evaluated:

While arsenic was identified in two source documents (References D2 and D6) applicable to SRS, no source documents described arsenic associated with the FB-Line operations. In both cases, the waste described is not confined to FB-Line during the period of generation under consideration. D004 was not assigned to any of the TRU Waste Package Data forms (Reference M2) for these drums. Because arsenic is not consistent with the FB-Line chemistry, D004 has not been assigned to this waste.

Barium (D005)

The waste was found not to exhibit the toxicity characteristic for barium. The following information was evaluated:

Barium was identified in two source documents (References D1 and M3). The limitations of the TWBIR are discussed above. The analytical results from dewatering effort water samples (Reference M3) are from a composite of many container wastewaters, 40% of which may not have been generated in FB-Line. The barium in the water samples was detected in low concentrations (361 micrograms/liter maximum). None of the other documentation reviewed identified a source for barium, including interviews with FB-Line personnel (Reference C7). Therefore, D005 will not be assigned to this waste.

Cadmium (D006)

Cadmium was identified in almost all of the source documents reviewed. Reference D8 indicates that cadmium was used as shielding for cation exchange columns. Interviews with FB-Line personnel (Reference C7) indicated that this was the only known source for cadmium. Cadmium was detected in water samples (Reference M3) in low concentrations (644 micrograms/liter maximum). Packaging procedures (References P1, P2, P11, P14, and P15) stated that D006 was to be assigned for cadmium and listed cadmium sheeting as an inorganic component of waste. D006 is identified on some TRU Waste Package Data forms (Reference M2). Based on this information, D006 will be assigned only to those drums for which it was indicated by generators. Waste stream SRS-W027-221F-Het-C-D is delineated for those containers identified as D006.

Chromium (D007)

The waste was found not to exhibit the toxicity characteristic for chromium. The following information was evaluated:

Chromium was identified in References D1, D2, and D6. That is, the TWBIR specifically identifies D007 for chrome. However, the TWBIR does not provide a basis for EPA code assignment (i.e. chemical usage). Similarly the RCRA Part B Permit renewal application specifies D007, but this document was never finalized or published and lacks supporting data for a FB-Line chemical list. Chromium was identified in a 1992 waste packaging procedure (Reference P13), but the waste streams under consideration were generated prior to January 25, 1990, and chromium was not identified in earlier versions of the same procedure (Reference P1).

Chromium was identified as an ingredient in paint (References M1 and P4) in low concentrations. No source documents described this paint as being associated with FB-Line operations.

Chromium was also detected in waste water samples collected during a dewatering effort (Reference M3) up to 103 ml/L. The samples collected in this dewatering effort were composited from a mixture of drums, approximately 40% of which were from waste streams other than the FB-Line. One of these other waste streams came from Building 772-F, an analytical laboratory, where chromium salts were used to titrate uranium. The chromium in the dewatering sample is attributed to this laboratory waste, and not from the FB-Line.

Other interviews with FB-Line personnel (References C6 and C7) identified the only possible source for chromium was from building air conditioning system water. Waste water from air conditioning maintenance would not be disposed of as TRU Waste, and is therefore not considered to be in this waste stream.

Finally, chromium was not included in FB-Line packaging procedures as a potential contaminant until December, 1990 (References P11 and P13). Therefore, D007 will not be assigned to this waste.

Lead (D008)

Based on the review of AK source documentation, lead was the primary toxicity characteristic hazardous material in TRU waste from the FB-Line. An FB-Line safety analysis (Reference D8) indicates that lead sheet and leaded acrylic were used as shielding. Also, leaded gloves and shielding were used inside cabinets and were replaced at periodic intervals as they became worn or damaged (References C6 and C7). One packaging procedure (Reference P11) indicates that lead aprons and bricks were expected to be present in TRU

waste. Packaging procedures (References P1, P2, P11, P14, and P15) stated that D008 was to be assigned when lead was present in the waste. Interviews with FB-Line personnel (References C6 and C7) confirmed that some TRU waste contained lead shielding and leaded gloves. FB-Line operators stated that they were effective at identifying and assigning hazardous waste number D008 when the waste contained lead (Reference C7).

In 1986, 1988, and 1989 the SRS TRU Waste Certification Program was satisfactorily audited by the WIPP Waste Acceptance Criteria Certification Committee. At that time, FB-Line programs and procedures for packaging and managing TRU waste (including identification of lead) were considered satisfactory and well implemented.

Lead was identified at low concentrations in water samples (Reference M3) from the dewatering effort conducted circa 1995 (Reference C12). The presence of lead in liquid removed from waste containers was anticipated because, as described above, some waste containers are known to contain lead. Additionally, the results were not representative of the FB-Line waste stream because wastewater from other SRS TRU waste generating facilities was composited with FB-Line wastewater prior to sampling. Forty percent of the wastewater from the dewatering effort may have been from sources other than the FB-Line.

In 1995, a study (Reference D10) was conducted to evaluate metals constituents of combustible debris waste from low-level waste streams including FB-Line streams. Debris in these waste streams is known to contain items and materials similar to TRU job control waste streams. Totals analysis found that PVC debris exhibited up to 117 parts per million (ppm) lead. In 1992, Toxicity Characteristic Leaching Procedure testing (by an independent laboratory) (Reference D16) of uncontaminated PVC debris supplied by the SRS determined that lead leached from such debris at <0.500 ppm and therefore would not constitute a hazardous waste upon disposal. Therefore, although some debris expected in the waste stream contains up to 117 ppm lead, the debris alone does not exhibit the toxicity characteristic for lead.

Although controls including assay and identification of lead on TRU Waste Package Data forms were in place at the time of waste packaging, it was found during waste characterization activities that containers for which generators did not assign D008 for lead did contain lead. As a result, D008 will be assigned to all containers investigated for all three waste streams.

Mercury (D009)

Mercury was identified in many of the source documents reviewed. References P11 and P15 indicate that mercury is present from thermometers. Mercury may

also be present in alkaline flashlight batteries, but not in sufficient quantities to exceed the toxicity characteristic threshold (Reference M1 and D18). Interviews with FB-Line personnel (References C6 and C7) indicated that thermometers or manometers were possible sources of mercury. Packaging procedures (References P1, P2, P11, P14, and P15) stated that D009 was to be assigned for mercury. D009 is assigned to only a very small percentage of the TRU Waste Package Data forms (Reference M2) in this waste stream. Based on this information, D009 will be assigned only to those drums for which it was assigned by generators on TRU Waste Package Data forms. Drums so identified as containing mercury are delineated into waste stream SRS-W027-221F-Het-E. During confirmation activities, any containers found to have fluorescent bulbs will be considered mercury contaminated and will be added to the SRS-WO27-221F-Het-E waste stream (C24).

Silver (D011)

The waste was found not to exhibit the toxicity characteristic for silver. The following information was evaluated:

Silver was identified in References D1, D2, and D6, but its source was not specified. Reference P4 specifies chemicals approved for use in FB-Line and identifies many brand-name products. MSDS information (Reference M1) for these products identifies two containing silver (Cool-Amp and Silver Goop). No other sources for silver have been identified. Silver Goop is a high-temperature anti-seize thread lubricant and contains 20-30% silver. The average net weight of a drum in this waste stream is 24.1 kilogram (kg), and the most frequently occurring net weight is 21.6 kg. Conservatively assuming that 100% of the silver would leach out of a sample of this heterogeneous waste stream (by dividing total silver by 20), more than 7.2 grams of Silver Goop would have to be present for this waste to be hazardous (7,200 milligrams Silver Goop / 21.6 kg waste * 30% / 20 = 5 milligrams per liter). Because this product is used on pipe threads, and a large percentage of this waste stream is organic (rags, wipes, plastic, etc.), there would not be enough Silver Goop present to cause this waste to be hazardous. Therefore, D011 will not be assigned to this waste stream.

In summary, EPA hazardous waste numbers D006 and D009 will be assigned only to the drums for which they were identified on TRU Waste Package Data forms. D008 for lead will be assigned to all containers investigated.

5.4.5 Ignitables, Reactives, and Corrosives

The TRU Waste Package Data forms for each drum were reviewed prior to inclusion in the AK tracking spreadsheet to ensure that FB-Line generators documented that the waste matrix did not contain explosives, compressed

gases, or pyrophorics. FB-Line operating procedures direct that residual acids in TRU waste be neutralized, and any corrosive, ignitable, or reactive characteristics are removed (through absorption or neutralization) before waste is packaged and transported to the solid waste storage facility. The presence of any liquids would have been detected at radiography, as was noted on some TRU Waste Package Data forms (Reference M2). Many procedures direct the assignment of D001 for isopropanol (References P11, P13, P14, and P15), but none of the TRU Waste Package Data forms for drums under consideration showed either D001 for isopropanol or listed the chemical in their descriptions.

In some cases, generators did assign D003 or D001 hazardous waste numbers on TRU Waste Package Data forms for calcium (Reference M2), as directed by SOP 221-FB-2504-NS (Reference P1); for other drums calcium was listed in the description, but the generator did not assign D001 or D003. Oxidized calcium from the Mechanical Line was placed in special metal 1-gallon waste calcium pails, taped shut, and placed in five-gallon metal containers, which were themselves covered with Elite (Reference P9). Sweepings that might have contained calcium were placed in a "calcium waste container," an S&C can, covered with sand, and sealed with a taped-on lid. Containers that listed calcium or had D001 or D003 hazardous waste numbers applied for ignitability or reactivity were excluded from this report and the waste streams under consideration.

5.4.6 Polychlorinated Biphenyls

Because waste was generated after 1985, more than six years after PCB production in the United States was halted, electrical capacitors were the only potential source of PCB contamination for these waste streams identified during the AK investigation. In 1981, the SRS PCB Committee identified several capacitors containing PCBs inside the FB-Line facility (Reference M4). Extensive efforts were undertaken during the early- to mid-1980s to replace or retro-fill electrical equipment containing PCB material (Reference C15). Although the precise history of the six FB-Line capacitors is unknown, the annual PCB Inventory Change Report (Reference C16) for calendar year 1984 stated that no large capacitors were in service at the SRS. In addition, no evidence was found of fluorescent bulb ballasts in container inventory information provided by generators (References M2 and M5). Therefore, by the end of 1984, the potential for PCB contamination of TRU waste from the FB-Line no longer existed. Since this waste stream was generated after March 7, 1986, there is no potential for PCB contamination.

5.4.7 Prohibited Items

Free Liquid

Any free liquids disposed from the FB-Line as TRU waste were absorbed on appropriate media, such as soda ash, elite, and Oil-Dri. Absorption of free liquid was directed by FB-Line procedures prior to placement in a TRU waste container (Reference P7). FB-Line operating procedures direct that free liquid not be placed in TRU waste containers (References P1 and P11). The TRU Waste Package Data forms for each drum were reviewed to ensure that FB-Line generators documented that waste did not contain free liquids (Reference M2). Sixty-three containers described as containing liquids and/or aerosol cans were excluded from the AK tracking spreadsheet and this report. Most of these items were identified via radiography conducted in the late 1980s as part of the SRS TRU Waste Certification Program.

Pending the results of confirmation activities, these containers will either be included in the appropriate waste stream (if the prohibited item has been removed) or continue to be managed by SRS until dispositioned. As noted in Section 5.4.3, some of the drums were submerged during a burial ground-flooding event and may also have experienced rainwater intrusion via the filter vent (Reference C12). A portion of these drums underwent a dewatering campaign in which free liquids were siphoned from the bottom of the drums (Reference C12). Therefore it is conceivable that some free liquid could be present in some of the drums.

Explosives

One potential explosive source, electrical discharge plugs (also known as squibs) used in Halex® fire suppression systems located in the FB-Line facility, was identified but would not have been disposed as TRU waste because they were not located in gloveboxes or cabinets (Reference C17).
As part of the SRS TRU Waste Certification Program, generators were required to explicitly state whether their TRU waste drums contained an explosive item/material on the TRU Waste Package Data form (References P1 and P11). The TRU Waste Package Data form (Reference M2) for each drum was reviewed to ensure that the FB-Line generator documented that waste matrix did not contain explosives in the waste and that the Waste Description Code was for "Job Control Waste" only. Based on the above information, the waste under consideration is not designated as containing explosives.

Pyrophorics

FB-Line operating procedures prohibited the placement of pyrophoric materials in TRU waste containers. The TRU Waste Package Data Form for each drum

was reviewed to ensure that the FB-Line generator documented that the waste matrix contained no pyrophoric material. Based on this information, the waste under investigation is considered non-pyrophoric.

5.5 Waste Packaging

5.5.1 Payload Containers

Payload containers are 55-gallon drums fabricated from 16 gauge (0.0598-inch nominal thickness), low carbon steel with a fully removable head. Inner and outer drum finish is either galvanized or finished with two coats of high bake phenolic epoxy coating. All drums were designed, fabricated, inspected, tested, accepted as DOT Shipping Container Specification 17-C in accordance with SRS procurement specification NMP-WMG-910067 prior to December 19, 1991. Containers were stamped 17C on the bottom (Reference D11).

Drum Liner

All waste from these waste streams is packaged in a 90-mil-thick high-density polyethylene drum liner with a lid providing a tight snap fit. Liner lids were sealed with Raycohesive and vented using the same stainless steel filter vent as is used for drums (described in Section 5.5.3) or with a minimum 0.3-inch-diameter hole. Drum liners were procured in accordance with SRS procurement specification NMP-WMG-910067 prior to December 19, 1991.

5.5.2 Layers of Confinement

Waste containers in the subject waste streams may have up to five layers of confinement. However, confinement layers cannot be correlated with individual waste streams. The normal 4 layers of confinement for cabinet waste were created as follows. TRU waste generated inside gloveboxes and cabinets was first bagged and sealed with tape (Reference P1) and removed from the cabinet through the enclosure bag-out port (Layer 1) (References P5 and C4). Another layer (Layer 2) (References P7 and C4) was added as the waste was removed from the glovebox/containment and placed into a "clean" bag. The waste was then placed in a five-gallon metal red pail lined with another plastic bag. When the waste was removed from the red pail, the liner bag was twisted, taped closed (Layer 3), and surveyed. The waste parcel was then placed in a 90-mil drum liner that was lined with a plastic bag (Layer 4). Prior to securing the drum liner lid with Raycohesive (subsequently vented as described above), the drum liner plastic bag was twisted and taped closed (Reference P14). The liner was then placed in a 55-gallon steel drum.

More than four layers of confinement are possible. One packaging procedure for sump waste required that waste be double-tagged if necessary or until outer

bag is clean before placing in red pail (Reference P7). Information developed in support of TRUCON code assignment also suggested that up to 5 layers may be present (Reference D19), as do VE results for this waste stream (BDR#). Finally, fewer than four confinement layers are also possible. For example, non-cabinet waste usually had two layers of confinement. Waste was packaged directly into a drum liner lined with a plastic bag (Layer 1). Up to 90 pounds of bagged waste was placed directly into a drum liner, which was then taped and labeled (Layer 2). The drum liner lid was sealed with Raycohesive (and subsequently vented), and then the assembly was placed in a 55-gallon drum (Reference P11).

5.5.3 Filter Vents

Technical standards (Reference D4) and certification plans (Reference D15) required that TRU drums be vented. All TRU waste drums in this stream were vented through a low-density porous carbon/carbon composite filter media housed in a threaded cylindrical 304 stainless steel housing. Filters were NucFil-013 type and comply with the requirements of the TRUPACT-II Safety Analysis Report (Reference C18). Filter vents were procured in accordance with SRS procurement specification NMP-WMG-910067 prior to December 19, 1991. The stainless-steel filter vent was used on all liners closed prior to August 19, 1997. Filter vents were tested prior to installation and testing records were supplied during procurement (Reference D11).

Information from the dewatering effort suggests that some drum liners may not have been vented at the time of packaging (Reference C12). Such containers were likely vented during a vent-and-purge effort conducted from 1996—1998 (Reference C20). Long-stem filter vents (NucFil Type NVT-072) were used during this effort. Venting of drum liners is confirmed via radiography. Containers with liners found not to be vented are not acceptable for transportation to or disposal at the WIPP.

As a result of the dewatering effort completed by June 30, 1995, all drum lids were removed. The vent date for containers that were dewatered is therefore listed on the AK Tracking Spreadsheet as June 30, 1995. Although drums stored in culverts were not dewatered, this date is conservative for those drums.

5.6 Hazardous Constituents

As described in Section 5.4.3, the following EPA hazardous waste numbers are assigned to all waste streams described in this document for hazardous constituents: F001, F002, F003, F005, and D008. The D006 and D009 hazardous waste codes also apply to certain streams. Hazardous waste number assignments for each stream are detailed in Section 2.0.

6.0 Supplemental Waste Stream Information

Assay Results

An examination of the TRU Waste Package Data forms for all of the drums in the original inventory of 6,178 containers revealed that only approximately 2,460 were assayed at >90 nCi/g (see Table 6-1). The 90 nCi/g figure was used because the FB-Line assay system had well known problems controlling/quantifying background during assay, resulting in a large number of underestimated (and even negative) assay results (Reference M2). An additional 753 containers had no assay result listed on the TRU Waste Package Data forms. Of these drums, 724 had 500000-series FSN numbers, denoting that they hold accountable quantities of Pu (Reference C10). In the larger population, 82% of the 500000-series drums had activity concentrations >100 nCi/g. As a result, 500000-series drums have been included on the AK tracking spreadsheet. However, it is anticipated that as many as 18% of the 724 drums (130 drums) may drop out of consideration due to low activity concentration after mobile vendors conduct assay activities.

Table 6-1 Historical Assay Results from TRU Waste Package Data Forms

Total Drums Assayed	5,403
Drums > 90 nCi/g (i.e., TRU waste)	2,460
Drums ≤100 nCi/g (i.e., low-level waste)	2,943

Seven containers included in the AK tracking spreadsheet are noted to have PE-Ci concentrations greater than 1,000, which was the limit allowed in the WIPP WAC Revision 3 to which the waste was certified. The affected containers are as follows: 226763, 543677, 543678, 548259, 548260, 548286, and 542510.

Radiography Results

Radiography of drums was conducted as part of the SRS TRU Waste Certification Program during the period of generation of the containers under consideration. TRU Waste Package Data forms contain a space for recording the date of radiography and the reason containers were not certified if problems such as prohibited items were found. Drums assayed as low-level waste were usually not subjected to radiography, nor were other types of waste considered non-certifiable at the time, such as drums containing filters (site-specific content code 004).

WIPP Disposal Program Characterization Results for Waste Stream SR-T001-221F-HET

The Savannah River Site WIPP Disposal Program began characterization of waste stream SR-T001-221F-HET on August 31, 2000. As of September 19, 2001, 594 containers were radiographed, 512 containers were assayed via NDA, and the headspace gas of 405 containers was analyzed. Each characterization was conducted in accordance with the WIPP Waste Analysis Plan (Reference 3). Results from the characterization of this "sister" non-mixed waste stream generated after January 25, 1990 are indicative of the physical form and radiological make up of these waste streams because the waste was generated in the same facility/process. With the exception of the hazardous constituents present in the waste streams documented, the characterization results confirmed the physical form of the waste and the radiological make up determined for the T001 waste stream.

7.0 Container Specific Information

Completed waste generator and storage facility records (i.e., TRU Waste Package Data forms and Radioactive Solid Waste Burial Ground Records) (Reference M2) have been compiled for the containers that comprise this waste stream. The CCP Records Custodian maintains responsibility for all referenced documentation, which will tentatively be stored at the WIPP Records Facility in Building 642-E at the SRS. These records are traceable to their corresponding drums through the FSN number. The records for each drum were reviewed to ensure that all information was consistent with the waste stream defined herein. Specific information for each individual container will be assembled from this report and from characterization validation results obtained when the respective drums undergo assay, radiography, headspace gas sampling, and visual examination (as applicable).

Attachment 1 - References

1 CCP-TP-005, *CCP Acceptable Knowledge Documentation*, Westinghouse TRU Solutions, LLC, Carlsbad, New Mexico

2 U.S. Congress. *Nuclear Waste Policy Act of 1982*, 42 U.S.C. 10101. Washington, D.C.

3 New Mexico Environment Department (NMED). *Waste Isolation Pilot Plant Hazardous Waste Facility Permit,* NM4890139088-TSDF. New Mexico Environment Department, Santa Fe, New Mexico.

4 CCP-PO-001, *CCP TRU Waste Characterization Quality Assurance Project Plan*, Westinghouse TRU Solutions, LLC, Carlsbad, New Mexico.

5 WSRC-TR-98-00301. *Acceptable Knowledge Summary Report for Waste Stream: SR-T001- 221F-HET.* Westinghouse Savannah River Company, Aiken, South Carolina.

6 DOE/LLW-217, DOE Waste Treatability Group Guidance. INEL-Lockheed Idaho Technologies Company, U.S. Department of Energy, Idaho Falls, Idaho.

7 DOE/WIPP-069, Waste Acceptance Criteria for the Waste Isolation Pilot Plant, Revision 7, 01/24/2001

C1 Memo, M. Ebra to H. Fincher and J. McClard re: FB-Line TRU Waste Characterization, 11/22/88

C4 Acceptable Knowledge Interview Record of M. Reuis by G. Lunsford, 4/20/99

C5 Summary of Solvent Rag Correspondence

C6 Interview of C. Allgood by J. Whitworth, 12/20/00

C7 Interview of FB-Line Personnel by J. Whitworth and J. Harrison, 1/16/01

C8 Memo from N. Dienes re: Plutonium metal feed specification

C9 Memo from Bellamy to Thomason re: Impact of Proposed Change in Pu Isotopics on FB-Line Low Level Waste Radioisotope Characterization, 5/30/96

C10 Interview of S. Mentrup by J. Whitworth, 12/11/00

C11 Letter from O. Morris to M.G. O'Rear re: Nonradioactive Inventory Data for WIPP Performance Assessment Activities - Revision 1, 12/01/98

C12 Summary of Correspondence on Dewatering Effort

C13 Interview with P. Spitzer and M. Bell by J. Whitworth and J. Harrison, 12/11/00

C14 Interview with D. Gartland by J. Whitworth, 12/20/00

C15 Letter from T. Hendrick to M. Sires re: PCBs used in electrical equipment, 5/12/82

C16 Memo from J. Roberts to R. Whitfield re: PCB inventory changes during Calendar Year 1984, 6/28/85

C17 Memo from K. Steeg to many re: Squib Igniters Used in "Halex" Halon Fire Suppression, 2/3/99

C18 Memo from T. Wickland to A. Caudill re: NFT and NucFil Equivalency, 1/10/01

C19 Correspondence from G. Molen to S. Berry re: FB-Line Pu Isotopic Distribution, 8/18/97 (transmitted via email to G. Lunsford)

C20 Interview with A. Gibbs by J. Whitworth and W. Estill, March 6, 2001

Attachment 1 - References (continued)

C21 Memo re: FB-Line Low-Level Waste Smear Analysis Results Evaluation, November 13, 1995

C22 Interview with Pam Griffin, SRS by J. Whitworth and W. Estill, October 9, 2001, 1 page, J. Whitworth, IT Corporation, Author.

C23 Record of Communication Interview with J. (Chip) McClard by G. Lunsford re: Use of (trans) – 1, 2 Dichloroethylene or Formaldehyde in FB-Line from 1986 to Present. September 19, 2001

C24 Summary of SRS Correspondence and Data on Fluorescent Light Bulbs; February 6, 1995

C25 Interview with A. Gibbs, SRS by J. Whitworth, re: chromium titration. *(ASTM Procedure C1267 "Uranium Fe2+ Reduction in Phosphoric Acid followed by Chromium Titration in the Presence of Vanadium")* March 27, 2002

D1 WSRC-IM-91-53, *Draft 1992 Renewal Application for a RCRA Part B Permit*, Revision B (12/21/93) (unpublished)

D2 WSRC-TR-94-0608, *Savannah River Site - Mixed Waste Approved Site Treatment Plan*, Volume II, Revision 4 (4/15/96)

D3 WSRC-RP-95-884, *SRS Data Preparation for the 1995 WIPP TRU Waste Baseline Inventory Report, Mixed Waste Inventory Report, and Integrated Database*, Revision 0 (10/31/95)

D4 DPST-88-48-33, *Technical Standard for the Management of Radioactive Waste at the Savannah River Project Storage/ Disposal Facilities, 643-7, 643-29G, 709-2G*, Revision 1 (3/10/89)

D5 DPST-86-449, *The FB Line Facility – A Training Aid Document*, Revised 12/7/94

D6 DOE/CAO-95-1121, *TRU Waste Baseline Inventory Report*, Revision 2 (12/95)

D7 OSR3-158, *SRS Atlas Including Off-Site Location and Building Index*, Revision A (1/95)

D8 DPSTSA-200-10, SUPP-9, *Safety Analysis – 200 Area SRP FB-Line Operations*, Science Applications International Corporation, April, 1988

D9 DP SOP-40, *SRP Radiation Contamination and Control*, Revision 77 (9/86)

D10 WSRC-RP-95-897, *Solid Heterogeneous Job Control Waste Raw Material Characterization*, Revision 1 (10/27/97)

D11 Audit Report Number W88-5, *Waste Acceptance Criteria Certification Committee Audit Report,* (4/29/88)

D12 Audit Report Number W89-6, *Waste Acceptance Criteria Certification Committee Audit Report,* (12/12/89)

D13 WIPP/DOE-120, *Quality Assurance Requirements for Certification of TRU Waste for Shipment to the Waste Isolation Pilot Plant*, Revision 2 (8/88)

D14 WIPP/DOE-069, *TRU Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, Revision 3 (1/89)

D15 DPSP 84-17-1, *Savannah River Certification Plan for Newly Generated, Contact-Handled Transuranic Waste*, Revisions 3 and 4

Attachment 1 - References (continued)

D16 SRT-WED-93-0222, *Response to DOE Request for Status on Procurement and Disposal of Yellow Pigmented Items at SRS*

D17 Action Plan for the Resumption of TRU Waste Shipments to the Solid Waste Disposal Facility, SRS. WER-VP-92-0136, 10/92.

D18 Air Force Center for Environmental Excellence: Battery Disposal Fact Sheet, http://www.afcee.brooks.af.mil/pro-act/fact/july97.asp, July, 1997, U.S. Air Force.

D19 *SRP Waste Content Code Information for TRUPACT-II Certificate of Compliance*, January, 1989.

D20 NUREG/CR-5550, *Passive Nondestructive Assay of Nuclear materials,* March 1991, Nuclear Regulatory Commission

D21 WSRC-RP-93-01102, *FB Line Basis for Interim Operation,* Rev. 0, September 23, 1994.

D22 WSRC-TR-94-0288, *Radioisotope Characterization of FB-Line Low-Level Waste (U),* July 14, 1994

M1 Materials Safety Data Sheets, SRS Shrine System

M2 TRU Waste Data Packages (March 7, 1986-January 1990)

M3 Sampling Results from Dewatering Effort

M4 PCB Committee Meeting Minutes, Meeting No. 1 (dated July 14, 1981)

M5 AK Tracking Spreadsheet

P1 221-FB-2502-NS, *Packaging General and Cabinet Waste into Red Pails*, Revisions 1 and 0 (12/87)

P2 DPSOL-221-FB-2514, *Waste Tracking Procedure*, Revision 2 (4/91)

P3 221-FB-2508-NS, *Packing and Handling HEPA Filter Waste* (UCNI), Revision 2 (8/89)

P4 SOP 221-FB-2544, *Controlled Procurement and Handling of Chemical and Blue Dot Products*, Revision 0 (10/16/90)

P5 DPSOL 221-FB-2500, *Introducing or Removing Material through Bag Ports,* Revision 1 (9/1/89)

P6 SOP 221-FB-2502-B-NS, *Transporting, Assaying, and Storing Red-Pail Waste,* Revision 0 (5/1/92)

P7 SOP 221-FB-1167-NS, *Removing Oil from Mechanical Line Hydraulic Sumps,* Revision 4 (11/21/91)

P8 SOP 221-FB-1125-NS, *Handling Mechanical Line Cabinet Sweepings,* Revision 21 (4/12/91)

P9 SOP 221-FB-1166, *Handling and Weighing of Calcium*, Revision 6 (4/22/91)

P10 SOP 221-FB-1515-NS, *Constructing a Plastic Hut* (UCNI), Revision 15 (7/5/91)

P11 DPSOL 221-FB-2506-NS, *Packaging TRU Waste (Excluding Process Cabinet Waste) into a TRU Drum Liner*, Revision 5 (9/89)

P12 Procedure Manual SI-1-1, *Item 7.02 Chemical Control Program in FB Line Facilities*, Revision 1 (96)

Attachment 1 - References (continued)

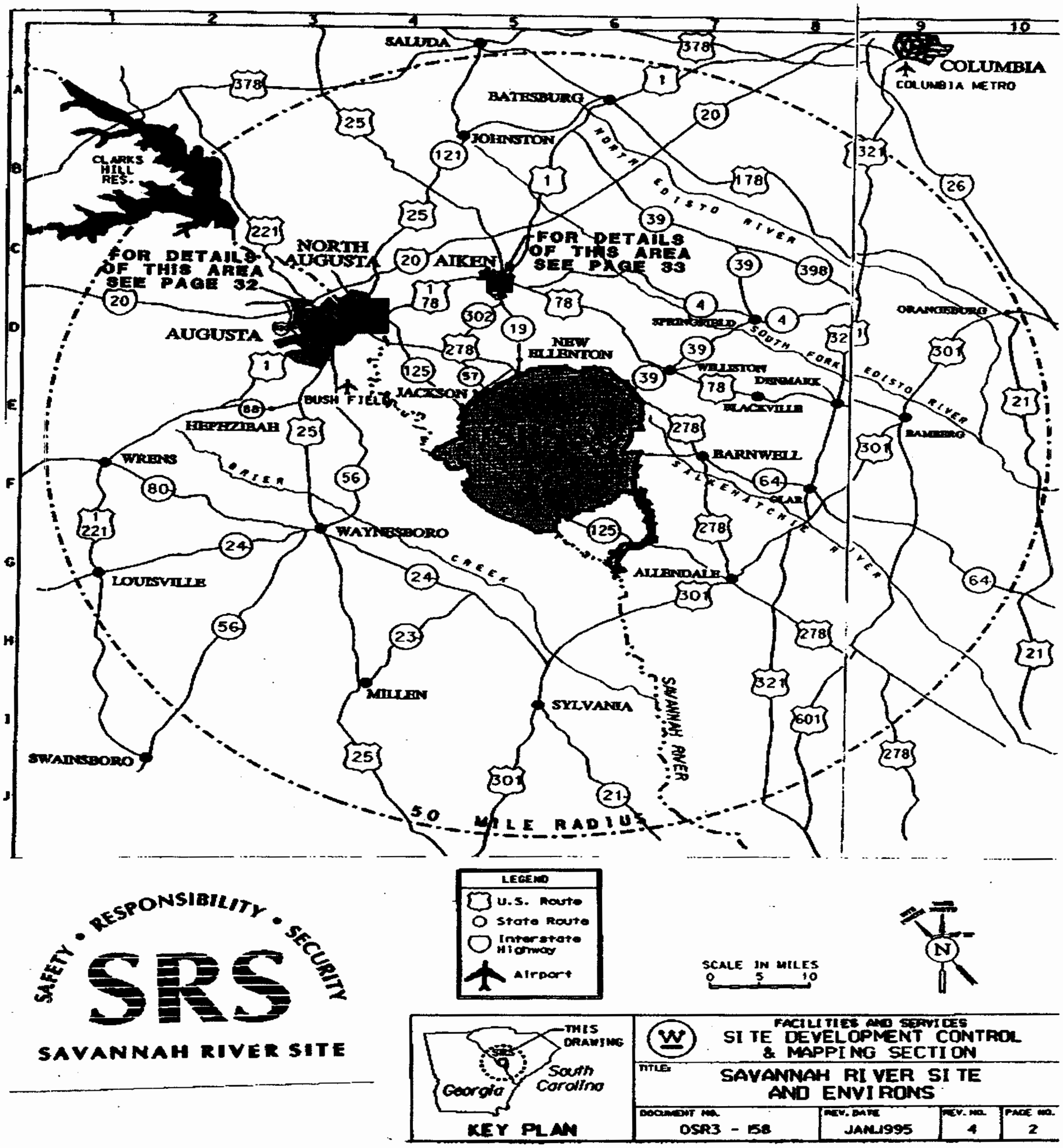
P13 SOP 221-FB-2502-A-NS, *Packaging General and Cabinet Waste into a Red Pail*, Revision 0 (3/26/92)

P14 DPSOL 221-FB-2504-NS, *Drumming Red Waste Pails and Shipment to Burial Ground*, Revision 4 (9/18/89)

P15 SOP 221-FB-2505-NS; *Packaging TRU (Process Cabinet) Waste into a TRU Drum Liner*, Revision 0 (8/14/91)

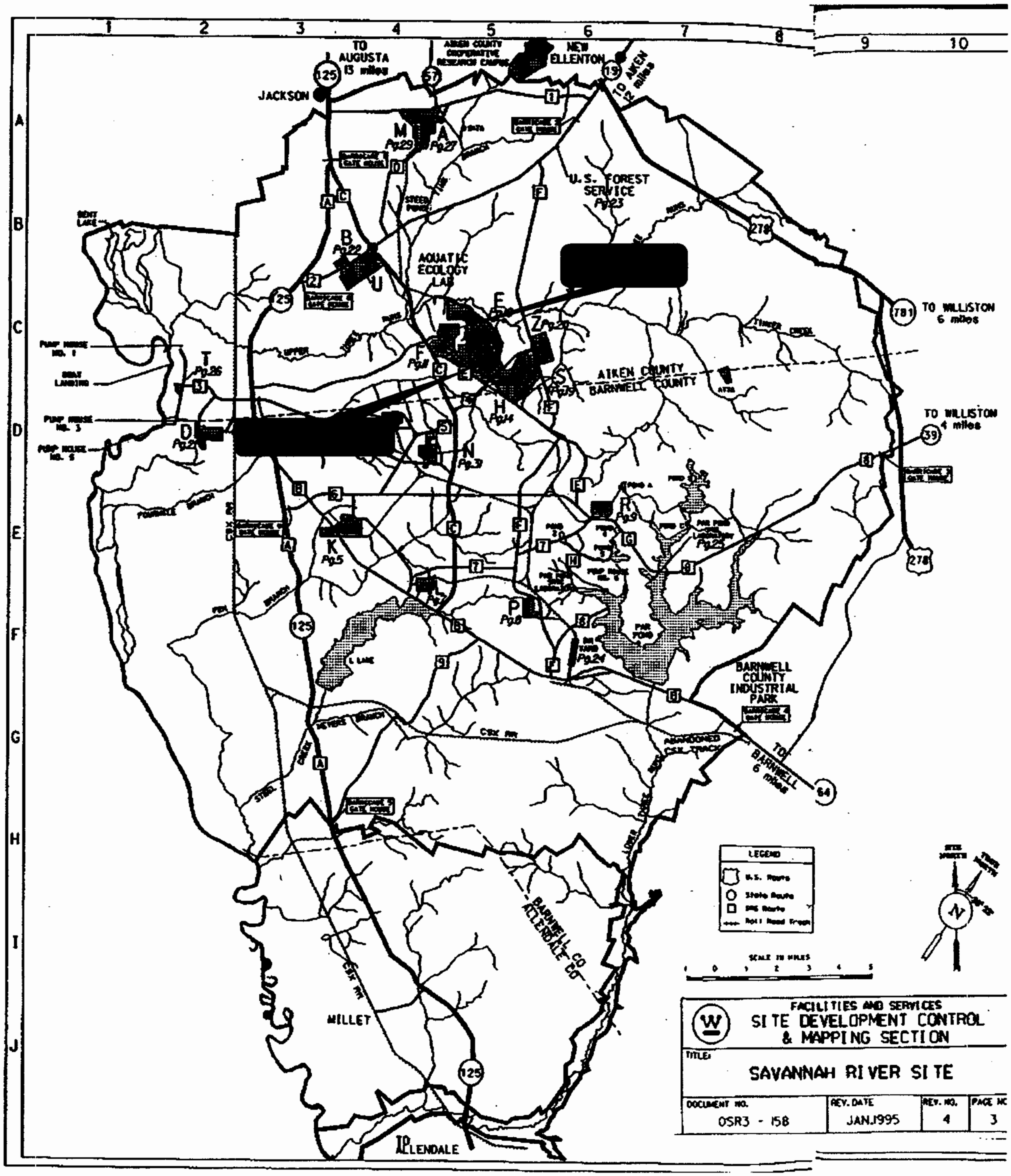
Attachment 2 - Maps

Savannah River Site (SRS) Geographic Location



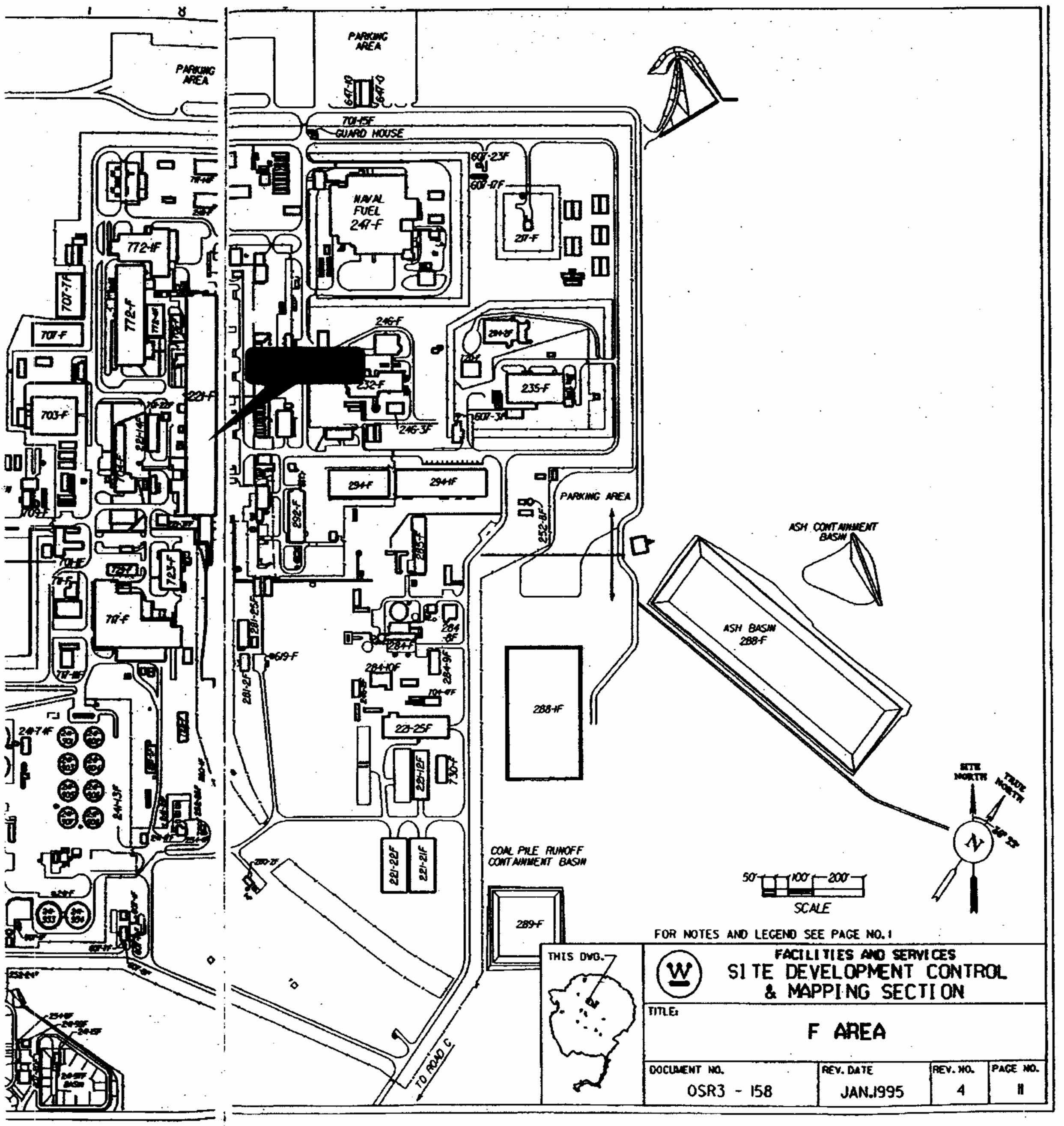
Attachment 2 - Maps (continued)

Savannah River Site (SRS) Geographic Location



Attachment 2 - Maps (continued)

Savannah River Site (SRS) Intra-Area (F-Area) Map



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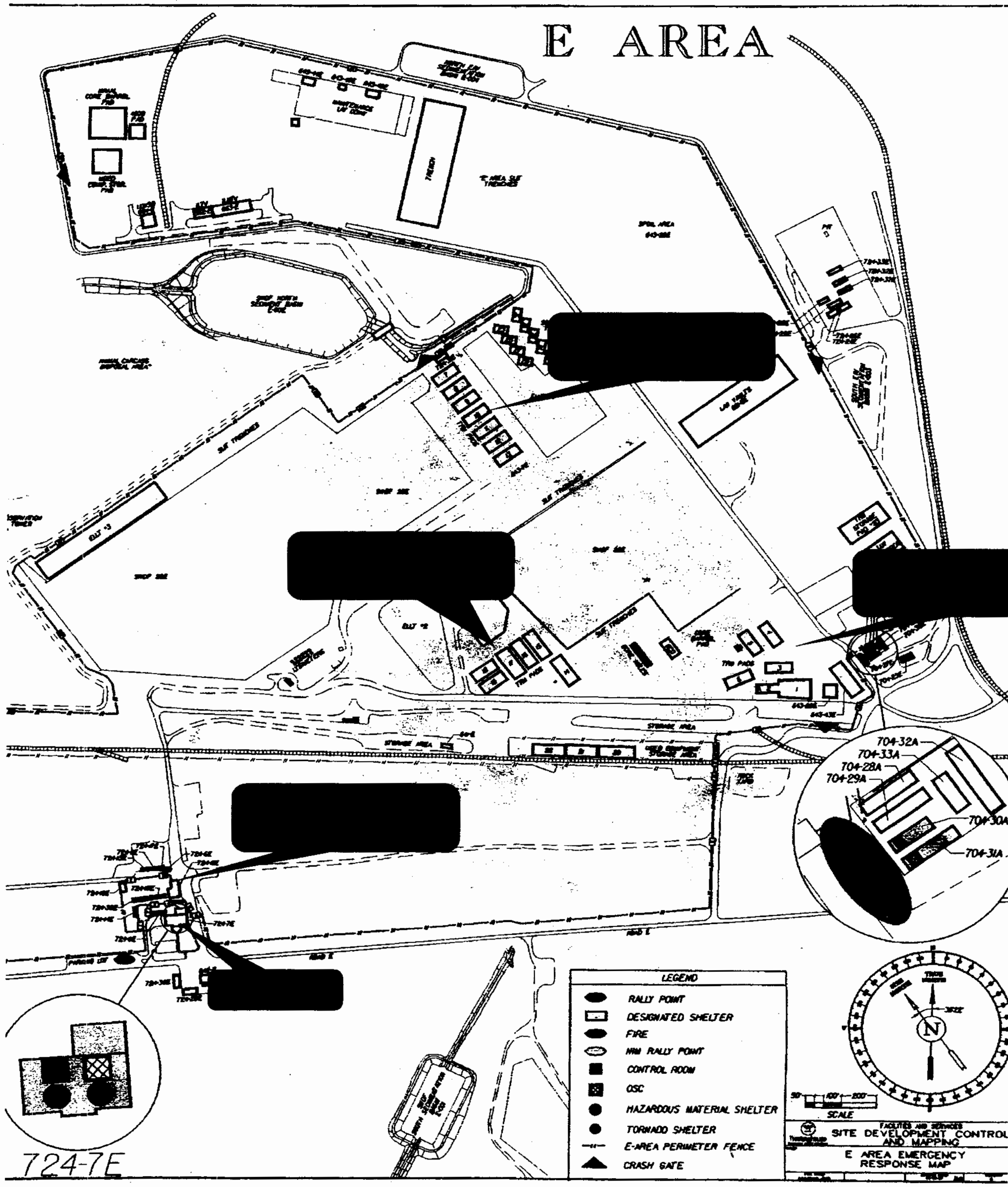
Attachment 2 - Maps (continued)

Savannah River Site (SRS) Intra-Area (E-Area) Map



Attachment 3 - Glossary

RED PAIL: A metal five gallon can with a crimp fit lid used to temporarily contain transuranic waste cuts prior to placement into a waste drum liner / drum. Pails used for transuranic waste are painted red for identification as transuranic waste. Figure 12 depicts a typical "red pail".

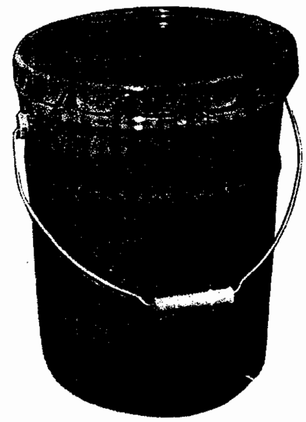


Figure 12- Typical Five Gallon Red Pail

WASTE "CUT": An individual parcel of waste packaged in a plastic bag. Each cut is managed as a discrete waste entity prior to placement into a waste drum liner / drum. Figure 13 depicts an example of a waste cut.

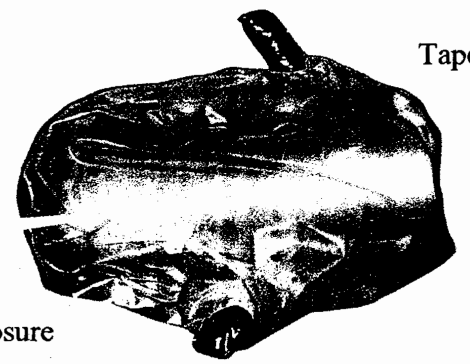


Figure 13- Example Waste Cut

SWEEPINGS: Plutonium bearing residue which falls or spills to the floor of glove boxes or cabinets and is collected by sweeping or vacuum and deposited into storage containers for later recycle/recovery.