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WRAP MODULE 1 WASTE ANALYSIS PLAN

STA. 4
SEP 22 1995

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT

609633

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) WRAP 1 Startup	4. Related EDT No.: n/a
5. Proj./Prog./Dept./Div.: W-026	6. Cog. Engr.: B.A. Mayancsik	7. Purchase Order No.: n/a
8. Originator Remarks: Approval and release of document.		9. Equip./Component No.: n/a
11. Receiver Remarks:		10. System/Bldg./Facility: n/a
		12. Major Assm. Dwg. No.: n/a
		13. Permit/Permit Application No.: n/a
		14. Required Response Date: n/a

15. DATA TRANSMITTED								
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Trans- mittal	(H) Origina- tor Dispo- sition	(I) Receiv- er Dispo- sition
1	WHC-SD-EN-WAP-006		0	WRAP Module 1 Waste Analysis Plan	Q	2	1	n/a

16. KEY					
Approval Designator (F)		Reason for Transmittal (G)		Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec. 12.7)		1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	/	Cog. Eng. B.A. Mayancsik	<i>B.A. Mayancsik</i>	9-19-95	T3-01	B.M. Barnes	<i>B.M. Barnes</i>	9-19-95	T3-04	3	
1	/	Cog. Mgr. R.J. Bortnerus	<i>R.J. Bortnerus</i>	9/22/95	T3-01	L.G. Irons	<i>L.G. Irons</i>	9/22/95	T3-04	3	
1	/	QA DL Vance	<i>DL Vance</i>	9/22/95	T4-06	C.K. Girres	<i>C.K. Girres</i>	9/22/95	T3-04	3	
		Safety				T.K. Orgill	<i>T.K. Orgill</i>	9/22/95	T3-01	3	
3		Env. R.C. Bowman	<i>R.C. Bowman</i>	9/22/95	H6-24	A.R. Sherwood	<i>A.R. Sherwood</i>	9/22/95	H6-20	3	
1	/	R.D. Pierce	<i>R.D. Pierce</i>	9-22-95	T3-04	P.L. Hapke	<i>P.L. Hapke</i>	9/22/95	T4-05	3	
3		S.L. Kooker	<i>S.L. Kooker</i>	9/22/95	T3-01	C.B. Hays	<i>C.B. Hays</i>	9/22/95	L4-97	3	
3		J.R. Weidert	<i>J.R. Weidert</i>	9/22/95	G3-15	R.M. Gordon	<i>R.M. Gordon</i>	9/22/95	S7-55	3	
3		W.W. Olson	<i>W.W. Olson</i>	9/22/95	H4-70	Central Files (2)	<i>Central Files (2)</i>	9/22/95	A3-88 ±8-04	3	
3		G.D. Cummins	<i>G.D. Cummins</i>	9/22/95	H6-24	Solid Waste Processing Center	<i>Solid Waste Processing Center</i>	9/22/95	T3-04	3	
3		S.E. Campbell	<i>S.E. Campbell</i>	9/22/95	T4-05	OSTI (2 copies) KMB	<i>OSTI (2 copies) KMB</i>	9/22/95	±8-07	-3	

18. B.A. Mayancsik <i>B.A. Mayancsik</i> 9-19-95 Signature of EDT Date Originator	19. R.J. Bortnerus <i>R.J. Bortnerus</i> 9/22/95 Authorized Representative Date for Receiving Organization	20. R.J. Bortnerus <i>R.J. Bortnerus</i> 9/22/95 Concurrent Manager Date	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
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BD-7400-172-2 (04/94) GEF097

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(USE BLACK INK OR TYPE)

BLOCK	TITLE	
(1)*	EDT	● Pre-assigned EDT number.
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(3)	From: (Originating Organization)	● Enter the title of the organization originating and transmitting the EDT.
(4)	Related EDT No.	● Enter EDT numbers which relate to the data being transmitted.
(5)*	Proj./Prog./Dept./Div.	● Enter the Project/Program/Department/Division title or Project/Program acronym or Project Number, Work Order Number or Organization Code.
(6)*	Cognizant Engineer	● Enter the name of the individual identified as being responsible for coordinating disposition of the EDT.
(7)	Purchase Order No.	● Enter related Purchase Order (P.O.) Number, if available.
(8)*	Originator Remarks	● Enter special or additional comments concerning transmittal, or "Key" retrieval words may be entered.
(9)	Equipment/Component No.	● Enter equipment/component number of affected item, if appropriate.
(10)	System/Bldg./Facility	● Enter applicable system, building or facility number, if appropriate.
(11)	Receiver Remarks	● Enter special or additional comments concerning transmittal.
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(13)	Permit/Permit Application No.	● Enter applicable permit or permit application number, if appropriate.
(14)	Required Response Date	● Enter the date a response is required from individuals identified in Block 17 (Signature/Distribution).
(15)*	Data Transmitted	
(A)*	Item Number	● Enter sequential number, beginning with 1, of the information listed on EDT.
(B)*	Document/Drawing No.	● Enter the unique identification number assigned to the document or drawing being transmitted.
(C)*	Sheet No.	● Enter the sheet number of the information being transmitted. If no sheet number, leave blank.
(D)*	Rev. No.	● Enter the revision number of the information being transmitted. If no revision number, leave blank.
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(17)	Signature/Distribution	
(G)	Reason	● Enter the code of the reason for transmittal (Block 16).
(H)	Disposition	● Enter the code for the disposition (Block 16).
(J)	Name	● Enter the signature of the individual completing the Disposition 17 (H) and the Transmittal.
(K)*	Signature	● Obtain appropriate signature(s).
(L)*	Date	● Enter date signature is obtained.
(M)*	MSIN	● Enter MSIN. Note: If Distribution Sheet is used, show entire distribution (including that indicated on Page 1 of the EDT) on the Distribution Sheet.
(18)	Signature of EDT Originator	● Enter the signature and date of the individual originating the EDT (entered prior to transmittal to Receiving Organization). If the EDT originator is the cognizant engineer, sign both Blocks 17 and 18.
(19)	Authorized Representative for Receiving Organization	● Enter the signature and date of the individual identified by the Receiving Organization as authorized to approve disposition of the EDT and acceptance of the data transmitted, as applicable.
(20)*	Cognizant Manager	● Enter the signature and date of the cognizant manager. (This signature is authorization for release.)
(21)*	DOE Approval	● Enter DOE approval (if required) by signature or control number that tracks the approval to a signature, and indicate DOE action.

*Asterisk denote the required minimum items check by Configuration Documentation prior to release; these are the minimum release requirements.

RELEASE AUTHORIZATION

Document Number: WHC-SD-EN-WAP-006, REV 0

Document Title: WRAP Module 1 Waste Analysis Plan

Release Date: 9/22/95

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara Broz

9/22/95

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SUPPORTING DOCUMENT		1. Total Pages 47
2. Title WRAP Module 1 Waste Analysis Plan	3. Number WHC-SD-EN-WAP-006	4. Rev No. 0
5. Key Words waste, analysis, plan, WRAP Module 1, permit, sampling, screening, verification, characterization	6. Author Name: B.A. Mayancsik <i>B.A. Mayancsik</i> Signature 87810 Organization/Charge Code A4GA1	
7. Abstract The purpose of this waste analysis plan is to document the necessary characterization, sampling, screening, analysis, and waste acceptance criteria for waste received at the WRAP Module 1. Waste expected to be received at WRAP Module 1 includes newly generated and retrieved waste. The newly generated waste will undergo verification prior to treatment, storage, or disposal. Retrieved waste from the burial grounds or above ground storage will undergo further characterization (as needed), treatment, supercompaction, and repackaging.		
8. RELEASE STAMP <div style="border: 1px solid black; padding: 5px; display: inline-block;"> OFFICIAL RELEASE BY WHC DATE SEP 22 1995 Sta. 4 </div>		

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GLOSSARY

1		
2		
3		
4	ASTM	American Society for Testing and Materials
5		
6	CFR	Code of Federal Regulations
7	CWC	Central Waste Complex
8		
9	DOE-RL	U.S. Department of Energy, Richland Operations Office
10	DQO	data quality objectives
11		
12	EPA	U.S. Environmental Protection Agency
13		
14	LDR	land disposal restriction
15	LLBG	Low-Level Burial Grounds
16		
17	MSDS	material safety data sheets
18		
19	PCB	polychlorinated biphenyls
20	ppm	parts per million
21	PQL	practical quantitation limit
22		
23	QA/QC	quality assurance and quality control
24		
25	RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
26	RTR	real-time radiography
27		
28	SWDD	Solid Waste Disposal Division
29		
30	TCLP	toxicity characteristic leaching procedure
31	TRU	transuranic (waste)
32		
33	VOC	volatile organic compound
34		
35	WAC	Washington Administrative Code
36	WIPP	Waste Isolation Pilot Plant
37	WRAP	Waste Receiving and Processing
38		

METRIC CONVERSION CHART

The following chart is provided as a tool to aid in conversion of units.

Into metric units

Out of metric units

If you know	Multiply by	To get	If you know	Multiply by	To get
Length			Length		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
Area			Area		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
Mass (weight)			Mass (weight)		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
Volume			Volume		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76	cubic meters	cubic meters	1.308	cubic yards
Temperature			Temperature		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths then add 32	Fahrenheit

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Second Ed., 1990, Professional Publications, Inc., Belmont, California.

WASTE ANALYSIS PLAN

The purpose of this waste analysis plan (WAP) is to document the waste acceptance process, sampling methodologies, analytical techniques, and overall processes that are undertaken for waste accepted for verification or processing through Waste Receiving and Processing (WRAP) Module 1. The WRAP Module 1 provides verification activities for other onsite organizations. The WRAP Module 1 is a treatment and storage unit located in the 200 West Area of the Hanford Facility, Richland, Washington.

This WAP applies to all dangerous waste regulated by WAC 173-303. Much of this dangerous waste is a mixed waste because the waste also contains radioactive constituents, as defined by the *Atomic Energy Act of 1954*.

The radioactive portion of mixed waste is interpreted by the U.S. Department of Energy to be regulated under *Atomic Energy Act*; the nonradioactive dangerous portion of mixed waste is interpreted to be regulated under the *Resource Conservation and Recovery Act (RCRA) of 1976* and the Washington State Department of Ecology (Ecology) *Dangerous Waste Regulations*, WAC 173-303. It is the position of the U.S. Department of Energy, Richland Operations Office (DOE-RL) that any procedures, methods, data, or information contained in this WAP that relate solely to the radioactive portion of mixed waste is outside the scope of the Hanford Facility RCRA Permit, Dangerous Waste Portion, but are included for the sake of completeness. It is the position of Ecology that the radioactive portion influences safe storage of the waste and therefore information concerning radioactive constituents is necessary to ensure compliance with WAC 173-303 and the Hanford Facility RCRA Permit. Both agencies acknowledge the other's position, but to avoid a conflict on the issue, DOE-RL has agreed to provide information on radioactive constituents without agreeing with Ecology's position and Ecology has agreed to accept the information in this context without giving up its position.

1.0 FACILITY DESCRIPTION

The following sections provide a description of processes, activities, and waste received in WRAP Module 1.

1.1 DESCRIPTION OF FACILITY PROCESSES AND ACTIVITIES

The WRAP Module 1 has a waste shipping and receiving area; nondestructive examination and nondestructive assay area; process area having enclosures for opening and sorting the contents of waste containers; restricted waste management enclosures for waste sampling and treatment; and a process support, sample management, and an administrative area.

Waste containers are received in the shipping and receiving area. After processing, the low-level portion of the waste is disposed in an onsite

TSD unit, as in the case of some mixed waste, stored elsewhere in the permitted TSD unit awaiting further treatment. The transuranic waste will be shipped to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, or to another approved waste disposal site.

The WRAP Module 1 provides nondestructive examination and nondestructive assay of the contact-handled waste. Nondestructive examination is used to identify the physical contents of the waste containers to support waste characterization and processing, confirmation, or certification. The assay results are used to determine radioactive content and distribution.

The WRAP Module 1 process area enclosures are designed for opening, sorting, and sampling to characterize retrieved¹ waste; to verify the characterization of newly generated² contact-handled containers of transuranic, low-level, and mixed waste. Limited treatment of waste are provided in the process area enclosures, including deactivation (neutralization, cementing, absorption, and controlled reaction with water), stabilization (cementing, absorption, and encapsulation), and amalgamation; volume reduction of waste (i.e., supercompaction); and repackaging of waste.

A sample management area is provided to manage the various samples that are taken from within the process area enclosures or elsewhere in WRAP Module 1.

Process support areas are provided with space for heating, ventilation, and air conditioning equipment, mechanical equipment, and electrical equipment.

The administrative area contains restrooms; change rooms, including an anticontamination change area; offices; and space for visitor control. This area also provides space for a computer control room. A computer is used to monitor the process control system, nondestructive examination equipment, nondestructive assay equipment, and other process equipment.

Exterior storage space is provided for the receipt of new containers and other materials.

Although a separate decontamination area is not provided within WRAP Module 1, manual decontamination of equipment and waste containers is performed throughout the various areas when necessary.

¹ Retrieved waste is defined as waste that has unknown or suspect contents and has been retrieved from the Hanford Facility (e.g., Low-Level Burial Grounds or from other retrievable storage areas). All retrieved waste, after being characterized, is newly generated waste.

² Newly generated waste is defined as waste that has been certified as to content by an onsite generating unit or an offsite generator.

1 1.2 IDENTIFICATION AND/OR CLASSIFICATION AND QUANTITIES OF DANGEROUS WASTE
2 GENERATED AND MANAGED IN WRAP MODULE 1
3

4 The WRAP Module 1 accepts only contact-handled¹ waste in up to
5 208-liter, 322-liter, and containers no larger than 2.4 meters long by 1.5
6 meters high by 1.5 meters (5 feet) wide. Contact-handled waste is any waste
7 where the external surface dose rate does not exceed 200 millirems per hour.
8 Waste is received from both offsite generators and onsite generating units.
9 For application in this document, the term "offsite waste" is defined as mixed
10 waste shipped from the following:
11

- 12 • Any generator or generating activity that is located in an area that
13 is not part of the contiguous Hanford Facility and/or
14
- 15 • Any generator or generating activity from which the shipment of waste
16 is transported over a public access roadway.
17

18 Some of the contact-handled waste containers received at WRAP
19 Module 1 could contain lead waste that was used to shield against radiation.
20 When these containers are identified, the lead could be removed in the
21 transuranic waste process and/or low-level waste process enclosures and
22 returned to storage pending future treatment and/or disposal. Remote-handled
23 waste or waste where the external surface dose rate exceeds 200 millirems per
24 hour is not handled in WRAP Module 1 but in other solid waste units. The
25 maximum weight of the containers received in WRAP Module 1 is 455 kilograms
26 for drums and 3,175 kilograms for boxes.
27

28 Design based annual throughput of waste processed through WRAP Module 1
29 includes the following:
30

- 31 • 2,625 containers of retrieved waste
32
- 33 • 2,100 containers of newly generated transuranic/transuranic mixed
34 waste
35
- 36 • 2,100 containers of newly generated low-level waste/mixed waste.
37

38 Actual throughput is expected to vary because of changes in generation rates.
39

40 Waste expected to be received at WRAP Module 1 include characteristic
41 waste (D001-D043), discarded chemicals (U and P numbers), spent solvents
42 (F001-F005, F020-F023, F026-F028 and F039), and Washington State numbers
43 (WT01-WT02, WP01-WP03, WC02, and W001). Specific dangerous constituents of
44 the waste received at WRAP Module 1 include equipment and materials
45 contaminated with small amounts of any of the following: antifreeze,
46 asbestos, beryllium, cadmium, carbon tetrachloride, copper, hydraulic fluid,
47 lead, lithium, methylene chloride, miscellaneous organic, nitric acid, oils,

48 ¹ Contact-handled waste is any waste where the external surface dose rate
49 does not exceed 200 millirems per hour.

1 polychlorinated biphenyls, sodium, sodium hydroxide, solvents, tributyl
2 phosphate, and zirconium.

3
4 Dangerous constituents and radioactivity of waste generated in WRAP
5 Module 1 during processing is consistent with the waste that is processed
6 through WRAP Module 1.

9 1.3 FUNCTIONAL AREAS

10
11 The following sections describe the functional areas of WRAP Module 1.

14 1.3.1 Shipping and Receiving Area

15
16 The shipping and receiving area provides approximately 350 square meters
17 of interim storage for incoming and outgoing waste. Incoming onsite transfers
18 and offsite shipments of waste packages arrive daily. Containers and the
19 respective delivery vehicles are inspected visually and radiologically and the
20 associated paperwork is reviewed. Any discrepancies noted are resolved either
21 with the shipper, flagged for resolution by WRAP Module 1 operations
22 personnel, flagged for resolution at another TSD unit, returned to the offsite
23 generator, or returned to the onsite generating unit.

24
25 Interim storage within the shipping and receiving area is handled by an
26 automated storage and retrieval system. Segregation of the waste occurs
27 within this storage system. Waste is segregated by container type and
28 compatibility. Mixed waste is segregated from waste that is only
29 radioactively contaminated. Processed waste is segregated from unprocessed
30 waste or waste awaiting analytical results. Transuranic waste is segregated
31 from low-level waste. Retrieved waste is segregated from newly generated
32 waste. Along with the administratively controlled placement of containers
33 within the automated storage and retrieval system, containment pallets could
34 be used to segregate the waste containers and to contain any leaks.

35
36 Space is provided to accommodate the storage of at least 216 containers.
37 A concrete wall provides shielding around the automated storage and retrieval
38 system for radiological protection of personnel. Space also is provided in
39 the shipping and receiving area for storage of up to eight waste boxes.
40 Container storage locations are recorded on a computerized tracking system,
41 which selects individual containers for processing that match current process
42 requirements.

43
44 Containers transferred or shipped from WRAP Module 1 are examined
45 visually to ensure acceptable condition, proper identification, marking,
46 labeling, and closure. Appropriate marking and labels are selected, filled
47 out, and applied to comply with U.S. Department of Transportation (49 CFR) and
48 Washington State Department of Ecology (Ecology) Washington Administrative
49 Code (WAC) 173-303 labeling requirements. Each container not weighed will be
50 weighed, and radiological surveys will be performed and documented.

Most low-level waste containers are banded four to a pallet and transported by flatbed trucks and enclosed vans to the Low-Level Burial Grounds. Mixed waste and transuranic waste ready for interim storage is transported to other storage areas in the Central Waste Complex.

Transuranic and transuranic mixed waste containers that are ready for shipment for disposal have their own loading and storage area in WRAP Module 1. In this area, the containers are stretch-wrapped in plastic in a seven-drum configuration for loading into TRUPACT¹-II shipping cask. Two seven-packs of containers or two standard waste boxes (SWB)² are loaded into each cask. Three casks can be on each trailer. Once the casks are loaded, the waste is shipped to WIPP for disposal or to another approved waste disposal site.

1.3.2 Nondestructive Examination and Nondestructive Assay Area

The nondestructive examination and nondestructive assay area provides approximately 700 square meters for radiography and nondestructive assay equipment. The nondestructive examination equipment uses penetrating radiation to examine the content of each incoming waste container. The nondestructive assay equipment is used to determine the radionuclide content of each waste container.

Nondestructive examination systems are used to identify dense waste items that could influence nondestructive assay, to indicate the physical appearance of the waste, and to identify if liquids or other noncompliant³ waste forms are present. Such identifications are noted in the data management system to ensure that these noncompliant items are removed in the open/sort location in a waste process enclosure in the process area.

Nondestructive assay indicates the radionuclide content and distribution in the waste. Two techniques are used to perform the assay and consist of passive-active neutron interrogation and segmented gamma energy scan. The passive-active neutron counting methods are used to detect and measure the quantity of uranium, plutonium, curium, and californium isotopes. The gamma

¹ Transuranic package transporter.

² SWB is a box designed expressly for transport in a TRUPACT-II to the WIPP repository or another approved waste disposal site. Each SWB is approximately 139 centimeters wide by 162 centimeters long by 83 centimeters high with round ends with either a welded or gasketed bolted lid. Each SWB is constructed of 12-gauge painted carbon steel with carbon steel reinforcement and is equipped with one or more carbon composite filtered vents. Each SWB has an empty weight of 368 kilograms with a nominal capacity of 1.8 cubic meters and 2,727 kilograms gross.

³ Noncompliant waste refers to materials that cannot be accepted for transportation or disposal or that cannot be accepted for disposal on the Hanford Facility without further reprocessing.

1 energy equipment assays uranium-233, uranium-235, some plutonium isotopes,
2 neptunium-237, americium-241, americium-243, and fission and activation
3 products. These measurements are used to sort the waste as either transuranic
4 or low-level waste and to group the low-level waste into Category 1,
5 Category 3, or greater than Category 3 (WHC 1988).

6
7 Separate nondestructive examination and nondestructive assay lines are
8 provided for containers and boxes. Space is provided within the
9 nondestructive examination and nondestructive assay area for the storage of
10 12 waste containers. Concrete shield walls are located around most of the
11 storage area to provide radiological protection for personnel.

12
13 Containers certified in the nondestructive examination and nondestructive
14 assay area are routed to the shipping and receiving area. Containers not
15 meeting confirmation requirements are processed through WRAP Module 1 or
16 stored at Central Waste Complex pending treatment capability or noncompliant
17 condition resolution.

18 19 20 1.3.3 Process Area

21
22 The process area provides approximately 650 square meters used for
23 low-level waste process, transuranic waste process, and restricted waste
24 management enclosures. The area is designed to provide secondary confinement
25 when waste containers are opened in the process enclosures. Automatic dry
26 chemical fire extinguishment systems are provided inside the enclosures. Two
27 separate lines are provided to segregate low-level waste from transuranic
28 waste.

29
30 In the process enclosures, containers are opened, the contents sorted,
31 waste and empty containers are compacted, compliant waste is loaded out into
32 new containers, and noncompliant waste items are transferred to a restricted
33 waste management enclosure. Samples are taken, field screening is performed,
34 and limited treatment occurs on noncompliant items in a restricted waste
35 management enclosure. Venting or puncturing of aerosol cans also occurs
36 within the restricted waste management enclosures. The sampling and screening
37 occurs for both verification and/or characterization (to determine proper
38 handling and/or laboratory analysis methods), depending on the waste stream.

39
40 Because much of the waste is contained in small inner packages inside the
41 containers, a nondestructive examination system is located within the process
42 enclosures to assist in the identification of noncompliant items. A small
43 nondestructive assay system located within the transuranic waste process
44 enclosure is used to identify high-gram loaded waste packages.

45
46 Limited treatment or processing of noncompliant waste is performed in the
47 restricted waste management enclosure. Noncompliant materials could include
48 the following:

- 49
50 • Aerosol cans
51 • Reactive metals
52 • Chelating compounds

- Chemically incompatible materials
- Corrosives
- Explosives
- Gas cylinders not permanently vented
- Lead
- Free liquids
- Mercury
- Particulate materials
- Pyrophoric materials.

Waste requiring treatment or processing other than what WRAP Module 1 can provide is repackaged, labeled, and transferred to the Central Waste Complex for storage pending identification or development of an appropriate treatment.

Waste sampling occurs in the restricted waste management enclosures, and to a lesser degree in the process enclosures, to determine the presence and characteristics of any dangerous waste constituents. Field screening techniques are used as much as practical to assist in the characterization of the waste, narrowing down the list of potential analytes for laboratory analysis.

Samples of waste are transferred to the sample management area for packaging and transferred to an onsite laboratory or shipped offsite to a laboratory for analysis. Samples are collected and analyzed in accordance with WAC 173-303-110 and SW-846 (EPA 1986), as much as practical.

Interim storage is provided for empty containers and waste containers while awaiting laboratory analysis. The storage area is surrounded by concrete shield walls and roof to protect operating personnel. The total space provided is for 24 containers. If there is insufficient space in this storage area, excess containers are stored either in the automated storage and retrieval system located in the shipping and receiving area or transferred to another TSD unit.

1.3.4 Sample Management Area

The sample management area receives samples from the low-level waste process, transuranic waste process, and restricted waste management enclosures. The sample management area is used to package samples for transport to appropriate onsite or offsite analytical laboratories. All samples have a bar code label and are accompanied by chain-of-custody documentation. Chain-of-custody within WRAP Module 1 can be achieved electronically.

The sample management area contains storage space for samples, which includes refrigerated storage, and laboratory supplies.

1.3.5 Process Support Area

The process support area provides approximately 900 square meters on the main level and the mezzanine for electrical equipment; mechanical equipment; heating, ventilation, and air conditioning systems; and a maintenance area.

1.3.6 Administrative Area

The WRAP Module 1 administrative area provides approximately 800 square meters on the main level and the mezzanine for offices, lunch rooms, records retention, conference rooms, restrooms, change rooms for operations personnel including an anticontamination clothing change area, and a computer control room.

The computer control room is located on the upper level of the building and is centrally located to allow for direct observation of the shipping and receiving area, nondestructive examination and nondestructive assay area, and the process area. The control room contains five control stations to support operation of the nondestructive examination and nondestructive assay equipment, and to monitor the internal transport of waste containers and building and process systems.

1.3.7 Exterior Storage Area

The exterior loading dock and storage area provides approximately 200 square meters of space for storage of new containers and other supplies. A dry-pipe fire suppression system is provided within this area. This area is located on the east side of the building.

2.0 SPECIAL REQUIREMENTS

This section covers any special requirements for the management of waste in the WRAP Module 1.

2.1 WASTE CHARACTERIZATION

For waste to be accepted for treatment or storage the waste must be properly characterized. Characterization can occur using either process knowledge or detailed laboratory analysis or both. Characterization efforts provide the data quality needed for management of the waste and ensure that waste is properly packaged.

2.1.1 Waste Characterization Methodology

Various methods or techniques can be used by offsite generators and/or onsite generating units to characterize waste. A brief description of the waste characterization techniques that could be used is discussed in the following sections.

2.1.1.1 Waste Characterization of Newly Generated Waste. Specific techniques used to characterize waste are depend on the waste generating process. Two techniques used are characterization of process stream wastes and characterization of batch process waste.

If the waste is being generated through a continuing process, such that the composition of the waste is not expected to vary appreciably over time, waste characterization requirements can be met through a series of process controls. Initially the waste stream must be thoroughly characterized through a campaign of sampling and analysis and process knowledge. However, if it can be shown that certain parameters are expected to remain within known limits, gross measurements or related process measurements could be substituted for specific chemical sampling and analysis. For each waste stream, the following information should be provided for certification.

- Specific parameters expected to remain constant (metal content, radionuclide content, etc.)
- Degree of variability of the parameter (by what percentage is it expected to vary per unit time, for example +/- 10 percent per year)
- Method of ensuring the waste stream characterization remains reliable between sampling campaigns, including an estimate of its reliability as an indicator of correct characterization. Depending on the process involved, gross measurements (e.g., radioactivity screening), process indicators, or other techniques might be appropriate
- Frequency of recharacterization--sampling and analysis is to be performed annually, at a minimum, and more frequently if the waste generating process is subject to frequent change.

If the waste is being generated through a short-term or infrequent operation, such that the composition of the waste is expected to vary appreciably over time, the waste could be characterized as a batch process. For such operations, waste characterization should describe the method for determining batch sizes and the mechanism for grouping waste into batches. Batches can be defined by the specific waste generating operation with several similar operations grouped together (e.g., the applicable waste collected from several different chemistry laboratories), by the type of waste being generated (e.g., waste oils regardless of the point of origin), by point of origin (e.g., all applicable wastes - either soils, liquids, or sludge, but not combinations of the three - from a given building, regardless of the generating process), or by some other method appropriate to the specific onsite generating unit and/or offsite generator. For this type of waste stream, the following information should be included for certification:

- Method of grouping waste into batches (e.g., by waste type, by waste generated, by point of origin, etc.)
- Size of batches that will be characterized in this manner (e.g., the amount of waste collected in one week, number of 208-liter containers, etc.)
- Waste characterization technique (e.g., sampling and analysis, etc.).

Other techniques, as appropriate, accepted by the Hanford Site could be used to characterize waste.

2.1.1.2 Waste Characterization of Retrieved Waste. Characterization of the retrieved waste can occur using the two techniques described for newly generated waste. These techniques can be used when there is sufficient information, i.e., either historical data or data collected on similar waste processed through WRAP Module 1. When sufficient information is not available, more detailed analyses will be performed.

2.1.2 Process Knowledge

If process knowledge is used in the characterization process, this process knowledge must be supported by a complete description of the process generating the waste, original product MSDSs, and published characterization data on the specific waste stream and/or characterization data on similar waste streams. All supporting data must be submitted to solid waste disposal organization for evaluation and approval of the waste transfer and/or shipment, including any supporting analysis documentation.

2.1.2.1 Process Knowledge for Newly Generated Waste. An onsite generating unit and/or offsite generator relying on process knowledge must perform a detailed chemical analysis on a representative sample of each waste stream whenever the chemical or physical composition of the waste changes (i.e., change in number of compounds, concentration of any compound, physical nature, etc.) and/or at the request of solid waste disposal organization (e.g., to resolve discrepancies in waste transfers and/or shipments).

2.1.2.2 Process Knowledge for Retrieved Waste. Process knowledge is used as much as possible when processing the retrieved waste stream. Screening methods are used to verify the process knowledge with some confirmation through laboratory analysis. Initially, more laboratory analysis is expected to be used to confirm the process knowledge and/or screening activities. As confidence is gained, the frequency of laboratory analysis is expected to decrease.

2.2 RECEIVING WASTE FROM OFFSITE GENERATORS AND ONSITE GENERATING UNITS

This section describes the pre-acceptance methodologies for accepting newly generated or retrieved waste at the WRAP Module 1.

2.2.1 Pre-acceptance Methodology

The waste specification system provides the mechanism for waste acceptance on the Hanford Site. A waste certification summary must be prepared on each waste stream before the waste can be shipped for treatment, storage, and/or disposal. The following sections summarize this system for newly generated and retrieved waste.

2.2.1.1 Pre-acceptance Methodology for Newly Generated Waste. Before shipment of waste, the onsite generating unit and/or offsite generator completes and submits a waste certification summary and materials inventory sheet to solid waste disposal organization. The waste characterization provided on this form can be based on process knowledge and/or a detailed chemical and physical analysis of a representative sample. The basic information required on the waste certification summary is as follows:

- ~ General information
- ~ Physical characteristics of the waste
- ~ Chemical characteristics of the waste
- ~ Radiological characteristics of the waste
- ~ Supporting documentation
- ~ Explanations and continuation from previous sections
- ~ Certification.

All supporting data are submitted to solid waste disposal organization for evaluation and approval. Any supporting analysis documentation and/or MSDS information must accompany the waste certification summary.

The evaluation is repeated when the process generating the waste has changed or if there is any reason to suspect the waste is not in compliance with pre-acceptance documentation.

Before transfer or shipment of the waste, the waste information pertinent to a specific shipment is reviewed and entered into the solid waste information and tracking system. A technical review by solid waste disposal organization is completed, reviewing the information against the waste certification summary. If the transfer/shipment information is found to be acceptable, a final operations review is completed and the transfer/shipment is scheduled by solid waste disposal organization. The offsite generator or onsite generating unit is given approval to transfer/ship their waste.

2.2.1.2 Pre-acceptance Methodology for Retrieved Waste. Although transferring the retrieved waste stream into WRAP Module 1 falls outside the scope of the waste specification system, as much characterization information as possible will be provided to facilitate the processing of that waste stream in WRAP Module 1. However, any waste containers processed through and repackaged in WRAP Module 1 must comply with the waste specification system for acceptance elsewhere at a permitted TSD unit.

The following steps are implemented for retrieved waste that is a candidate for processing at WRAP Module 1.

- All obtainable information describing the retrieved waste is submitted to WRAP Module 1 to assist in processing. This information can include (1) pertinent chemical, radiological, and physical data; (2) a description of the waste contents; (3) other supporting documentation such as generator characterization data, MSDSs, etc.
- Physical parameters such as weight and container dose rate are checked against design limits of the WRAP Module 1 handling equipment.
- Waste contents and/or any additional field screening information collected are reviewed against the safety limits established for WRAP Module 1.

Information on the retrieved waste can be submitted on hard copy or electronically as appropriate.

2.2.2 Incoming Waste Shipment Acceptance

The following sections describe the process for acceptance or rejection of waste received at the WRAP Module 1 and any corrective actions that might be required.

2.2.2.1 Manifest System. Offsite waste shipments must meet the requirements of WAC 173-303-370 and -180 for manifests.

The Hanford Facility has one U.S. Environmental Protection Agency (EPA)/State identification number as required by WAC 173-303-060, and all TSD units on the Hanford Facility are part of a single dangerous waste facility. Therefore, onsite shipments of dangerous or mixed waste are not subject to the manifesting requirements specified in WAC 173-303-370 and -180. However, all onsite waste transfers are conducted in a manner to ensure protection of human health and the environment.

2.2.2.2 Receiving Shipments of Newly Generated Waste. Offsite newly generated waste arriving on the Hanford Facility is received at the 1100 Area. Receiving personnel inspect the waste containers for damage and proper labeling, and review the transportation documentation for completeness and accuracy. If discrepancies are identified, the shipment is not allowed on the Hanford Facility until the discrepancies are resolved. If the shipment passes inspection, the waste shipment proceeds to the WRAP Module 1 for verification or to another TSD unit.

Onsite newly generated waste is transferred directly to either WRAP Module 1 where it is accepted for verification or transferred to another permitted TSD unit.

On arrival at WRAP Module 1, the operating contractor ensures the following.

- The waste falls within the criteria for acceptance into WRAP Module 1 as listed in Table 1 or other information provided in the *Hanford Site Solid Waste Acceptance Criteria* (WHC 1988).
- The number of waste containers are verified against the shipping/waste tracking papers (number of containers sent equals the number received).
- Waste containers are in acceptable condition and properly labeled.
- Documentation is accurate (by cross-checking the waste containers received and the applicable documentation).
- The Uniform Hazardous Waste Manifest or the onsite waste tracking form is properly signed and dated.
- Verification activities are performed on the waste as appropriate.
- After verification, appropriate dispositioning of the waste is identified.

The TSD unit operating contractor indicates acceptance of the waste by placing a date and signature on the appropriate spaces on the Uniform Hazardous Waste Manifest or the onsite waste tracking form. Following acceptance of the waste, the operating contractor ensures the following.

- Significant discrepancies, if any, are noted on the Uniform Hazardous Waste Manifest or the onsite waste tracking form.
- General conformance issues are reviewed with the offsite generator or onsite generating unit and resolved before acceptance of the waste.
- The transporter is given a signed copy of the Uniform Hazardous Waste Manifest or the onsite waste tracking form.
- For offsite waste shipments, the operating contractor transmits the original Uniform Hazardous Waste Manifest to the offsite generator within 30 days of waste receipt. For onsite waste transfers, the operating contractor transmits a copy of the waste tracking form to the onsite generating unit.

The onsite waste tracking forms and all waste characterization information are maintained on file until closure of WRAP Module 1 or at the TSD unit where the waste ultimately is dispositioned.

2.2.2.3 Receiving Shipments of Retrieved Waste. All available documentation on the retrieved waste is reviewed by WRAP Module 1 personnel to ensure that it falls within the design and mission envelope of the plant. This includes any additional data that may have been collected during retrieval operations, i.e., nondestructive assay, headspace sampling, etc. Once the waste is

determined that it meets all pertinent criteria, then it is accepted at WRAP Module 1 for processing.

2.2.3 Corrective Action

Corrective action is necessary when discrepancies or conformance issues are identified. These issues are associated more with newly generated waste as opposed to the retrieved waste stream because the retrieved waste already has been accepted on the Hanford Facility. The following sections describe corrective actions when dealing with newly generated waste and retrieved waste.

2.2.3.1 Response to Significant Discrepancies for Newly Generated Waste.

Waste packages exhibiting any discrepancies or compliance issues during waste receipt and screening are evaluated further to determine appropriate action. Depending on the severity of the discrepancy or issue, the action to resolve the discrepancies could range from conditional acceptance to complete rejection of the shipment.

Resolution of discrepancies are handled by using one or more of the following alternatives, depending on the seriousness of the condition.

- The waste packages could be held in an appropriate staging area with a request that the onsite generating unit and/or offsite generator provide written instructions to WRAP Module 1 personnel for correcting the condition before the waste package is accepted. The condition could be corrected in WRAP Module 1 with charges sent to the onsite generating unit and/or offsite generator for any costs incurred.
- The waste packages could be returned to the onsite generating unit and/or offsite generator for correction.
- If a noncompliant waste package is not returnable because of its condition or packaging, and agreement on disposition cannot be reached between involved parties, the issue will be referred to DOE-RL, Ecology, and other appropriate regulatory agencies as necessary for resolution.
- Increased sampling frequencies are applied to future waste shipments; in addition, it might be necessary to evaluate the need to sample previously accepted waste from the noncomplying offsite generator or onsite generating unit to determine if any of the waste has the potential for similar discrepancies.

For offsite generators, the DOE-RL provides notification to Ecology of any unreconciled manifest discrepancies that are not resolved within 15 days. Discrepancies for onsite generators are handled internally.

2.2.3.2 Response to Significant Discrepancies for Retrieved Waste. Any retrieved waste container received at WRAP Module 1 and later determined not to meet the waste acceptance criteria will be evaluated immediately,

corrective action identified, and waste packages dispositioned appropriately. The type of compliance issues encountered with the retrieved waste stream could include dose rates, container weights, and fissile content above the limits established for WRAP Module 1.

2.2.4 Provisions for Nonacceptance of Shipment

The following sections discuss the provisions for nonacceptance of a shipment.

2.2.4.1 Nonacceptance of Undamaged Shipment. All waste shipped to WRAP Module 1 is approved before shipment. This helps to ensure that only waste that can be handled in WRAP Module 1 is accepted.

Manifest or other documentation discrepancies are handled in the manner prescribed in Section 2.2.3. If a discrepancy exists that cannot be resolved, the waste could be returned to the generator if the waste package is deemed safe for further transportation.

2.2.4.2 Activation of Contingency Plan for Damaged Shipment. If a waste arrives at WRAP Module 1 in a condition that could present a hazard to public health or the environment, the building emergency plan (as identified in the Hanford Facility Dangerous Waste Permit, Waste Receiving and Processing (DOE/RL-91-16) is implemented.

2.2.5 Tracking System

Waste containers received in WRAP Module 1 are tracked using a unique package identification number that is applied to the waste at the time of generation. Bar codes applied on the containers are used to automatically track the containers through WRAP Module 1. Both newly generated and retrieved waste containers are logged and recorded in the data management system. This information is used to provide location and inventory information of all waste processed in the WRAP Module 1. History files containing location and inventory are maintained in the data management system and eventually are archived for the life of WRAP Module 1.

2.3 ADDITIONAL REQUIREMENTS FOR WASTE GENERATED OFFSITE

There are no additional requirements for waste generated offsite.

2.4 METHODOLOGIES FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTES

The WRAP Module 1 handles ignitable, reactive, and incompatible waste. All waste handling is performed according to applicable regulations and in a manner that minimizes the threat to human health or the environment. The following specific precautions will be taken.

- No smoking is allowed in WRAP Module 1.
- No open flames, sparking devices, cutting or welding, hot surfaces, or static or friction sparks are allowed in WRAP Module 1 while ignitable or reactive waste is present, unless an appropriate authorization has been received from the responsible internal safety organizations. This authorization details the work restrictions necessary to ensure that ignitable or reactive waste is not exposed to conditions that could cause detonation or ignition.
- Compatibility testing is conducted using the methods listed in Tables 2 and 3 and with a compatibility chart (WHC 1988) before mixing any two types of waste.
- Incompatible waste is segregated into separate containers and stored apart from each other.

2.5 METHODOLOGY TO ENSURE COMPLIANCE WITH LAND DISPOSAL RESTRICTIONS REQUIREMENTS

The *Hazardous and Solid Waste Amendments of 1984* restrict the land disposal of certain types of waste subject to RCRA. Waste managed on the Hanford Site fall within the purview of these land disposal restrictions (LDRs) per 40 CFR 268. Waste constituents that are subject to LDRs are listed in 40 CFR 268. Waste listed in these sections must meet certain treatment standards, as specified in 40 CFR 268, if the waste is to be land disposed.

Offsite generators or onsite generating units perform waste analysis to determine if land disposal restrictions apply to the waste. Each waste is analyzed for those LDR constituents contained in the listed and characteristic waste numbers identified by the onsite generating unit and/or offsite generator that cause the waste to be dangerous. If the restricted waste does not meet the applicable treatment standards, the offsite generator or onsite generating unit provides, with each shipment of waste, written notification stating so. If the waste is prohibited and meets the standards, the offsite generator or onsite generating unit must send a certification or notification that the waste meets the treatment standards. Offsite generators or onsite generating units retain copies of these records and all waste analysis data for 5 years from the date the waste was accepted by the initial transporter [WAC 173-303-210(1)].

Required manifests are completed for waste shipped to an offsite TSD facility. Records documenting that the waste shipped from WRAP Module 1 to an offsite TSD facility meets the standards required by 40 CFR 268 are prepared and maintained as required by 40 CFR 264. All demonstration and certification records required for exempting waste from land disposal prohibitions, for extension of an effective date, or variance from a treatment standard is maintained on file at the WRAP Module 1. The notifications required by 40 CFR 268 for a treatment facility and a disposal facility is prepared to accompany the offsite waste shipments. Copies of the

1 notifications are maintained in the operating records until closure of WRAP
2 Module 1 as required by 40 CFR 264.

3 4 5 2.6 WASTE TREATMENT 6

7 Waste treated in WRAP Module 1 include newly generated, retrieved, and
8 WRAP Module 1 operations-generated waste. The waste is treated to meet LDR as
9 specified in 40 CFR 268, with the exception of transuranic mixed waste. The
10 EPA is expected to grant the U.S. Department of Energy a no-migration variance
11 for the land disposal of untreated, restricted transuranic mixed waste,
12 therefore, this waste is not required to be treated before disposal. Although
13 the WIPP is expected to have this variance in place for their operational
14 phase, WIPP does require that some characteristic waste (D001, D002, and D003)
15 and certain waste forms not regulated by RCRA be treated to meet performance
16 criteria for the WIPP. Treatment of the characteristic waste for disposal in
17 WIPP basically is performed in the same manner as that which is performed to
18 meet LDR. Treatment of the various waste forms, such as particulate, required
19 before disposal at WIPP is outside the scope of this WAP.

20
21 Specific treatments performed in WRAP Module 1 include deactivation
22 (neutralization, cementing, absorption, and controlled reaction with water),
23 stabilization (cementing, absorption, and sealing or encapsulation), and
24 amalgamation. As the need for other treatment techniques are identified and
25 evaluated as to the acceptability for use in WRAP Module 1, they will be
26 developed for use in WRAP Module 1 and will follow the same guidelines as
27 specified in this WAP.

28
29 Waste treated in WRAP Module 1 is treated to meet either concentration-
30 based treatment standards or technology-based standards. When dealing with
31 underlying dangerous constituents or mixtures, both standards could apply
32 requiring a treatment train for ultimate compliance to LDR. In some instances
33 as with the cementing process, treatability studies could be performed to
34 ensure that when the waste is treated, LDR requirements are met.

35
36 Grab samples are collected on each batch of treated waste, as required,
37 to ensure that the treatment process was successful. Methods used to ensure
38 compliance include visual inspection, pH, toxicity characteristics leaching
39 procedure, and extraction procedure. Other methods are performed as required.

40 41 42 2.7 RECORDKEEPING 43

44 Records associated with this WAP and waste verification program are
45 maintained by the WRAP Module 1 organization. These records will be
46 maintained in the operating record until closure of WRAP Module 1. Records
47 associated with the characterization of the retrieved waste are maintained by
48 the WRAP Module 1 organization for 5 years.
49

1 This WAP will be revised under the following circumstances:

- 2
- 3 • Whenever changes occur in the waste acceptance criteria or the waste
- 4 categories accepted for treatment and/or storage that may require a
- 5 change in the parameters to be tested
- 6
- 7 • Whenever referenced personnel, organizations, or methods are change
- 8
- 9 • Whenever regulatory changes occur that affect the waste analysis plan.
- 10

11 This WAP is maintained as a controlled document under the existing
12 guidelines for document control within the WRAP Module 1.

13 2.8 QUALITY ASSURANCE AND QUALITY CONTROL

14

15 The quality assurance (QA) and quality control (QC) program for waste
16 analysis has two parts and two objectives. The first part, QA, focuses on
17 limiting the introduction of error in the collected data. The QA activities
18 include the use of standard methods for collecting samples. The second part,
19 QC, focuses on providing the information needed to characterize any errors in
20 the data. The QC activities include collecting duplicate samples, such as
21 blanks in sample sets, and surveillance of ongoing and completed activities to
22 ensure that the specified methods are followed and that the necessary
23 information is obtained.

24

25 The following sections present and discuss the overall objectives of the
26 waste analysis program, as well as the specific data quality objectives
27 (DQOs). Specific field and laboratory QA/QC requirements to meet these
28 objectives are addressed in Sections 4.0 and 5.0.

29 2.8.1 Objectives of the Waste Analysis Program

30

31 The primary objective of this waste analysis program is to ensure that
32 the waste received is adequately verified so that the waste can be managed for
33 treatment, storage, and/or disposal. The waste analysis program is designed
34 to meet this objective and the general waste analysis requirements of
35 WAC 173-303-300. These requirements, and the specific objectives of the waste
36 analysis program, are as follows.

- 37 • The WRAP must verify the generating unit knowledge concerning a
- 38 dangerous waste before the waste is stored, treated, or disposed of
- 39 onsite.
- 40
- 41 • The WRAP operations personnel obtain a detailed chemical, physical, or
- 42 biological analysis of dangerous waste (either through documented
- 43 process knowledge or sampling and analysis) before storing, treating,
- 44 or disposing of the material. This analysis must contain the
- 45 information necessary to manage the waste in accordance with the
- 46 requirements of WAC 173-303.
- 47
- 48
- 49
- 50
- 51
- 52

- The owner or operator of an offsite facility must confirm, by analysis if necessary, that dangerous waste received matches the identity of the waste specified on the accompanying manifest or shipping paper.
- Waste analysis must be repeated as necessary to ensure that it is accurate and current.

2.8.2 Data Quality Objectives

The data used to support the WRAP Module 1 waste analysis program need to be scientifically sound, of known quality, and thoroughly documented. In developing DQOs for the waste characterization and verification program, the following standards were considered.

- **Precision.** Precision refers to the level of agreement between samples (duplicates) collected for the same parameters, at the same location, and from the same collection vessel.
- **Representativeness.** Representativeness addresses the degree to which the data accurately and precisely represents a real characterization of the population, parameter variation at a sampling point, sampling condition, and environmental condition at the time of sampling. The issue of representativeness is addressed for the following points.
 - That an adequate number of sampling locations has been selected based on the generating process, the waste stream, and its volume
 - That the representativeness of selected media has been defined accurately
 - That the sampling and analytical methodologies are appropriate
 - That the environmental conditions at the time of sampling are documented.
- **Completeness.** Completeness is defined as the ability of the sampling and analytical methodologies to accurately measure the contaminants present in the waste.
- **Comparability.** The comparability of the data generated is controlled by using standardized sampling methods, standardized analysis methods, and quality-controlled data reduction and validation methods.

The DQOs for the waste analysis program and the means by which the DQOs are satisfied by the waste analysis requirements are summarized in Table 4.

The field data for verification testing meets EPA quality level I and II criteria. The laboratory data for chemical analyses meets EPA quality level III criteria. Data from radiological analyses meets EPA quality level V criteria.

1 The completeness goal for the characterization activities conducted by
2 solid waste disposal organization is 90 percent. The precision goal set for
3 laboratory testing is ± 10 percent.

7 3.0 IDENTIFICATION OF WASTE PARAMETERS

10 This section discusses the criteria and rationale applicable to waste
11 coming into the WRAP Module 1.

14 3.1 CRITERIA AND RATIONALE FOR PARAMETER SELECTION

16 The WRAP Module 1 performs verification activities for the acceptance of
17 waste for treatment, storage, or disposal at TSD units. These activities
18 consist of performing nondestructive examination to verify physical contents,
19 nondestructive assay to verify radionuclide content and distribution, and
20 testing a few key chemical and physical properties (i.e., waste screening and
21 fingerprint analysis) as appropriate. Fingerprint parameters are a subset of
22 waste characterization information provided by the offsite generator or onsite
23 generating unit before acceptance of the waste.

25 The nondestructive examination is performed using a combination of
26 real-time radiography and linear array. Each container selected for
27 verification undergoes examination using the linear array. If the results of
28 the linear array show an area that is suspicious, then real-time radiography
29 is used to zero in on those areas. Nondestructive assay is performed using
30 either gamma energy assay or passive-active neutron interrogation. Chemical
31 parameters are measured using field testing methods that provide verification
32 of waste identity without the use of intensive laboratory analysis. These
33 methods are listed in Table 2. Other screening methods to determine the
34 chemical properties of the waste also can be used as needed. Sampling for
35 verification will follow the guidelines and methods listed in Table 5.

38 Verification parameters were selected based on the following criteria:

- 40 • The need to identify restricted waste such as unvented aerosol cans,
41 free liquids, etc.
- 43 • Parameters important to the proper management of waste stored or
44 disposed of on the Hanford Facility, e.g., verification of potential
45 ignitability, reactivity, corrosivity, or other incompatible waste
- 47 • Parameters that can be used to confirm that waste received matches the
48 identity of waste specified on accompanying waste tracking papers.

50 Methods for inspection, sampling, and analysis were chosen on the basis
51 of being easily performed in the field, providing real- and near-real-time
52 analysis, and providing results that conclusively indicate waste acceptance or

rejection. The verification process can apply to the retrieved waste stream in those instances where there is sufficient process knowledge to do so.

Exceptions to the foregoing verification requirements include the following 'special materials':

- ~ Remote-handled (RH) waste
- ~ Empty product containers
- ~ Single substance spill material
- ~ Asbestos waste from demolition and cleaning
- ~ Contaminated debris from demolition, decommissioning or cleaning (does not include liquids or soils).

'Special materials' have been exempted from pre-acceptance screening because the materials potentially are dangerous (e.g., RH), are well defined and nonvariable (e.g., single substance spill material, asbestos), or are unusually difficult to sample and analyze (e.g., empty product containers, contaminated debris or demolition materials). For these exceptions, the onsite generating unit or offsite generator supplies sufficient chemical and physical characteristics information for proper management of the waste. Waste verification also could occur at the offsite generator or onsite generating unit during the packaging process.

4.0 SAMPLING METHODS

This section discusses sampling methods that are used in sampling newly generated or retrieved waste.

4.1 SAMPLING OF NEWLY GENERATED WASTE

The onsite generating unit and/or offsite generator determines the appropriate sampling method, conducts all field screening and sampling QA and QC, and documents the sampling activities. Specific sampling and analysis plans could be written to identify and document pertinent methods. Sample collection methods used for each waste form should adhere to the guidance provided in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) (EPA 1986), other pertinent references accepted by Ecology and/or the EPA, and other equivalent methods as appropriate. Deviations from these methods could occur because of the radioactive nature of the waste and/or the restrictive conditions under which the samples can be collected. Sampling methods are provided in Table 5.

4.2 SAMPLING OF RETRIEVED WASTE

Sampling of the retrieved waste is similar to that required for newly generated waste.

4.3 SAMPLING QUALITY ASSURANCE AND QUALITY CONTROL

All sampling activities associated with the waste processed through or generated at WRAP Module 1 are documented in a controlled field logbook and/or the data management system depending on the sample collection location. The logbook and/or data management system are maintained by WRAP Module 1. Information collected includes the following:

- Name of person collecting the sample or performing the screening
- Any pre-job meetings held for the sampling events
- Sample identification number
- Sample location
- Package identification number of the container sampled or screened
- Date and time sample collected
- Temperature that the sample is collected at
- Sample volume
- Description of sample matrix
- Package identification of any outer container used to transport the sample (as appropriate)
- Lot number of the bottles used to collect samples
- Sampling methods
- Marking/labeling on any containers sampled (if applicable)
- Photocopies or other electronic scans of the logs/worksheets and waste profile forms containing data collected during field screening.

Other information deemed necessary or pertinent by the sample personnel also will be recorded.

4.4 QUALITY ASSURANCE AND QUALITY CONTROL SAMPLES

All QA/QC samples will be collected on the same day and at the same time that samples are collected. Sampling for RCRA protocol laboratory analysis

1 will use trip blanks, equipment blanks, and duplicate samples. The following
2 sections describe these types of QA/QC samples.

3 4 5 4.4.1 Trip Blank

6
7 Trip blanks will be collected by filling a sample bottle with reverse
8 osmosis/de-ionized type II "Q" water prior to sampling. The collection bottle
9 will be filled in a manner consistent with SW-846 (EPA 1986). The field
10 bottle will travel with the bottle designated for sample collection. This
11 method also will apply for a solid matrix; pre-certified silica sand will be
12 substituted in place of the reverse osmosis/de-ionized water.

13
14 The trip blank bottle(s) will be labeled in the same manner as the sample
15 collection bottles, but will have a unique identification number different
16 from the actual samples. A trip blank could be collected on every fifth day
17 of sampling.

18 19 20 4.4.2 Equipment Blanks

21
22 Equipment blanks will be collected to represent the potential
23 contamination of the sample due to the equipment used to collect the sample.
24 Pre-certified silica sand or reverse osmosis/de-ionized water will be used to
25 mimic collection of the sample, depending on the matrix of the actual sample.
26 The equipment blank will be analyzed for the same constituents as the actual
27 sample that blank represents.

28
29 The equipment blank sample bottles will be labeled identically to the
30 actual sample, but will be assigned a unique identification number. This
31 information will not be indicated on the label, the chain of custody or any
32 other documents that accompany the sample to the laboratory. The field
33 notebook/data management system entry will document the equipment blank. The
34 equipment blank could be collected the same time as the trip blank.

35 36 37 4.4.3 Duplicate Samples

38
39 A duplicate sample will be collected at the same time and from the same
40 homogenized mixture that the actual sample is collected. The duplicate will
41 be analyzed for the same constituents as the actual sample that the duplicate
42 represents. The duplicate sample bottles will be labeled identically to the
43 actual sample, but will be assigned a unique identification number.

44
45 The field logbook/data management system will contain indicators of the
46 sample locations that were composited and that one sample is a duplicate of
47 the other. This information will not be indicated on the label, the chain of
48 custody, or any other documents that accompany the sample to the laboratory.
49 This is done to ensure that the laboratory cannot ascertain the existence of a
50 duplicate. As a guide, one duplicate sample should be collected for every
51 20 actual samples (or 5 percent of the time).

5.0 LABORATORY TESTING AND ANALYTICAL METHODS

In cases where process knowledge is unavailable or incomplete, analyzing the waste stream for pertinent parameters through laboratory methods are employed. Knowledge of the history and origin of the waste and/or field screening methods could be used to determine the analytical testing needed to identify the hazardous constituents of the waste. If there is no reason to suspect certain chemical compounds like pesticides, there is no reason to test for such parameters. However, documentation must establish that there is no reason to suspect the constituent is in the waste. This can be accomplished by including a detailed process description and/or published data of the process. Field screening methods can be used to assist in the characterization process to narrow down the constituent list for laboratory analysis. This section describes the field screening and laboratory analysis methods used in analyzing newly generated and retrieved waste.

5.1 ANALYSIS OF NEWLY GENERATED WASTE

The onsite generating unit and/or offsite generator conducts all field screening, arranges for and coordinates analysis activities with appropriate analytical laboratories, and documents the field screening activities. The onsite generating unit and/or offsite generator must certify that the waste analysis information is complete and accurate. Specific sampling and analysis plans could be written to identify and document pertinent methods.

Laboratory analysis methods used for each waste form will adhere to the guidance provided in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) (EPA 1986), other pertinent references accepted by Ecology and/or the EPA, and other equivalent methods, as appropriate. Deviations from these methods could occur because of the radioactive nature of the waste and/or the restrictive conditions under which the samples are collected. A listing of laboratory analysis methods that can be used is provided in Table 3.

5.2 ANALYSIS OF RETRIEVED WASTE

Analysis of the retrieved waste is similar to that required for newly generated waste. Field screening methods that are used in WRAP Module 1 to either confirm process knowledge, assist in the proper management of the waste (i.e., waste segregation), and/or identify appropriate laboratory methods are listed in Table 2.

5.3 FIELD SCREENING QA/QC

The QC standards will be analyzed before the analysis of collected samples. The results of the standards will be documented in the field logbook.

1 Duplicate analyses can be performed on positive results or as needed.
 2 Where applicable, a blank will be analyzed along with the sample.
 3 Approximately 1 out of every 20 samples will be sent to a laboratory for
 4 confirmation of the field screening method. Results of field screening
 5 activities are recorded in the field logbook (same logbook that is used for
 6 sampling) and/or the data management system. This information includes the
 7 following:

- 8
- 9 ○ Field screening methods
- 10 ○ Field screening results
- 11 ○ Equipment identification number
- 12 ○ Identification of person performing field screening activities.
- 13

14 Other information deemed necessary or pertinent by the screening personnel
 15 also is recorded.

16 17 18 **5.4 LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL**

19
20 The following laboratory QA/QC requirements apply to laboratory analyses
 21 requested by WRAP Module 1 for characterization of retrieved waste, residuals
 22 characterization, or for recharacterization as part of a corrective action.
 23 The daily quality of analytical data generated in the contracted analytical
 24 laboratories will be controlled by the implementation of an analytical
 25 laboratory QA plan.

- 26
- 27 ○ Sample custody and management practices
- 28 ○ Sample preparation and analytical methods
- 29 ○ Instrument maintenance and calibration procedures
- 30 ○ Internal QA/QC measures, including the use of method blanks
- 31 ○ Sample preservatives used
- 32 ○ Analyses requested.
- 33

34 The following are the types of internal QC checks.

- 35
- 36 ○ **Method Blanks.** Method blanks usually consist of laboratory
 37 reagent-grade water that is treated in the same manner as the sample
 38 (i.e., digested, extracted, distilled). Method blanks are analyzed
 39 and reported like a standard sample.
- 40
- 41 ○ **Method Blank Spike.** A method blank spike is a sample of laboratory
 42 reagent-grade water fortified (spiked) with the analytes of interest,
 43 which is prepared and analyzed with the associated sample batch.
- 44
- 45 ○ **Laboratory Control Sample for Inorganic.** This is a standard solution
 46 with a certified concentration that is analyzed as a sample and used
 47 to monitor analytical accuracy. It is equivalent to a method blank
 48 spike.
- 49
- 50 ○ **Matrix Spikes.** A matrix spike is an aliquot of an investigative
 51 sample that is fortified (spiked) with a known quantity of the
 52 analytes of interest and analyzed with an associated sample batch to

1 monitor the effects of the investigative sample matrix on the
2 analytical method. Matrix spikes are performed only for selected
3 protocols. Matrix spikes are performed on 5 percent of the samples
4 (1 in 20) or one per batch of samples, whichever is greater.
5

- 6 • **Laboratory Duplicate Samples.** Duplicate samples are obtained by
7 splitting a field sample into two separate aliquots and performing two
8 separate analyses on the aliquots. Analysis of laboratory duplicates
9 monitors the precision of the analytical method for the sample matrix.
10 However, it might be affected by nonhomogeneity of the sample,
11 particularly in the case of nonaqueous samples. Duplicates are
12 performed only for selected protocols. Laboratory duplicates are
13 performed on 5 percent of the samples (1 in 20) or one per batch of
14 samples, whichever is greater. If the precision value exceeds the
15 control limit, the sample set must be reanalyzed for the parameter in
16 question.
17
- 18 • **Known QC Check Sample.** This is a reference QC sample of known
19 concentration (as denoted by SW-846) that is obtained from the EPA,
20 the National Institute of Standards and Technology, or an EPA-approved
21 commercial source. This QC sample checks the accuracy of an
22 analytical method. It is particularly applicable when a minor
23 revision or adjustment has been made to an analytical method or
24 instrument. The results of a QC check standard analysis are compared
25 with the true values and the percent recovery of the check standard is
26 calculated.
27

28 Practical quantitation limits (PQLs) are determined for each analytical
29 method. Because some non-standard techniques are required to safely handle
30 the highly-radioactive samples to be analyzed, it is necessary to establish
31 minimum criteria. Because of method variations (i.e., additional dilution,
32 change in sample aliquot size, etc.) and matrix variations in the waste, it is
33 anticipated that the method quantitation limits specified in SW-846 (EPA 1986)
34 and in other documents may not be achievable. Because the samples analyzed
35 under this plan are being characterized to assist in determining the
36 regulatory compliance status of the samples, the required PQLs usually are
37 based on an assessment of regulatory requirements for characterization of the
38 materials where possible. The PQLs needed to determine adequate
39 characterization with respect to applicable regulations are shown in Table 6.
40 These PQLs are generally 20 to 50 percent of the regulatory limit.
41
42
43

44 6.0 WASTE RE-EVALUATION FREQUENCIES

45
46

47 To ensure that waste received at WRAP Module 1 matches its documentation,
48 a frequency of analysis has been established for the verification of newly
49 generated waste. As part of the characterization process for the retrieved
50 waste, a frequency of analysis and methodology has also been identified. The
51 following sections provide details on the frequency for analysis for both of
52 these streams.

6.1 FREQUENCY OF ANALYSIS OF NEWLY GENERATED WASTE

Five percent of the waste received at WRAP Module 1 during a federal fiscal year (October 1 through September 30) from offsite generators or onsite generating units undergoes verification. The number of containers to meet the 5 percent requirement is calculated monthly based on the average of containers for the previous 3 months. For example, if 200 containers are received each month in January, February and March, then the monthly average is 200 and the number of containers to be verified in April is 10. At the discretion of the solid waste organization acceptance personnel, additional containers could be verified. The frequency of analysis for any one generator or generating unit could increase because of the receipt of waste packages that are determined to be out of compliance. The frequency also might decrease for any one offsite generator or onsite generating unit when no discrepancies or compliance issues have been identified over time.

Conditions could exist that preclude the screening of newly generated waste received on the Hanford Site for treatment, storage, or disposal. These conditions include the following:

- Insufficient number of waste containers received within a given month that cannot undergo verification screening, because of a waste matrix that can not be sampled i.e., debris waste
- Lack of available manpower
- Equipment breakdowns
- Evolving technology.

Deviation from newly generated waste verification frequency will be documented as appropriate.

6.2 FREQUENCY OF ANALYSIS OF RETRIEVED WASTE

To ensure that the retrieved waste is properly characterized, the waste must undergo sampling and analysis. The frequency of the sampling and analysis depends on existing process information either from the point of generation or through processing similar waste in WRAP Module 1. Analysis could consist of either field screening or laboratory analysis based on the amount of information or process knowledge available on each waste stream. All attempts will be made to group the retrieved waste into batches based on this information. The batches could be subdivided further into lots for processing and sampling at WRAP Module 1. The lot size is based on the number of containers WRAP Module 1 can retain and process.

The number of samples analyzed per lot is based on the methodology in SW-846 (EPA 1986). For a given lot, the number of samples needed to properly characterize the waste varies depending on the variability within the lot, and the proximity of measured variables to regulatory thresholds. Where there is

1 greater variability, more samples are analyzed to characterize the waste.
2 Where a measured value is close to a regulatory threshold, more samples are
3 analyzed. If measured values are well above or well below threshold values,
4 fewer samples are analyzed.
5

6 The process for determining the number of samples analyzed is as follows.
7 Using the expected composition of the waste, based on process knowledge, a
8 mean measurement and standard deviation is estimated for variables critical to
9 the classification of the waste. The formula for using these values to
10 estimate the needed number of samples is shown in Tables 7 and 8 along with
11 related statistical terminology.
12

13 Based on the estimated number of samples required, containers are
14 selected randomly from the lot for processing, sampling, and classification in
15 WRAP Module 1. The results from these samples are used to recalculate the
16 mean and standard deviation for critical variables, and to recalculate the
17 number of samples needed to characterize the waste. The remainder of the lot
18 is processed with additional samples taken as necessary.
19

20 In some cases, the formula in Table 7 results in a number of samples per
21 lot that exceeds one per container. In these cases, each container is treated
22 as a lot, and each container is sampled. The sampling method is selected such
23 that a sample is considered representative of the container, and one sample
24 normally characterizes the container, confirming process knowledge. Limited
25 cases of multiple samples per container could be required to demonstrate that
26 the sampling method reliably provides a representative sample or to compensate
27 for lack of process knowledge in special cases.
28
29
30

7.0 REFERENCES

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- 30
- 31

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Table 1. Waste Analysis Parameters for Waste Acceptance.

Parameter	Acceptance criteria	Rationale	Test method
Container appearance	No visible bulging or deformation	Bulging or deformed containers could be indicative of reactive materials and could require special handling	Visual inspection
Container appearance	No visible corrosion	Corroding containers could be indicative of spilled corrosive materials and could require special handling	Visual inspection
Container weight	Drums are ≤ 453 kg. Small boxes are $\leq 3,175$ kg. Standard waste boxes are $\leq 1,360$ kg.	Weights of the containers must be $\leq$ the design limits of the equipment.	Scale
Flammability	Matches information provided on waste tracking forms	Flammability is key parameter for safe handling of the waste	Headspace gas analysis
kg = kilograms.			
$\leq$ = less than or equal to.			

Table 2. Field Screening Methodologies. (sheet 1 of 2)

Screening	Property	Waste form	Suggested method(s)
Flammability	Liquid with a flash point less than 60°C according to published or experimental closed cup test data	Liquid	HazCat* combustibility test closed cup flashpoint
	Ignitable compressed gas as defined in 49 CFR 173.300	Gas	Visual observation
	Oxidizer as defined in 49 CFR 173.127	---	None
	An additional definition from SW-846: "For the purpose of this, an oxidizer is any material that yields oxygen readily to stimulate the combustion of organic matter (e.g., chlorate, permanganate, inorganic peroxide, or a nitrate) (EPA 1986).	Liquids/solids	HazCat oxidizer test
pH	Aqueous with a pH less than or equal to 2 (≤ 2), or a pH greater than or equal to 12.5 (≥ 12.5)	Liquid	pH paper pH meter HazCat inorganic/organic acid test
	Solid or semi-solid that has an aqueous phase pH of ≤ 2 , or a pH ≥ 12.5 when it is made into a 50 wt% mixture with water	Solid - solution from a 1:1 slurry of water to waste	pH paper pH meter HazCat inorganic/organic acid test
Organic	Organic liquids and solids	Liquids/solids	HazCat organic test
	Chlorine and organic solvents	Liquids/solids	HazCat copperwire test
	Organic solvents	Liquids/solids	HazCat iodine crystal test
	Halogenated hydrocarbons 0-50 parts per million	Liquids/oil/solids	Chlor-N-Oil test
	Halogenated hydrocarbons >550	Liquids/oil/solids	Chlor-N-Oil test HazCat chlorine hotwire
Polychlorinated biphenyls (PCBs)	PCB specific testing	Liquids/oil/solids	ENSYS PCB RISC** test
Water reactivity	Is normally unstable and readily undergoes violent change without detonating	Liquids/solids	Visual observation
	Reacts violently with water or forms potentially explosive mixtures with water	Liquid/solids	HazCat water reactivity HazCat water solubility test
	When mixed with water, generates toxic gases, vapors or fumes in quantities that present a danger to human health or the environment	Liquid/solids	HazCat water solubility test
	Is capable of detonation or explosive reaction if subjected to a strong initiating source or heated under confinement	Liquid/solids	HazCat ignition test (hairpin test)
	Is readily capable of detonation or explosive decomposition, or reaction at standard temperature and pressure	Liquid/solids	Visual observation
	It is a U.S. Department of Transportation Forbidden Explosive, a Class A or Class B Explosive as defined in 40 CFR 173.51, .53, and .88	Liquid/solids	Visual observation

Table 2. Field Screening Methodologies. (sheet 2 of 2)

Screening	Property	Waste form	Suggested method(s)
1 Sulfide	It is a sulfide (-S) bearing waste that, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in amounts sufficient to present a danger to human health or the environment. Number provided in SW-846 (EPA 1986) for evaluating reactivity is 500 milligrams hydrogen sulfide per kilogram of waste	Liquid/solids	Approximately 10 ml of sample is added to a beaker or test tube and enough 1:1 hydrochloric acid is added slowly to bring the pH down to 2.0. pH paper is placed in the solution as the contents are agitated. If the paper turns brown or silvery black, the presence of sulfides in the sample is indicated. If there is no color change, the total sulfides are reported as non-detectable.
2 Cyanide	It is a cyanide (-CN) bearing waste that, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in amounts sufficient to present a danger to human health or the environment. Number provided in SW-846 (EPA 1986) for evaluating reactivity is 250 milligrams hydrogen cyanide per kilogram of waste	Liquid/solids	To a test tube or beaker containing approximately 10 ml of sample, enough caustic is added to bring the pH to 12-13; then 3 to 5 ml of 10 percent ferrous sulfate solution is added and stirred. Three to 5 ml of 5 percent ferric chloride is then added and enough concentrated sulfuric acid is slowly added to bring the pH down to 1 or less. A bright blue color indicates the presence of cyanide. The test can detect free cyanide and complex cyanides in concentrations below 200 ppm.
3 Metals and element	Metals and elements screening is used to determine the presence of regulated quantities of heavy metals in the waste and confirm the presence or absence of other inorganic elements.	Liquids/solids	X-Ray Fluorescence (XRF) Spectrometer TCLP extraction [SW-846 Method 1311 (EPA 1986)] HazCat metals test(s) Water solubility
5 Headspace volatile organic compounds	Gross screen to detect the presence or absence of solvents or other volatile organic compounds in wastes. One of the few methods available to evaluate the presence of volatile organic compounds in heterogeneous matrices or matrices that can not be sampled.	Liquids/solids	Fourier transform infrared spectroscopy organic vapor analyzer
9 Volatile and semivolatile compounds	Screening is used to evaluate the presence or absence of volatile and/or semivolatile organic compounds and verify the treatment standards associated with organic chemical content.	Liquids/solids	Fourier transform infrared spectroscopy Fourier transform raman spectroscopy
12 Asbestos	Asbestos fibers	Solids	HazCat asbestos test
13 Solids	Verification of the presence or absence of free liquid in solid or semi-solid material to be placed in a landfill.	Solids/semi-solids	Paint filter test [SW-846 Method 9095 (EPA 1986)]

HAZCAT is a registered trademark of Haztech Systems Incorporated, San Francisco, California.
 ENSYS PCB RISC is a registered trademark of ENSYS Incorporated, Research Triangle Park, North Carolina.
 Note: Petroleum hydrocarbons greater than 10,000 parts per million could give a false positive result.
 ml = milliliter.
 pH = negative concentration logarithm of the hydrogen-ion concentration.
 ppm = parts per million.
 TCLP = toxicity characteristics leaching procedure.
 wt% = weight percent.

Table 3. Waste Characterization Chemical Analysis.

Analysis Name	Waste form of sample	Suggested reference analytical methods
Ignitability	Liquid/solid	1010/1020 ¹
	Gas sample	ASTM E681 (ASTM 1989)
Corrosivity	Aqueous liquid	WDOE 83-13 (Ecology 1984), 9040 ¹
	Non-aqueous liquid	WDOE 83-13 (Ecology 1984)
	Solid or semisolid	WDOE 83-13 (Ecology 1984), 9045 ¹
Reactivity	Liquid and solid	9010 ¹
Total cyanide		9030 ¹
TCLP/RCRA ² Metals (non-mercury)	Liquid and solid	6010 ¹
TCLP Metal mercury		7470/7471 ¹
TCLP/RCRA ² volatile organic compound		8240 ¹
TCLP/RCRA ² semivolatile organic compound		8270/8250 ¹
TCLP/RCRA ² PCB/pesticides		8080 ¹
PCB	Oils	ASTM D4059 (ASTM 1991)
TCLP/RCRA ² herbicides	Liquid and solid	8150 ¹
Persistence	Liquid and solid	WDOE 83-13, Appendix E (Ecology 1984)
Toxic organic carbon	Liquid/solid	9020 ¹
Total organic carbon	Liquid/solid	9060 ¹

¹ SW-846 Methods (EPA 1986).

² Metals or organic in the target compound list of the referenced method.

TCLP = toxicity characteristics leaching procedure.

PCB = polychlorinated biphenyls.

Table 4. Data Quality Objectives.

Objective	Waste analysis activity
Waste characterization	
Obtain and document information necessary to properly designate retrieved waste	<ul style="list-style-type: none"> Specify parameters to be evaluated for waste characterization
Confirm that data collected for waste characterization are of sufficient quality to support waste management decisions	<ul style="list-style-type: none"> Specify information required to document process knowledge Specify sampling and analytical methods to be used Require field blanks and duplicates
Identify and reject waste that does not meet acceptance criteria	<ul style="list-style-type: none"> Implement waste verification program
Ensure compliance with LDR requirements	<ul style="list-style-type: none"> Require waste generators to specify concentrations for all toxicity characteristic constituents in waste and identify listed waste Specify LDR documentation requirements
Waste verification	
Confirm that the waste received matches the accompanying documentation and is what was expected	<ul style="list-style-type: none"> Check completeness of shipping/transfer papers and screen waste containers for surface dose and weight measurements to identify obvious discrepancies between the waste received, the shipping/transfer papers, and the acceptance documentation Perform nondestructive examination or visual inspection and chemical screening on a percentage of the containers received to confirm that the waste matches the shipping papers and acceptance documentation
Confirm that no restricted waste forms are present	<ul style="list-style-type: none"> Review inventory of waste containers received Perform nondestructive examination or visual inspection on a percentage of containers received
Confirm that the data collected during the verification evaluation are of sufficient quality to support waste management decisions	<ul style="list-style-type: none"> Require regular, documented calibration and reagent checks for testing equipment and supplies

LDR = land disposal restriction.

Table 5. Sampling Methodologies.

Waste form	Waste forms - SW-846*	Sampling/equipment method
Liquids	Free-flowing liquids and slurries	Coliwasa
Sludges	Sludges	Trier
Solidified liquids		
Wet absorbents	Moist powders or granules	Trier
Process solids and salts		
Ion exchange resins		
Process solids and salts	Dry powders or granules	Thief
Ion exchange resins		
Soils	Sand or packed powders and granules	Auger
Ion exchange resins		
Process solids and salts		
Absorbents	Large-grained solids	Large trier
Process solids and salts		

* EPA 1986.

Table 6. Analysis Practical Quantitation Limit.
(sheet 1 of 2)

Analysis	Source of regulatory limit	Regulatory limit	Suggested PQL ¹
Ignitability	WAC 173-303-090	< 60°C Flashpoint	NA
Corrosivity			
aqueous liquid, solid	WAC 173-303-090	pH < 2, pH > 12.5	pH = 1 to 13
liquid	WAC 173-303-090	corrodes steel at a rate ≥ 6.35 mm/yr at 55°C	3.0 mm/yr
Reactivity - all forms	WAC 173-303-090 49 CFR (EPA 1986) SW-846	Refer to qualitative descriptions in regulations. sulfide 500 mg/kg cyanide 250 mg/kg	NA 50 mg/kg 25 mg/kg
TCLP metals	WAC 173-303 40 CFR 261.24	Refer to TCLP levels	TCLP ² limits for solids 50% TCLP for liquids per method 6010
Persistence	WAC 173-303 WDOE-83-13 (Ecology 1984)		
Halogenated hydrocarbons		0.01% (100 ppm)	0.005%
Polycyclic aromatic hydrocarbons		1% (10,000 ppm)	0.5%
Headspace gases	DOE/EM/48063-1 (DOE 1991)	50% of LEL 2.5% v/v H ₂ 2.5% v/v CH ₄	25% of LEL 0.5% v/v H ₂ 0.5% v/v CH ₄
Headspace gases	DOE/EM/48063-1 (DOE 1991)	500 ppm	100 ppm
Volatile organic compounds (VOC)			
Toxic organic carbon	NA	NA	0.005%
Total organic carbon	WAC 173-303	10%	0.5%
Radionuclides	WAC-EP-0063 (WAC 1993)		
low-level waste		per specified limits	1% of specified limits
TRU		100 nCi/g	10 nCi/g
TCLP VOCs	WAC 173-303 40 CFR 261	TCLP levels NA	TCLP limits for solids 50% TCLP for liquids per Method 8240/8260 (EPA 1986)
TCLP Semivolatile Organic Compounds	WAC 173-303 40 CFR 261	TCLP levels	TCLP limits for solids 50% TCLP for liquids per Method 8250/8270 (EPA 1986)
PCB			
TCLP pesticide	WAC 173-303 40 CFR 261	TCLP levels	TCLP limits for solids 50% TCLP for liquids
PCB	WAC 173-303 40 CFR 761 if > 50 ppm	2 ppm	1.0 ppm

Table 6. Analysis Practical Quantitation Limit.
(sheet 2 of 2)

Analysis	Source of regulatory limit	Regulatory limit	Suggested PQL ¹
TCLP herbicides	WAC 173-303 40 CFR 261	TCLP levels	TCLP limits for solids 50% TCLP for liquids per method 8150

¹ PQL is "Practical Quantitation Limit" with the definition of Chapter 1, SW-846 (EPA 1986).

² TCLP limits mg/kg wet weight for solid waste, mg/L for liquid waste.

mg/kg = milligram per kilogram.

nCi/L =

PCB = polychlorinated biphenyls.

ppm = parts per million.

% = percent.

TCLP = toxicity characteristics leaching procedure.

Table 7. Basic Statistical Terminology.
(sheet 1 of 2)

Terminology	Symbol	Mathematical equation	(Equation)
• Variable (e.g., barium or endrin)	x	—	
• Individual measurement of variable	x_i	—	
• Mean of all possible measurements of variable (population mean)	μ	$\mu = \frac{\sum_{i=1}^N x_i}{N}, \text{ with } N = \text{number of possible measurements}$	(1)
• Mean of measurements generated by sample (sample mean)	$\bar{x}$	<p><u>Simple random sampling and systematic random sampling</u></p> $\bar{x} = \frac{\sum_{i=1}^n x_i}{n}, \text{ with } n = \text{number of sample measurements}$ <p><u>Stratified random sampling</u></p> $\bar{x} = \sum_{k=1}^r W_k \bar{x}_k, \text{ with } \bar{x}_k = \text{stratum mean and } W_k = \text{fraction of population represented by Stratum } k \text{ (number of strata } [k] \text{ range from 1 to } r)$	(2a) (2b)
• Variance of sample	s^2	<p><u>Simple random sampling and systematic random sampling</u></p> $s^2 = \frac{\sum_{i=1}^n x_i^2 - (\sum_{i=1}^n x_i)^2/n}{n - 1}$ <p><u>Stratified random sampling</u></p> $s^2 = \sum_{k=1}^r W_k s_k^2, \text{ with } s_k^2 = \text{stratum variance and } W_k = \text{fraction of population represented by Stratum } k \text{ (number of strata } [k] \text{ ranges from 1 to } r)$	(3a) (3b)

Table 7. Basic Statistical Terminology.
(sheet 2 of 2)

Terminology	Symbol	Mathematical equation	(Equation)
• Standard deviation of sample	s	$s = \text{square root of } s^2$	(4)
• Standard error (also standard error of mean and standard deviation of mean) of sample	$s_{\bar{x}}$	$s_{\bar{x}} = \frac{s}{\text{square root of } n}$	(5)
• Confidence interval for μ^a	CI	$CI = \bar{x} \pm t_{.20} s_{\bar{x}}$, with $t_{.20}$	(6)
• Regulatory threshold ^a	RT	Defined by WAC 173-303-090	(7)
• Appropriate number of samples to collect from a solid waste (financial constraints not considered)	n	$n = \frac{t_{.20}^2 s^2}{\Delta^2}$, with $\Delta = RT - \bar{x}$	
• Degrees of freedom	df	$df = n - 1$	(9)
• Square root transformation	---	$x_i + 1/2$	(10)
• Arcsin transformation	---	Arcsin p; if necessary, refer to any text on basic statistics; measurements must be converted to percentages (p)	(11)

^aThe upper limit of the CI for μ is compared with the applicable regulatory threshold (RT) to determine if a solid waste contains the variable (chemical contaminant) of concern at a hazardous level. The contaminant of concern is not considered to be present in the waste at a hazardous level if the upper limit of the CI is less than the applicable RT. Otherwise, the opposite conclusion is reached.

Table 8. Tabulated Values of Student's "t" for
Evaluating Solid Waste.

Degrees of freedom (n-1) ^a	Tabulated "t" value ^b
1	3.078
2	1.886
3	1.638
4	1.533
5	1.476
6	1.440
7	1.415
8	1.397
9	1.393
10	1.372
11	1.363
12	1.356
13	1.350
14	1.345
15	1.341
16	1.337
17	1.333
18	1.330
19	1.328
20	1.325
21	1.323
22	1.321
23	1.319
24	1.318
25	1.316
26	1.315
27	1.314
28	1.313
29	1.311
30	1.310
40	1.303
60	1.296
120	1.289
	1.282

^aDegrees of freedom (df) are equal to the number of samples (n) collected from a solid waste less one.

^bTabulated "t" values are for a two-tailed confidence interval and a probability of 0.20 (the same value s are applicable to a one-tailed confidence interval and a probability of 0.10).

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