S

MAY 03 2000

STA#4

4

ENGINEERING DATA TRANSMITTAL

1. EDT 627148

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Retrieval Engineering	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: RPP/WFD	6. Design Authority/Design Agent/Cog. Engr.: RS Popielarczyk, 373-5751	7. Purchase Order No.: N/A
8. Originator Remarks: Document transmitted for approval and release.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: Tank Farms
11. Receiver Remarks:	11A. Design Baseline Document? [X]Yes [] No	12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: April 21, 2000

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 Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	HNF-4154	---	0	Double-Shell Tank Process Waste Sampling Subsystem Specification	ESQ	1,2	1	

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	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
1	1	Design Auth. RS Popielarczyk	RS Popielarczyk	4/21/00	R2-58	1	1	CE Leach	for CE L	4/20/00	R1-44
		Design Agent				1		RW Root		4/20/00	R2-53
1	1	Cog. Eng. JH Rasmussen	JH Rasmussen	4/20/00	R2-12	1	1	GP Duncan		4/20/00	R3-72
1	1	Cog. Mgr. TJ Conrads	for T.J. Conrads	4-20-00	R3-73	1	1	JE Van Beek		4/19/00	R3-47
1	1	QA W. L. Adams	WL Adams	4/19/00	S6-15	1		CE Grenard		4/20/00	R3-73
1		Safety RE DeBusk	Susan Alexander		S7-86						
1	1	Env. BG Erlandson		4-20-00	R1-51						

18.	19.	20.	21. DOE APPROVAL (if required)
JH Rasmussen JH Rasmussen 5/3/00 Signature of EDT Originator Date	RS Popielarczyk RS Popielarczyk 4/21/00 Authorized Representative for Receiving Organization Date	TJ Conrads TJ Conrads 5/3/00 Design Authority/ Cognizant Manager Date	Ctrl. No. N/A [] Approved [] Approved w/comments [] Disapproved w/comments

BD-7400-172-2 (10/97)

HNF-4154
Revision 0

Double-Shell Tank Process Waste Sampling Subsystem Specification

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC06-99RL14047

Approved for Public Release; Further Dissemination Unlimited

LEGAL DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced from the best available copy.
Available in paper copy and microfiche.

Available electronically at
http://www.doe.gov/bridge. Available for a processing fee to the U.S. Department of Energy and its contractors, in paper, from:
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
phone: 865-576-8401
fax: 865-576-5728
email: reports@adonis.osti.gov(423) 576-8401

Available for sale to the public, in paper, from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800-553-6847
fax: 703-605-6900
email: orders@ ntis.fedworld.gov
online ordering:
http://www.ntis.gov/ordering.htm

Printed in the United States of America

Double-Shell Tank Process Waste Sampling Subsystem Specification

J. H. Rasmussen
CH2M HILL Hanford Group Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL-14047

EDT/ECN: 627148 UC: 721
Org Code: 6N100 Charge Code: 110296
B&R Code: Total Pages: 181

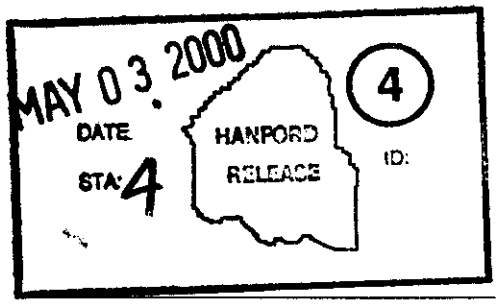
Key Words: privatization, double-shell tank, waste feed delivery, subsystem, specification, level 2, sampling, process waste

Abstract:

This specification establishes the performance requirements and provides references to the requisite codes and standards to be applied to the Double-Shell Tank (DST) Process Waste Sampling Subsystem which supports the first phase of Waste Feed Delivery.

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed in the United States of America. To obtain copies of this document, contact: Document Control Services, P.O. Box 950, Mailstop H6-08, Richland WA 99352, Phone (509) 372-2420; Fax (509) 376-4989.



5/3/00

Release Approval Date Release Stamp

APPROVED FOR PUBLIC RELEASE

HNF-4154
Revision 0

Double-Shell Tank Process Waste Sampling Subsystem Specification

J. H. Rasmussen

Date Published
April 2000

CH2MHILL
Hanford Group, Inc.

P. O. Box 1500
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC06-99RL14047

Approved for Public Release; Further Dissemination Unlimited

This page intentionally left blank.

CONTENTS

1.0 SCOPE 1-1
1.1 DESCRIPTION 1-1
1.2 CLASSIFICATION 1-1

2.0 APPLICABLE DOCUMENTS 2-1
2.1 GOVERNMENT DOCUMENTS 2-1
2.2 NON-GOVERNMENT DOCUMENTS 2-3

3.0 REQUIREMENTS 3-1
3.1 SUBSYSTEM/COMPONENT DEFINITION 3-1
3.1.1 Subsystem/Component Diagrams 3-7
3.1.2 Interface Definition 3-8
3.1.2.1 Functional Interfaces 3-9
3.1.2.2 Physical Interfaces 3-11
3.1.3 Major Component List 3-11
3.1.4 Government-Furnished Property List 3-11
3.1.5 Government-Loaned Property Lists 3-11
3.2 CHARACTERISTICS 3-11
3.2.1 Performance Characteristics 3-12
3.2.1.1 Sample Double-Shell Tank Waste for Safe Storage 3-12
3.2.1.2 Sample Source Tank High-Level Waste 3-16
3.2.1.3 Sample Prepared Low-Activity Waste 3-19
3.2.1.4 Sample Staging Tank High-Level Waste 3-21
3.2.1.5 Sample Staging Tank Low-Activity Waste 3-24
3.2.1.6 Sample Double-Shell Tank Headspace Gases and Vapors. 3-27
3.2.2 Physical Characteristics 3-29
3.2.3 Reliability 3-29
3.2.4 Maintainability 3-29
3.2.5 Environmental Conditions 3-30
3.2.5.1 Natural Environments 3-30
3.2.5.2 Induced Environments. This section defines the induced environment impinging on the subsystem. 3-30
3.2.6 Transportability 3-30
3.2.7 Flexibility and Expansion 3-31
3.3 DESIGN AND CONSTRUCTION 3-31
3.3.1 Materials, Processes, and Parts 3-31
3.3.2 Electromagnetic Radiation 3-32
3.3.3 Nameplates and Product Marking 3-32
3.3.4 Workmanship 3-32
3.3.5 Interchangeability 3-32
3.3.6 Safety 3-32
3.3.6.1 Personnel Safety 3-32

3.3.6.2 Equipment Protection 3-33
3.3.6.3 Environmental Safety 3-33
3.3.7 Human Performance/Human Engineering 3-35
3.3.8 Decontamination and Decommissioning 3-35
3.4 DOCUMENTATION 3-35
3.5 LOGISTICS 3-36
3.5.1 Maintenance 3-36
3.5.2 Supply 3-36
3.5.3 Facility and Facility Equipment 3-36
3.6 PERSONNEL AND TRAINING 3-36
3.7 CHARACTERISTICS OF SUBELEMENTS 3-36
3.7.1 Core Sampling Subsystem 3-37
3.7.2 Grab Sampling Subsystem 3-37
3.7.3 Vapor Sampling Subsystem 3-37
3.7.4 Agitated Grab Sampling Subsystem 3-37
3.7.5 Solid Surface Sampling Subsystem 3-38
3.7.6 Liquid Surface Sampling Subsystem 3-38
3.7.7 Pumped Sampling and Analysis Loop Subsystem 3-38
3.7.8 Ambient Temperature Sample Handling and Transport Subsystem 3-38
3.7.9 Controlled Temperature Sample Handling and Transport Subsystem 3-38
3.8 PRECEDENCE 3-39
3.9 SECURITY 3-39
3.10 COMPUTER RESOURCE RESERVE CAPACITY 3-39

4.0 QUALITY ASSURANCE PROVISIONS 4-1
4.1 GENERAL 4-1
4.1.1 Responsibility 4-1
4.1.2 Special Tests 4-1
4.2 DESIGN VERIFICATION 4-1

5.0 PREPARATION FOR DELIVERY 5-1

6.0 NOTES 6-1
6.1 DEFINITIONS 6-1
6.2 LIST OF TERMS 6-2

7.0 REFERENCES 7-1

APPENDICES

A SOURCE DOCUMENTS AND TEST METHODS ..... A-i

B PRELIMINARY SAFETY CLASSIFICATIONS ..... B-i

C CRITICAL ISSUES ..... C-i

D TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED ..... D-i

E TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED ..... E-i

F RIVER PROTECTION PROJECT PROCESS ENGINEERING PRELIMINARY POSITION WASTE FEED DELIVERY SAMPLING REQUIREMENTS ..... F-i

FIGURES

Figure 3-1. Double-Shell Tank Process Waste Sampling Subsystem Functional Hierarchy for Waste Storage. 3-2

Figure 3-3. Double-Shell Tank System Architecture Tree. 3-5

Figure 3-4. Subsystem for Double-Shell Tank Mechanical System Interfaces. 3-5

Figure 3-5. Interfaces for Double-Shell Tank Monitor and Control Subsystem. 3-6

Figure 3-6. Architectural Decomposition of the Double-Shell Tank Process Waste Sampling Subsystem. 3-8

Figure 3-7. Major Interfaces of the Double-Shell Tank Process Waste Sampling Subsystem. 3-9

TABLES

Table 2-1. Government Documents. (2 Sheets) 2-1

Table 2-2. Non-Government Documents. (3 Sheets) 2-3

This page intentionally left blank.

1.0 SCOPE

1.1 DESCRIPTION

This specification establishes the performance requirements and provides references to the requisite codes and standards to be applied during the design of the Double-Shell Tank (DST) Process Waste Sampling Subsystem that will support the first phase of waste feed delivery (WFD). The DST Process Waste Sampling Subsystem consists of equipment required to obtain samples of waste from DSTs and to prepare and deliver the waste samples to designated laboratories for analysis to support WFD processes.

This specification is intended to be the basis for new projects/installations (W-521, etc.). This specification is not intended to retroactively affect previously established project design criteria without specific direction by the program.

1.2 CLASSIFICATION

Not applicable.

This page intentionally left blank.

2.0 APPLICABLE DOCUMENTS

Design requirements applicable to the DST Process Waste Sampling Subsystem come from government and non-government source documents and various codes and standards. Each document (of the exact revision identified) in this section is invoked by one or more requirements of this specification and represents a part of this specification to the extent specified.

2.1 GOVERNMENT DOCUMENTS

U.S. Department of Energy (DOE) orders and regulatory documents, including those promulgated by the Federal Government and Washington State, constitute a part of this specification to the extent specified herein. The regulatory documents that form a part of this specification are listed in Table 2-1.

Table 2-1. Government Documents. (2 Sheets)

Document Number	Title
10 CFR 30, 2000	"Rules of General Applicability to Domestic Licensing of Byproduct Material," *Code of Federal Regulations*, as amended.
10 CFR 835, 1999	"Occupational Radiation Protection," *Code of Federal Regulations*, as amended.
29 CFR 1910, 1999	"Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
40 CFR 61, 1999	"National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.
40 CFR 261	"Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.
40 CFR 265, 1999	"Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Control Facilities," *Code of Federal Regulations*, as amended.
49 CFR 172	"Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements," *Code of Federal Regulations*, as amended.
49 CFR 173, 1999	"Shippers-General Requirements for Shipments and Packagings," *Code of Federal Regulations,* as amended.
49 CFR 177, 1999	"Carriage by Public Highway," *Code of Federal Regulations,* as amended.
DOE-EM-STD-5502-94, 1994	*Hazard Baseline Documentation*, U.S. Department of Energy, Washington, D.C.

Table 2-1. Government Documents. (2 Sheets)

Document Number	Title
DOE O 435.1, 1999	*Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C. (Replaces DOE Order 5820.2A, 1988)
DOE Order 460.1A, 1996	*Packaging and Transportation Safety*, U.S. Department of Energy, Washington, D.C.
DOE Order 5400.5, 1993	*Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C.
DOE Order 5480.23, 1994	*Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.
DOE Order 6430.1A, 1989	*General Design Criteria*, U.S. Department of Energy, Washington, D.C., Washington, D.C.
DOE/RL-96-68, Rev. 2, 1998	*Hanford Analytical Services Quality Assurance Requirements Document*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
DOE-STD-1027-92, 1992	*Guidance on Preliminary Hazard Classification and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.
RCRA, 1976	*Resource Conservation and Recovery Act of 1976*, 42 USC 6901.
SW-846, 3rd ed., 1992	*Test Methods for Evaluating Solid Wastes: Physical/Chemical Properties*, SW-846, as amended by Updates I (July 1992), IIA (August 1993), IIB (January 1995), and III (1997), U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C.
WAC 173-303, 1999	"Dangerous Waste Regulations," *Washington Administrative Code*, as amended.
WAC 173-303-300, 1999	"General Waste Analysis," *Washington Administrative Code*, as amended.
WAC 173-400, 1999	"General Regulations for Air Pollution Sources," *Washington Administrative Code,* as amended.
WAC 173-480, 1999	"Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, as amended.
WAC 246-247, 1999	"Radiation Protection - Air Emissions," *Washington Administrative Code*, as amended.

2.2 NON-GOVERNMENT DOCUMENTS

National codes, standards, and the Hanford Site documents listed in Table 2-2 constitute a part of this specification to the extent specified herein. Note: The RPP-PRO procedures implement Federal and state regulations and DOE orders. In addition, it should be noted that some requirements are based on the existing authorization basis documents (e.g., *Tank Waste Remediation System Final Safety Analysis Report*, HNF-SD-WM-SAR-067, and *Tank Waste Remediation System Technical Safety Requirements*, HNF-SD-WM-TSR-006). The authorization basis requirements may be changed, if necessary, after the analysis and justification of the resulting risk have been outlined in a final safety analysis report amendment and approval is obtained from the DOE Office of River Protection (ORP).

Table 2-2. Non-Government Documents. (4 Sheets)

Document Number	Title
ASME B31.3, 1999	*Process Piping*, American Society of Mechanical Engineers, New York, New York.
ASME NQA-1, 1997	*Quality Assurance Requirements for Nuclear Facility Applications*, American Society of Mechanical Engineers, New York, New York.
HNF-2004, Rev. 1, 1999	*Estimated Dose to In-Tank Equipment and Ground-Level Transfer Equipment During Privatization*, COGEMA Engineering Corporation for Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-2937, Rev. 0, 1999	*Estimated Maximum Concentration of Radionuclides and Chemical Analytes in Phase 1 and Phase 2 Transfers*, COGEMA Engineering Corporation for Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-2962, Rev. 0, 1998	*A List of EMI/EMC Requirements*, Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-5183, Rev. 0, 2000	*Tank Farms Radiological Control Manual (TFRCM)*, CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. II, Section 6.1, Rev. 0a, 1999	*RPP Administration,* "Tank Farm Operations Equipment Labeling," Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-IP-0842, Vol. XI, Section 1.0, Rev. 2a, 1999	*RPP Administration, RPP Administration,* "Tank Farm Operations Equipment Labeling," Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-IP-1266, Rev. 2, 1999	*Tank Farms Operations Administrative Controls*, DE&S Hanford, Incorporated for Fluor Daniel Hanford, Inc., Richland, Washington.

Table 2-2. Non-Government Documents. (4 Sheets)

Document Number	Title
HNF-PRO-5123, Rev. 0, 2000	*Mixed Waste*, Fluor Hanford, Richland, Washington.
HNF-PRO-5125, Rev. 0, 2000	*Radioactive Waste*, Fluor Hanford, Richland, Washington.
HNF-SD-GN-ER-501, Rev. 1, 1998	*Natural Phenomena Hazards, Hanford Site Washington*, Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-MP-SRID-001, Rev. 2, 1999	*Tank Waste Remediation System Standards/Requirements Identification Document*, Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-SD-WM-DQO-001, Rev. 3, 1999	*Data Quality Objectives for Tank Farms Waste Compatibility Program*, Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-SD-WM-DQO-002, Rev. 2, 1995	*Data Quality Objectives for Tank Hazardous Vapor Safety Screening*, Westinghouse Hanford Company, Richland, Washington.
HNF-SD-WM-DQO-004, Rev. 3, 1997	*Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue*, DE&S Hanford, Inc., for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-WM-DQO-021, Rev. 1, 1999	*Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-SD-WM-DQO-025, Rev. 1, 1999	*Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis*, Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-SD-WM-HSP-002, Rev. 3B, 1999	*Tank Farms Health and Safety Plan*, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-WM-SAR-067, Rev. 1, 1999	*Tank Waste Remediation System Final Safety Analysis Report*, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

Table 2-2. Non-Government Documents. (4 Sheets)

Document Number	Title
HNF-SD-WM-SP-012, Rev. 1, 1999	*TWRS Operation and Utilization Plan to Support Waste Feed Delivery*, Numatec Hanford Corporation, Lockheed Martin Hanford Corporation, and COGEMA Engineering Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-SD-WM-TSR-006, Rev. 1, 1999	*Tank Waste Remediation System Technical Safety Requirements*, Fluor Daniel Hanford, Inc., Richland, Washington.
RPP-PRO-081, Rev. 0, 1999	*Hazardous Energy Control Program.*
RPP-PRO-083, Rev. 0, 1999	*Personal Protection.*
RPP-PRO-084, Rev. 0, 1999	*Safety Showers and Eyewashes.*
RPP-PRO-096, Rev. 0, 1999	*Material Handling and Storage.*
RPP-PRO-097, Rev. 0, 1999	*Engineering Design and Evaluation.*
RPP-PRO-102, Rev. 0, 1999	*Safety Color Coding.*
RPP-PRO-120, Rev. 0a, 1999	*Respiratory Protection Program.*
RPP-PRO-156, Rev. 0, 1999	*Non-Radioactive Hazardous Materials/Hazardous Waste (HM/HW) Shipments.*
RPP-PRO-157, Rev. 0, 1999	*Radioactive Material/Waste Shipments.*
RPP-PRO-163, Rev. 0, 1999	*Documentation and Record Keeping.*
RPP-PRO-222, Rev. 0, 1999	*Quality Assurance Records Standards.*
RPP-PRO-224, Rev. 0, 1999	*Document Control Program Standards.*
RPP-PRO-340, Rev. 0, 1999	*Fire Protection Program Overview.*
RPP-PRO-341, Rev. 0, 1999	*Fire Protection Policy.*
RPP-PRO-349, Rev. 1, 1999	*Fire Protection Design/Operations Criteria.*

Table 2-2. Non-Government Documents. (4 Sheets)

Document Number	Title
RPP-PRO-350, Rev. 0, 1999	*Fire Hazards Analysis Requirements.*
RPP-PRO-354, Rev. 0, 1999	*Fire Surveillance Requirements.*
RPP-PRO-358, Rev. 0, 1999	*Flammable/Combustible Liquids.*
RPP-PRO-359, Rev. 0, 1999	*Control of Combustibles.*
RPP-PRO-699, Rev. 0, 1999	*Storing and Handling Chemicals.*
RPP-PRO-702, Rev. 0, 1999	*Safety Analysis Process - Facility Change or Modification.*
RPP-PRO-703, Rev. 0, 1999	*Safety Analysis Process - New Project.*
RPP-PRO-704, Rev. 0, 1999	*Hazard and Accident Analysis Process.*
RPP-PRO-709, Rev. 0, 1999	*Preparation and Control Standard for Engineering Drawings.*
RPP-PRO-1621, Rev. 0, 1999	*ALARA Decision-Making Methods.*
RPP-PRO-1622, Rev. 0, 1999	*Radiological Design Review Process.*
RPP-PRO-1819, Rev. 0, 1999	*Engineering Requirements.*

3.0 REQUIREMENTS

3.1 SUBSYSTEM/COMPONENT DEFINITION

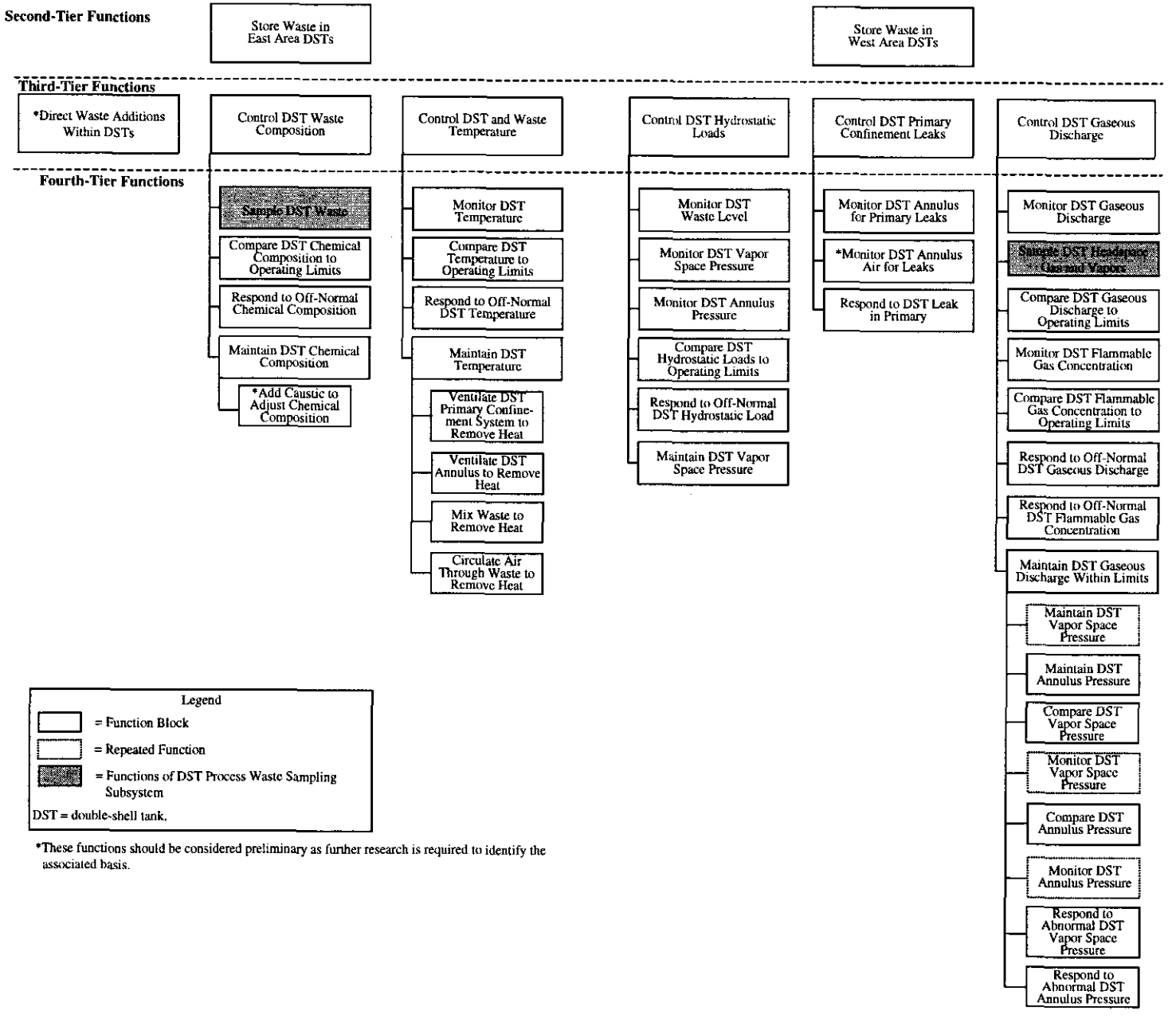
The DST System provides safe storage of waste products, serves as a waste processing system for waste pretreatment, and provides a staging system for delivery of waste feed to the River Protection Project (RPP) Privatization Contractor facility for waste treatment/immobilization.

The DST System includes six tank farms containing a total of 28 DSTs. Five of the DST farms are located in the 200 East Area (241-AN, 241-AP, 241-AW, 241-AY, and 241-AZ), and one is located in the 200 West Area (241-SY). The four tanks in the 241-AY and 241-AZ tank farms are designed to store high heat or "aging" waste and have a design storage capacity of 3,800 m^3 (1 Mgal) each. Each of the other DSTs has a design capacity of 4,390 m^3 (1.16 Mgal) per tank. Tank 241-AN-107, with a capacity of 4,390 m^3 (1.16 Mgal), could be used as an aging waste storage tank. The planned usage of the DSTs during Phase 1 Waste Feed Delivery is detailed in the *Tank Waste Remediation System Operation and Utilization Plan to Support Waste Feed Delivery*, HNF-SD-WM-SP-012. This specification's requirements are based on the Case 3, Project Planning, DST usage scenario documented therein. Notice that Case 3S6D, 2006 Hot Start, will be documented in Revision 2 of HNF-SD-WM-SP-012 and will serve as the baseline case for the Readiness to Proceed-2 -RPP milestone. Case 3S6D incorporates changes to Case 3 to resolve feed staging tank issues, reflect changes in the assumptions, and include additional programmatic constraints, as directed by DOE ORP. Preliminary quantitative and qualitative assessments were performed to determine the impacts of these changes to the DST subsystem requirements. Generally, the DST subsystem requirements were determined to be insensitive to the aforementioned changes; that is, the fundamental system-level requirements remained constant between Cases 3 and 3S6D (e.g., the need to prepare and transfer AN Farm tank waste to the vitrification facility). In instances where quantitative assessments were performed, the enveloping case was selected to develop the DST subsystem requirements.

The DST System specification (*System Specification for the DST System*, HNF-SD-WM-TRD-007) identifies several second-tier waste transfer functions (Figures 3-1 and 3-2). The Store Waste in East/West Area DSTs, Prepare Waste in West Area DSTs, Prepare Waste in East Area DSTs, Prepare Low-Activity Waste (LAW) in LAW Staging Tanks, and Prepare High-Level Waste (HLW) Sludges in HLW Staging Tanks functions have been further decomposed as shown. These are shown as third- and fourth-tier functions of the waste storage and preparation functions in Figure 3-1. *Functional Analysis for Double-Shell Tank Subsystems*, HNF-5136, allocates the shaded third- and fourth-tier functions of Figure 3-1 to the DST Process Waste Sampling Subsystem. These fourth-tier functions from HNF-5136 have been further decomposed by further functional analysis as follows:

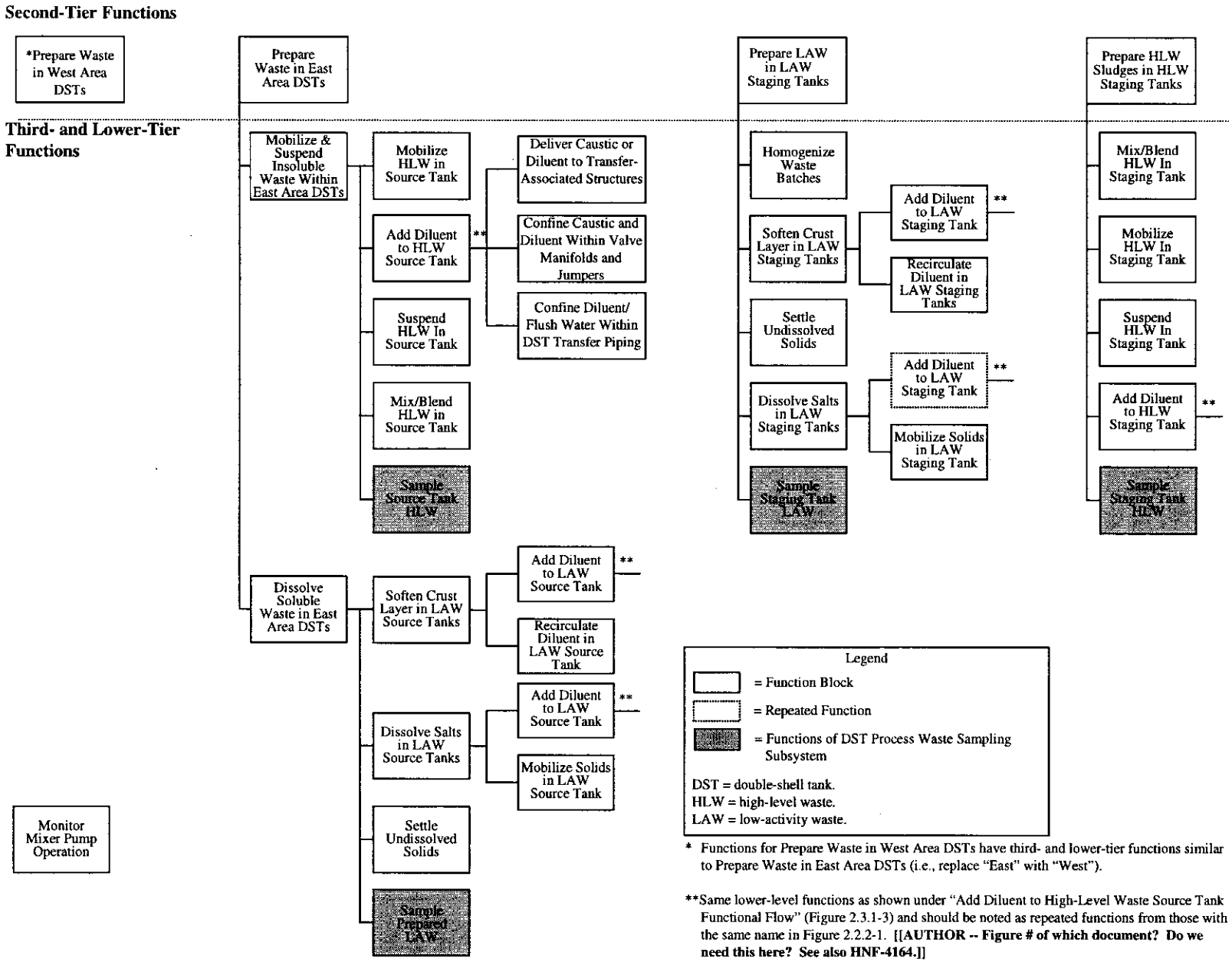
- Sample DST Waste for Safe Storage
  - Collect DST Liquid and Suspended Solids Samples
  - Collect DST Solids Samples
  - Handle and Transport DST Liquid and Suspended Solids Samples
  - Handle and Transport DST Solids Samples

Figure 3-1. Double-Shell Tank Process Waste Sampling Subsystem Functional Hierarchy for Waste Storage.



*These functions should be considered preliminary as further research is required to identify the associated basis.

Figure 3-2. Double-Shell Tank Process Waste Sampling Subsystem Functional Hierarchy for Waste Preparation.



* Functions for Prepare Waste in West Area DSTs have third- and lower-tier functions similar to Prepare Waste in East Area DSTs (i.e., replace "East" with "West").

Same lower-level functions as shown under "Add Diluent to High-Level Waste Source Tank Functional Flow" (Figure 2.3.1-3) and should be noted as repeated functions from those with the same name in Figure 2.2.2-1. **[[AUTHOR -- Figure # of which document? Do we need this here? See also HNF-4164.]]

- Sample Source Tank HLW
  - Collect HLW Source Tank Liquid and Suspended Solids Sample
  - Handle and Transport HLW Source Tank Liquid and Suspended Solids Sample
  - Collect DST Solids Samples
  - Handle and Transport DST Solids Samples
- Sample Prepared LAW
  - Collect Prepared LAW Liquid and Suspended Solids Samples
  - Handle and Transport Prepared LAW Liquid and Suspended Solids Samples
  - Collect Prepared LAW Solids Sample
  - Handle and Transport Prepared LAW Solids Sample
- Sample Staging Tank HLW
  - Collect HLW Staging Tank Liquid and Suspended Solids Sample
  - Handle and Transport HLW Staging Tank Liquid and Suspended Solids Sample
- Sample Staging Tank LAW
  - Collect LAW Staging Tank Liquid and Suspended Solids Sample
  - Handle and Transport LAW Staging Tank Liquid and Suspended Solids Sample
- Sample DST Headspace Gases and Vapors
  - Collect DST Headspace Sample
  - Handle and Transport DST Headspace Sample

Section 3.2.1 of this specification is organized to accommodate these shaded functions, as well as the lower-tier functions listed above.

The DST System consists of the 12 subsystems identified in Figure 3-3. Five of these subsystems (electrical, raw water, potable water, service air, and instrument air) will be collected into one specification for the DST Utilities Subsystem. Several of these subsystems have been further subdivided to identify lower level subsystem/components. Subsystem specifications will be prepared for the subsystems/components shaded in Figure 3-3, because they will be constructed or modified in support of Phase 1 Waste Feed Delivery.

The primary interfaces between DST subsystems/components are shown in Figures 3-4 and 3-5. Figure 3-4 shows the primary DST mechanical system interfaces for nine subsystems. Different materials going between the subsystems are shown as different types of lines. For waste preparation, the mixer pump moves waste within the waste confinement subsystem (i.e., the tanks) at a high velocity to suspend undissolved solids and/or to mix supernatant. Once waste preparation is complete, waste is removed from the DST Confinement Subsystem source tank by the transfer pump and is routed by the valving subsystem through the piping subsystem toward its destination (i.e., another DST or the RPP Privatization Contractor facility). If the destination is another DST, the valving subsystem will direct the waste into the receiving DST. If the destination is the processing plant, the plant's waste receipt piping will route the waste into the plant.

Figure 3-3. Double-Shell Tank System Architecture Tree.

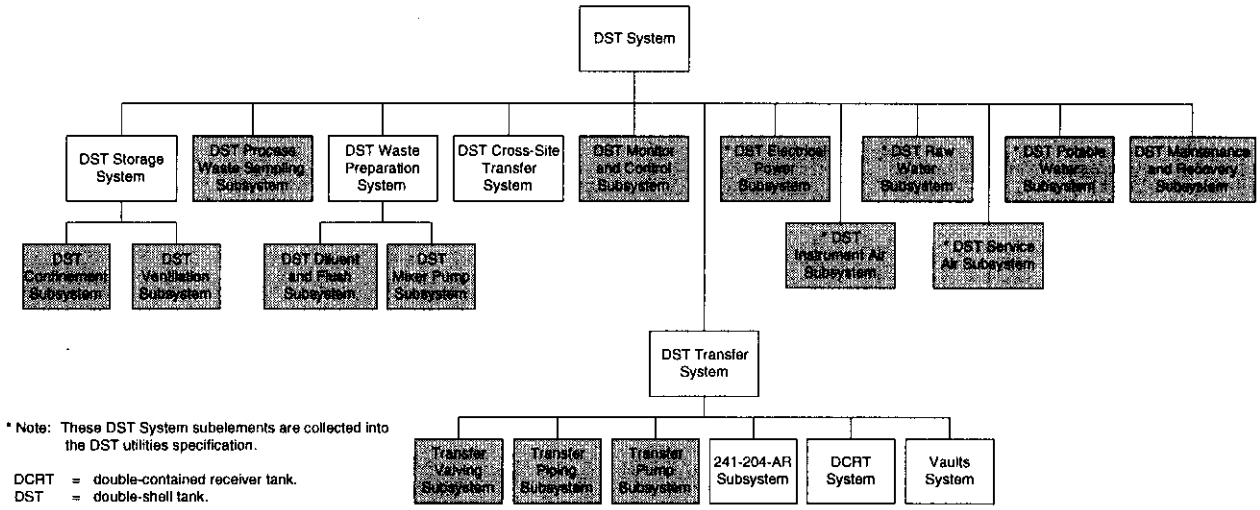


Figure 3-4. Subsystem for Double-Shell Tank Mechanical System Interfaces.

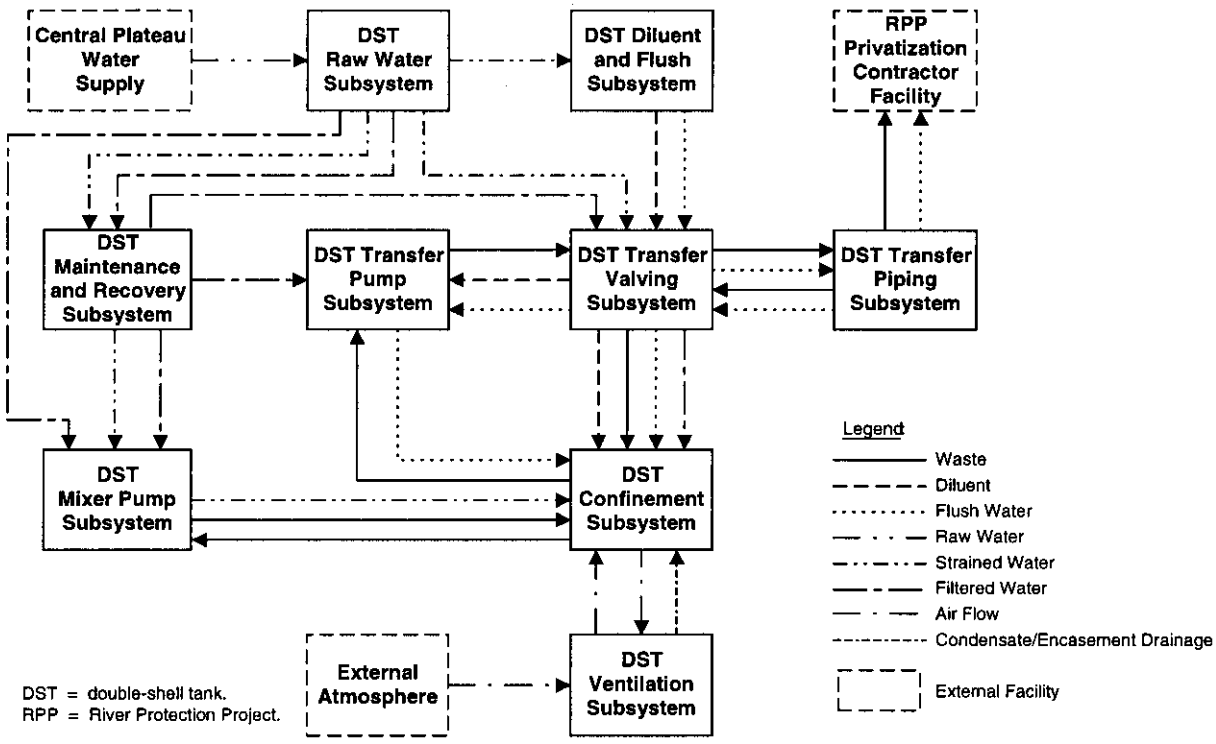
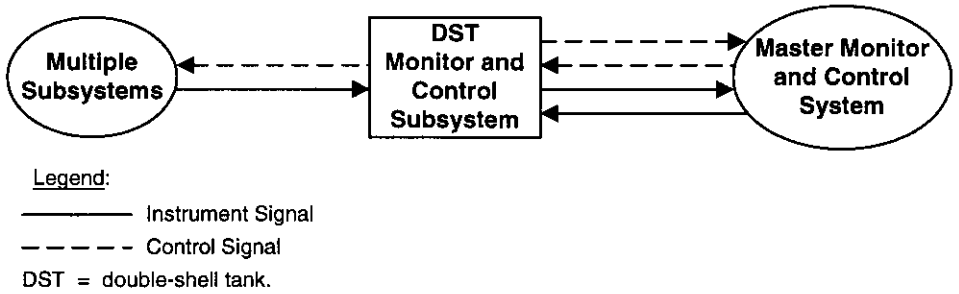


Figure 3-5. Interfaces for Double-Shell Tank Monitor and Control Subsystem.



The role of the DST Process Waste Sampling Subsystem is to sample in-process waste undergoing preparation or staging in the DST System for delivery to the HLW and LAW vitrification plants. Some of the functions identified for the DST Process Waste Sampling Subsystem are similar to those currently being performed by the existing Tank Waste Sampling System. While the DST Process Waste Sampling Subsystem will use the capabilities of the existing Tank Waste Sampling System where feasible, the DST Process Waste Sampling Subsystem may include additional hardware to perform functions not within the capabilities of the existing Tank Waste Sampling System. Consequently, the DST System architecture, as established in the *Tank Waste Remediation System Architecture Tree* (HNF-4208), was developed to include the DST Process Waste Sampling Subsystem as a subsystem separate from Tank Waste Sampling System. This separation of the DST Process Waste Sampling Subsystem from the Tank Waste Sampling System is discussed in greater detail in the *Double-Shell Tank Process Waste Sampling Subsystem Definition Report* (RPP-5786). A systemwide DST System description follows.

The DST Confinement Subsystem must confine the tank waste during both in-tank waste processing (e.g., mixing, diluent addition) and in static storage. In either case, the DST Ventilation Subsystem draws air in from, and exhausts air out to, the external atmosphere to cool and to maintain confinement of the DST Confinement Subsystem vapors. Before exhausting the air, the DST Ventilation Subsystem removes radioactive particulates and hazardous and toxic gases (primary only) from the confinement subsystem's primary and annulus vapor space.

The DST Raw Water Subsystem receives water from the Site Raw Water Distribution System, where it is strained to remove large particulates before being used by the DST Diluent and Flush Subsystem. The DST Diluent and Flush Subsystem chemically adjusts the water for dilution or for flushing. The degree of chemical adjustment of diluent will depend on the batch of waste being transferred. The raw water is heated to match the waste temperature (see *Waste Feed Delivery Technical Basis*, HNF-1939, Volume II, Revisions 0a [Addendum 1-1], 0b [Addendum 2-1], and 0c [Addendum 3-1]).

Diluent is routed by the valving subsystem either to the transfer pump for in-line dilution of the waste or to the confinement subsystem for in-tank dilution. When a LAW transfer is complete, the flush water flow to the transfer pump is increased sufficiently to stop the transfer of waste. The transfer pump pushes the flush water through the valving and piping subsystems into the

confinement subsystem (see HNF-1939, Volume II, Revision 0b [Addendum 2-1] and 0c [Addendum 3-1]). When an HLW transfer is complete, flush water is introduced into the waste transfer line. The point of entry of the flush water into the waste transfer line, at either the pump suction or discharge, is yet to be determined (see HNF-1939, Volume II, Revision 0a [Addendum 1-1]).

The DST Raw Water Subsystem filters water to remove small particles before the water is piped directly to the mixer pump and transfer valving subsystems. Filtered water is routed to the confinement subsystem via the transfer valving subsystem. Filtered water also can be routed to the mixer pump, the transfer pump, and the valve pit via the DST Maintenance and Recovery Subsystem for infrequent needs. Infrequent needs may include filling a mixer pump drive shaft and providing water to the pump seals.

The DST Maintenance and Recovery Subsystem will be used for many other infrequent needs that were not shown on the diagram for reasons of clarity. For example, raw water will be used to decontaminate the pumps when they are removed from the tanks. It also will be used in decontaminating the valve and pump pits.

Figure 3-5 generically shows how the DST Monitor and Control Subsystem interfaces with other systems. The subsystems shown in Figure 3-4 provide instrument data signals to the DST Monitor and Control Subsystem. The DST Monitor and Control Subsystem transmits selected data to the Master Monitor and Control System. The DST Monitor and Control Subsystem also receives data and control signals from the Master Monitor and Control System. Based on the data and control signals received, the DST Monitor and Control Subsystem sends control signals to the multiple DST subsystems.

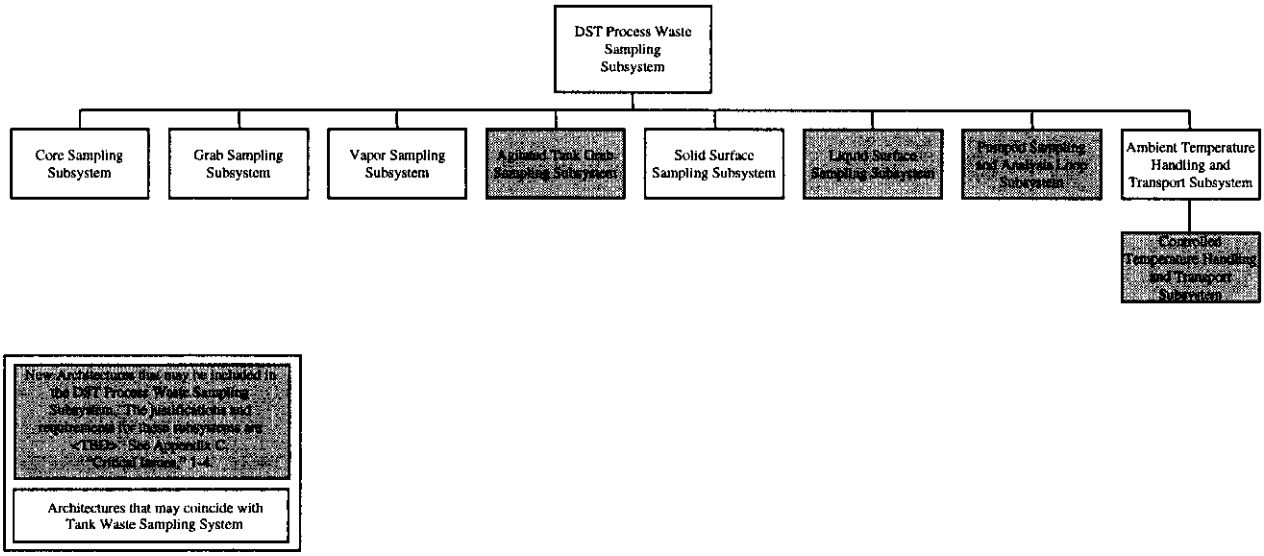
3.1.1 Subsystem/Component Diagrams

Major subsystems for the DST Process Waste Sampling Subsystem were chosen based on the subsystem's functional requirements and the DST System architecture (see RPP-5786). The importance of, and need for, sampling during mixer pump operation, performing real-time sample analysis in the field, or controlling the temperature of the retrieved sample, has not been established.

Figure 3-6 shows the architectural decomposition of the DST Process Waste Sampling Subsystem. The major subsystems that have been identified are:

- Core sampling subsystem
- Grab sampling subsystem
- Vapor sampling subsystem
- Agitated tank grab sampling subsystem
- Solid surface sampling subsystem
- Liquid surface sampling subsystem
- Pumped sampling and analysis loop subsystem
- Ambient temperature sampling handling and transport subsystem
- Controlled temperature sampling handling and transport subsystem

Figure 3-6. Architectural Decomposition of the Double-Shell Tank Process Waste Sampling Subsystem.



DST = double-shell tank.

The DST Process Waste Sampling Subsystem removes waste from DSTs for observation, testing, and/or analysis in support of the WFD mission. In most cases, the DST Process Waste Sampling Subsystem captures samples of DST contents in sample containers and transports the filled sample containers to a laboratory for analysis. In some cases, observations or measurements may be performed in the field. Various sample collection and handling architectures are employed to accommodate different waste characteristics, locations within DSTs, measurement criteria, and operating conditions. The purpose of sampling is to obtain specific information about waste characteristics that is needed to make informed decisions about the storage and processing of the waste. Consequently, the type, quantity, and timing of samples obtained are driven by data requirements and constrained by waste characteristics and process conditions.

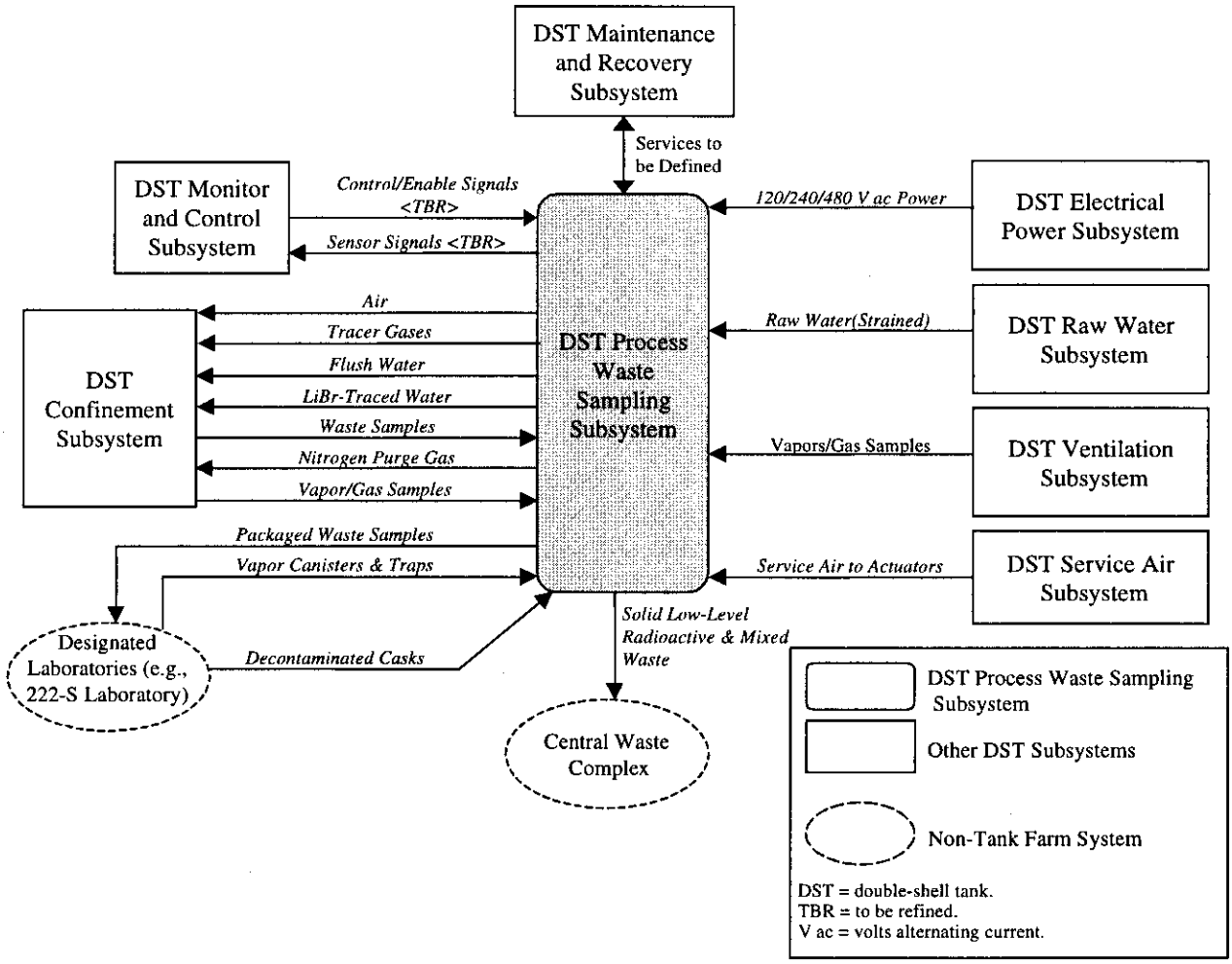
The data requirements that drive sampling for storage and transfer of wastes within the DST System have been evaluated through the data quality objective (DQO) process. These DQOs do not address the transfer of slurries containing >5% solids by volume from tanks undergoing mixing. DQOs have not yet been developed to establish the data requirements that drive sampling for process control and feed certification. Interface control documents, process control strategies, and flowsheets that establish these data requirements are being developed concurrently with the preparation of this specification. This specification includes those sampling capabilities judged to be likely to be required to implement the WFD mission as described in these draft documents being prepared.

3.1.2 Interface Definition

This section identifies the major interfaces of the DST Process Waste Sampling Subsystem with other systems. The interface descriptions that follow are intended to help define the subsystem

boundaries. These interface relationships are illustrated in Figure 3-7. This section discusses the inputs from these interfacing systems and facilities. Outputs from the DST Process Waste Sampling Subsystem to other systems and facilities are discussed in Section 3.2.1.

Figure 3-7. Major Interfaces of the Double-Shell Tank Process Waste Sampling Subsystem.



3.1.2.1 Functional Interfaces

3.1.2.1.1 Double-Shell Tank Electrical Power Subsystem. The DST Process Waste Sampling Subsystem receives power from the DST Electrical Power Subsystem to energize instrumentation loops, signal conditioners, input/output devices, programmable logic controllers, operator-interface stations, computers, servers, data-storage devices, motors, actuators, lights, fans, and sampling devices. Heating, ventilation, and air conditioning systems used to maintain samples at a constant temperature may be powered electrically.

a. The DST Process Waste Sampling Subsystem shall be designed to operate using 120/240/480 V ac power as supplied by the DST Electrical Power Subsystem.

3.1.2.1.2 Double-Shell Tank Raw Water Subsystem. The DST Raw Water Subsystem provides small quantities of water for flushing and/or decontamination.

a. The DST Process Waste Sampling Subsystem shall be designed to use filtered raw water at a <TBD> rate and <TBD> pressure for flushing and decontamination.

3.1.2.1.3 Double-Shell Tank Service Air Subsystem. The DST Service Air Subsystem provides small quantities of compressed air for controls and actuators.

a. The DST Process Waste Sampling Subsystem's controls, instrumentation, and actuators shall be designed to use <TBD> metric <TBD> lbf/in^2) of instrument air, as provided by the DST Service Air Subsystem.

3.1.2.1.4 Double-Shell Tank Ventilation Subsystem. The DST Process Waste Sampling Subsystem interfaces with the DST Ventilation Subsystem to collect samples of headspace vapors and gases.

a. The DST Process Waste Sampling Subsystem shall be designed to remove gas and vapor samples using existing DST Ventilation Subsystem access points.

3.1.2.1.5 Designated Laboratories. Non-DST System laboratories, such as the 222-S Laboratory and other laboratories designated by the RPP or Privatization Contractor, receive and analyze samples obtained by the DST Process Waste Sampling Subsystem. The designated laboratories decontaminate sample shipping casks and return them to the DST Process Waste Sampling Subsystem. The designated laboratories also provide vapor canisters and traps for sampling.

a. The DST Process Waste Sampling Subsystem shall be capable of using sampling casks decontaminated to a surface contamination level meeting SARP requirements <TBD>.

b. The DST Process Waste Sampling Subsystem shall be capable of using designated laboratory-supplied canisters and traps for capturing specified gaseous and vapor analytes. Quantitative requirements have not been determined at this time and are <TBD>.

3.1.2.1.6 Double-Shell Tank Maintenance and Recovery Subsystem. The DST Maintenance and Recovery Subsystem provides the equipment, material, facilities, and qualified personnel to perform required preventive and repair maintenance for the DST Process Waste Sampling Subsystem. The requirements for this interface have not been determined at this time and are <TBD>.

3.1.2.1.7 Double-Shell Tank Confinement Subsystem. The DST Process Waste Sampling Subsystem interfaces with the DST Confinement Subsystem by gaining access to the tank waste through risers and other tank confinement system penetrations. The DST Process Waste Sampling Subsystem also will exhaust air into the DST Ventilation Subsystem, provided that the tank containment or air balance are not adversely affected.

a. The DST Process Waste Sampling Subsystem shall be designed to remove tank waste samples from the DST Confinement Subsystem using existing risers and access points.

b. The DST Process Waste Sampling Subsystem shall be designed to remove samples of waste that have leaked into the secondary containment system, if necessary.

3.1.2.1.8 Double-Shell Tank Monitor and Control Subsystem. The DST Monitor and Control Subsystem provides selected tank-parameter information (data) to and receives sensor data from the DST Process Waste Sampling Subsystem for purposes of operational support as well as for safety and safety interlocking.

a. The DST Process Waste Sampling Subsystem shall be capable of accepting data from the DST Monitor and Control Subsystem. Data flow requirements have not been established at this time and are <TBD>.

3.1.2.2 Physical Interfaces

Detailed physical interface definition and requirements associated with the DST Process Waste Sampling Subsystem are captured in interface control documents that are application-specific and are (to be) developed by line item project organizations responsible for the design of DST subsystems, as directed by the WFD Program Office.

3.1.3 Major Component List

Major components of the DST Process Waste Sampling Subsystem are listed in Section 3.1.1.

3.1.4 Government-Furnished Property List

Not applicable.

3.1.5 Government-Loaned Property Lists

Not applicable.

3.2 CHARACTERISTICS

This section contains the minimum requirements related to performance characteristics, physical characteristics, reliability, maintainability, environmental conditions, transportability, and flexibility and expansion. Minimum requirements are identified by SHALL statements, while design goals are identified by SHOULD statements. If a requirement with a "should" statement cannot be satisfied, justification of an alternative design shall be submitted to the Design Authority for approval. The source documents that provide the basis for each requirement are identified in Appendix A.

3.2.1 Performance Characteristics

This section contains requirements related to the functionality and performance capabilities for the DST Process Waste Sampling Subsystem.

3.2.1.1 Sample Double-Shell Tank Waste for Safe Storage

The DST Process Waste Sampling Subsystem shall obtain representative samples of the DST contents for analysis of the waste's chemical composition, radiological content, physical properties, and other properties necessary to confirm that applicable operational and safety parameters are being met for safe storage of the DST contents.

a. **Corrosivity.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of supernate corrosivity characteristics. These samples shall reflect and retain the following properties of DST contents during sample collection, handling, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Supernate	Liquid and suspended solids	Hydroxide Concentration	
	Liquid and suspended solids	Hydroxide demand	Titration to measure buffering behavior
	Liquid and suspended solids	Nitrate Concentration	
	Liquid and suspended solids	Nitrite Concentration	

b. **Safety Screening.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to screen tank wastes for safety hazards. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Headspace (see Section 3.2.1.6)	Vapor/gas	Flammability	Additional analyses required if >10% of lower flammability limit
Supernate	Liquid and suspended solids	Energetics	- Additional analyses required if exotherms >480 J/g on a dry weight basis
	Liquid and suspended solids	Alpha activity	- Additional analyses required if alpha activity >2.3 TBq/mL (62 μCi/mL)
	Liquid and suspended solids	Moisture content	-per WHC-SD-WM-SP-004

Waste Location	Waste Phase	Characteristic	Remarks
Solids	Solids	Energetics	Additional analyses required if exotherms >480 J/g on a dry weight basis-
	Solids	Alpha activity	Additional analyses required if alpha activity >2.3 TBq/mL (62 µCi/mL)
	Solids	Moisture content	-
	Solids	Density	-

c. **Flammable Gas.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for resolution of flammable gas safety issues per *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue*, HNF-SD-WM-DQO-004. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Headspace (see Section 3.2.1.6)	Vapor/gas	Chemical composition	Per HNF-SD-WM-DQO-004
Supernate	Liquid and suspended solids	Chemical composition	Per HNF-SD-WM-DQO-004
		Viscosity	Per HNF-SD-WM-DQO-004
		Density	Per HNF-SD-WM-DQO-004
		Moisture content	Per HNF-SD-WM-DQO-004
Solids	Solids	Chemical composition	Per HNF-SD-WM-DQO-004
		Radionuclides	Per HNF-SD-WM-DQO-004
		Shear strength	Per HNF-SD-WM-DQO-004
		Moisture content	Per HNF-SD-WM-DQO-004
		Particle size	Per HNF-SD-WM-DQO-004
	Gas retained within solid phase	Retained gas volume	Per HNF-SD-WM-DQO-004
		Composition	Per HNF-SD-WM-DQO-004

d. **Regulatory Status of Waste.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of the waste per *Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis*, HNF-SD-WM-DQO-025). These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Supernate	Liquid and suspended solids	Cations	Various cations per HNF-SD-WM-DQO-025
		Anions	Various anions per HNF-SD-WM-DQO-025
		Volatile organic analysis	Various compounds per HNF-SD-WM-DQO-025
		Semivolatile organic analysis	Per HNF-SD-WM-DQO-025
		Polychlorinated Biphenyls (PCBs)	Per HNF-SD-WM-DQO-025
		Mercury	Per HNF-SD-WM-DQO-025
		Ignitability (flash point)	Per HNF-SD-WM-DQO-025
		pH	Per HNF-SD-WM-DQO-025
Solids	Solids	Cations	Various cations per HNF-SD-WM-DQO-025
		Anions	Various anions per HNF-SD-WM-DQO-025
		Volatile Organic Analysis (VOA)	Various compounds per HNF-SD-WM-DQO-025
		Semivolatile Organic Analysis (SVOA)	Various compounds per HNF-SD-WM-DQO-025
		Polychlorinated Biphenyls (PCB)	Per HNF-SD-WM-DQO-025
		Mercury	Per HNF-SD-WM-DQO-025
		Ignitability (flash point)	Per HNF-SD-WM-DQO-025
		pH	Per HNF-SD-WM-DQO-025

e. **Regulatory Status of Air Emissions.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of actual or potential air emissions from the waste per *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, HNF-SD-WM-DQO-021. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Headspace (see Section 3.2.1.6)	Vapor/gas	Chemical composition	Per HNF-SD-WM-DQO-021
	Aerosols	Chemical composition	Per HNF-SD-WM-DQO-021
		Radionuclides	Per HNF-SD-WM-DQO-021
	Deposits on filters	Chemical composition	Per HNF-SD-WM-DQO-021
Supernate	Liquid and suspended solids	Chemical composition	Per HNF-SD-WM-DQO-021
Solids	Solids	Chemical composition	Per HNF-SD-WM-DQO-021

f. **Regulatory Status of Privatization Project.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of the waste, waste retrieval activities, and actual or potential air emissions from the waste. These samples shall reflect and preserve the properties of the DST contents identified in *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, PNNL-12040 through sample collection, handling, transport, and analysis.

3.2.1.1.1 Collect Double-Shell Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of DST liquids and suspended solids.

a. The DST Process Waste Sampling Subsystem shall be able to collect 100 mL or 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.

b. The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within ±5 cm (2 in.) <TBR>.

c. The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.

d. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below the riser selected for sampling. <TBR>.

e. The DST Process Waste Sampling Subsystem shall be able to collect samples with zero headspace for VOA and SVOA.

3.2.1.1.2 Handle and Transport Double-Shell Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

b. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or unacceptable alteration of the collected waste samples.

c. The DST Process Waste Sampling Subsystem shall be capable of preserving or refrigerating samples collected for VOA and SVOA analysis in accordance with *Test Methods for Evaluating Solid Wastes: Physical/Chemical Properties*, SW-846 requirements. <TBD>

d. The DST Process Waste Sampling Subsystem shall be capable of delivering a sample to the designated laboratory within one working day. <TBD>

3.2.1.1.3 Collect Double-Shell Tank Solids Samples. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of DST solids.

a. The DST Process Waste Sampling Subsystem shall be able to obtain a full vertical profile of the solids located below the riser selected for sampling.

b. The DST Process Waste Sampling Subsystem shall be capable of capturing and retaining liquids and gases associated with the solids in the solids sampling container.

c. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below the riser selected for sampling. <TBR>.

d. The DST Process Waste Sampling Subsystem shall be able to collect samples with zero headspace for VOA and SVOA. <TBD>

3.2.1.1.4 Handle and Transport Double-Shell Tank Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

b. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or unacceptable alteration of the collected waste samples.

c. The DST Process Waste Sampling Subsystem shall be capable of preserving or refrigerating samples collected for VOA and SVOA in accordance with SW-846 requirements. <TBD>

d. The DST Process Waste Sampling Subsystem shall be capable of delivering a sample to the designated laboratory within one working day. <TBD>

3.2.1.2 Sample Source Tank High-Level Waste

The DST Process Waste Sampling Subsystem shall obtain representative samples of the HLW source tank contents for analysis of the waste's chemical composition, radiological content, physical properties, and other properties necessary to confirm that applicable operational,

regulatory (environmental) and safety parameters are being met during HLW preparation activities. The DST Process Waste Sampling Subsystem shall preserve the integrity of the samples during packaging, handling, and transportation to the designated laboratory.

a. **Process Control.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to monitor the progress of the HLW solids mobilization activity, establish dilution ratios, and determine when a mobilized HLW batch is ready for transfer per <TBD DQOs have not yet been prepared for control of the HLW preparation activity>. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace (see Section 3.2.1.6)	Vapor/gas	<TBD>	<TBD>
Supernate	Liquid and suspended solids	<TBD based on requirements to be documented in future DQO>	<TBD based on requirements to be documented in future DQO>
Solids	Unsuspended solids heel	<TBD based on requirements to be documented in future DQO>	<TBD based on requirements to be documented in future DQO>

b. **Compatibility.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in *Data Quality Objectives for Tank Farm Waste Compatibility Program*, HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids by volume. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids>.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace (see Section 3.2.1.4)	Vapor/gas	Various	<TBD based on requirements documented in future HNF-SD-WM-DQO-001revision>
Supernate surface	Liquid and suspended solids	Presence of separable organic phase <TBR based on requirements documented in future HNF-SD-WM-DQO-001 revision>	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision>

Waste Location	Waste Phase	Characteristic	Measurement Range
Supernate	Liquid and suspended solids	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision>	Various <TBR based on requirements documented in future HNF-SD-WM-DQO-001revision>
Solids	Solids	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision; current DQO does not require solids samples>	<TBD based on requirements documented in future HNF-SD-WM-DQO-001revision>

3.2.1.2.1 Collect High-Level Waste Source Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of HLW source tank liquids and suspended solids.

a. The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.

b. The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within ±5 cm (2 in.) <TBR>.

c. The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.

d. The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.

e. The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.

f. The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry when the tank is undergoing mixing within <TBD>%.

g. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.

h. The DST Process Waste Sampling Subsystem shall be able to obtain real-time measurements of <TBD> with an accuracy of <TBD> at the sampling location.

3.2.1.2.2 Handle and Transport High-Level Waste Source Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.

b. The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.

c. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.1.2.3 Collect Double-Shell Tank Solids Samples. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of DST solids.

a. The DST Process Waste Sampling Subsystem shall be able to obtain a full vertical profile of the solids located below the riser selected for sampling.

b. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.

3.2.1.2.4 Handle and Transport Double-Shell Tank Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.

b. The sample shall be maintained within <TBD> degrees of tank temperature during handling and transport to minimize uncontrolled formation or dissolution of solids within the sample container caused by temperature changes. <TBD formation of solids during handling and transport could result in overstating the amount of solids mobilized><TBD the importance or need for this feature has not been established>.

c. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.1.3 Sample Prepared Low-Activity Waste

The DST Process Waste Sampling Subsystem shall obtain representative samples of the prepared LAW for analysis of the waste's chemical composition, radiological content, physical properties, and other properties necessary to confirm that applicable operational, regulatory (environmental) and safety parameters are being met during LAW preparation activities. The DST Process Waste Sampling Subsystem shall preserve the integrity of the samples during packaging, handling, and transportation to the designated laboratory.

a. **Process Control.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for process control to monitor the progress of the LAW solids dissolution activity, establish dilution ratios, and determine when a prepared LAW batch is ready for transfer per <TBD DQOs have not yet been prepared for control of the LAW preparation activity>.

These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace (see Section 3.2.1.6)	Vapor/gas	<TBD>	<TBD>
Supernate	Liquid and suspended solids	<TBD based on requirements to be documented in future DQO>	<TBD based on requirements to be documented in future DQO>
Undissolved solids heels and crusts	Solids	<TBD based on requirements to be documented in future DQO>	<TBD based on requirements documented in future DQO>

b. **Compatibility.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the properties of the DST contents specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis.

3.2.1.3.1 Collect Prepared Low-Activity Waste Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of prepared LAW liquids and suspended solids from the DST Confinement Subsystem.

a. The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.

b. The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.

c. The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling. <TBD>

d. The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.

e. The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.

f. The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.

g. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.

h. The DST Process Waste Sampling Subsystem shall be able to obtain real-time measurements of <TBD> with an accuracy of <TBD> at the sampling location.

3.2.1.3.2 Handle and Transport Prepared Low-Activity Waste Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.

b. The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.

c. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.1.3.3 Collect Prepared Low-Activity Waste Solids Samples. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of undissolved solids during LAW preparation.

a. The DST Process Waste Sampling Subsystem shall be able to obtain a full vertical profile of the solids located below the riser selected for sampling.

b. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.

3.2.1.3.4 Handle and Transport Prepared Low-Activity Waste Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.

b. The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.

c. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.1.4 Sample Staging Tank High-Level Waste

The DST Process Waste Sampling Subsystem shall obtain representative samples of the HLW staging tank contents for delivery of samples to the Privatization Contractor, and for analysis of the waste's chemical composition, radiological content, physical properties, and other properties

necessary to certify the waste, establish dilution ratios for waste transfers, evaluate compliance with applicable operational, regulatory (environmental) and safety parameters, and perform a compatibility analysis.

a. **Provide Sample to BNFL Inc.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support composite preparation and delivery of representative samples to the Privatization Contractor per <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Supernate	Liquid and suspended solids	Sufficient quantity to prepare composites and delivers samples to BNFL <TBD>	<TBD>
	Liquid and suspended solids	Representative of tank contents <TBD>	<TBD>

b. **HLW Certification.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to certify the quantity and composition of HLW feed per BNFL ICD-20 <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Supernate	Liquid and suspended solids	Representative of tank contents <TBD>	<TBD>
	Liquid and suspended solids	Visible Separable Organic	<Measurement protocol TBD>
		Chemical composition	Per BNFL ICD-20
		Radionuclides	Per BNFL ICD-20
		Suspended solids	Per BNFL ICD-20

c. **Compatibility.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids.> <TBR HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may be revised when the DQO is revised to include this transfer route>.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace (see Section 3.2.1.4)	Vapor/gas	Various	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision>
Supernate Surface	Liquid and suspended solids	Presence of separable organic phase <TBR based on requirements documented in future HNF-SD-WM-DQO-001 revision>	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision>
Supernate	Liquid and suspended solids	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision>	Various <TBR based on requirements documented in future HNF-SD-WM-DQO-001 revision>
Solids	Solids	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision; current DQO does not require solids samples>	<TBD based on requirements documented in future HNF-SD-WM-DQO-001 revision>

3.2.1.4.1 Collect High-Level Waste Staging Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of HLW source tank liquids and suspended solids.

a. The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.

b. The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.

c. The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.

d. The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.

e. The DST Process Waste Sampling Subsystem shall prevent displacement of any organic collected in the sample container by denser aqueous liquids or slurries <TBD>.

f. The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.

g. The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.

h. The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of HLW staging tank slurry in one working day <TBR>

i. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.

3.2.1.4.2 Handle and Transport High-Level Waste Source Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.

b. The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.

c. The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.

d. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.1.5 Sample Staging Tank Low-Activity Waste

The DST Process Waste Sampling Subsystem shall obtain representative samples of the LAW staging tank contents for delivery of samples to the Privatization Contractor and for analysis of the waste's chemical composition, radiological content, physical properties, and other properties necessary to certify the waste, establish dilution ratios for waste transfers, evaluate compliance with applicable operational, regulatory (environmental), and safety parameters, and perform a compatibility analysis.

a. **Deliver Samples to BNFL, Inc.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support composite preparation and delivery of representative samples to the Privatization Contractor per <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Measurement Range
Supernate	Liquid and suspended solids	Representative of tank contents <TBD>	<TBD>
	Liquid and suspended solids	<TBD>	<TBD>

b. **LAW Certification.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to certify the quantity and composition of LAW feed. These samples shall reflect and retain those properties of the DST contents specified in <TBD: no DQO has been prepared for waste certification> through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Waste surface <TBD>	Liquid and suspended solids	Presence of visible separate organic phase	<TBD measurement protocol>
Supernate	Liquid and suspended solids	Representative of tank contents <TBD>	Per BNFL ICD-19 and DQO <TBD>
	Liquid and suspended solids	Chemical Composition	Per BNFL ICD-19 and DQO <TBD>
		Radionuclides	Per BNFL ICD-19 and DQO <TBD>
		Suspended Solids	Per BNFL ICD-19 and DQO <TBD>

c. **Compatibility.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis and establish transfer parameters such as dilution ratios in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBD HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may change when the DQO is revised to include this transfer route>.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace (see Section 3.2.1.4)	Vapor/gas	Various	Various
Supernate surface	Liquid and suspended solids	Presence of separable organic phase	<TBD based on requirements established when HNF-SD-WM-DQO-001 is revised>
Supernate	Liquid and suspended solids	<TBD based on requirements established when HNF-SD-WM-DQO-001 is revised>	<TBD based on requirements established when HNF-SD-WM-DQO-001 is revised>
Solids	Solids	<TBD based on requirements established when HNF-SD-WM-DQO-001 is revised>	<TBD based on requirements established when HNF-SD-WM-DQO-001 is revised>

3.2.1.5.1 Collect Low-Activity Waste Staging Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall be capable of collecting representative samples of DST liquids and suspended solids.

a. The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.

b. The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.

c. The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.

d. The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.

e. The DST Process Waste Sampling Subsystem shall prevent displacement of any organic collected in the sample container by denser aqueous liquids or slurries <TBD>.

f. The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.

g. The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.

h. The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of LAW staging tank slurry in one working day <TBR>.

i. The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.

3.2.1.5.2 Handle and Transport Low-Activity Waste Staging Tank Liquid and Suspended Solids Sample. The DST Process Waste Sampling Subsystem shall preserve the integrity and representativeness of the samples during handling and transport to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.

b. The sample shall be maintained within <TBD> degrees of tank temperature during handling and transport in order to minimize uncontrolled formation or dissolution of solids within the sample container due to temperature changes <TBD formation of solids during handling and transport could result in overstating the amount of solids present in the staged LAW> <TBD the importance or need for this feature has not been established>.

c. The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.

d. The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.1.6 Sample Double-Shell Tank Headspace Gases and Vapors.

The DST Process Waste Sampling Subsystem shall be able to obtain confirmatory samples of the DST headspace on an as-needed basis to supplement routine headspace vapor monitoring performed by the DST Ventilation Subsystem. The DST Process Waste Sampling Subsystem shall be capable of obtaining defensible samples as required to identify and quantify trapped gases and vapors that are released into the DST headspace during storage and waste-disturbing activities such as waste mobilization, dilution, blending, and transfers.

a. **Safety Screening.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to screen tank wastes for safety hazards. These samples shall reflect and retain the properties of the DST contents identified in WHC-SD-WM-SP-004 through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Headspace	Vapor/gas	Flammability	Additional analyses per WHC-SD-WM-SP-004 if > 10% of lower flammability limit

b. **Flammable Gas.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for resolution of flammable gas safety issues. These samples shall reflect and preserve the properties of the DST contents identified in HNF-SD-WM-DQO-004 through sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Headspace	Vapor/gas	Chemical composition	As specified in HNF-SD-WM-DQO-004

c. **Regulatory Status of Air Emissions.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of actual or potential air emissions from the waste. These samples shall reflect and preserve the parameters identified in *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, HNF-SD-WM-DQO-021 through sample collection, handling, transport, and analysis.

d. **Regulatory Status of Privatization Project.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of the waste, waste

retrieval activities, and actual or potential air emissions from the waste. These samples shall reflect and preserve the following DST waste properties identified PNNL-12040 during sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Remarks
Headspace	Vapor/gas	Various as per chemical composition specified in PNNL-12040.	Various, as specified in PNNL-12040.
		Radionuclides	

e. **HLW Mobilization Process Control.** The DST Process Waste Sampling Subsystem shall have the capability to obtain samples to evaluate the gases and vapors released into the tank headspace by waste-disturbing activities during HLW mobilization and transfer and to control the HLW mobilization activity to maintain gaseous releases within limits. These samples shall reflect and preserve the properties of the DST contents identified in <TBD: no DQO has been prepared for HLW mobilization and transfer process control> during sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace	Vapor/gas	<TBD>	<TBD>

f. **LAW Dissolution Process Control.** The DST Process Waste Sampling Subsystem shall have the capability to obtain representative samples to evaluate the gases and vapors released into the tank headspace by waste-disturbing activities during LAW dissolution and transfer and to control the LAW dissolution activity to maintain gaseous releases within limits. These samples shall reflect and preserve the properties of the DST contents identified in <TBD: no DQO has been prepared for LAW mobilization and transfer process control> during sample collection, handling, transport, and analysis.

Waste Location	Waste Phase	Characteristic	Measurement Range
Headspace	Vapor/gas	<TBD>	<TBD>

3.2.1.6.1 Collect Double-Shell Tank Headspace Sample. The DST Process Waste Sampling Subsystem vapor sampling subsystem shall be capable of collecting samples of DST headspace vapors and gases in appropriate traps or canisters for the analytes to be measured.

a. The DST Process Waste Sampling Subsystem vapor sampling subsystem shall be capable of collecting samples of DST headspace vapors and gases in appropriate traps or canisters for the analytes to be measured.

b. The existing DST Tank Waste Sampling System Vapor Sampling Subsystem shall be used to the maximum extent practical.

3.2.1.6.2 Handle and Transport Double-Shell Tank Headspace Samples. The DST Process Waste Sampling Subsystem shall preserve the integrity of the headspace samples during packaging, handling, and transportation to the RPP-designated laboratory.

a. The DST Process Waste Sampling Subsystem shall be able to remove the sample container or trap from the sample collection device(s) and deliver the sample to the designated laboratory.

3.2.2 Physical Characteristics

This section contains requirements related to physical characteristics (e.g., maximum/minimum physical size, weight, shape).

a. The DST Process Waste Sampling Subsystem shall be limited in size and weight to comply with-- *Tank Farms Operations Administrative Controls,* HNF-IP-1266.

b. The DST Process Waste Sampling Subsystem shall be able to access the waste through risers of 10 cm (4 in.) diameter.

3.2.3 Reliability

This section contains the requirements and other features that promote reliability.

a. The Process Waste Sampling Subsystem shall have a design life of 35 years.

b. All long-term, non-replaceable components shall have a service life-time of <TBD>. In-tank and above-tank components that require maintenance or replacement should be designed for ease of maintenance and as low as reasonably achievable (ALARA) and should have a minimum service life of <TBD> months before maintenance is required. The design goal is to be able to support a complete sampling campaign and not have maintenance adversely impact or become critical path in the campaign.

c. Average availability of batch sampling systems (e.g., core sampling, grab sampling) shall be at least 80%. Average availability is defined as total uptime divided by total time.

d. Average availability of continuous monitoring systems (e.g., pumped sampling and analysis loop) shall be at least 95%. Average availability is defined as total uptime divided by total time.

3.2.4 Maintainability

The design shall consider the maintainability factors peculiar to the specific equipment to be used in the DST Process Waste Sampling Subsystem.

a. The mean time to recover from failures of the DST Process Waste Sampling Subsystem subsystems used for waste certification samples shall be less than <TBD> days.

b. The mean time between DST Process Waste Sampling Subsystem failures shall be less than <TBD> years for repairable components.

3.2.5 Environmental Conditions

This section provides design requirements relevant to natural and induced environmental conditions.

3.2.5.1 Natural Environments

This section defines the natural environmental conditions (e.g., weather) impinging on the subsystem.

a. The subsystem shall be designed for the natural environmental conditions specified in *Natural Phenomena Hazards, Hanford Site, Washington*, HNF-SD-GN-ER-501.

b. The subsystem shall be designed to withstand the natural phenomena hazards as specified in *Engineering Design and Evaluation*, RPP-PRO-097.

3.2.5.2 Induced Environments. This section defines the induced environment impinging on the subsystem.

3.2.5.2.1 Chemistry. The subsystem components that are exposed to the tank waste contents shall be designed to perform their intended function in the chemical environment defined in- *Estimated Maximum Concentration of Radionuclides and Chemical Analytes in Phase 1 and Phase 2 Transfers*, HNF-2937.

3.2.5.2.2 Radiation. The subsystem shall be designed for the maximum (calculated) bounding radiation environment for direct contact with tank waste as defined in *Estimated Dose to In-Tank Equipment and Ground-Level Transfer Equipment During Privatization*, HNF-2004.

3.2.5.2.3 Waste Motion. The subsystem shall be designed for the maximum (calculated) bounding mechanical loads resulting from waste motions induced by operation of mixer pumps as defined in *Double-Shell Tank Mixer Pump Subsystem Specification*, HNF-4164.

a. The Process Waste Sampling Subsystem must be capable of obtaining a representative sample under moving waste conditions.

3.2.6 Transportability

This section provides design requirements relevant to transportation concerns.

a. Support equipment used to ship hazardous materials shall be designed to comply with requirements defined in *Non-Radioactive Hazardous Materials/Hazardous Waste (HM/HW) Shipments*, RPP-PRO-156; and *Hanford Analytical Services Quality Assurance Requirements Document*, DOE/RL-96-68.

b. Major above-ground components of the DST Process Waste Sampling Subsystem shall be equipped with wheels or lifting points to allow the DST Process Waste Sampling Subsystem to be relocated from one riser to another or from one tank to another without extensive disassembly or damage.

c. The Process Waste Sampling Subsystem must be capable of continuous deployment in/on a tank for a <TBD> month time period to support a sampling campaign.

3.2.7 Flexibility and Expansion

Not applicable.

3.3 DESIGN AND CONSTRUCTION

The DST Process Waste Sampling Subsystem shall comply with DOE Order 6430.1A, *General Design Criteria*, Sections 1300-7 and 1323.

3.3.1 Materials, Processes, and Parts

This section defines requirements governing the use of materials, parts and processes in the DST Process Waste Sampling Subsystem.

a. The materials of construction shall not introduce contaminants that interfere with analysis of the samples for waste constituents listed in Section 3.2.1 for which samples obtained by the DST Process Waste Sampling Subsystem are to be analyzed.

b. The materials of construction of sample delivery lines and containers shall not absorb, adsorb, or otherwise interfere with collection of those waste constituents listed in Section 3.2.1 for which the DST Process Waste Sampling Subsystem samples are to be analyzed.

c. The DST Process Waste Sampling Subsystem shall be capable of collecting defensible samples in accordance with SW-846.

d. The DST Process Waste Sampling Subsystem shall be readily removed from the riser after sampling to make that riser available for other uses.

e. The DST Process Waste Sampling Subsystem shall be operable from above grade without a need to remove cover blocks.

f. Vapor sample collection lines shall be constructed of polytetrafluoroethylene (TFE), stainless steel, or other inert material to minimize loss of gases and/or vapors by deposition on the surfaces of the sample lines.

3.3.2 Electromagnetic Radiation

The subsystem shall comply with electromagnetic radiation emission requirements set forth in *A List of EMI/EMC Requirements*, HNF-2962.

3.3.3 Nameplates and Product Marking

This section defines marking and nameplate requirements of the various assemblies and subassemblies that make up the DST Process Waste Sampling Subsystem.

a. The subsystem shall label new equipment and/or modifications to existing equipment in a standardized format in accordance with the tank farm labeling program as specified in *RPP Administration,* "Tank Farm Operations Equipment Labeling," Volume II, Section 6.1, HNF-IP-0842.

3.3.4 Workmanship

Reserved. The requirements for workmanship are to be addressed in lower level project design documentation (drawings, procurement specifications, etc.).

3.3.5 Interchangeability

All like equipment and parts shall be interchangeable/standardized to the maximum extent practical.

3.3.6 Safety

The subsystem shall be designed to protect the public, environment, workers, and equipment in accordance with the requirements of this section.

3.3.6.1 Personnel Safety

Personnel shall be protected from work place hazards in accordance with the following requirements:

a. The subsystem shall be designed to keep personnel exposures ALARA in accordance with *ALARA Decision*-Making Methods, RPP-PRO-1621; *Radiological Design Review Process*, RPP-PRO-1622; "Occupational Radiation Protection," 10 CFR 835; and *Tank Farms Radiological Control Manual (TFRCM)*, HNF-5183.

b. The subsystem shall incorporate occupational design features that comply with the requirements of *Tank Farms Health and Safety Plan*, HNF-SD-WM-HSP-002.

c. The subsystem shall be designed to comply with the safety constraints for working with hazardous material as described in *Hazardous Energy Control Program*, RPP-PRO-081;

Personal Protection, RPP-PRO-083; *Safety Showers and Eyewashes*, RPP-PRO-084; *Material Handling and Storage*, RPP-PRO-096; *Safety Color Coding*, RPP-PRO-102; *Respiratory Protection Program*, RPP-PRO-120; *Flammable/Combustible Liquids*, RPP-PRO-358; *Control of Combustibles*, RPP-PRO-359; and *Storing and Handling Chemicals*, RPP-PRO-699.

3.3.6.2 Equipment Protection

The DST Process Waste Sampling Subsystem shall be designed to avoid damage to other components.

a. The Hazard and Accident Analysis Process shall be followed in accordance with *Hazard and Accident Analysis Process*, RPP-PRO-704; "Occupational Safety and Health Standards," 29 CFR 1910; "Rules of General Applicability to Domestic Licensing of Byproduct Material," 10 CFR 30; "Shippers—General Requirements for Shipments and Packagings," 49 CFR 173; *Nuclear Safety Analysis Reports*, DOE Order 5480.23; *Safety Analysis and Review System*, DOE; *Guidance on Preliminary Hazard Classification and Accident Analysis Techniques for Compliance with DOE Order 5480.23*, DOE-STD-1027-92; *DOE Standard, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, DOE-STD-3009-94; and *Hazard Baseline Documentation*, DOE-EM-STD-5502-94.

b. Tank dome loading shall satisfy the requirements in HNF-IP-1266, Chapter 5-16.

c. The sampler shall be designed to maintain and support and not compromise the tank containment (tank shell) and tank containment systems or adversely impact the performance or decontamination of other in-tank systems.

d. The DST Process Waste Sampling Subsystem shall be designed to detect a leak within 24 h to avoid damage to other components. The subsystem shall be designed in accordance with "Dangerous Waste Regulations," WAC 173-303-640(3) for final status facilities and "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Control Facilities," 40 CFR 265, Subpart J, for interim status facilities; DOE Order 6430.1A, Section 0262; and *Radioactive Waste Management*, DOE O 435.1. The design of the subsystem shall allow for detection of a leak within 24 h.

e. The DST Process Waste Sampling Subsystem shall meet fire protection design requirements as defined in – *Fire Protection Design/Operations Criteria*, RPP-PRO-349; *Fire Protection Policy*, RPP-PRO-341; *Fire Protection Program Overview*, RPP-PRO-340; *Fire Hazards Analysis Requirements*, RPP-PRO-350; and *Fire Surveillance Requirements*, RPP-PRO-354.

3.3.6.3 Environmental Safety

The DST Process Waste Sampling Subsystem shall be designed to protect the public and environment in accordance with the following requirements:

a. The DST Process Waste Sampling Subsystem and components shall be designed in accordance with the safety classification for each. The safety classification shall be determined using the process described in *Safety Analysis Process - Facility Change or Modification*, RPP-PRO-702; *Safety Analysis Process - New Project*, RPP-PRO-703; HNF-5183; and RPP-PRO-704, based on the guidelines in HNF-SD-WM-SAR-067, Section 3.0. Preliminary safety classifications are provided for reference in Appendix B.

b. All equipment installed in areas in and around the tank that are subject to ignition controls shall be designed to meet the requirements of HNF-SD-WM-TSR-006, Section 5.10, "Ignition Controls." Areas requiring controls are delineated in HNF-SD-WM-SAR-067, Appendix K. The Flammable Gas Equipment Advisory Board shall be consulted whenever the application or interpretation of the requirements is unclear.

c. Emissions of radioactive airborne pollutants must be minimized to protect human health during any of the sampling processes that access any of the tanks and other units such that compliance with the requirements is achieved. Also, air emissions must comply with the standards for leaks from equipment at facilities that treat, store, or dispose of hazardous waste. Also, the DST Process Waste Sampling Subsystem must limit upsets and off-normal conditions in the DST Ventilation Subsystem. Air releases shall be kept ALARA. Emissions of radionuclides shall not exceed amounts listed in "National Emission Standard Radionuclide Emissions from Department of Energy Facilities," 40 CFR 61.92; "Radiation Protection – Air Emissions," WAC 246-247; and "Ambient Air Quality Standards and Emission Limits for Radionuclides," WAC 173-480.

d. Sampling processes shall comply with the requirements in HASQARD Rev. 2, "General Waste Analysis," WAC 173-303-300; and HNF-SD-WM-DQO-001.

e. The subsystem shall incorporate secondary containment, leak detection, and spill prevention in areas where hazardous, mixed, and/or radioactively contaminated items are handled.

f. Containment of flush and decontamination water for equipment shall be provided

g. Support equipment used to ship hazardous materials shall be designed to comply with, and shipped samples must be contained and transported according to requirements from *Radioactive Material/Waste Shipments*, RPP-PRO-157; *Packaging and Transportation Safety*, DOE O 460.1A; "Carriage by Public Highway," 49 CFR 177; RPP-PRO-156; *Documentation and Record Keeping*, RPP-PRO-163; *Tank Waste Remediation System Standards/Requirements Identification Document*, HNF-SD-MP-SRID-001; 40 CFR 265; "Identification and Listing of Hazardous Waste," 40 CRF 261; "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information and Training Requirements," 49 CFR 172; *Resource Conservation and Recovery Act of 1976*; *Hanford Site Resource Conservation and Recovery Act Permit*; WAC 173-303; and "General Regulations for Air Pollution Sources," WAC 173-400.

h. Radioactive wastes must be managed in accordance with requirements of *Radioactive Waste*, HNF-PRO-5125; *Mixed Waste*, HNF-PRO-5123; RPP-PRO-157; DOE O 435.1; *General Environmental Protection Program*, DOE Order 5400.5; and WAC 173-303.

i. The DST Process Waste Sampling Subsystem shall limit transient and steady-state air leakage into a DST such that the tank's containment is safely maintained and environmental emissions remain within acceptable limits.

3.3.7 Human Performance/Human Engineering

The subsystem shall be designed for ease of operation.

a. Subsystem design shall comply with DOE Order 6430.1A, Section 1300.12, "Human Factors Engineering."

3.3.8 Decontamination and Decommissioning

This section defines features found to enhance decontamination at the end of the DST Process Waste Sampling Subsystem's life.

a. All components that may become contaminated with radioactive or other hazardous materials under normal or abnormal operating conditions shall be designed to incorporate measures to simplify future decontamination and decommissioning in accordance with DOE Order 6430.1A, Section 1300-11.

b. All welds that will be in direct contact with tank waste shall be full penetration to eliminate crud traps.

c. Designs should simplify cut-up, dismantlement, removal, and packaging of contaminated components.

d. The subsystem shall provide a means of internally flushing the system to reduce source term before it is removed from the tank.

3.4 DOCUMENTATION

This section defines the procedures that will control various documents associated with the DST Process Waste Sampling Subsystem.

a. Records, documents, and drawing control pertinent to design functions shall be in accordance with *Quality Assurance Records Standards*, RPP-PRO-222, and *Document Control Program Standards*, RPP-PRO-224. Engineering document development shall be in accordance with *Preparation and Control Standard for Engineering Drawings*, RPP-PRO-709.

b. All DST Process Waste Sampling Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with <TBD>.

c. Records of sample shipments shall comply with RPP-PRO-163.

3.5 LOGISTICS

This section identifies maintenance infrastructure support requirements.

3.5.1 Maintenance

Facility design shall provide for routine preventive maintenance/calibration, where required, and maintenance, repair, or replacement of equipment subject to failure. The subsystem shall be designed to be maintained in accordance with the following requirements:

a. Components used internally to the DST Confinement Subsystem shall be designed to be remotely removed, repaired, replaced, or operated.

b. Components used externally to the DST Confinement Subsystem shall be designed for minimal contact and hands-on operation.

3.5.2 Supply

The subsystem shall use readily available commercial parts and components to the greatest extent practical.

3.5.3 Facility and Facility Equipment

Not applicable.

3.6 PERSONNEL AND TRAINING

Not applicable.

3.7 CHARACTERISTICS OF SUBELEMENTS

The major elements of the DST Process Waste Sampling Subsystem are as follows:

- Core sampling subsystem
- Grab sampling subsystem
- Vapor sampling subsystem
- Agitated grab sampling subsystem
- Solid surface sampling subsystem
- Liquid surface sampling subsystem

- Pumped sampling and analysis loop subsystem
- Ambient temperature sample handling and transport subsystem
- Controlled temperature sample handling and transport subsystem.

The importance of, and need for, sampling during mixer pump operation, performing real-time sample analysis in the field, or controlling the temperature of the retrieved sample, has not been established.

3.7.1 Core Sampling Subsystem

The core sampling subsystem captures solids, sludges, and highly viscous slurries. Specialized, self-contained core-sampling trucks insert a core drill string into the waste that contains a retrievable core sampler. The core drill system has a pressurized head (liquid or gas) capability that prevents the drill string from filling when a core sampler is retrieved. The drill string may be inserted into the waste by pushing a sample bit directly into the waste or by drilling action with cutting bits at the end of the drill string. The sampling devices incorporate a variety of seals and closures that can retain liquids and gases within the sampler. Controls are established to prevent penetrating the tank shell or igniting flammable gases within the tank. The core drill string currently is approved for sampling when there are no side forces. The ability of the core sampling subsystem to sample tanks undergoing mixing is <TBD>.

3.7.2 Grab Sampling Subsystem

The grab sampling subsystem captures liquids and low-viscosity slurries in sample bottles lowered directly into the waste. Bottles are lowered by a lanyard and rely on gravity for position within the waste. Specialized hoists and holding fixtures lower closed bottles to precise elevations in the tank, then release the closures to admit tank waste for filling. The grab sampling subsystem cannot withstand the jet impingement forces produced by a mixer pump and, consequently, can only sample tanks not undergoing mixing.

3.7.3 Vapor Sampling Subsystem

The vapor sampling subsystem captures gases and vapors in the tank headspace. A variety of portable systems route DST gases and vapors to canisters and sorbents that are selected according to the chemical or radiological component of interest, required detection limits, and other considerations.

3.7.4 Agitated Grab Sampling Subsystem

The agitated tank grab sampling subsystem captures liquids and low-viscosity slurries in sample bottles directly into the waste. Specialized hoists and holding fixtures lower closed bottles to precise elevations in the tank, then release the closures to admit tank waste for filling. Robust mechanical guides allow the agitated grab sampling system to withstand the jet impingement forces produced by a mixer pump and, consequently, allow the sampling of tanks undergoing mixing.

3.7.5 Solid Surface Sampling Subsystem

The solid surface sampling subsystem captures solids from the uppermost layer of a tank containing a solid waste surface.

3.7.6 Liquid Surface Sampling Subsystem

The liquid surface sampling subsystem obtains samples from the surface of tanks containing a liquid waste surface to confirm the absence of a "visible floating organic layer" as defined in the Privatization Contractor.

3.7.7 Pumped Sampling and Analysis Loop Subsystem

The pumped sampling and analysis loop subsystem circulates tank waste through an above-ground-sample-container-filling station and measurement devices. Real-time information can be obtained for a limited set of key parameters to evaluate mixing behavior, waste uniformity, and transfer-related properties for which timeliness is important. By adjusting the sample intake elevation, a representative composite sample of the as-suspended tank contents can be prepared. The pumped sampler intake is deployed on a semi-rigid mast which contains positive rigging to position the pump inlet at any elevation within the tank waste. Robust mechanical guides allow the pumped sample/analysis loop to withstand mixer pump jet impingement forces. Tanks can be sampled when undergoing mixing.

3.7.8 Ambient Temperature Sample Handling and Transport Subsystem

The ambient temperature sample handling and transport subsystem retrieves, seals, overpacks, stores, transports, and delivers sample containers to RPP-designated laboratories.

3.7.9 Controlled Temperature Sample Handling and Transport Subsystem

The controlled temperature sample handling and transport subsystem maintains the sample container at a temperature selected for sample preservation or to match that of the tank waste layer from which the sample was obtained from the time that the sample is retrieved from the tank until custody of the sample is transferred to the RPP-designated laboratory. <TBD – the importance or need for this subsystem has not been established>

3.8 PRECEDENCE

Except in those instances where Washington State has been granted regulatory authority by the Federal Government, the hierarchical relationship among requirements specified in Section 3.0 is as follows:

- Federal requirements (e.g., *Code of Federal Regulations*, DOE orders)
- State requirements (e.g., Revised Code of Washington, as specified in the *Washington Administrative Code*)
- Local ordinances
- RPP procedures
- National consensus codes and standards.

The hierarchy is useful in establishing the relative order of precedence of the requirements documents levied in this specification.

3.9 SECURITY

The subsystem shall be designed such that access controls to radiation and high-radiation areas meet the requirements of HNF-5183.

3.10 COMPUTER RESOURCE RESERVE CAPACITY

Not applicable.

This page intentionally left blank.

4.0 QUALITY ASSURANCE PROVISIONS

Quality assurance for the DST Process Waste Sampling Subsystem shall be performed in accordance with "Tank Farm Operations Equipment Labeling," HNF-IP-0842, Volume XI, Section 1.0.

4.1 GENERAL

Quality assurance provisions, as defined in Section 4.2, shall be conducted during the design and development of the DST Process Waste Sampling Subsystem to provide assurance of compliance with the requirements of this specification. Field verification, which takes place during the construction/turnover life-cycle phase, is not addressed in this specification. Field verification is addressed at the construction project level in operational test plans/procedures and acceptance test plans/procedures.

4.1.1 Responsibility

The design agent shall be responsible for the performance and documentation of design verifications (see Section 4.2) for each subsystem developed in accordance with this specification. Design verifications shall be conducted at the design agent's facilities or the facilities of the design agent's choice with the approval of the sponsor organization. The sponsor organization reserves the right to witness the specified design verifications.

4.1.2 Special Tests

The following design verification qualification testing requirements apply to the qualification tests of the DST Process Waste Sampling Subsystem components. These test requirements correlate to the qualification testing of the design to the requirements of Section 3.0 of this specification. The design agent is responsible for planning and executing the required qualification tests.

a. TBD

4.2 DESIGN VERIFICATION

Design verification shall be performed on the DST Process Waste Sampling Subsystem, as represented in design drawings, prototypes, engineering models, etc., for the purposes of verifying that the design meets the requirements of this specification. Design verification is subject to the procedure identified in *Engineering Requirements*, RPP-PRO-1819, Section 2.5.1. Inspection of the subsystem design to ensure compliance with the requirements of Section 3.0 shall be performed by one or more of the following methods: qualification testing, reviews, and/or alternate calculations. The verification method(s) that applies to each specification

requirement is identified in Appendix A. Definitions of qualification testing, reviews, and alternate calculations are as follows.

a. Qualification testing is a design verification method consisting of tests on hardware representative of the design being verified. Qualification testing can be subdivided into methods that consist of checking functional operation (Demonstration) and methods that consist of measuring specific hardware inputs/outputs (Test) to verify compliance of the design with requirements.

   i. Demonstration is a subcategory of the "qualification testing" design verification method. Demonstration is limited to readily observable functional operation to determine compliance with requirements. Demonstration does not require the use of special equipment or sophisticated instrumentation.

   ii. Test is another subcategory of the "qualification testing" design verification method. Test employs technical means including, but not limited to, the evaluation of functional characteristics by use of special equipment or instrumentation and the application of established principles and procedures to determine compliance with requirements. The evaluation of data derived from test is an integral part of Test.

b. Review is a design verification method that consists of an investigation of the existing design information. This can be done via a simple review of the design media (Examination) or a rigorous analysis of the design, as represented in the design media (Analysis).

   i. Examination is a subcategory of the "review" design verification method. Examination consists of investigation without the use of special laboratory equipment or procedures to determine compliance with requirements. Examination can be performed on design media such as drawings, design reports, etc.

   ii. Analysis is a subcategory of the "review" design verification method. Analysis takes the form of processing accumulated results and conclusions, intended to provide proof that verification of a requirement has been accomplished. The analytical results may comprise a compilation/interpretation of existing information or may be obtained from lower level examination, tests, demonstrations, or analyses.

c. Alternate calculation is a verification of a calculation or analysis using alternate methods or procedures.

Field verification of DST Process Waste Sampling Subsystem performance/design features and acceptance inspection of construction is called out in Section 2.5.2 of RPP-PRO-1819.

5.0 PREPARATION FOR DELIVERY

Safety-class and safety-significant SSCs will require special packaging to protect against corrosion, contamination, physical damage, or any effect that would lower the quality or cause the items to deteriorate during the time they are shipped and handled. Packaging, receipt, and storage requirements will depend on the classification level of the items shown in ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications*, Subpart 2.2, Section 3-2. Lower level specifications (e.g., procurement specifications) will establish the specific packaging requirements for SSCs.

This page intentionally left blank.

6.0 NOTES

6.1 DEFINITIONS

Confinement System—The barrier and its associated systems (including ventilation) between areas containing hazardous materials and the environment or other areas in the facility that are normally expected to have levels of hazardous materials lower than allowable concentration limits.

General Service (GS) SSC—Structures, systems, and components (SSC) not classified as either safety class or safety significant.

Human Factors—The biomedical, psychosocial, workplace environment, and engineering considerations pertaining to people in a human-machine system. Some of these considerations are allocation of functions, task analysis, human reliability, training requirements, job performance aiding, personnel qualifications and selection, staffing requirements, procedures, organizational effectiveness, and workplace environmental conditions.

RPP Design Authority—A qualified engineer responsible for implementation of authorization basis requirements into the facility design.

Safety Class (SC) SSC – An SSC that prevents or mitigates releases to the public that would otherwise exceed the offsite radiological risk guidelines, or that prevents a nuclear criticality (HNF-SD-WM-SAR-067, Section 4.1).

Safety Significant (SS) SSC – An SSC that prevents or mitigates releases of radiological materials to onsite workers and toxic chemicals to the offsite public and onsite workers. Safety Significant also describes worker safety SSCs that protect the facility worker from serious injury (or fatality) caused by hazards not controlled by institutional safety programs. Facility SSCs that are major contributors to defense-in-depth are identified as Safety-Significant SSCs (HNF-SD-WM-SAR-067, Section 4.1).

NOTE: Safety-Significant SSC distinguishes a specific category of SSCs other than Safety-Class SSCs. It should not be confused with the generic modifier "safety significant" used in DOE orders (e.g., DOE Order 5480.23).

Shall—Denotes a requirement.

Should—Denotes a recommendation. If a "should" requirement cannot be satisfied, justification of an alternative design shall be submitted to the Design Authority for approval.

TBD—To be determined. A study and/or calculation needs to be performed to provide a sufficient technical basis for the requirement.

TBR—To be refined. A "soft" basis for the requirement has been identified. However, a further study and/or calculation needs to be performed to solidify the requirement's technical basis.

Transfer-Associated Structure—Pump pits, valve pits, diversion boxes, or cleanout boxes.

6.2 LIST OF TERMS

ALARA	as low as reasonably achievable
ASME	American Society of Mechanical Engineers
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DQO	data quality objective
DST	double-shell tank
HLW	high-level waste
LAW	low-activity waste
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
ORP	Office of River Protection
RAM	reliability, availability, and maintainability
RCRA	*Resource Conservation and Recovery Act of 1976*
RPP	River Protection Project
SARP	Safety Analysis Report for Packaging
SC	safety class
SS	safety significant
SSC	structures, systems, and component
SVOA	semi-volatile organic analysis
TBD	to be determined
TBR	to be refined
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
V ac	volts alternating current
VOA	volatile organic analysis
WAC	*Washington Administrative Code*
WFD	waste feed delivery

7.0 REFERENCES

BNFL-5193-ID-19, 2000, *Interface Control Document for Low-Activity Waste Feed*, Rev. 4, as amended, BNFL Inc., Richland, Washington.

BNFL-5193-ID-20, 2000, *Interface Control Document for High-Level Waste Feed*, Rev. 4, as amended, BNFL Inc., Richland, Washington.

HNF-1939, Rev. 0a, 1999, *Waste Feed Delivery Technical Basis*, Vol. II, Addendum 1-1, "Waste Feed Delivery Flow Sheet for Tank 241-AZ-101," Numatec Hanford Company for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-1939, Rev. 0b, 1999, *Waste Feed Delivery Technical Basis*, Vol. II, Addendum 2-1, "Waste Feed Delivery Flow Sheet for Tank 241-AN-105," Numatec Hanford Company for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-1939, Rev. 0c, 1999, *Waste Feed Delivery Technical Basis*, Vol. II, Addendum 3-1, "Waste Feed Delivery Flow Sheet for Tank 241-AN-104," Numatec Hanford Company for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-4208, 1999, *Tank Waste Remediation System Architecture Tree*, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-4164, 2000, *Double-Shell Tank Mixer Pump Subsystem Specification*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-TRD-007, 1999, *Technical Requirements for Specification for the Double-Shell Tank System*, Draft E, COGEMA Engineering Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

PNNL-12040, 1998, *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

RPP-5786, 2000, *Double-Shell Tank Process Waste Sampling Subsystem Definition Report*, Rev. 0 DRAFT, CH2M HILL Hanford Group, Inc., Richland, Washington.

WHC-SD-WM-SP-004, 1995, *Tank Safety Screening Data Quality Objective*, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

This page intentionally left blank.

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.1.2.1.1.a	The DST Process Waste Sampling Subsystem shall be designed to operate using 120/240/480 V ac power as supplied by the DST Electrical Power Subsystem.	<TBD>							X
3.1.2.1.2.a	The DST Process Waste Sampling Subsystem shall be designed to use filtered raw water at a <TBD> rate and <TBD> pressure for flushing and decontamination.	<TBD>							X
3.1.2.1.3.a	The DST Process Waste Sampling Subsystem's controls, instrumentation, and actuators shall be designed to use <TBD> metric <TBD> lbf/in^2) of instrument air, as provided by the DST Service Air Subsystem.	<TBD>							X
3.1.2.1.4.a	The DST Process Waste Sampling Subsystem shall be designed to remove gas and vapor samples using existing DST Ventilation Subsystem access points.	<TBD>			X				
3.1.2.1.5.a	The DST Process Waste Sampling Subsystem shall be capable of using sampling casks decontaminated to a surface contamination level meeting SARP requirements <TBD>.	<TBD>					X		
3.1.2.1.5.b	The DST Process Waste Sampling Subsystem shall be capable of using designated laboratory-supplied canisters and traps for capturing specified gaseous and vapor analytes. Quantitative requirements have not been determined at this time and are <TBD>.	<TBD>			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.1.2.1.7.a	The DST Process Waste Sampling Subsystem shall be designed to remove tank waste samples from the DST Confinement Subsystem using existing risers and access points.	<TBD>							X
3.1.2.1.7.b	The DST Process Waste Sampling Subsystem shall be designed to remove samples of waste that have leaked into the secondary containment system, if necessary.	<TBD>			X				
3.1.2.1.8.a	The DST Process Waste Sampling Subsystem shall be capable of accepting data from the DST Monitor and Control Subsystem. Data flow requirements have not been established at this time and are <TBD>.	<TBD>							X
3.2.1.1.a	Corrosivity. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of supernate corrosivity characteristics. These samples shall reflect and retain the following properties of DST contents during sample collection, handling, and analysis.	HNF-SD-WM-DQO-001			X		X		
3.2.1.1.b	Safety Screening. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to screen tank wastes for safety hazards. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	WHC-SD-WM-SP-004			X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.1.2.1.1.c	Flammable Gas. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for resolution of flammable gas safety issues per *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue*, HNF-SD-WM-DQO-004. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	HNF-SD-WM-DQO-004			X		X		
3.2.1.1.d	Regulatory Status of Waste. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of the waste per *Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis*, HNF-SD-WM-DQO-025). These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	HNF-SD-WM-DQO-025			X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.1.e	Regulatory Status of Air Emissions. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of actual or potential air emissions from the waste per *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, HNF-SD-WM-DQO-021. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	HNF-SD-WM-DQO-021			X		X		
3.2.1.1.f	Regulatory Status of Privatization Project. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of the waste, waste retrieval activities, and actual or potential air emissions from the waste. These samples shall reflect and preserve the properties of the DST contents identified in *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, PNNL-12040 through sample collection, handling, transport, and analysis.	PNNL-12040					X		
3.2.1.1.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL or 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	WHC-SD-WM-ER-409			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.1.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within ±5 cm (2 in.) <TBR>.	<TBD>			X		X		
3.2.1.1.1.c	The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.	<TBD>				X			
3.2.1.1.1.d	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below the riser selected for sampling. <TBR>.	SW-846			X		X		
3.2.1.1.1.e	The DST Process Waste Sampling Subsystem shall be able to collect samples with zero headspace for VOA and SVOA.	SW-846							
3.2.1.1.2.a	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>			X				
3.2.1.1.2.b	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or unacceptable alteration of the collected waste samples.	<TBD>			X	X	X		
3.2.1.1.2.c	The DST Process Waste Sampling Subsystem shall be capable of preserving or refrigerating samples collected for VOA and SVOA analysis in accordance with *Test Methods for Evaluating Solid Wastes: Physical/Chemical Properties*, SW-846 requirements. <TBD>	SW-846		X					

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.1.2.d	The DST Process Waste Sampling Subsystem shall be capable of delivering a sample to the designated laboratory within one working day. <TBD>	SW-846		X					
3.2.1.1.3.a	The DST Process Waste Sampling Subsystem shall be able to obtain a full vertical profile of the solids located below the riser selected for sampling.	WHC-SD-WM-SP-004				X			
3.2.1.1.3.b	The DST Process Waste Sampling Subsystem shall be capable of capturing and retaining liquids and gases associated with the solids in the solids sampling container.	HNF-SD-WM-DQO-004				X			
3.2.1.1.3.c	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below the riser selected for sampling. <TBR>.	<TBD>				X			
3.2.1.1.3.d	The DST Process Waste Sampling Subsystem shall be able to collect samples with zero headspace for VOA and SVOA. <TBD>	SW-846			X				
3.2.1.1.4.a	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>				X			
3.2.1.1.4.b	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or unacceptable alteration of the collected waste samples.	<TBD>					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.1.4.c	The DST Process Waste Sampling Subsystem shall be capable of preserving or refrigerating samples collected for VOA and SVOA analysis in accordance with SW-846 requirements. <TBD>	SW-846		X					
3.2.1.1.4.d	The DST Process Waste Sampling Subsystem shall be capable of delivering a sample to the designated laboratory within one working day. <TBD>	SW-846		X					
3.2.1.2.a	Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to monitor the progress of the HLW solids mobilization activity, establish dilution ratios, and determine when a mobilized HLW batch is ready for transfer per <TBD DQOs have not yet been prepared for control of the HLW preparation activity>. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	<TBD>							X

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.2.b	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in *Data Quality Objectives for Tank Farm Waste Compatibility Program*, HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids by volume. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids>.	HNF-SD-WM-DQO-001							X
3.2.1.2.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	<TBD>			X				
3.2.1.2.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within ±5 cm (2 in.) <TBR>.	<TBD>				X			
3.2.1.2.1.c	The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.	<TBD>				X			

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.2.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	<TBD>			X				
3.2.1.2.1.e	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	<TBD>				X			
3.2.1.2.1.f	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry when the tank is undergoing mixing within <TBD>%.	<TBD>			X				
3.2.1.2.1.g	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	<TBD>			X				
3.2.1.2.1.h	The DST Process Waste Sampling Subsystem shall be able to obtain real-time measurements of <TBD> with an accuracy of <TBD> at the sampling location.	<TBD>			X				
3.2.1.2.2.a	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.	<TBD>			X		X		
3.2.1.2.2.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	<TBD>				X			

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.2.2.c	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>							X
3.2.1.2.3.a	The DST Process Waste Sampling Subsystem shall be able to obtain a full vertical profile of the solids located below the riser selected for sampling.	<TBD>					X		
3.2.1.2.3.b	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	WHC-SD-WM-SP-004			X		X		
3.2.1.2.4.a	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.	<TBD>			X		X		
3.2.1.2.4.b	The sample shall be maintained within <TBD> degrees of tank temperature during handling and transport to minimize uncontrolled formation or dissolution of solids within the sample container caused by temperature changes. <TBD formation of solids during handling and transport could result in overstating the amount of solids mobilized><TBD the importance or need for this feature has not been established>.	<TBD>					X		
3.2.1.2.4.c	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.3.a	Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for process control to monitor the progress of the LAW solids dissolution activity, establish dilution ratios, and determine when a prepared LAW batch is ready for transfer per <TBD DQOs have not yet been prepared for control of the LAW preparation activity>. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	<TBD>	TBD DQOs have not yet been prepared for control of the LAW preparation activity		X		X		
3.2.1.3.b	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the properties of the DST contents specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis.	HNF-SD-WM-DQO-001			X		X		
3.2.1.3.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	HNF-SD-WM-TI-710					X		
3.2.1.3.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.	WHC-SD-WM-ER-409	TBR		X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.3.1.c	The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling. <TBD>	<TBR>	TBR- this requirement may disqualify the existing PWSS grab sampling subsystem because the bottles remain open while being raised through the waste layers above the intended sampling location during sample retrieval.		X				
3.2.1.3.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	SW-846			X		X		
3.2.1.3.1.e	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	SW-846			X				
3.2.1.3.1.f	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.	<TBD>			X				
3.2.1.3.1.g	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	<TBR>	TBR- there may not be a need for a new system here				X		
3.2.1.3.1.h	The DST Process Waste Sampling Subsystem shall be able to obtain real-time measurements of <TBD> with an accuracy of <TBD> at the sampling location.	<TBD>		X	X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.3.2.a	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.	<TBD>			X		X		
3.2.1.3.2.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	<TBD>					X		
3.2.1.3.2.c	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>			X	X			
3.2.1.3.3.a	The DST Process Waste Sampling Subsystem shall be able to obtain a full vertical profile of the solids located below the riser selected for sampling.	HNF-SD-WM-TI-710					X		
3.2.1.3.3.b	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	WHC-SD-WM-SP-004			X				
3.2.1.3.4.a	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.	<TBD>					X		
3.2.1.3.4.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	<TBD>			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.3.4.c	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>			X				
3.2.1.4.a	Provide Sample to BNFL Inc. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support composite preparation and delivery of representative samples to the Privatization Contractor per <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	BNFL-5193-ID-20	TBD: No DQO has been prepared for waste certification.		X		X		
3.2.1.4.b	HLW Certification. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to certify the quantity and composition of HLW feed per BNFL ICD-20 <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	BNFL-5193-ID-20	TBD: No DQO has been prepared for waste certification.		X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.4.c	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids.> <TBR HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may be revised when the DQO is revised to include this transfer route>.	HNF-SD-WM-DQO-001	TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids.> <TBR HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may be revised when the DQO is revised to include this transfer route.		X		X		
3.2.1.4.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	HNF-SD-WM-TI-710					X		
3.2.1.4.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.	WHC-SD-WM-ER-409	TBR		X				
3.2.1.4.1.c	The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.	<TBD>			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.4.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	<TBD>			X				
3.2.1.4.1.e	The DST Process Waste Sampling Subsystem shall prevent displacement of any organic collected in the sample container by denser aqueous liquids or slurries <TBD>.	SW-846					X		
3.2.1.4.1.f	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	<TBD>			X				
3.2.1.4.1.g	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.	<TBD>			X				
3.2.1.4.1.h	The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of HLW staging tank slurry in one working day <TBR>	<TBD>	TBD this was identified in fluidic sampler spec as an important feature to shorten cycle times and reduce radiological exposure from unnecessary samples (i.e., not to sample a batch until it's ready)		X				
3.2.1.4.1.i	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	<TBD>				X			

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.4.2.a	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.	<TBD>					X		
3.2.1.4.2.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	<TBD>			X				
3.2.1.4.2.c	The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.	<TBD>			X				
3.2.1.4.2.d	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>			X				
3.2.1.5.a	Deliver Samples to BNFL Inc. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support composite preparation and delivery of representative samples to the Privatization Contractor per <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	BNFL-5193-ID-19	TBD: no DQO has been prepared for waste certification.		X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.5.b	LAW Certification. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to certify the quantity and composition of LAW feed. These samples shall reflect and retain those properties of the DST contents specified in <TBD: no DQO has been prepared for waste certification> through sample collection, handling, transport, and analysis.	BNFL-5193-ID-19	TBD: no DQO has been prepared for waste certification.		X		X		
3.2.1.5.c	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis and establish transfer parameters such as dilution ratios in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBD HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may change when the DQO is revised to include this transfer route>.	HNF-SD-WM-DQO-001	TBR HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may be revised when the DQO is revised to include this transfer route.		X		X		
3.2.1.5.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	HNF-SD-WM-TI-710					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.5.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.	WHC-SD-WM-ER-409	TBR		X				
3.2.1.5.1.c	The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling.	<TBD>			X				
3.2.1.5.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	<TBD>			X				
3.2.1.5.1.e	The DST Process Waste Sampling Subsystem shall prevent displacement of any organic collected in the sample container by denser aqueous liquids or slurries <TBD>.	SW-846			X		X		
3.2.1.5.1.f	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	<TBD>			X				
3.2.1.5.1.g	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.	<TBD>			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.5.1.h	The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of LAW staging tank slurry in one working day <TBR>.	<TBD>	TBD this was identified in fluidic sampler spec as an important feature to shorten cycle times and reduce radiological exposure from unnecessary samples (i.e., not to sample a batch until it's ready).		X				
3.2.1.5.1.i	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	<TBD>	TBD- the sample will not be representative of the suspended solids of collected after mixer pumps are shut off. The significance of this nonrepresentativeness is unknown at this time.		X				
3.2.1.5.2.a	The DST Process Waste Sampling Subsystem shall prevent any loss, leakage, or alteration of the collected waste samples.	<TBD>			X		X		
3.2.1.5.2.b	The sample shall be maintained within <TBD> degrees of tank temperature during handling and transport in order to minimize uncontrolled formation or dissolution of solids within the sample container due to temperature changes <TBD formation of solids during handling and transport could result in overstating the amount of solids present in the staged LAW> <TBD the importance or need for this feature has not been established>.	<TBD>	TBD the importance or need for this feature has not been established.			X			
3.2.1.5.2.c	The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.	<TBD>			X				

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.5.2.d	The DST Process Waste Sampling Subsystem shall be able to remove the sample container from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>			X				
3.2.1.6.a	Safety Screening. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to screen tank wastes for safety hazards. These samples shall reflect and retain the properties of the DST contents identified in WHC-SD-WM-SP-004 through sample collection, handling, transport, and analysis.	WHC-SD-WM-SP-004			X		X		
3.2.1.6.b	Flammable Gas. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for resolution of flammable gas safety issues. These samples shall reflect and preserve the properties of the DST contents identified in HNF-SD-WM-DQO-004 through sample collection, handling, transport, and analysis.	HNF-SD-WM-DQO-004			X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.6.c	Regulatory Status of Air Emissions. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of actual or potential air emissions from the waste. These samples shall reflect and preserve the parameters identified in *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, HNF-SD-WM-DQO-021 through sample collection, handling, transport, and analysis.	HNF-SD-WM-DQO-021			X		X		
3.2.1.6.d	Regulatory Status of Privatization Project. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to establish the regulatory status of the waste, waste retrieval activities, and actual or potential air emissions from the waste. These samples shall reflect and preserve the following DST waste properties identified PNNL-12040 during sample collection, handling, transport, and analysis.	PNNL-12040			X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.6.e	HLW Mobilization Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples to evaluate the gases and vapors released into the tank headspace by waste-disturbing activities during HLW mobilization and transfer and to control the HLW mobilization activity to maintain gaseous releases within limits. These samples shall reflect and preserve the properties of the DST contents identified in <TBD: no DQO has been prepared for HLW mobilization and transfer process control> during sample collection, handling, transport, and analysis.	PNNL-12040			X		X		
3.2.1.6.f	LAW Dissolution Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain representative samples to evaluate the gases and vapors released into the tank headspace by waste-disturbing activities during LAW dissolution and transfer and to control the LAW dissolution activity to maintain gaseous releases within limits. These samples shall reflect and preserve the properties of the DST contents identified in <TBD: no DQO has been prepared for LAW mobilization and transfer process control> during sample collection, handling, transport, and analysis.	<TBD>	TBD: no DQO has been prepared for HLW mobilization and transfer process control		X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.1.6.1.a	The DST Process Waste Sampling Subsystem vapor sampling subsystem shall be capable of collecting samples of DST headspace vapors and gases in appropriate traps or canisters for the analytes to be measured.	<TBD>					X		
3.2.1.6.1.b	The existing DST Tank Waste Sampling System Vapor Sampling Subsystem shall be used to the maximum extent practical.	<TBD>				X	X		
3.2.1.6.2.a	The DST Process Waste Sampling Subsystem shall be able to remove the sample container or trap from the sample collection device(s) and deliver the sample to the designated laboratory.	<TBD>		X					
3.2.2.a	The DST Process Waste Sampling Subsystem shall be limited in size and weight to comply with-- *Tank Farms Operations Administrative Controls,* HNF-IP-1266.	HNF-IP-1266					X		
3.2.2.b	The DST Process Waste Sampling Subsystem shall be able to access the waste through risers of 10 cm (4 in.) diameter.	HNF-SD-WM-TI-710				X	X		
3.2.3.a	The Process Waste Sampling Subsystem shall have a design life of 35 years.	<TBD>							

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.3.b	All long-term, non-replaceable components shall have a service life-time of <TBD>. In-tank and above-tank components that require maintenance or replacement should be designed for ease of maintenance and ALARA and should have a minimum service life of <TBD> months before maintenance is required. The design goal is to be able to support a complete sampling campaign and not have maintenance adversely impact or become critical path in the campaign.	<TBD>		X			X		
3.2.3.c	Average availability of batch sampling systems (e.g., core sampling, grab sampling) shall be at least 0.80. Average availability is defined as total uptime divided by total time.	<TBD>		X			X		
3.2.3.d	Average availability of continuous monitoring systems (e.g., pumped sampling and analysis loop) shall be at least 95%. Average availability is defined as total uptime divided by total time.	<TBD>		X			X		
3.2.4.a	The mean time to recover from failures of the DST Process Waste Sampling Subsystem subsystems used for waste certification samples shall be less than <TBD> days.	<TBD>						X	
3.2.4.b	The mean time between DST Process Waste Sampling Subsystem failures shall be less than <TBD> years for repairable components.	<TBD>					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.5.1.a	The subsystem shall be designed for the natural environmental conditions specified in *Natural Phenomena Hazards, Hanford Site, Washington*, HNF-SD-GN-ER-501.	HNF-SD-GN-ER-501						X	
3.2.5.1.b	The subsystem shall be designed to withstand the natural phenomena hazards as specified in *Engineering Design and Evaluation*, RPP-PRO-097.	RPP-PRO-097						X	
3.2.5.2.1	The subsystem components that are exposed to the tank waste contents shall be designed to perform their intended function in the chemical environment defined in- *Estimated Maximum Concentration of Radionuclides and Chemical Analytes in Phase 1 and Phase 2 Transfers*, HNF-2937.	HNF-2937						X	
3.2.5.2.2	The subsystem shall be designed for the maximum (calculated) bounding radiation environment for direct contact with tank waste as defined in *Estimated Dose to In-Tank Equipment and Ground-Level Transfer Equipment During Privatization*, HNF-2004.	HNF-2004						X	
3.2.5.2.3	The subsystem shall be designed for the maximum (calculated) bounding mechanical loads resulting from waste motions induced by operation of mixer pumps as defined in *Double-Shell Tank Mixer Pump Subsystem Specification*, HNF-4164.	<TBD>						X	
3.2.5.2.3.a	The Process Waste Sampling Subsystem must be capable of obtaining a representative sample under moving waste conditions.	<TBD>			X	X			

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.2.6.a	Support equipment used to ship hazardous materials shall be designed to comply with requirements defined in *Non-Radioactive Hazardous Materials/Hazardous Waste (HM/HW) Shipments*, RPP-PRO-156; and *Hanford Analytical Services Quality Assurance Requirements Document*, DOE/RL-96-68.	RPP-PRO-156, Rev.0; DOE/RL-96-68					X		
3.2.6.b	Major above-ground components of the DST Process Waste Sampling Subsystem shall be equipped with wheels or lifting points to allow the DST Process Waste Sampling Subsystem to be relocated from one riser to another or from one tank to another without extensive disassembly or damage.	<TBD>		X					
3.2.6.c	The Process Waste Sampling Subsystem must be capable of continuous deployment in/on a tank for a <TBD> month time period to support a sampling campaign.	<TBD>		X					
3.2.7	Not applicable.	Not applicable.							X
3.3	The DST Process Waste Sampling Subsystem shall comply with DOE Order 6430.1A, *General Design Criteria*, Sections 1300-7 and 1323.	DOE Order 6430.1A, Sections 1300-7 and 1323							X
3.3.1.a	The materials of construction shall not introduce contaminants that interfere with analysis of the samples for waste constituents listed in Section 3.2.1 for which samples obtained by the DST Process Waste Sampling Subsystem are to be analyzed.	<TBD>					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.1.b	The materials of construction of sample delivery lines and containers shall not absorb, adsorb, or otherwise interfere with collection of those waste constituents listed in Section 3.2.1 for which the DST Process Waste Sampling Subsystem samples are to be analyzed.	<TBD>				X	X		
3.3.1.c	The DST Process Waste Sampling Subsystem shall be capable of collecting defensible samples in accordance with SW-846.	SW-846						X	
3.3.1.d	The DST Process Waste Sampling Subsystem shall be readily removed from the riser after sampling to make that riser available for other uses.	<TBD>			X				
3.3.1.e	The DST Process Waste Sampling Subsystem shall be operable from above grade without a need to remove cover blocks.	<TBD>			X				
3.3.1.f	Vapor sample collection lines shall be constructed of polytetrafluoroethylene (TFE), stainless steel, or other inert material to minimize loss of gases and/or vapors by deposition on the surfaces of the sample lines.	HNF-SD-WM-DQO-021		X					
3.3.2	The subsystem shall comply with electromagnetic radiation emission requirements set forth in *A List of EMI/EMC Requirements*, HNF-2962.	HNF-2962			X		X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.3.a	The subsystem shall label new equipment and/or modifications to existing equipment in a standardized format in accordance with the tank farm labeling program as specified in *RPP Administration,* "Tank Farm Operations Equipment Labeling," Volume II, Section 6.1, HNF-IP-0842.	HNF-IP-0842, Volume II, Section 6.1			X				
3.3.4	Reserved. The requirements for workmanship are to be addressed in lower level project design documentation (drawings, procurement specifications, etc.).	Not applicable							X
3.3.5	All like equipment and parts shall be interchangeable/standardized to the maximum extent practical.	DOE 6430.1A, Sections 0110-3 and 1100			X				
3.3.6.1.a	The subsystem shall be designed to keep personnel exposures as low as reasonably achievable (ALARA) in accordance with *ALARA Decision*-Making Methods, RPP-PRO-1621; *Radiological Design Review Process,* RPP-PRO-1622; "Occupational Radiation Protection," 10 CFR 835; and *Tank Farms Radiological Control Manual (TFRCM),* HNF-5183.	HNF-5183; HNF-IP-0842, Volume IX, Section 5.3; RPP-PRO-1621; RPP-PRO-1622; 10 CFR 835							X

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.1.b	The subsystem shall incorporate occupational design features that comply with the requirements of *Tank Farms Health and Safety Plan*, HNF-SD-WM-HSP-002.	HNF-IP-0842, Volume IX, Section 5.3; RPP-PRO-081; RPP-PRO-083; RPP-PRO-084; RPP-PRO-096; RPP-PRO-102; RPP-PRO-120; RPP-PRO-358; RPP-PRO-359; RPP-PRO-699					X		
3.3.6.1.c	The subsystem shall be designed to comply with the safety constraints for working with hazardous material as described in *Hazardous Energy Control Program*, RPP-PRO-081; *Personal Protection*, RPP-PRO-083; *Safety Showers and Eyewashes*, RPP-PRO-084; *Material Handling and Storage*, RPP-PRO-096; *Safety Color Coding*, RPP-PRO-102; *Respiratory Protection Program*, RPP-PRO-120; *Flammable/Combustible Liquids*, RPP-PRO-358; *Control of Combustibles*, RPP-PRO-359; and *Storing and Handling Chemicals*, RPP-PRO-699.	RPP-PRO-081; RPP-PRO-083; RPP-PRO-084; RPP-PRO-096; RPP-PRO-102; RPP-PRO-120; RPP-PRO-358; RPP-PRO-359; RPP-PRO-699		X					

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.2.a	The Hazard and Accident Analysis Process shall be followed in accordance with *Hazard and Accident Analysis Process*, RPP-PRO-704; "Occupational Safety and Health Standards," 29 CFR 1910; "Rules of General Applicability to Domestic Licensing of Byproduct Material," 10 CFR 30; "Shippers—General Requirements for Shipments and Packagings," 49 CFR 173; *Nuclear Safety Analysis Reports*, DOE Order 5480.23; *Safety Analysis and Review System*, DOE; *Guidance on Preliminary Hazard Classification and Accident Analysis Techniques for Compliance with DOE Order 5480.23*, DOE-STD-1027-92; *DOE Standard, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, DOE-STD-3009-94; and *Hazard Baseline Documentation*, DOE-EM-STD-5502-94.	RPP-PRO-704; 29 CFR 1910; 10 CFR 30; 49 CFR 173; DOE Order 5480.23; DOE 5481.1B; DOE Notice 5400.9; DOE-STD-1027-92; DOE-STD-3009-94; DOE-EM-STD-5502-94					X		
3.3.6.2.b	Tank dome loading shall satisfy the requirements in HNF-IP-1266, Chapter 5-16.	<TBD>					X	X	
3.3.6.2.c	The sampler shall be designed to maintain and support and not compromise the tank containment (tank shell) and tank containment systems or adversely impact the performance or decontamination of other in-tank systems.	RPP-PRO-1621; RPP-PRO-1622; and HNF-5183					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.2.d	The DST Process Waste Sampling Subsystem shall be designed to detect a leak within 24 h to avoid damage to other components. The subsystem shall be designed in accordance with "Dangerous Waste Regulations," WAC 173-303-640(3) for final status facilities and "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Control Facilities," 40 CFR 265, Subpart J, for interim status facilities; DOE Order 6430.1A, Section 0262; and DOE O 435.1. The design of the subsystem shall allow for detection of a leak within 24 h.	<TBD>					X		
3.3.6.2.e	The DST Process Waste Sampling Subsystem shall meet fire protection design requirements as defined in – *Fire Protection Design/Operations Criteria*, RPP-PRO-349; *Fire Protection Policy*, RPP-PRO-341; *Fire Protection Program Overview*, RPP-PRO-340; *Fire Hazards Analysis Requirements*, RPP-PRO-350; and *Fire Surveillance Requirements*, RPP-PRO-354.	RPP-PRO-349; RPP-PRO-341; RPP-PRO-340; RPP-PRO-350; RPP-PRO-354					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.3.a	The DST Process Waste Sampling Subsystem and components shall be designed in accordance with the safety classification for each. The safety classification shall be determined using the process described in *Safety Analysis Process - Facility Change or Modification*, RPP-PRO-702; *Safety Analysis Process - New Project*, RPP-PRO-703; HNF-5183; and RPP-PRO-704, based on the guidelines in HNF-SD-WM-SAR-067, Section 3.0. Preliminary safety classifications are provided for reference in Appendix B.	RPP-PRO-702; RPP-PRO-703; RPP-PRO-704; HNF-SD-WM-SAR-067, Section 3.0			X		X		
3.3.6.3.b	All equipment installed in areas in and around the tank that are subject to ignition controls shall be designed to meet the requirements of HNF-SD-WM-TSR-006, Section 5.10, "Ignition Controls." Areas requiring controls are delineated in HNF-SD-WM-SAR-067, Appendix K. The Flammable Gas Equipment Advisory Board shall be consulted whenever the application or interpretation of the requirements is unclear.	HNF-SD-WM-TSR-006, Section 5.10; HNF-SD-WM-SAR-067, Appendix K					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.3.c	Emissions of radioactive airborne pollutants must be minimized to protect human health during any of the sampling processes that access any of the tanks and other units such that compliance with the requirements is achieved. Also, air emissions must comply with the standards for leaks from equipment at facilities that treat, store, or dispose of hazardous waste. Also, the DST Process Waste Sampling Subsystem must limit upsets and off-normal conditions in the DST Ventilation Subsystem. Air releases shall be kept ALARA. Emissions of radionuclides shall not exceed amounts listed in "National Emission Standard Radionuclide Emissions from Department of Energy Facilities," 40 CFR 61.92; "Radiation Protection – Air Emissions," WAC 246-247; and "Ambient Air Quality Standards and Emission Limits for Radionuclides," WAC 173-480.	HNF-PRO-349 Rev.0; RPP-PRO-341; RPP-PRO-340; RPP-PRO-350; RPP-PRO-354; 40 CFR 61.92; WAC 246-247; WAC 173-480					X		
3.3.6.3.d	Sampling processes shall comply with the requirements in HASQARD Rev. 2, "General Waste Analysis," WAC 173-303-300; and HNF-SD-WM-DQO-001.	WAC 173-303-300; HNF-SD-WM-DQO-001					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.3.e	The subsystem shall incorporate secondary containment, leak detection, and spill prevention in areas where hazardous, mixed, and/or radioactively contaminated items are handled.	RPP-PRO-704 Rev.0; 29 CFR 1910; 10 CFR 30; 49 CFR 173; DOE 5480.23; DOE 5481.1B; DOE N 5400.9, DOE-STD-1027-92; DOE-STD-3009-94; DOE-EM-STD-5502-94			X				
3.3.6.3.f	Containment of flush and decontamination water for equipment shall be provided.	<TBD>					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.3.g	Support equipment used to ship hazardous materials shall be designed to comply with, and shipped samples must be contained and transported according to requirements from *Radioactive Material/Waste Shipments*, RPP-PRO-157; *Packaging and Transportation Safety*, DOE O 460.1A; "Carriage by Public Highway," 49 CFR 177; RPP-PRO-156; *Documentation and Record Keeping*, RPP-PRO-163; *Tank Waste Remediation System Standards/Requirements Identification Document*, HNF-SD-MP-SRID-001; 40 CFR 265; "Identification and Listing of Hazardous Waste," 40 CRF 261; "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information and Training Requirements," 49 CFR 172; *Resource Conservation and Recovery Act of 1976*; *Hanford Site Resource Conservation and Recovery Act Permit*; WAC 173-303; and "General Regulations for Air Pollution Sources," WAC 173-400.	RPP-PRO-156; RPP-PRO-157; RPP-PRO-163; DOE O 460 1A; DOE Order 5480.3; HNF-SD-MP-SRID-001; 40 CFR 261; 40 CFR 265; 49 CFR 172; 49 CFR 177; WAC 173-303; WAC 173-400; RCRA					X		
3.3.6.3.h	Radioactive wastes must be managed in accordance with requirements of *Radioactive Waste*, HNF-PRO-5125; *Mixed Waste*, HNF-PRO-5123; RPP-PRO-157; DOE O 435.1; *General Environmental Protection Program*, DOE Order 5400.5; and WAC 173-303.	HNF-PRO-5125; HNF-PRO-5123; RPP-PRO-157; DOE Order 435.1; DOE Order 5400.5; WAC 173-303					X		

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.3.6.3.i	The DST Process Waste Sampling Subsystem shall limit transient and steady-state air leakage into a DST such that the tank's containment is safely maintained and environmental emissions remain within acceptable limits.	<TBD>					X		
3.3.7.a	Subsystem design shall comply with DOE Order 6430.1A, Section 1300.12, "Human Factors Engineering."	DOE Order 6430.1A, Sect. 1300					X		
3.3.8.a	All components that may become contaminated with radioactive or other hazardous materials under normal or abnormal operating conditions shall be designed to incorporate measures to simplify future decontamination and decommissioning in accordance with DOE Order 6430.1A, Section 1300-11.	DOE Order 6430.1A, Section 1300-11					X		
3.3.8.b	All welds that will be in direct contact with tank waste shall be full penetration to eliminate crud traps.	<TBD>	Good ALARA practice	X					
3.3.8.c	Designs should simplify cut-up, dismantlement, removal, and packaging of contaminated components.	<TBD>	Good ALARA practice	X					
3.3.8.d	The subsystem shall provide a means of internally flushing the system to reduce source term before it is removed from the tank.	<TBD>	Good ALARA practice	X					

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.4.a	Records, documents, and drawing control pertinent to design functions shall be in accordance with *Quality Assurance Records Standards*, RPP-PRO-222, and *Document Control Program Standards*, RPP-PRO-224. Engineering document development shall be in accordance with *Preparation and Control Standard for Engineering Drawings*, RPP-PRO-709.	RPP-PRO-222; RPP-PRO-224; RPP-PRO-709							X
3.4.b	All DST Process Waste Sampling Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with <TBD>.	<TBD>							X
3.4.c	Records of sample shipments shall comply with *Documentation and Recordkeeping*, RPP-PRO-163.	RPP-PRO-163		X					
3.5.1.a	Components used internally to the DST Confinement Subsystem shall be designed to be remotely removed, repaired, replaced, or operated.	<TBD>			X				
3.5.1.b	Components used externally to the DST Confinement Subsystem shall be designed for minimal contact and hands-on operation.	<TBD>			X				
3.5.2	The subsystem shall use readily available commercial parts and components to the greatest extent practical.	DOE Order 6430.1A, Section 1100							X
3.5.3	Not applicable.	N/A							X
3.6	Not applicable.	N/A							X
3.7.1	Core Sampling Subsystem	N/A							X

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.7.2	Grab Sampling Subsystem	N/A							X
3.7.3	Vapor Sampling Subsystem	N/A							X
3.7.4	Agitated Grab Sampling Subsystem	N/A							X
3.7.5	Solid Surface Sampling Subsystem	N/A							X
3.7.6	Liquid Surface Sampling Subsystem	N/A							X
3.7.7	Pumped Sampling and Analysis Loop Subsystem	N/A							X
3.7.8	Ambient Temperature Sample Handling and Transport Subsystem	N/A							X
3.7.9	Controlled Temperature Sample Handling and Transport Subsystem	N/A							X
3.8	Except in those instances where Washington State has been granted regulatory authority by the Federal Government, the hierarchical relationship among requirements specified in Section 3.0 is as follows: • Federal requirements (e.g., *Code of Federal Regulations*, DOE orders) • State requirements (e.g., Revised Code of Washington, as specified in the *Washington Administrative Code*) • Local ordinances • RPP procedures • National consensus codes and standards. The hierarchy is useful in establishing the relative order of precedence of the requirements documents levied in this specification.	N/A							X

APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

Section	Function/Requirement	Source Document(s)	Remarks	Verification Method					
				Exam	Demo	Test	Anal	Alt Calc	N/A
3.9	The subsystem shall be designed such that access controls to radiation and high-radiation areas meet the requirements of HNF-5183.	HNF-5183; HNF-SD-WM-SAR-067, Section 7.0							X
4.0	Quality assurance for the DST Process Waste Sampling Subsystem shall be performed in accordance with "Tank Farm Operations Equipment Labeling," HNF-IP-0842, Volume XI, Section 1.0.	HNF-IP-0842, Volume XI, Section 1.0							X
4.2	Design verification.	RPP-PRO-1819, Sections 2.9.1 and 2.9.2							X

REFERENCES

10 CFR 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," *Code of Federal Regulations*, as amended.

10 CFR 835, 1999, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

29 CFR 1910, "Occupational Safety and Health Standards," *Code of Federal Regulations,* as amended.

40 CFR 61, 1998, "National Emission Standard, for Hazardous Air Pollutants," *Code of Federal Regulations,* as amended.

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

40 CFR 265, 1999, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Control Facilities," *Code of Federal Regulations*, as amended.

49 CFR 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements," *Code of Federal Regulations*, as amended.

49 CFR 173, "Shippers--General Requirements for Shipments and Packagings," *Code of Federal Regulations*, as amended.

49 CFR 177, "Carriage by Public Highway," *Code of Federal Regulations*, as amended.

BNFL-5193-ID-19, 2000, *Interface Control Document for Low-Activity Waste Feed*, Rev. 4, as amended, BNFL Inc., Richland, Washington.

BNFL-5193-ID-20, 2000, *Interface Control Document for High-Level Waste Feed*, Rev. 4, as amended, BNFL Inc., Richland, Washington.

DOE-EM-STD-5502-94, 1994, *Hazard Baseline Documentation*, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, 1999, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C. (Replaces DOE Order 5820.2A, 1988)

DOE Order 460.1A, 1996, *Packaging and Transportation Safety*, U.S. Department of Energy, Washington, D.C.

DOE Order 5400.5, 1993, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C.

DOE Order 5480.23, *Nuclear Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.

DOE Order 6430.1A, *General Design Criteria*, U.S. Department of Energy, Washington, D.C.

DOE/RL-96-68, 1998, *Hanford Analytical Services Quality Assurance Requirements* Document, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-STD-1027-92, 1992, *Guidance on Preliminary Hazard Classification and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.

DOE-STD-3009-94, *DOE Standard, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, U.S. Department of Energy, Washington, D.C.

HNF-2004, 1999 *Estimated Dose to In-Tank Equipment and Ground-Level Transfer Equipment During Privatization*, Rev. 1, COGEMA Engineering Corporation for Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-2937, 1999, *Estimated Maximum Concentration of Radionuclides and Chemical Analytes in Phase 1 and Phase 2 Transfers*, Rev. 0, COGEMA Engineering Corporation for Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-2962, 1998, *A List of EMI/EMC Requirements*, Rev. 0, Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-4164, 2000, *Double-Shell Tank Mixer Pump Subsystem Specification*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-5183, 2000, *Tank Farms Radiological Control Manual (TFRCM),* Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington

HNF-IP-0842, 1999, *RPP Administration*, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-IP-1266, 1999, *Tank Farms Operations Administrative Controls*, Rev. 2, DE&S Hanford, Incorporated for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-PRO-5123, Rev. 0, 2000, *Mixed Waste.*

HNF-PRO-5125, Rev. 0, 2000, *Radioactive Waste.*

HNF-SD-GN-ER-501, 1998, *Natural Phenomena Hazards, Hanford Site Washington*, Rev. 1, Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-MP-SRID-001, 1999, *Tank Waste Remediation System Standards/Requirements Identification Document*, Rev. 2, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-DQO-001, 1999, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, Rev. 3, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-DQO-004, 1997, *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue*, Rev. 3, DE&S Hanford, Inc., for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-WM-DQO-021, 1999, *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-DQO-025, 1999, *Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis*, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-HSP-002, 1999, *Tank Farms Health and Safety Plan*, Rev. 3B, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-WM-SAR-067, 1999, *Tank Waste Remediation System Final Safety Analysis Report*, Rev. 1, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-WM-TI-710, 1997, *Waste Tank Risers Available for Sampling*, Rev. 4, Numatec Hanford Corporation, Richland, Washington.

HNF-SD-WM-TSR-006, 1999, *Tank Waste Remediation System Technical Safety Requirements*, Rev. 1, Fluor Daniel Hanford, Inc., Richland, Washington.

PNNL-12040, 1998, *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Procedures, CH2M Hill Hanford Group, Inc., Richland, Washington:

- RPP-PRO-081, Rev. 0, 1999, *Hazardous Energy Control Program.*
- RPP-PRO-083, Rev. 0, 1999, *Personal Protection.*
- RPP-PRO-084, Rev. 0, 1999, *Safety Showers and Eyewashes.*
- RPP-PRO-096, Rev. 0, 1999, *Material Handling and Storage.*
- RPP-PRO-097, Rev. 0, 1999, *Engineering Design and Evaluation.*
- RPP-PRO-102, Rev. 0, 1999, *Safety Color Coding.*
- RPP-PRO-120, Rev. 0a, 1999, *Respiratory Protection Program.*

- RPP-PRO-156, Rev. 0, 1999, *Non-Radioactive Hazardous Materials/Hazardous Waste (HM/HW) Shipments.*
- RPP-PRO-157, Rev. 0, 1999, *Radioactive Material/Waste Shipments.*
- RPP-PRO-163, Rev. 0, 1999, *Documentation and Record Keeping.*
- RPP-PRO-222, Rev. 0, 1999, *Quality Assurance Records Standards.*
- RPP-PRO-224, Rev. 0, 1999, *Document Control Program Standards.*
- RPP-PRO-340, Rev. 0, 1999, *Fire Protection Program Overview.*
- RPP-PRO-341, Rev. 0, 1999, *Fire Protection Policy.*
- RPP-PRO-349, Rev. 1, 1999, *Fire Protection Design/Operations Criteria.*
- RPP-PRO-350, Rev. 0, 1999, *Fire Hazards Analysis Requirements.*
- RPP-PRO-354, Rev. 0, 1999, *Fire Surveillance Requirements.*
- RPP-PRO-358, Rev. 0, 1999, *Flammable/Combustible Liquids.*
- RPP-PRO-359, Rev. 0, 1999, *Control of Combustibles.*
- RPP-PRO-699, Rev. 0, 1999, *Storing and Handling Chemicals.*
- RPP-PRO-450, Rev. 0, 1999, *Air Quality, Radioactive Emissions.*
- RPP-PRO-702, Rev. 0, 1999, *Safety Analysis Process – New Project.*
- RPP-PRO-703, Rev. 0, 1999, *Safety Analysis Process – Facility Change or Modification.*
- RPP-PRO-704, Rev. 0, 1999, *Hazard and Accident Analysis Process.*
- RPP-PRO-709, Rev. 0, 1999, *Preparation and Control Standard for Engineering Drawings.*
- RPP-PRO-1621, Rev. 0, 1999, *ALARA Decision-Making Methods.*
- RPP-PRO-1622, Rev. 0, 1999, *Radiological Design Review Process.*
- RPP-PRO-1819, Rev. 0, 1999, *Engineering Requirements.*

SW-846, 1986, *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods*, 3rd ed., U.S. Environmental Protection Agency, Washington, D.C.

WAC 173-303-300, 1999, "General Waste Analysis," *Washington Administrative Code*, as amended.

WAC 173-400, 1999, "General Regulations for Air Pollution Sources," *Washington Administrative Code,* as amended.

WAC-173-480, 1999, "Ambient Air Quality Standards and Emissions Limits for Radionuclides." *Washington Administrative Code*, as amended.

WAC 246-247, 1999, "Radiation Protection - Air Emissions," *Washington Administrative Code*, as amended.

WHC-SD-WM-ER-409, 1995, *Tank Characterization Report for Double-Shell Tank 241-SY-101*, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-WM-SP-004, 1995, *Tank Safety Screening Data Quality Objective*, Rev. 2, Westinghouse Hanford Company, Richland, Washington.

This page intentionally left blank.

APPENDIX B

PRELIMINARY SAFETY CLASSIFICATIONS

This page intentionally left blank.

APPENDIX B

PRELIMINARY SAFETY CLASSIFICATIONS

The preliminary safety classifications for the Double-Shell Tank Process Waste Sampling Subsystem major components were derived from the *Tank Waste Remediation System Final Safety Analysis Report*, HNF-SD-WM-SAR-067. See Table B-1 below.

Note: At this time specific components have not yet been identified. As these are defined, Table B-1 will be populated.

Table B-1. Safety Classification of Double-Shell Tank Process Waste Sampling Subsystem Components.

Component	GS	SS	SC
<TBD>	<TBD>	<TBD>	<TBD>

GS = general service.
SC = safety class.
SS = safety significant.

REFERENCES

HNF-SD-WM-SAR-067, 1999, *Tank Waste Remediation System Final Safety Analysis Report*, Rev. 1, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

This page intentionally left blank.

APPENDIX C

CRITICAL ISSUES

This page intentionally left blank.

APPENDIX C

CRITICAL ISSUES

Number	Sections Affected	Description of Issue	Effect on DST Process Waste Sampling Subsystem Specification	Path for Closure	Severity		
					Scope	Time	Cost
1	3.2.1.2.1h 3.2.1.3.1h	The real-time information, if any, required for process control has not been established.	The need for and type of instrumentation in the pumped sampling and analysis loop cannot be fully defined. If real-time data are not required, the pumped sampling and analysis loop may not be needed.	A preliminary assessment by CHG Process Engineering concluded that no real-time data provided by the pumped sampling and analysis loop are required to control the HLW mobilization process. Please refer to Appendix F.	M	M	M
				A preliminary assessment by CHG Process Engineering concluded that no real-time data provided by the pumped sampling and analysis loop are required to control the LAW dissolution process. Please refer to Appendix F.			
			The interfaces to the DST Monitor and Control Subsystem cannot be fully defined.	A preliminary assessment by CHG Process Engineering concluded that no real-time data provided by the pumped sampling and analysis loop are required to control HLW feed deliveries. Please refer to Appendix F.			
				A preliminary assessment by CHG Process Engineering concluded that no real-time data provided by the pumped sampling and analysis loop are required to control the LAW feed deliveries. Please refer to Appendix F.			

APPENDIX C

CRITICAL ISSUES

Number	Sections Affected	Description of Issue	Effect on DST Process Waste Sampling Subsystem Specification	Path for Closure	Severity		
					Scope	Time	Cost
2	3.2.1.2.1e 3.2.1.2.1f 3.2.1.4.1g 3.2.1.5.1g	The extent to which HLW source tanks and staging tanks must be sampled while undergoing mixing has not yet been established.	**Major.** If tanks must be sampled while undergoing mixing, then either the agitated tank grab sampling subsystem or the pumped sampling and analysis loop subsystem must be developed.	Obtain settling rate data for HLW sludges per HNF-1558 to quantify the bias that would be introduced by sampling after mixer pumps are shut down	H	H	H
				Review outcome of settling studies with ICD team members and determine if bias is acceptable for feed certification			
				Review outcome of settling studies with process control personnel to determine if bias is acceptable for process control.			
				Review outcome of Tank 241-AZ-101 mixer pump test to evaluate variability of solids distribution and performance of proposed in situ instrumentation.			
3	3.2.1.2.2b 3.2.1.2.4b 3.2.1.3.2b 3.2.1.3.4b 3.2.1.4.2b 3.2.1.5.2b	The extent to which samples must be maintained at tank temperature during handling, transport, and analysis has not yet been established.	**Major.** If the temperatures of samples must be controlled during handling, transport, and analysis, then the temperature controlled sample handling and transport subsystem must be developed.	Negotiate with ICD –19 partners to determine whether the potential to overstate the solids content of LAW staging tank samples is acceptable.	H	H	H
				Negotiate with ICD –20 partners to determine whether the potential to overstate the solids content of HLW staging tank samples is acceptable.			

APPENDIX C

CRITICAL ISSUES

Number	Sections Affected	Description of Issue	Effect on DST Process Waste Sampling Subsystem Specification	Path for Closure	Severity		
					Scope	Time	Cost
4	3.2.1.4.1d 3.2.1.4.1e	A protocol for detecting the presence of separable organic in staged HLW and LAW has not been established	The scope, complexity, and cost of the liquid surface sampling subsystem depends on the protocol established for detecting a floating organic layer.	Negotiate a protocol for detecting a separable organic phase with RPP, ORP, and BNFL ICD partners. A preliminary assessment by CHG Process Engineering concluded that the separable organic requirement may apply to subsurface certification samples, and that no special sampling techniques may be required. Please refer to Appendix F.	H	H	M

BNFL = BNFL Inc.
CHG = CH2M HILL Hanford Group, Inc.
DST = double-shell tank.
H = high.
HLW = high-level waste.
ICD = interface control document.
L = low.
LAW = low-activity waste.
ORP = Office of River Protection.
RPP = River Protection Project.
TBD = to be determined.

REFERENCES

BNFL-5193-ID-19, 2000, *Interface Control Document for Low-Activity Waste Feed,* BNFL Inc., Richland, Washington.

BNFL-5193-ID-20, 2000, *Interface Control Document for High-Level Waste Feed,* Rev. 4, as amended, BNFL Inc., Richland, Washington.

HNF-1558, 1999, *Data Quality Objectives for RPP Privatization Phase 1: Confirm Tank T is an Appropriate Feed Source for High-Level Waste Feed Batch X*, Rev. 2, Lockheed Martin Hanford Corporation, Richland, Washington.

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

This page intentionally left blank.

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
Figure 3-6	Legend key for shaded boxes: New architectures which may be included in the Process Waste Sampling Subsystem. The justifications and requirements for these subsystems are <TBD>. See Critical Issues 1-4.	The process control and certification data required for the WFD process are not fully defined. Therefore, the roles of and justifications for these subsystems are not well defined.	Resolve Critical Issues 1-4.	L	L	L
3.1.2.1.2.a	The DST Process Waste Sampling Subsystem shall be designed to use filtered raw water at a <TBD> rate and <TBD> pressure for flushing and decontamination.	Filtered raw water usage rates are not known.	Filtered raw water usage will be established during the design phase.	L	L	L
3.1.2.1.3.a	The DST Process Waste Sampling Subsystem's controls, instrumentation, and actuators shall be designed to use <TBD> metric <TBD> lbf/in^2) of instrument air, as provided by the DST Service Air Subsystem.	Instrument air usage rate and pressure are not known.	Instrument air usage will be established during the design phase.	L	L	L
3.1.2.1.5.a	The DST Process Waste Sampling Subsystem shall be capable of using sampling casks decontaminated to a surface contamination level meeting SARP requirements <TBD>.	Cask decontamination limits are not defined for those architectures which have not yet been selected.	Decontamination levels will be established using design when sample containers, casks, and handling systems are specified.	L	L	L
3.1.2.1.5.b	The DST Process Waste Sampling Subsystem shall be capable of using designated laboratory-supplied canisters and traps for capturing specified gaseous and vapor analytes. Quantitative requirements have not been determined at this time and are <TBD>.	Vapor sampling requirements and detection limits have not been established for HLW mobilization and LAW dissolution activities.	DQOs and/or process control plans will be prepared to establish the vapor sampling requirements.	L	L	L

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.1.2.1.6	The DST Maintenance and Recovery Subsystem provides the equipment, material, facilities, and qualified personnel to perform required preventive and repair maintenance for the DST Process Waste Sampling Subsystem. The requirements for this interface have not been determined at this time and are <TBD>.	Maintenance and recovery requirements cannot be defined until hardware selections have been made.	The interface will be defined during design when equipment selections are made.	L	L	L
3.1.2.1.8.a	The DST Process Waste Sampling Subsystem shall be capable of accepting data from the DST Monitor and Control Subsystem. Data flow requirements have not been established at this time and are <TBD>.	The sensors, controls, and interlocks for the pumped sampling and analysis loop subsystem cannot be defined until process control requirements are established.	CRITICAL ISSUE #1- see Appendix C. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem. See Appendix F.			
3.2.1.1.2.c	The DST Process Waste Sampling Subsystem shall be capable of preserving or refrigerating samples collected for VOA and SVOA analysis in accordance with SW-846 requirements. <TBD>	The sensors, controls, and interlocks for the pumped sampling and analysis loop subsystem cannot be defined until process control requirements are established.	CRITICAL ISSUE #1- see Appendix C. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem. See Appendix F.			
3.2.1.1.2.d	The DST Process Waste Sampling Subsystem shall be capable of delivering a sample to the designated laboratory within one working day. <TBD>	The sensors, controls, and interlocks for the pumped sampling and analysis loop subsystem cannot be defined until process control requirements are established.	CRITICAL ISSUE #1- see Appendix C. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem. See Appendix F.			
3.2.1.1.3.d	The DST Process Waste Sampling Subsystem shall be able to collect samples with zero headspace for VOA and SVOA. <TBD>	The sensors, controls, and interlocks for the pumped sampling and analysis loop subsystem cannot be defined until process control requirements are established.	CRITICAL ISSUE #1- see Appendix C. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.1.4.c	The DST Process Waste Sampling Subsystem shall be capable of preserving or refrigerating samples collected for VOA and SVOA analysis in accordance with SW-846 requirements. <TBD>	The sensors, controls, and interlocks for the pumped sampling and analysis loop subsystem cannot be defined until process control requirements are established.	CRITICAL ISSUE #1- see Appendix C. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem. See Appendix F.			
3.2.1.1.4.d	The DST Process Waste Sampling Subsystem shall be capable of delivering a sample to the designated laboratory within one working day. <TBD>	The SW-846 holding time requirements include the time required for sample collection, delivery, and analysis. Further evaluation is required to establish a sample delivery time requirement.	Evaluate SW-846 holding time requirements and establish a delivery requirement.	L	L	L
3.2.1.2.a	Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to monitor the progress of the HLW solids mobilization activity, establish dilution ratios, and determine when a mobilized HLW batch is ready for transfer per <TBD DQOs have not yet been prepared for control of the HLW preparation activity>. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	DQOs have not been prepared for control of the HLW preparation process. Therefore, the type of samples cannot be fully specified at this time.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for HLW mobilization process control.	H	H	H
			Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.b	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in *Data Quality Objectives for Tank Farm Waste Compatibility Program*, HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids by volume. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids>.	The data requirements for a compatibility assessment have not been established for HLW slurries containing >5% solids. The data requirements for waste transfer per HNF-SD-WM-DQO-001 do not apply to slurries containing >5% solids.	Revise HNF-SD-WM-DQO-001 to incorporate sampling requirements for HLW slurries containing >5% solids.	M	M	M
			Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.	M	M	M

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.1.e	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	The accuracy with which the HLW slurry sample must capture the distribution of liquids and solids within the waste has not been established.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.			
		See Critical Issue # 2. If it is determined that HLW source tanks must be sampled while undergoing mixing in order to ensure representative samples, the agitated tank grab sampling subsystem or pumped sampling and analysis loop subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the Pumped Sampling and Analysis Loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.1.f	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry when the tank is undergoing mixing within <TBD>%.	The accuracy with which the HLW slurry sample must capture the suspended solids within the waste has not been established.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.			
		See Critical Issue # 2. If it is determined that HLW source tanks must be sampled while undergoing mixing in order to ensure representative samples, the agitated tank grab sampling subsystem or pumped sampling and analysis loop subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.1.h	The DST Process Waste Sampling Subsystem shall be able to obtain real-time measurements of <TBD> with an accuracy of <TBD> at the sampling location.	See Critical Issue #1 in Appendix C. The type of real-time data that must be provided by the pumped sampling and analysis loop has not been defined.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements. Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.	H	H	H

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.2.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	Solids formed when the sample cools during handling and transport cannot be distinguished from solids initially present in the tank. Therefore the HLW sample may overstate the amount of solids present unless the temperature is controlled.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.	H	H	H
		See Critical Issue #3 in Appendix C. If the sample temperature must be controlled, then the temperature controlled sample handling and transport subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.4.b	The sample shall be maintained within <TBD> degrees of tank temperature during handling and transport to minimize uncontrolled formation or dissolution of solids within the sample container caused by temperature changes. <TBD formation of solids during handling and transport could result in overstating the amount of solids mobilized><TBD the importance or need for this feature has not been established>.	Solids formed when the sample cools during handling and transport cannot be distinguished from solids initially present in the tank. Therefore the HLW sample may overstate the amount of solids present unless the temperature is controlled.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.	H	H	H
		See Critical Issue #3 in Appendix C. If the sample temperature must be controlled, then the temperature controlled sample handling and transport subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.3.a	Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary for process control to monitor the progress of the LAW solids dissolution activity, establish dilution ratios, and determine when a prepared LAW batch is ready for transfer per <TBD DQOs have not yet been prepared for control of the LAW preparation activity>. These samples shall reflect and preserve the following waste properties of the DST contents through sample collection, handling, transport, and analysis.	DQOs have not been prepared for control of the LAW dissolution and preparation process. Therefore, the type of samples cannot be fully specified at this time.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control			
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.3.1.c	The DST Process Waste Sampling Subsystem shall exclude liquids or slurries from elevations other than that selected for sampling. <TBD>	Quantitative requirement not established. The grab sampling subsystem exposes the open sample bottle to wastes at elevations above that selected for sampling while the sample is hoisted to the surface. If this bias is not acceptable, then the agitated tank grab sampling subsystem of pumped sampling and analysis loop subsystems must be developed.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control	M	M	M
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.3.1.e	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	The accuracy with which the LAW slurry sample must capture the distribution of liquids and solids within the waste has not been established.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control			
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.1.f	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.	The accuracy with which the LAW sample must capture the suspended solids within the waste has not been established.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control.			
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.3.1.h	The DST Process Waste Sampling Subsystem shall be able to obtain real-time measurements of <TBD> with an accuracy of <TBD> at the sampling location.	See Critical Issue #1 in Appendix C. The type of real-time data that must be provided by the pumped sampling and analysis loop has not been defined.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control	H	H	H
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.3.2.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	Solids formed when the sample cools during handling and transport cannot be distinguished from solids initially present in the tank. Therefore the LAW sample may overstate the amount of solids present unless the temperature is controlled.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.	H	H	H
		See Critical Issue #3 in Appendix C. If the sample temperature must be controlled, then the temperature controlled sample handling and transport subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.	H	H	H
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.	H	H	H

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.3.4.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	Solids formed when the sample cools during handling and transport cannot be distinguished from solids initially present in the tank. Therefore the LAW sample may overstate the amount of solids present unless the temperature is controlled.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.	H	H	H
		See Critical Issue #3 in Appendix C. If the sample temperature must be controlled, then the temperature controlled sample handling and transport subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.	H	H	H
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.	H	H	H
3.2.1.4.a	Provide Sample to BNFL Inc. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support composite preparation and delivery of representative samples to the Privatization Contractor per <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	No DQO has been prepared for HLW certification samples provided to BNFL Inc. ICD-20 provides some guidance in this area.	Prepare HLW certification DQO to establish requirements for HLW samples provided to BNFL Inc.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.4.b	HLW Certification. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to certify the quantity and composition of HLW feed per BNFL ICD-20 <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	No DQO has been prepared for HLW certification samples. ICD-20 provides some guidance in this area.	Prepare HLW certification DQO to establish requirements for HLW certification samples. A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			
3.2.1.4.c	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids.> <TBR HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may be revised when the DQO is revised to include this transfer route>.	Information requirements have not been established for compatibility assessments of HLW transfers between HLW staging tanks and the Waste Treatment Plant. HNF-SD-WM-DQO-001 does not apply to transfers containing >5% solids, nor to transfers through the new transfer line to the Waste Treatment Plant. Additional requirements may be imposed when the DQO is revised to allow transfers to the HLW/LAW plant, and to allow transfers of >5% solids.	Revise HNF-SD-WM-DQO-001 to establish sampling requirements for transfers of >5% solids, and for transfers through the piping to the HLW/LAW vitrification facility.	M	M	M

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.4.1.e	The DST Process Waste Sampling Subsystem shall prevent displacement of any organic collected in the sample container by denser aqueous liquids or slurries <TBD>.	A protocol for detecting the presence of separable organic in staged HLW has not been established.	See Critical Issue #4 in Appendix C. Negotiate protocol to detect separable organic phase in HLW with RPP, ORP, and BNFL ICD partners.			
3.2.1.4.1.f	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	The accuracy with which the HLW certification sample must capture the distribution of liquids and solids within the waste has not been established.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control.			
		See Critical Issue # 2 in Appendix C. If the HLW staging tank must be sampled while undergoing mixing, then the agitated tank grab sampling subsystem or the pumped sampling and analysis loop subsystem must be developed.	Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.4.1.g	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.	The accuracy with which the HLW sample must capture the suspended solids within the waste has not been established.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control.			
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			
3.2.1.4.1.h	The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of HLW staging tank slurry in one working day <TBR>	The DST Process Waste Sampling Subsystem must collect HLW certification samples quickly enough to meet the time constraints in ICD-20.	Evaluate time constraints and establish sample collection rate.	L	L	L

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.4.2.b	The DST Process Waste Sampling Subsystem shall maintain samples at tank temperature during handling and transport <TBD the importance or need for this feature has not been established>.	Solids formed when the sample cools during handling and transport cannot be distinguished from solids initially present in the tank. Therefore the HLW certification sample may overstate the amount of solids present unless the temperature is controlled.	Prepare DQOs or process control plans for HLW mobilization, to define sampling requirements.			
		See Critical Issue #3 in Appendix C. If the sample temperature must be controlled, then the temperature controlled sample handling and transport subsystem must be developed.	Incorporate information being developed in *High Level Waste Feed Delivery Process Control Strategy* (HNF-5145). HNF-5145 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			
3.2.1.4.2.c	The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.	The DST Process Waste Sampling Subsystem must collect HLW certification samples quickly enough to meet the time constraints in ICD-20.	Evaluate time constraints and establish sample collection rate.	L	L	L

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.5.a	Deliver Samples to BNFL Inc. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support composite preparation and delivery of representative samples to the Privatization Contractor per <TBD: no DQO has been prepared for waste certification>. These samples shall reflect and retain the following properties of the DST contents through sample collection, handling, transport, and analysis.	No DQO has been prepared for LAW certification samples provided to BNFL Inc. ICD-19 provides some guidance in this area.	Prepare LAW certification DQO to establish requirements for LAW samples provided to BNFL Inc.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			
3.2.1.5.b	LAW Certification. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements to certify the quantity and composition of LAW feed. These samples shall reflect and retain those properties of the DST contents specified in <TBD: no DQO has been prepared for waste certification> through sample collection, handling, transport, and analysis.	No DQO has been prepared for LAW certification samples. ICD-20 provides some guidance in this area.	Prepare LAW certification DQO to establish requirements for LAW certification samples.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.5.c	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis and establish transfer parameters such as dilution ratios in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBD HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may change when the DQO is revised to include this transfer route>.	Sampling requirements have not been established for compatibility assessments for transfers to the HLW/LAW vitrification plant. HNF-SD-WM-DQO-001 currently does not apply to transfers to the Waste Treatment plant. Additional requirements may be imposed when the DQO is revised.	Revise HNF-SD-WM-DQO-001 to establish sampling requirements for LAW transfers to the Waste Treatment Plant.	L	L	L
3.2.1.5.1.e	The DST Process Waste Sampling Subsystem shall prevent displacement of any organic collected in the sample container by denser aqueous liquids or slurries <TBD>.	A protocol for detecting the presence of separable organic in staged LAW has not been established.	See Critical Issue #4 in Appendix C. Negotiate protocol to detect separable organic phase in LAW with RPP, ORP, and BNFL ICD partners.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.5.1.f	The distribution of liquids and solids in the collected sample shall match that present in the DST waste at the time and location sampled within <TBD>.	The accuracy with which the LAW certification sample must capture the distribution of liquids and solids within the waste has not been established.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control			
		See Critical Issue # 2 in Appendix C. If the LAW staging tank must be sampled while undergoing mixing, then the agitated tank grab sampling subsystem or the pumped sampling and analysis loop subsystem must be developed.	Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.5.1.g	The quantity, particle size distribution, type, and density of solids collected in the sample shall match that present in the slurry at the time and location sampled when the tank is undergoing mixing within <TBD>%.	The accuracy with which the LAW sample must capture the suspended solids within the waste has not been established.	Data needs and sampling requirements will be identified during the development of a DQO and/or process control plans for LAW dissolution and preparation process control			
			Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			
3.1.2.5.1.h	The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of LAW staging tank slurry in one working day <TBR>.	The DST Process Waste Sampling Subsystem must collect LAW certification samples quickly enough to meet the time constraints in ICD-19.	Evaluate time constraints and establish sample collection rate.	L	L	L

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.5.2.b	The sample shall be maintained within <TBD> degrees of tank temperature during handling and transport in order to minimize uncontrolled formation or dissolution of solids within the sample container due to temperature changes <TBD formation of solids during handling and transport could result in overstating the amount of solids present in the staged LAW> <TBD the importance or need for this feature has not been established>.	Solids formed when the sample cools during handling and transport cannot be distinguished from solids initially present in the tank. Therefore the LAW certification sample may overstate the amount of solids present unless the temperature is controlled.	Prepare DQOs or process control plans for LAW staging tank samples to define handling and transport requirements.	H	H	H
		See Critical Issue #3 in Appendix C. If the sample temperature must be controlled, then the temperature controlled sample handling and transport subsystem must be developed.	Incorporate information being developed in *Low Activity Waste Feed Delivery Process Control Strategy* (HNF-5146). HNF-5146 is being drafted concurrently with this DST Process Waste Sampling Subsystem specification.			
			A preliminary assessment by Process Engineering concluded that there may be no need for real-time data provided by the pumped sampling and analysis loop subsystem, nor for sampling while mixing. See Appendix F.			
3.2.1.5.2.c	The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.	The DST Process Waste Sampling Subsystem must deliver LAW certification samples quickly enough to meet the time constraints in ICD-20.	Evaluate time constraints and establish sample delivery rate.	L	L	L

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.1.2.6.e	HLW Mobilization Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples to evaluate the gases and vapors released into the tank headspace by waste-disturbing activities during HLW mobilization and transfer and to control the HLW mobilization activity to maintain gaseous releases within limits. These samples shall reflect and preserve the properties of the DST contents identified in <TBD: no DQO has been prepared for HLW mobilization and transfer process control> during sample collection, handling, transport, and analysis.	No DQO has been prepared for HLW mobilization process control. Consequently, vapor sampling requirements, if any, are undefined. However, it is anticipated that the vapors and gases to be analyzed will be a subset of those already identified in the HNF-SD-WM-DQO-004, HNF-SD-WM-DQO-021, and PNNL-12040, and that no additional sampling capabilities will be required as a result.	Prepare DQO and/or process control plans to define process control vapor sampling requirements. For HLW mobilization.	L	L	L
3.1.2.6.f	LAW Dissolution Process Control. The DST Process Waste Sampling Subsystem shall have the capability to obtain representative samples to evaluate the gases and vapors released into the tank headspace by waste-disturbing activities during LAW dissolution and transfer and to control the LAW dissolution activity to maintain gaseous releases within limits. These samples shall reflect and preserve the properties of the DST contents identified in <TBD: no DQO has been prepared for LAW mobilization and transfer process control> during sample collection, handling, transport, and analysis.	No DQO has been prepared for LAW dissolution process control. Consequently, vapor sampling requirements, if any, are undefined. However, it is anticipated that the vapors and gases to be analyzed will be a subset of those already identified in the HNF-SD-WM-DQO-004, HNF-SD-WM-DQO-021, and PNNL-12040, and that no additional sampling capabilities will be required as a result.	Prepare DQO and/or process control plans to define process control vapor sampling requirements. For HLW mobilization.	L	L	L

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.3.b	All long-term, non-replaceable components shall have a service life-time of <TBD>. In-tank and above-tank components that require maintenance or replacement should be designed for ease of maintenance and ALARA and should have a minimum service life of <TBD> months before maintenance is required. The design goal is to be able to support a complete sampling campaign and not have maintenance adversely impact or become critical path in the campaign.					
3.2.4.a	The mean time to recover from failures of the DST Process Waste Sampling Subsystem subsystems used for waste certification samples shall be less than <TBD> days.					
3.2.4.b	The mean time between DST Process Waste Sampling Subsystem failures shall be less than <TBD> years for repairable components.					
3.2.6.c	The Process Waste Sampling Subsystem must be capable of continuous deployment in/on a tank for a <TBD> month time period to support a sampling campaign.					
3.4.b	All DST Process Waste Sampling Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with <TBD>.					

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.7.1	The core sampling subsystem captures solids, sludges, and highly viscous slurries. Specialized, self-contained, core-sampling trucks insert a core drill string into the waste that contains a retrievable core sampler. The core drill system has a pressurized head (liquid or gas) capability that prevents the drill string from filling when a core sampler is retrieved. The drill string may be inserted into the waste by pushing a sharpened sample bit directly into the waste or by drilling action with cutting bits at the end of the drill string. The sampling devices incorporate a variety of seals and closures that can retain liquids and gases within the sampler. Controls are established to prevent penetrating the tank shell or igniting flammable gases within the tank. The core drill string currently is approved for sampling when there are no side forces. The ability of the core sampling subsystem to sample tanks undergoing mixing is <TBD>.					
3.7.9	The controlled temperature sample handling and transport subsystem maintains the sample container at a temperature selected for sample preservation or to match that of the tank waste layer from which the sample was obtained from the time that the sample is retrieved from the tank until custody of the sample is transferred to the RPP-designated laboratory. <TBD – the importance or need for this subsystem has not been established>					

APPENDIX D

TBD: LIST OF ITEMS THAT REMAIN TO BE DETERMINED

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
4.1.2.a	<TBD>	Testing requirement to verify that sample collection and handling requirements are satisfied cannot be determined until performance requirements are fully defined				

REFERENCES

BNFL-5193-ID-19, 2000, *Interface Control Document for Low-Activity Waste Feed,* BNFL Inc., Richland, Washington.

BNFL-5193-ID-20, 2000, *Interface Control Document for High-Level Waste Feed,* BNFL Inc., Richland, Washington.

HNF-5145, 2000, *High-Level Waste Feed Delivery Process Control Strategy*, Numatec Hanford Corporation for Fluor Hanford, Inc., Richland, Washington.

HNF-5146, 2000, *Low-Activity Waste Feed Delivery Process Control Strategy*, Numatec Hanford Corporation for Fluor Hanford, Inc., Richland, Washington.

HNF-SD-WM-DQO-001, 1999, *Data Quality Objectives for Tank Farms Waste Compatibility Program*, Rev. 3, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-DQO-004, 1997, *Data Quality Objective to Support Resolution of the Flammable Gas Safety Issue*, Rev. 3, DE&S Hanford, Inc., for Fluor Daniel Hanford, Inc., Richland, Washington.

HNF-SD-WM-DQO-021, 1999, *Data Quality Objectives for Regulatory Requirements for Hazardous and Radioactive Air Emissions Sampling and Analysis*, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-DQO-025, 1999, *Data Quality Objectives for Regulatory Requirements for Dangerous Waste Sampling and Analysis*, Rev. 1, Lockheed Martin Hanford Corporation, Richland, Washington.

PNNL-12040, 1998, *Regulatory Data Quality Objectives Supporting Tank Waste Remediation System Privatization Project*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

SW-846, 1992, *Test Methods for Evaluating Solid Wastes: Physical/Chemical Properties,* 3rd ed., as amended by Updates I (July 1992), IIA (August 1993), IIB (January 1995), and III (1997), U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C.

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED

This page intentionally left blank.

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED (6 SHEETS)

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.1.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL or 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	Maximum slurry viscosity not stated.	Use values determined to support waste transfer analysis.	L	L	L
3.2.1.1.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within ±5 cm (2 in.) <TBR>.	A basis for the positioning accuracy of the DST liquid/slurry sample intake has not been identified.		L	M	L
3.2.1.1.1.d	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below the riser selected for sampling. <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L
3.2.1.1.3.c	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below the riser selected for sampling. <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED (6 SHEETS)

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.b	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in *Data Quality Objectives for Tank Farm Waste Compatibility Program*, HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids by volume. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids>.					
3.2.1.2.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	Maximum slurry viscosity not stated.	Use values determined to support waste transfer analysis.	L	L	L
3.2.1.2.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within ±5 cm (2 in.) <TBR>.	A basis for the positioning accuracy of the HLW source tank liquid/slurry sample intake has not been identified.		L	M	L
3.2.1.2.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	A protocol for determining the amount of separable organic in the HLW feed has not been established.	Negotiations between CHG, ORP, and BNFL to determine a protocol for determining the amount of visible organic in HLW feed.			
3.2.1.2.1.g	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED (6 SHEETS)

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.2.3.b	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L
3.2.1.3.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	Maximum slurry viscosity not stated.	Use values determined to support waste transfer analysis.	L	L	L
3.2.1.3.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.	A basis for the positioning accuracy of the LAW source tank liquid/slurry sample intake has not been identified.		L	M	L
3.2.1.3.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	A protocol for determining the amount of separable organic in the LAW feed has not been established.	Negotiations between CHG, ORP, and BNFL to determine a protocol for determining the amount of visible organic in LAW feed.			
		Sampling 2.5 cm (1 in.) below the liquid surface has generally been acceptable for compatibility assessments, however a basis for the 2.5 cm (1 in.) value has not been identified.	Review available documentation and clarify/provide basis.			
3.2.1.3.1.g	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L
3.2.1.3.3.b	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED (6 SHEETS)

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.4.c	Compatibility. The DST Process Waste Sampling Subsystem shall have the capability to obtain samples that support measurements of waste characteristics necessary to perform a compatibility analysis in preparation for waste transfer. These samples shall reflect and preserve the DST waste properties specified in HNF-SD-WM-DQO-001 through sample collection, handling, transport, and analysis. <TBR: HNF-SD-WM-DQO-001 does not currently apply to waste transfers containing over 5% solids. Additional requirements may be imposed when the DQO is revised to allow for transfers over 5% solids.> <TBR HNF-SD-WM-DQO-001 does not currently apply to transfers through the pipeline to the Waste Treatment Plant. Requirements may be revised when the DQO is revised to include this transfer route>.					
3.2.1.4.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	Maximum slurry viscosity not stated.	Use values determined to support waste transfer analysis.	L	L	L
3.2.1.4.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.	A basis for the positioning accuracy of the LAW source tank liquid/slurry sample intake has not been identified.		L	M	L
3.2.1.4.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	A protocol for detecting the presence of separable organic in staged HLW has not been established.	See Critical Issue #4 in Appendix C. Negotiate protocol to detect separable organic phase in HLW with RPP, ORP, and BNFL ICD partners.			

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED (6 SHEETS)

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.4.1.h	The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of HLW staging tank slurry in one working day <TBR>	The Process Waste Sampling Subsystem must collect HLW certification samples quickly enough to meet the time constraints in ICD-20.	Evaluate time constraints and establish sample collection rate.	L	L	L
3.2.1.4.1.i	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L
3.2.1.4.2.c	The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.	The Process Waste Sampling Subsystem must collect HLW certification samples quickly enough to meet the time constraints in ICD-20.	Evaluate time constraints and establish sample collection rate.	L	L	L
		The amount of sample required to obtain sufficient HLW solids is unknown.	Complete flowsheets for HLW tanks and determine sample quantity required to provide solids to BNFL Inc.	L	M	M
3.2.1.5.1.a	The DST Process Waste Sampling Subsystem shall be able to collect 100 mL to 500 mL of DST liquids or slurries with a viscosity up to 10^6 cP <TBR>.	Maximum slurry viscosity not stated.	Use values determined to support waste transfer analysis.	L	L	L
3.2.1.5.1.b	The DST Process Waste Sampling Subsystem shall be able to obtain the samples from waste at any selected elevation below the waste surface within 5 cm (2 in.) <TBR>.	A basis for the positioning accuracy of the LAW staging tank liquid/slurry sample intake has not been identified.		L	M	L
3.2.1.5.1.d	The DST Process Waste Sampling Subsystem shall be able to collect a sample within 2.5 cm (1 in.) <TBR> from the waste surface to detect a separable organic layer.	A protocol for detecting the presence of separable organic in staged LAW has not been established.	See Critical Issue #4 in Appendix C. Negotiate protocol to detect separable organic phase in HLW with RPP, ORP, and BNFL ICD partners.			

APPENDIX E

TBR: LIST OF ITEMS THAT REMAIN TO BE REFINED (6 SHEETS)

Section	Function/Requirement	Description of Issue(s)	Path for Closure	Severity		
				Scope	Time	Cost
3.2.1.5.1.h	The DST Process Waste Sampling Subsystem shall be able to collect <TBD> L of LAW staging tank slurry in one working day <TBR>.	The Process Waste Sampling Subsystem must collect LAW certification samples quickly enough to meet the time constraints in ICD-19.	Evaluate time constraints and establish sample collection rate.	L	L	L
3.2.1.5.1.i	The DST Process Waste Sampling Subsystem shall be able to collect samples of wastes located 6 to 15 meters (20 to 50 ft) below grade <TBR>.	The elevations of the waste relative to the sampling risers have not been identified for each DST.	Review drawings and insert appropriate values.	L	L	L
3.2.1.5.2.c	The DST Process Waste Sampling Subsystem shall be able to deliver <TBD> L of HLW staging tank slurry to the RPP-designated laboratory within one working day <TBR>.	The Process Waste Sampling Subsystem must collect HLW certification samples quickly enough to meet the time constraints in ICD-20.	Evaluate time constraints and establish sample collection rate.	L	L	L

BNFL = BNFL Inc.
CHG = CH2M HILL Hanford Group, Inc.
DST = double-shell tank.
H = high.
HLW = high-level waste.
ICD = interface control document.
L = low.
LAW = low-activity waste.
M = medium.
ORP = Office of River Protection.
RPP = River Protection Project.
TBD = to be determined.
TBR = to be refined.

REFERENCES

BNFL-5193-ICD-19, 2000, *Interface Control Document for Low-Activity Waste Feed,* BNFL Inc., Richland, Washington.

BNFL-5193-ICD-20, 2000, *Interface Control Document for High-Level Waste Feed,* BNFL Inc., Richland, Washington.

HNF-SD-WM-DQO-001, 1999, *Data Quality Objectives for Tank Farms Waste Compatibility Program,* Rev. 3, Lockheed Martin Hanford Corporation, Richland, Washington.

This page intentionally left blank.

APPENDIX F

RIVER PROTECTION PROJECT PROCESS ENGINEERING PRELIMINARY POSITION WASTE FEED DELIVERY SAMPLING REQUIREMENTS

This page intentionally left blank.

TERMS

BNFL	BNFL Inc.
CHG	CH2M HILL Hanford Group, Inc.
DQO	data quality objective
DST	double-shell tank
HLW	high-level waste
ICD	interface control document
LAW	low-activity waste
PWSS	Process Waste Sampling Subsystem
TBD	to be determined
WFD	Waste Feed Delivery

This page intentionally left blank.

APPENDIX F

RIVER PROTECTION PROJECT PROCESS ENGINEERING PRELIMINARY POSITION WASTE FEED DELIVERY SAMPLING REQUIREMENTS

The *Double-Shell Tank Process Waste Sampling Subsystem Definition Report*, RPP-5786, identified several unknowns pertaining to the type of data to be provided by the Double-Shell Tank (DST) Process Waste Sampling Subsystem (PWSS) during Waste Feed Delivery (WFD) operations. These information gaps were grouped into the following three areas, and engineering studies were proposed to develop performance requirements for each area:

- Process control sampling
- Waste certification sampling
- Trade-offs between sampling and in situ instrumentation.

In each case the main objective was to identify any need for sampling capabilities in addition to the core, grab, auger, and vapor sampling systems currently available.

To accelerate development of the PWSS specification, an ad hoc panel was convened to establish a preliminary position within Process Engineering on these issues. While it was recognized that such an approach might not provide answers to all the questions, the panel meeting on March 16, 2000, provided substantive input and reached consensus in a number of important areas.

The panel consisted of the following individuals within the CH2M HILL Hanford Group, Inc. (CHG) Process Engineering organization:

N. W. Kirch, manager, Tank Farm Process Control
J. W. Hunt, manager, Requirements Planning and Support
J. G. Field, manager, Data Development and Interpretation
D. L. Banning, Process Engineering representative on waste certification interface team
D. M. Nguyen, author of "Tank T Batch X" retrieval data quality objectives (DQOs)
D. A. Reynolds, engineer with extensive experience in waste characteristics
J. M. Conner, tank coordinator for Tank 241-SY-101
S. D. Estey, active in Tank 241-C-106 sluicing and Tank 241-SY-101 dilution activities
J. H. E. Rasmussen, author of RPP-5786 and this report, HNF-4154.

This panel included individuals knowledgeable in waste properties; those who will be writing the DQOs and tank sampling and analysis plans that will use the DST PWSS for data collection; those who will interpret characterization data; and those who will use data collected by the DST PWSS to develop the process control plans that execute the WFD mission. The issues that were addressed by the engineering studies and the conclusions reached by the expert panel are presented in this report.

Process Control Study for Sampling Subsystem Specification

This study was to determine what sample data are required for process control, to develop performance requirements for the DST PWSS specification. Questions raised in RPP-5786 include the following:

1. What sampling is required to determine the extent to which high-level waste (HLW) solids are suspended in source tanks?

   The main concern was whether HLW DSTs would have to be sampled while undergoing mixing to determine how well fast-settling solids were being suspended by the mixer pumps. In situ instrumentation would provide more timely data to assess how long to run the mixer pumps, how to orient them, their sweep rates, etc. The upcoming mixer pump test in Tank 241-AZ-101 will provide some of this information. Fast-settling solids were not judged to be a major process control concern.

   A panel member described the recent Tank 241-AZ-102 sample compositing activities at the 222-S Laboratory wherein waste was transferred from a 2-L jar containing a representative mixture of supernate and solids into centrifuge cones for separation. Heavy solids settled out during the brief interval between shutting off the tissue homogenizer, removing it from the composite jar, and pouring the suspension into centrifuge cones. This observation suggests that a fraction of the solids in Phase 1 HLW tanks may settle fast enough to potentially affect waste transfers. Qualitative information of this type is not readily captured in test reports or in rheology studies.

   To guard against solids plugging the transfer lines, in-line instrumentation would be far more useful and timely than sampling and laboratory analysis. While the proposed pumped sampling and analysis loop would provide more timely data, it would not be as representative of transfer conditions as in-line measurements such as density, pressure, flow, pump speed, and pump amperage. It was pointed out that laboratory or tank-top (provided by the pumped sampling and analysis loop) analytical results may be subject to considerable interpretation and may not be easily used to predict incipient pluggage, adjust parameters, etc.

   Conclusion: Sampling to determine when solids are adequately suspended <TBD> is pending the outcome of the upcoming mixer pump test in Tank 241-AZ-101. Sampling to guard against pipeline pluggage is not warranted, because in-line instrumentation will provide more useful and timely information.

2. To what extent do we need to know the spatial distribution of solids during waste mobilization/dissolution?

   This parameter may be important for HLW to guard against pipeline pluggage in case localized pockets of high solids concentration exist, or if "slugs" of solids are mobilized when the mixer pump jet first encounters a settled solids deposit. However, sample data will not be as useful as in-line pressure, flow, density, and pump amperage indications.

For low-activity waste (LAW), the spatial distribution of solids may be important in specifying at what level the waste should be decanted to exclude solids from a transfer. Such samples could consist of ordinary grab samples after the waste has been allowed to settle.

Conclusions: No new sampling features are needed beyond grab sampling.

3. Do we need to sample while mixing to capture fast-settling solids in samples?

   This question was largely answered by the discussion in question 1. It was pointed out that the laboratory has had difficulty analyzing large solids in the past.

   Conclusion: No. The data primarily would be used to assess the potential for line plugging. In-line instrumentation is preferred.

4. What sampling is required to assess the completion of LAW dissolution activities?

   Grab samples would be obtained from the supernate phase. In the LAW process, solids carryover will be minimized by allowing time for settling. There is no need to sample LAW while the tank is undergoing mixing.

   Conclusions: Obtain grab samples from the supernate while the tank is not undergoing mixing.

5. Do we need to maintain samples at tank temperature during handling/analysis to determine the solids content of source tanks (i.e., to distinguish between samples present in tank versus samples formed during handling)?

   This topic engendered considerable discussion. Panel members cited examples where tank samples had been clear initially and solids formed during transport and handling. In some cases, the solids did not go back into solution after the samples were reheated at the laboratory. This occurs primarily in tanks containing high ionic strength solutions, such as Tanks 241-SY-101, 241-SX-104, and 241-A-101. This may be less of a problem for the more dilute solutions prepared for delivery to the Privatization Contractor. A couple of LAW feeds may not be diluted in-tank before transfer but rather may be diluted in-line during transfer. In those cases, it may be very difficult to assess the amount of solids carryover without controlled-temperature sample handling. A panel member pointed out that even if only one tank needs controlled-temperature sample handling on one occasion, the DST PWSS specification will have to address it, and a system would have to be designed and built to accomplish that. An upcoming technical report will address this issue.

   Conclusions: <TBD> An upcoming technical report will address this issue.

6. To what extent can we rely on Tank T DQO source tank characterization to determine dilution ratios and establish process control parameters for dissolution/mobilization?

   A panel member stated that the data developed per *Data Quality Objectives for RPP Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for High-Level Waste Feed Batch X*, HNF-1558, and *Data Quality Objectives for TWRS Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X*,

HNF-1796, are far more extensive than what we have relied upon historically for process control. Another panel member stated that an analogous approach was successful during the Tank 241-SY-101 dilution and transfer. It was mentioned that the WFD mission would involve much longer transfer lines than the transfer from Tank 241-SY-101 to 241-SY-102. These longer transfer lines may result in more cooling of the waste during transfer. However, if dilution ratios are specified conservatively, then the operation should be successful.

Conclusions: These data will be useful but may not necessarily suffice to replace all process control samples.

7. Do we need to maintain samples at tank temperature during handling/analysis to predict cooling behavior and establish dilution ratios? It is non-conservative to analyze the well-behaved liquids that remain after the troublesome constituents precipitate during handling/transport (and that are attributed to the suspended solids fraction).

   Scott Estey stated that the approach of developing dilution and transfer parameters based on composites of liquids and solids prepared in the laboratory proved to be successful during the Tank 241-SY-101 dilution and transfer activities. John Conner mentioned that the WFD mission would involve much longer transfer lines than the transfer from Tank 241-SY-101 to 241-SY-102. Even if a fraction of the solids do not redissolve when recombined with the liquids and heated, conservative dilution parameters can be established to prevent plugging the transfer lines.

   Conclusions: Handling samples at ambient temperature will be sufficient.

8. Do we have to detect localized regions of elevated solids concentration to guard against pipeline plugging?

   Discussion: In-line measurements are more timely and useful than sample data to detect incipient pluggage as discussed in question 1.

   Conclusions: No.

9. Do we need real-time indication of solids loading, viscosity, or other parameters (phosphate?) to guard against line plugging? If the mixer pump jet sweeps into a mound of solids, transient high solids loadings could result.

   Discussion: In-line measurements are more timely and useful than sample data to detect incipient pluggage as discussed in question 1.

   Conclusions: No.

10. To what extent can we rely on Tank T DQO source tank characterization to establish dilution ratios and establish process control parameters for transfers? Historically we've relied on collecting liquids and solids separately and preparing composites in the lab to answer such questions.

Discussion: This issue was covered by the discussion in response to question 6. This approach should be successful here as it has been in the past.

Conclusions: The Tank T Batch X data may provide much of the information needed to prepare process control plans.

11. Other performance requirements identified during this study or arising from the process control strategy effort.

    Discussion: No new sampling performance requirements were identified.

    Conclusions: No new sampling performance requirements were identified.

Waste Certification Study for Sampling Subsystem

This study was to establish staging tank certification requirements, which drive performance requirements for the DST PWSS specification. Again, the focus is on anything that would require performance features in addition to those provided by the existing grab, core, vapor, and auger systems. Specific areas that were to be addressed in the engineering study include the following:

1. Do samples need to be handled/transported at tank temperature? Solids formed during handling and transport may be indistinguishable from solids originally present in the tank.

   Discussion: This topic stimulated considerable discussion with regard to meeting the LAW solids specification. This would involve transportation to and handling at the BNFL Inc. (BNFL) laboratory as well as the laboratory designated by CHG. A number of individuals speculated whether the solids specification should be referenced to a given temperature. LAW staging tanks may be heated above ambient by mixer pumps. It was mentioned that Tank 241-AN-107 may present a particular challenge because it contains 10-12M sodium, and the plan is to dilute it to 7M by in-line dilution during transfer. If the tank must be certified at its present sodium concentration, meeting the percent solids criterion may require especially careful temperature control. This will be explored further in a study to be conducted by Process Engineering. This topic will be discussed with Waste Feed Delivery and brought up at an interface control document (ICD) resolution meeting if required.

   Conclusion: <TBD> Temperature-controlled sample handling and transport may be required. A study being conducted by Process Engineering will explore this issue further. This subject will be discussed with Waste Feed Delivery and brought up at an ICD resolution meeting if required.

2. To what extent do the samples have to capture the vertical and horizontal distribution of solids in a tank?

   Discussion: The ICDs state that the vertical distribution shall be captured by obtaining grab samples from eight levels in a staging tank. It was stated that the customer and BNFL agree with this approach, and that it's not an issue. According to Rev. 4F of ID-20, this same sampling scheme has been agreed to for HLW as well as LAW tanks. Horizontal variability is not an issue, either. A number of individuals pointed out that the assumption of lateral

homogeneity might not reflect conditions in a tank with mixer pumps. The solids in particular may vary considerably between those areas in line with the discharge jets and quiescent areas not affected by the jets. The upcoming Tank 241-AZ-101 mixer pump test may provide more insight into this phenomenon. It was stated that these issues have been discussed in the ICD issue resolution meetings, and that to date the ICDs do not require additional sampling to determine horizontal distribution during certification.

Conclusion: Grab samples at eight vertical levels in a single riser will be acceptable for certification.

3. To what extent do the samples have to capture the full range of particle sizes suspended by the mixer pumps (i.e., do samples have to be obtained during mixing, or is it permissible to sample after mixer pump shutdown)?

   Discussion: It was stated that this was considered in the ICD issue resolution meetings, and to date the requirement for grab samples at eight vertical levels beneath a single riser after mixer pump shutdown has not been changed.

   Conclusion: The tanks may be sampled after mixer pump shutdown for certification.

4. What constitutes a visible separable organic layer, and how accurately must the surface organic sample be?

   Discussion: The specification does not provide a clear protocol for determining the presence or absence of a "visible" organic layer. It was pointed out that visual observation of separable layers depends on the size and shape of the sample bottle, vial, or graduated cylinder used for the observations. There are options to improve the detection of separable organic layers. The Evaporator DQO specifies surface samples to check for large floating organic layers. A panel member mentioned recently seeing what looked like a floating organic layer on a videotape of Tank 241-AN-107. It was stated that in the ICD the requirement for no visible, separable organic layer pertains to the eight subsurface grab samples. It does not appear that there will be a need for even a surface organic sample akin to that in the Evaporator DQO for certification. This will be discussed with Waste Feed Delivery and brought up at an ICD issue resolution meeting.

   Conclusions: <TBD> This does not appear to be an issue that will drive new sampling requirements.

5. Do we need real-time data to verify that solids are resuspended at the time of transfer to BNFL?

   Discussion: Such a requirement is not anticipated. LAW tanks will not be mixed after the initial feed preparation step. The ICD does not require HLW tanks to be homogenous and recognizes that prepared and staged HLW is likely to be inhomogeneous. A run interval and sweep pattern similar to that employed for initial mobilization should be sufficient.

   Conclusion: Neither real-time data nor sampling are anticipated at the time of transfer.

6. How accurately do staging tank samples have to represent what's being sent to BNFL? Is staging tank data being relied on for formulation of glass or certification of waste canisters or just for order-of-magnitude estimates of quantities and constituents being transferred?

   Discussion: The idea behind this question was that it may be easier to obtain better analytical results from certification samples by sampling smaller, better-mixed tanks at the Waste Treatment Plant after transfer. It was stated that staging tank analyses will be used for certification requirements. The ICDs state the accuracy requirements for the certification samples. The Waste Treatment Plant will use its own internal samples for batch formulation, environmental requirements, and other internal process control tasks.

   Conclusion: Staging tank samples need to be taken according to the ICDs.

7. Could certification samples be obtained in a more optimally configured blending tank at the BNFL facility instead of in the million-gallon River Protection Project staging tanks? Would this activity be in BNFL's work scope?

   Discussion: There are contractual and potential safety difficulties if noncompliant batches are sent to the vitrification facility before analysis. The location for some sampling requirements is still being negotiated. However, waste cannot be transferred to BNFL before certification.

   Conclusion: No.

8. Identify any special requirements to meet regulatory data needs.

   Discussion: It was stated that the existing grab sampling system is an accepted method for collecting samples as specified in the *Resource Conservation and Recovery Act of 1976*. It was mentioned that the compositing scheme in the ICD might lead to a loss of volatile organic analyses, ammonia, and other volatiles. This topic will be addressed in the study being prepared by Process Engineering. However, this is not likely to affect the DST PWSS specification.

   Conclusion: No new performance requirements are likely to arise.

9. Identify any other special performance features required such as simultaneous sampling at multiple depths, closing grab sample containers before hoisting them through the waste to exclude solids from other layers, etc.

   Discussion: The sample collection and transport rates may have to be higher than what is available with the current systems. Currently we can ship only two 500-mL bottles at a time in each of the two pig trucks. This may not support the 7-day turnaround in the ICD between sampling and delivery of a representative composite to BNFL with the intermediate analyses required. The answer may be more or different trucks, casks, or overpacks. There is risk of bottle breakage if bottles are left in the tank farms overnight awaiting shipment. If temperature-controlled transport and handling are implemented, bottle freezing may not be an issue. Special sample collection performance requirements are not anticipated, because

the customer and Privatization Contractor are satisfied with the protocol using grab samples as stated in the ICDs.

Conclusion: The specification must ensure that the sampling and transport rate is high enough to support the ICDs.

10. Other issues identified during the performance of this study or ICD negotiations:

Discussion: No other issues were identified.

Conclusion: No other issues were identified.

Sampling versus In Situ Instrumentation Study for Sampling Subsystem Specification

This study was proposed to evaluate whether certain key parameters should be measured either by sampling and laboratory analysis or by in situ instrumentation. Parameters measured by in situ instrumentation would be covered by the *Double-Shell Tank Monitor and Control Subsystem Specification*, HNF-4155, and may not need to be duplicated in the DST PWSS specification unless confirmatory samples also are anticipated. Specific areas that were to be addressed include the following:

1. Rheology:

Discussion: Rheological measurements of tank wastes are often suspect because the waste is disturbed during the sample collection, transport, and handling activities before examination. Panel members believed that in-line instrumentation would be more useful and timely. In situ rheology instrumentation may involve complex or unproven technology. The flow rate, pump amperage, voltage, power factor, pressure drop along a known transfer piping configuration, and density measured in-line during transfer will provide all the real-time data that is needed for process control.

Conclusions: In-line measurements are preferable to in situ instruments or sampling.

2. Density:

Discussion: Density is a good indicator of the extent of dissolution of soluble salts. Experience with in situ ENRAF densitometers has been inconsistent. Reliable, proven technology would be preferable to sampling if it were truly reliable and proven in the in-tank environment. Grab samples are preferable to unproven instrumentation.

Conclusion: In situ density measurement may be a good alternative to grab sampling; however, until more reliable techniques are employed, grab samples are fine for monitoring a slow process like salt cake dissolution.

3. Spatial distribution of solids:

Discussion: Little discussion occurred on this topic because of limited time. Proven, reliable instrumentation would be preferable if available.

Conclusions: None

4. Detection of a floating organic layer:

   Discussion: Little discussion occurred on this topic because of limited time. There may be little need for this measurement unless more stringent requirements are specified in the ICD negotiations.

   Conclusion: <TBD> This will be discussed with Waste Feed Delivery and brought up at an ICD issue resolution meeting.

5. Key indicators of incipient plugging (phosphate, sodium, aluminum, cloudiness or scale formation in a chilled section of the sampling/analysis loop):

   Discussion: Little discussion occurred on this topic because of limited time.

   Conclusion: None.

6. Should field instruments be installed in risers, or in an aboveground pumped sampling/analysis loop skid?

   Discussion: Little discussion occurred on this topic because of limited time.

   Conclusion: None.

7. Other issues identified during the performance of this study:

   Discussion: No other issues were identified.

   Conclusion: No other issues were identified.

REFERENCES

BNFL-5193-ID-20, 2000, *Interface Control Document for High-Level Waste Feed*, BNFL Inc., Richland, Washington.

HNF-1558, 1999, *Data Quality Objectives for RPP Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for High-Level Waste Feed Batch X*, Rev. 2, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-1796, 1999, *Data Quality Objectives for TWRS Privatization Phase I: Confirm Tank T is an Appropriate Feed Source for Low-Activity Waste Feed Batch X*, Rev. 2, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-4155, 2000, *Double-Shell Tank Monitor and Control Subsystem Specification*, Rev. 0, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-5786, 2000, *Double-Shell Tank Process Waste Sampling Subsystem Definition Report*, Rev. 0, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

Resource Conservation and Recovery Act of 1976, Public Law 94-580, 90 Stat. 2795, 42 U.S.C. 6901 et seq.

DISTRIBUTION

Onsite

1	U.S. Department of Energy Richland Operations Office	
	DOE Public Reading Room	H2-53
1	Pacific Northwest National Laboratory	
	Hanford Technical Library	P8-55
2	Lockheed Martin Services, Inc.	
	Central Files	B1-07
	Document Processing Center	A3-94

This page intentionally left blank.

DISTRIBUTION SHEET

To:	From:	Page 1 of 13
Distribution	Retrieval Engineering	Date April 21, 2000
Project Title/Work Order:		EDT No. 627148
HNF-4154, Rev. 0, *Double-Shell Tank Process Waste Sampling Subsystem Specification*		ECN No. ---

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
W. L. Adams	S6-15	X			
R. R. Bafus	R3-73	X			
D. G. Baide	S5-05	X			
D. L. Banning	R2-12	X			
G. E. Bingham	R3-73	X			
R. M. Boger	S7-12	X			
A. F. Choho	R3-73	X			
T. J. Conrads	R3-73	X			
R. E. DeBusk	S7-86	X			
C. Defigh-Price	R2-12	X			
G. C. DeWeese	R3-73	X			
R. A. Dodd	R3-72	X			
G. P. Duncan	R3-73	X			
W. J. Eischens	R3-75	X			
B. G. Erlandson	R1-51	X			
D. P. Fassett	R3-73	X			
J. E. Ferguson	H7-06	X			
J. G. Field	R2-12	X			
A. H. Friberg	R1-56	X			
J. L. Gilbert	R3-25	X			
T. G. Goetz	R1-49	X			
C. E. Graves	R3-73	X			
C. E. Grenard	R3-73	X			
C. C. Haass	H6-64	X			
D. M. Hammond	R1-49	X			
J. P. Harris	R1-49	X			
J. W. Hunt	R2-12	X			
G. P. Janicek	S7-12	X			
N. W. Kirch	R2-11	X			
P. F. Kison	T4-07	X			
R. E. Larson	T4-07	X			
C. E. Leach	R1-44	X			
J. W. Lentsch	R3-25	X			
G.A. Leshikar	S0-08	X			
G. W. McLellan	S2-48	X			
R. L. Neavill (Project Files)	R3-73	X			
D. M. Nguyen	R2-12	X			
T. C. Oten	R1-56	X			
S. M. O'Toole	R2-53	X			
R. S. Popielarczyk	R2-58	X			

DISTRIBUTION SHEET

To:	From:	Page 2 of 13
Distribution	Retrieval Engineering	Date April 21, 2000
Project Title/Work Order:		EDT No. 627148
HNF-4154, Rev. 0, *Double-Shell Tank Process Waste Sampling Subsystem Specification*		ECN No. ---

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
J. A. Ranschau	S7-86	X			
J. H. Rasmussen (3)	R2-12	X			
F. R. Reich	S7-12	X			
H. R. Rossi	B1-45	X			
J. S. Schofield	S7-12	X			
C. P. Shaw	R3-74	X			
W. J. Stokes	R2-89	X			
J. E. Van Beek	S2-48	X			
W. L. Willis	R3-73	X			

DISTRIBUTION

Onsite

1	U.S. Department of Energy Richland Operations Office	
	DOE Public Reading Room	H2-53
1	Pacific Northwest National Laboratory	
	Hanford Technical Library	P8-55
2	Lockheed Martin Services, Inc.	
	Central Files	B1-07
	Document Processing Center	A3-94