S

ENGINEERING CHANGE NOTICE

Page 1 of 3

1. ECN 644521

Proj. ECN

2. ECN Category (mark one) Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	3. Originator's Name, Organization, MSIN, and Telephone No. CE Graves, Plant Support Engrg, R3-73, 376-5235	4. USQ Required? [] Yes [X] No	5. Date December 15, 2000
	6. Project Title/No./Work Order No. RPP/WFD	7. Bldg./Sys./Fac. No. Tank Farms	8. Approval Designator ESQ
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) HNF-4162, Rev. 0 and HNF-4164, Rev. 0	10. Related ECN No(s). NA	11. Related PO No. NA

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	NA	NA Design Authority/Cog. Engineer Signature & Date	NA Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? [X] Yes [] No

See page 3 for list of sections to be changed in each specification.

14a. Justification (mark one)	14b. Justification Details
Criteria Change [X] Design Improvement [] Environmental [] Facility Deactivation [] As-Found [] Facilitate Const. [] Const. Error/Omission [] Design Error/Omission []	This ECN incorporates DST Transfer Pump and Mixer Pump Subsystem specification changes detailed in RPP-7011, *DST Subsystem Specification/Project Media Baseline Comparison Summary Report*, as agreed to by the Baseline Comparison team. Pressure and flow rate values have been updated to the revised values in Rev. 1 of RPP-5346, *Waste Feed Delivery Transfer System Analysis*. Procedure references and boilerplate text are also updated.

15. Distribution (include name, MSIN, and no. of copies)

See Distribution List

RELEASE STAMP

A-7900-013-2 (10/97)

A-7900-013-1

ENGINEERING CHANGE NOTICE		1. ECN 644521

16. Design Verification Required	17. Cost Impact						18. Schedule Impact (days)		
	ENGINEERING			CONSTRUCTION					
[] Yes	Additional	[]	$ NA	Additional	[]	$ NA	Improvement	[]	N/A
[X] No	Savings	[]	$	Savings	[]	$	Delay	[]	______

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]	None	[X]
Environmental Permit	[]	Inventory Adjustment Request	[]	____________	[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

21. Approvals

	Signature		Date		Signature	Date
Design Authority RW Reed	RW Reed	R3-83	16 Jan 2001	Design Agent		
Cog. Eng. CE Graves	CE Graves	R3-73	01/15/01	PE		
Cog. Mgr. TJ Conrads	TJ Conrads	R3-73	1/16/01	QA		
QA WL Adams	WL Adams	S5-11	1/17/01	Safety		
Safety: JP Harris	JP Harris	R1-49	1-17-01	Design		
Licensing Environ. KS Tollefson	KS Tollefson	R1-51	1-17-01	Environ.		
Other				Other		
CE Grenard	Charles E. Grenard	R3-73	1/15/01			

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

ENGINEERING CHANGE NOTICE CONTINUATION SHEET		ECN 644521
	Page 3 of 3	Date 12/15/00

Changes to HNF-4162, *DST Transfer Pump Subsystem Specification*

Revise these Sections per Appendix L in RPP-7011:

3.1.2.1.1.a*	3.2.1.1.d*	3.2.3.a	3.3.8.b	3.5.1.a
3.2.1.1.b*	3.2.1.5.a	3.2.5.2.4.b	3.4.a	3.5.2.a

Delete this Section per Appendix L in RPP-7011:
3.3.3.b

Update procedure references in Sections 3.3.6.1.a, 3.3.6.3.a, and 3.4.b.

Update boilerplate text (for consistency amongst Subsystem specifications).

Update Table 2-1, Table 2-2, and Appendix A to reflect the above changes/deletions.

Changes to HNF-4164, *DST Mixer Pump Subsystem Specification*

Revise these Sections per Appendix L in RPP-7011:

3.1.2.1.2.a	3.1.2.1.3.a*	3.3.8.c	3.5.2.a
3.1.2.1.2.b	3.2.3.a	3.4.a	

Delete these Sections per Appendix L in RPP-7011:
3.3.1.j 3.3.8.e

Update procedure references in Sections 3.3.6.1.a, 3.3.6.3.a, and 3.4.b.

Update boilerplate text (for consistency amongst Subsystem specifications).

Update Table 2-1, Table 2-2, and Appendix A to reflect the above changes/deletions.

* Update to use new pressure and/or flow rate value(s) in Rev. 1 of RPP-5346.

DISTRIBUTION SHEET		
To: Distribution	From: Plant Support Engineering	Page 1 of 1
		Date January 15, 2001
Project Title/Work Order: HNF-4162, Rev. 1, *Double-Shell Tank Transfer Pump Subsystem Specification*		EDT No. ---
		ECN No. 644521

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
D. D. Acree	R2-36	X			
W. L. Adams	S5-11	X			
J. P. Bailey	R3-25	X			
P. J. Certa	R3-73	X			
A. F. Choho	R2-50	X			
T. J. Conrads	R3-73	X			
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R. P. Tucker	S5-07	X			
K. A. White	R3-47	X			

Double-Shell Tank Transfer Pump Subsystem Specification

C. E. Graves
Fluor Federal Services
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL-14047

EDT/ECN: 644521 UC: 721
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Key Words: privatization, double-shell tank, waste feed delivery, subsystem, specification, level 2, transfer pump

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) Transfer Pump Subsystem which supports the first phase of Waste Feed Delivery.

Release Approval 1/18/01 Date

DATE: JAN 18 2001 STA: 4 HANFORD RELEASE ID: 2

Release Stamp

APPROVED FOR PUBLIC RELEASE

RECORD OF REVISION

(1) Document Number
HNF-4162

Page 1

(2) Title
Double-Shell Tank Transfer Pump Subsystem Specification

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initial Release by EDT #629056.	GA Leshikar	TJ Conrads
1 RS	Complete Revision incorporating ECNS #644464 and #644521.	CE Graves CE Graves	TJ Conrads TJ Conrads 1/16/01

HNF-4162
Revision 1

Double-Shell Tank Transfer Pump 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

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HNF-4162
Revision 1

Double-Shell Tank Transfer Pump Subsystem Specification

Prepared by:
C. E. Graves
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Date Published
January 2001

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

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

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CONTENTS

APPENDIX

FIGURES

TABLES

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1.0 SCOPE

1.1 DESCRIPTION

This specification establishes the performance requirements and provides the references to the requisite codes and standards to be applied during the design of the Double-Shell Tank (DST) Transfer Pump Subsystem that supports the first phase of waste feed delivery (WFD). The DST Transfer Pump Subsystem consists of a pump for supernatant and/or slurry transfer for the DSTs that will be retrieved during the Phase 1 WFD operations. This system is used to transfer low-activity waste (LAW) and high-level waste (HLW) to designated DST staging tanks. It also will deliver blended LAW and HLW feed from these staging tanks to the River Protection Project (RPP) Waste Treatment Plant where it will be processed into an immobilized waste form.

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

Transfer pumps may be classified into the following four types:

Type	Criterion
1.	Where the individual tank mission may require variable-level suction features
2.	Where the individual tank mission may require simultaneous operation with mixer pumps
3.	Where the transfer pumps must satisfy <u>both</u> criterion 1 and criterion 2
4.	Where the transfer pumps require neither criterion 1 nor criterion 2.

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2.0 APPLICABLE DOCUMENTS

Design requirements applicable to the DST Transfer Pump 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.

Document Number	Title
10 CFR 835, 200	"Occupational Radiation Protection," *Code of Federal Regulations*, as amended.
29 CFR 1910, 1999	"Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
DOE Order 6430.1A, 1989	*General Design Criteria*, U. S. Department of Energy, Washington, D.C.

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. 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.

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

Document Number	Title
API 610, 7th Edition, 1989	*Centrifugal Pumps for Petroleum, Heavy Duty Chemical and Gas Industry Services*, American Petroleum Institute, Washington, D.C.
ASME NQA-1, 1994	*Quality Assurance Requirements for Nuclear Facility Applications,* American Society of Mechanical Engineers, New York, New York.
Best-Basis Inventory (database), 2000	*Best-Basis Inventory*, Tank Characterization Database, at http://twins.pnl.gov:8001/twins.htm.
H-2-90185, Rev. 2, 1991	*Male Nozzle 2" PUREX*, Westinghouse Hanford Company.
H-2-90186, Rev. 1, 1989	*Male Nozzle 3" PUREX*, Westinghouse Hanford Company.
HNF-2004, Rev. 1, 1999	*Estimated Dose to In-Tank Equipment and Ground-Level Transfer Equipment During Pressurization,* COGEMA Engineering Corporation for Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-2962, Rev. 0, 1998	*A List of Electromagnetic Interference (EMI)) and Electromagnetic Compatibility (EMC) Requirements,* Numatec Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-4164, Rev. 1, 2001	*Double-Shell Tank Mixer Pump Subsystem Specification*, CH2M HILL Hanford Group, 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. IV, Section 4.23, Rev. 0, 1999	*RPP Administration,* "Vendor Information," Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-IP-0842, Vol. IV, Section 5.4, Rev. 12, 1999	*RPP Administration*, "Unreviewed Safety Questions," Lockheed Martin Hanford Corporation, Richland, Washington.

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

Document Number	Title
HNF-IP-0842, Vol. IV, Section 6.9, Rev. 0, 2000	*RPP Administration,* "Hazard and Accident Analysis Process," CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. IV, Section 6.10, Rev. 0, 2000	*RPP Administration,* "Safety Analysis Process – New Project," CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. IV, Section 6.11, Rev. 0, 2000	*RPP Administration,* "Safety Analysis Process – Facility Change or Modification," CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. IV, Section 6.12, Rev. 0, 2000	*RPP Administration,* "Safety Analysis and Technical Safety Requirements," CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. V, Section 7.3, Rev. 4d, 2000	*RPP Administration,* "Preventive Maintenance Program," CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. VII, Section 12.4, Rev. 0, 2000	*RPP Administration,* "Radiological Design Review Process," CH2M HILL Hanford Group, Inc., Richland, Washington.
HNF-IP-0842, Vol. XI, Section 1.0, Rev. 2, 1999	*RPP Administration,* "Quality Assurance Program," Lockheed Martin Hanford Corporation, Richland, Washington.
HNF-IP-1266, Chapter 5.16, Rev. 2, 1999	*Tank Farms Operations Administrative Controls*, DE&S Hanford, Incorporated, for Fluor Daniel Hanford, Inc., Richland, Washington.
HNF-PRO-224, Rev. 3, 2000	*Document Control Program Standards*, Fluor Hanford, Inc., 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-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.
HNF-SD-WM-TSR-006, Rev.1, 1999	*Tank Waste Remediation System Technical Safety Requirements,* Fluor Daniel Hanford, Inc., Richland, Washington.

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

Document Number	Title
Hydraulic Institute Standards, 1994	Pump Standards 1.1 through 2.6, *Hydraulic Institute Standards*, Hydraulic Institute, Cleveland, Ohio.
NEMA ICS 6, 1993	*Industrial Controls and Systems,* National Electrical Manufacturers Association, Arlington, Virginia.
NEMA MG-1, 1993	*Motors and Generators*, National Electrical Manufacturers Association, Arlington, Virginia.
NFPA 70, 1999	*National Electric Code*, National Fire Protection Association, Quincy, Massachusetts.
RPP-5346, Rev. 0, 2001	*Waste Feed Delivery Transfer System Analysis*, Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-097, Rev. 0, 1999	*Engineering Design and Evaluation*, CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-222, Rev. 0, 1999	*Quality Assurance Records Standards*, CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-709, Rev. 0, 1999	*Preparation and Control Standards for Engineering Drawings*, CH2M HILL Hanford Group, Inc., Richland, Washington.
RPP-PRO-1819, Rev. 0, 1999	*Engineering Requirements*, CH2M HILL Hanford Group, Inc., Richland, Washington.

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 RPP Waste Treatment Plant 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 (RTP-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 functions (Figure 3-1). The Transfer Waste to LAW Staging Tanks function has been further decomposed as shown. Other decompositions are shown as third- and fourth-tier 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 Transfer Pump Subsystem. Section 3.2.1 of this specification is organized to accommodate these shaded functions.

The Monitor Position of Transfer Pump Suction Intake and Monitor Transfer Pump Operation functions cannot be fully allocated to a subsystem. Therefore, these functions have been decomposed into the subfunctions identified in Table 3-1.

Figure 3-1. Double-Shell Tank Transfer Pump Subsystem Functional Hierarchy for Waste Transfers.

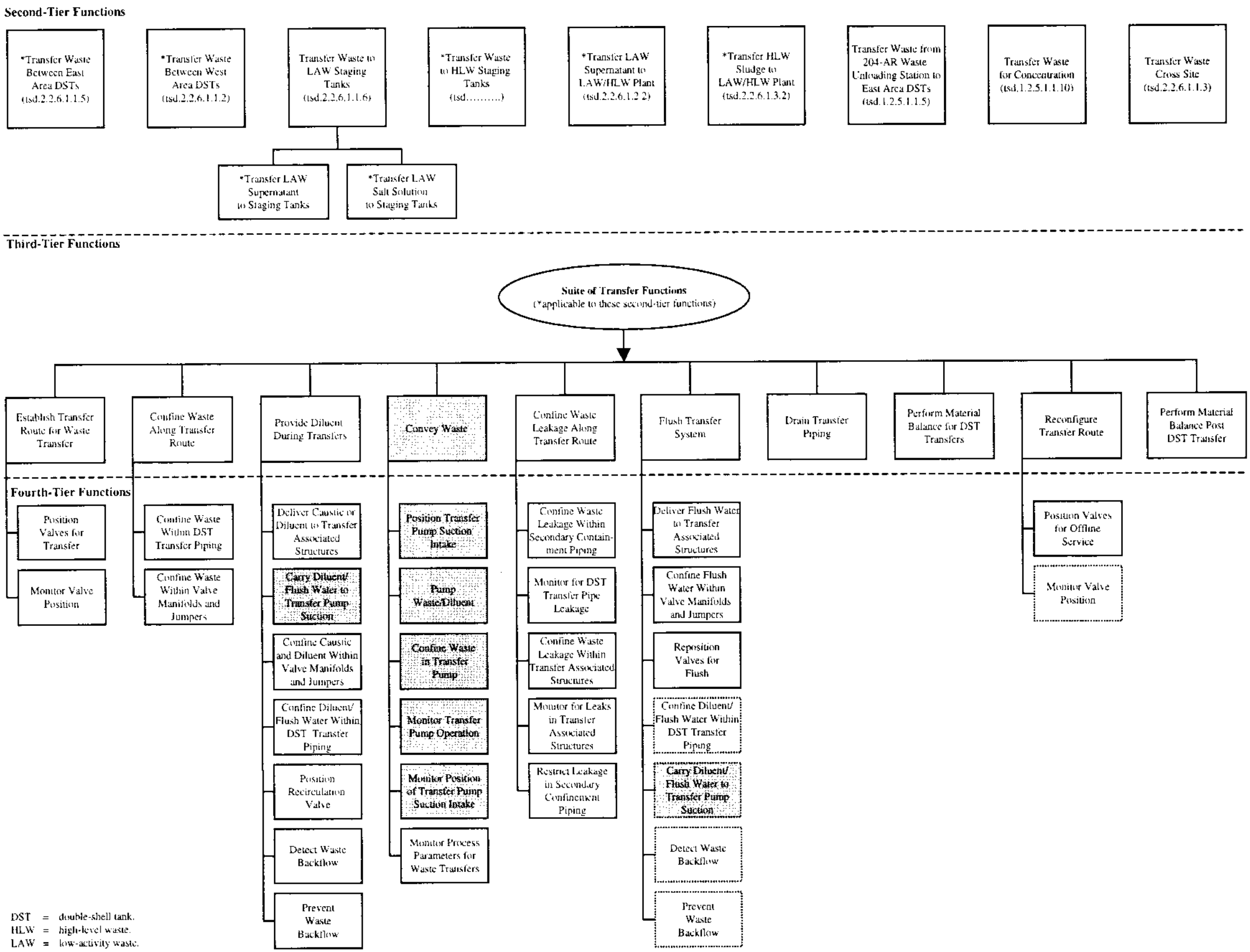


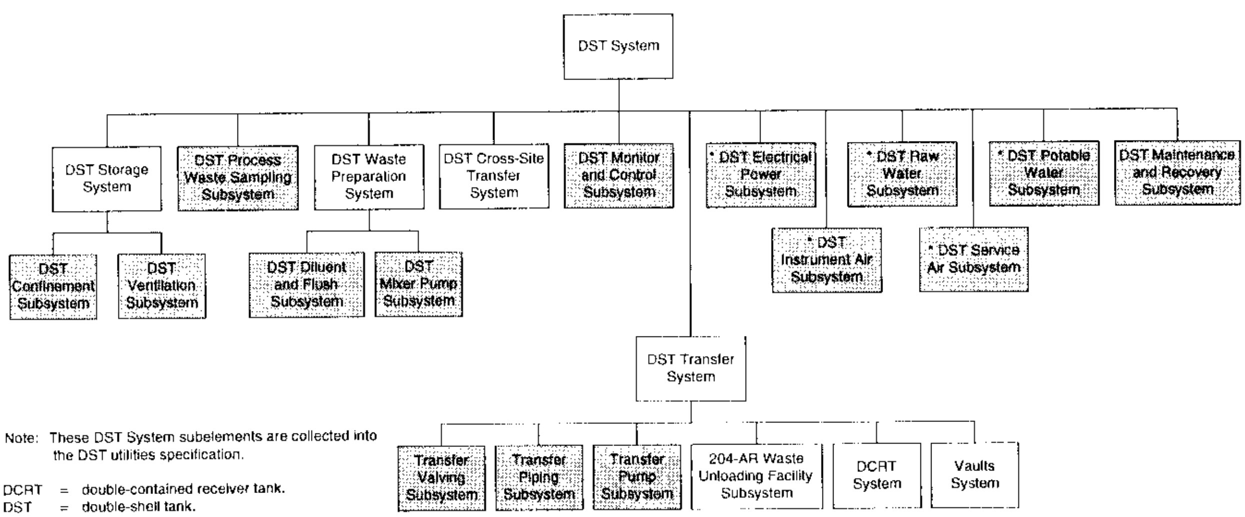
Table 3-1. Decomposition of Monitor Position of Transfer Pump Suction Intake and Monitor Transfer Pump Operations Functions.

Monitor Position of Transfer Pump Suction Intake	**Monitor Transfer Pump Operation**
Measure Position of Transfer Pump Suction Intake	Measure Transfer Pump Operation
Transmit Transfer Pump Suction Intake Position	Transmit Transfer Pump Operation Data
Receive Transfer Pump Suction Intake Position	Receive Transfer Pump Operation Data
Compare Transfer Pump Suction Intake Position	Compare Transfer Pump Operation Data
Display Transfer Pump Suction Intake Position	Display Transfer Pump Operation Data
Record Transfer Pump Suction Intake Position	Record Transfer Pump Operation Data
	Respond to Abnormal Transfer Pump Operation

The "Measure" functions listed above are performed by the DST Transfer Pump Subsystem; therefore, the functional and performance requirements for these functions are defined herein (see Section 3.2.1). The balance of the above listed functions is performed by the DST Monitor and Control Subsystem and will be defined in the DST Monitor and Control Subsystem specification.

The DST System consists of the 12 subsystems identified in Figure 3-2. Five of these subsystems (electrical, raw water, potable water, service air, and instrument air) will be collected into one specification for the DST Utilities System. 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 3-2, because they will be constructed or modified in support of Phase 1 Waste Feed Delivery.

Figure 3-2. Double-Shell Tank System Architecture Tree.



* Note: These DST System subelements are collected into the DST utilities specification.

DCRT = double-contained receiver tank.
DST = double-shell tank.

The primary interfaces between DST subsystems/components are shown in Figures 3-3 and 3-4. Figure 3-3 shows the primary DST mechanical system interfaces for eight 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, is routed by the valving subsystem through the piping subsystem toward its destination (i.e., another DST or the RPP Waste Treatment Plant). 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. Subsystem for Double-Shell Tank Mechanical System Interfaces.

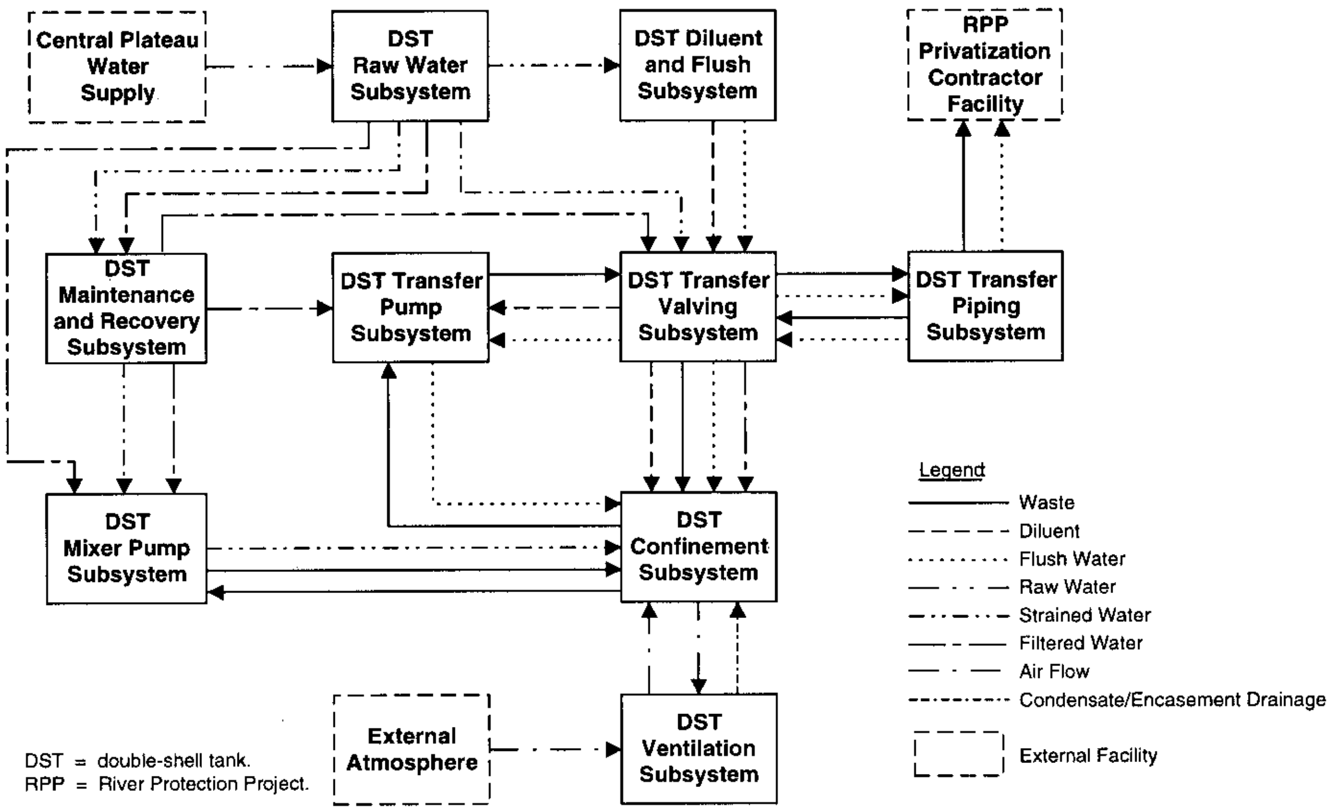
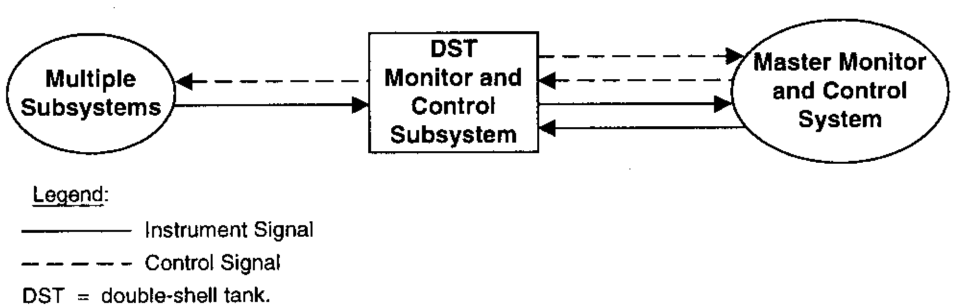


Figure 3-4. Interfaces for Double-Shell Tank Monitor and Control Subsystem.



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 from the primary and annulus tanks' vapor space to the environment, the DST Ventilation Subsystem HEPA filters remove radioactive particulates.

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 transfer is complete, the transfer pump, valving, and piping subsystems are flushed with water.

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 3-4 generically shows how the DST Monitor and Control Subsystem interfaces with other systems. All of the subsystems shown in Figure 3-3 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.

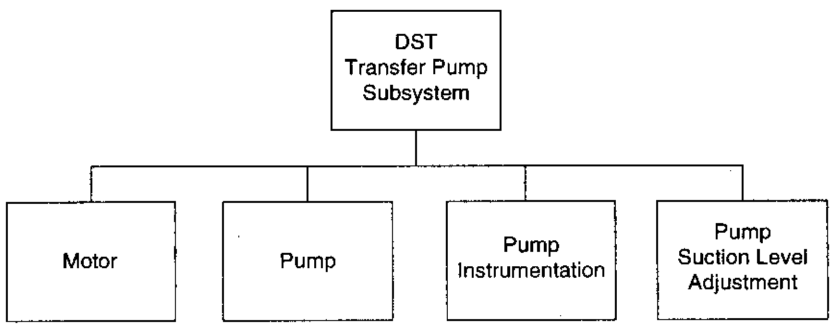
3.1.1 Subsystem/Component Diagrams

Major subsystems for the DST Transfer Pump Subsystem were chosen based on the subsystem's functional requirements and the DST System architecture. Figure 3-5 shows the architectural decomposition of the DST Transfer Pump Subsystem. The major subsystems that have been identified are:

- Motor
- Pump
- Pump Instrumentation
- Pump Suction Level Adjustment.

A general description of each subsystem and components is provided in Section 3.7.

Figure 3-5. Architectural Decomposition of the Double-Shell Tank Transfer Pump Subsystem.

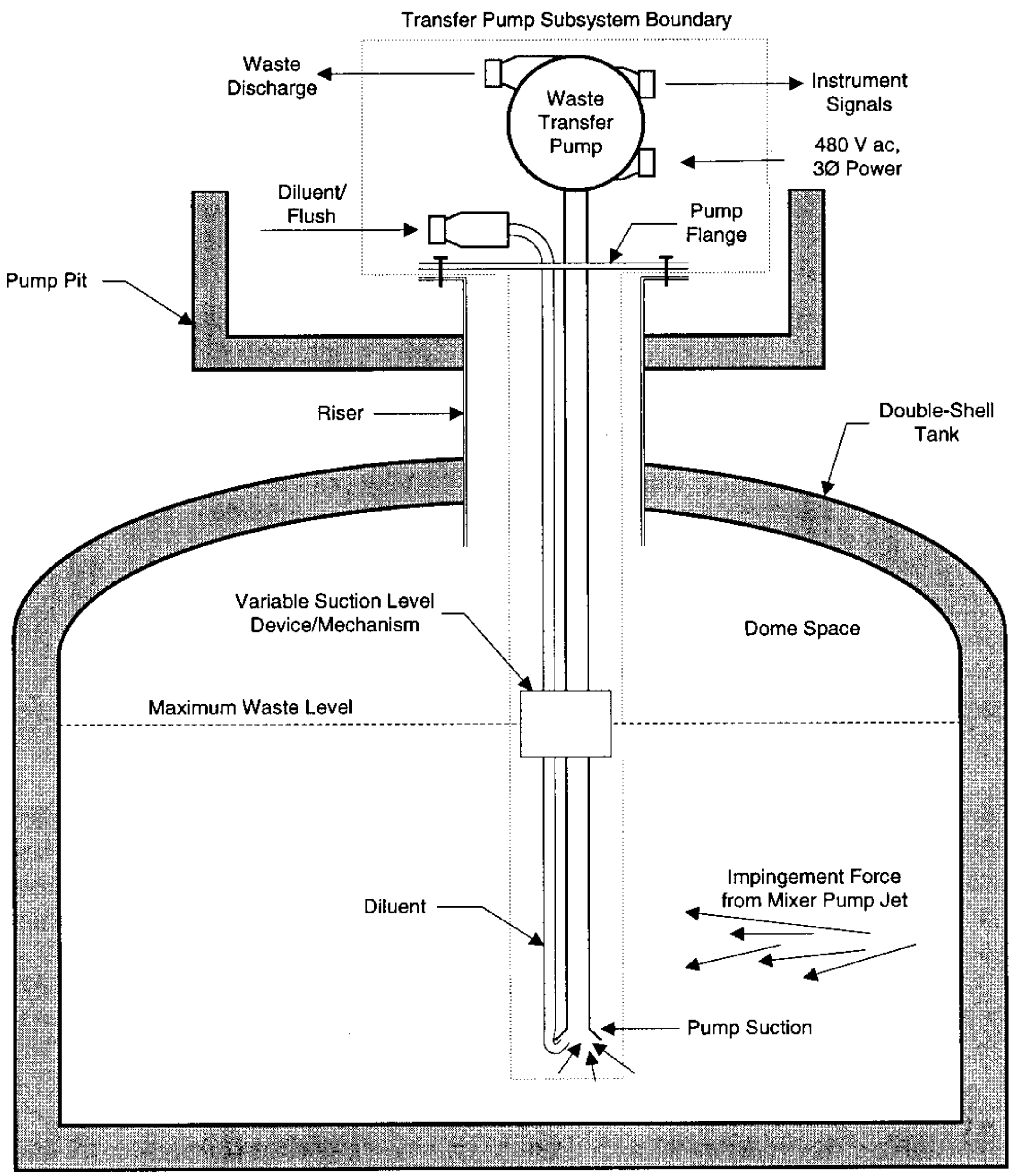


To support Phase 1 WFD, new transfer pumps will be installed. Pump selection may be different for each tank, depending on whether it is to be operated concurrently with mixer pumps; the waste type being pumped (supernatant, dissolved salts, or suspended solids); and the depth from which the waste must be pumped (Type 1). Dilution water will be added, as required, at the suction to achieve the rheological properties defined in Section 3.2.5.2.5, ensuring pumpability. Pump pits provide access to the risers to mount the pumps and provide containment for process leakage. Figure 3-6 depicts the general configuration and physical interfaces of the DST Transfer Pump Subsystem.

3.1.2 Interface Definition

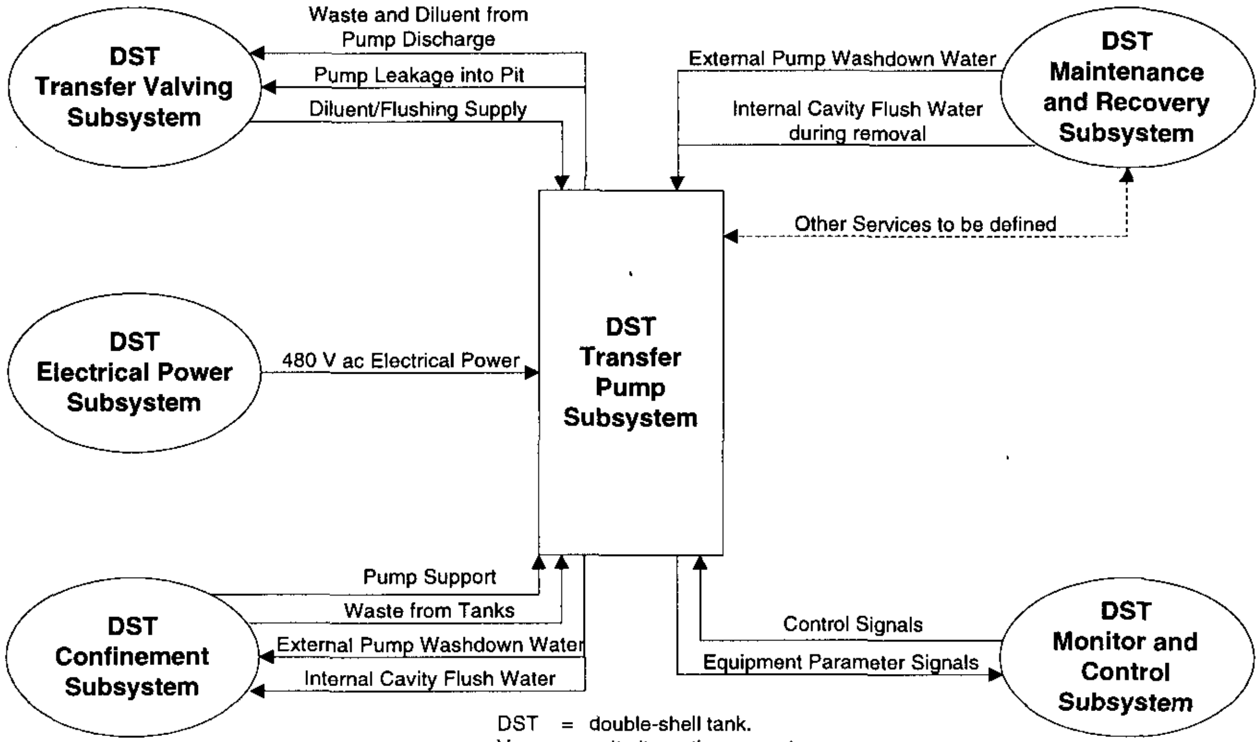
This section identifies the major interfaces of the DST Transfer Pump Subsystem with other systems. The interface descriptions that follow are intended to help define the subsystem boundaries. These interface relationships are illustrated in Figure 3-7. This section discusses the inputs from these interfacing systems and facilities. Outputs from the DST Transfer Pump Subsystem to other systems and facilities are discussed in Section 3.2.1.

Figure 3-6. System Schematic for the Double-Shell Tank Transfer Pump Subsystem.



V ac = volts alternating current.

Figure 3-7. Major Interfaces of the Double-Shell Tank Transfer Pump Subsystem.



3.1.2.1 Functional Interfaces

3.1.2.1.1 Double-Shell Tank Transfer Valving Subsystem. This section describes the routing of process fluids to the transfer pump by the DST Transfer Valving Subsystem. By definition, the pump pit is part of the DST Valving Subsystem.

a. The DST Transfer Pump Subsystem shall be provided water at a pressure of 7.2 kPa (150 lbf/in^2) and flow rate of 630 L/min (166 gal/min).

b. The DST Transfer Pump Subsystem shall accept 8.8 L/s (140 gal/min) backflush of water through the discharge of the pump, without damaging the pump.

3.1.2.1.2 Double-Shell Tank Electrical Power Subsystem. The DST Electrical Power Subsystem provides electrical power to the DST Transfer Pump Subsystem.

a. DST transfer pumps shall operate with 480 V ac, 3-phase, 60 Hz, electric power.

3.1.2.1.3 Double-Shell Tank Confinement Subsystem. The DST Confinement Subsystem provides the following functions to the DST Transfer Pump Subsystem.

a. The DST Transfer Pump Subsystem shall be physically supported by the DST Confinement Subsystem.

b. The DST Transfer Pump Subsystem shall be capable of moving waste out of the DST Confinement Subsystem as required.

3.1.2.1.4 Double-Shell Tank Maintenance and Recovery Subsystem. The DST Maintenance and Recovery Subsystem provides the equipment to perform installation and removal of transfer pumps, including the following:

- Cranes, harnesses, spreader bars, and other lifting devices required to handle a transfer pump
- Flexible receivers or other devices required to confine waste and waste vapors during pump removal
- High-pressure external water wash systems for decontamination of the transfer pump as it is retracted from the tank in preparation for final waste packaging
- Connectors that mate to the transfer pump discharge, dilution, and flush ports, to allow internal cavity decontamination water flush of the transfer pump as it is retracted from the tank
- A laydown area for contaminated pumps after removal.

3.1.2.1.5 Double-Shell Tank Monitor and Control Subsystem. The DST Monitor and Control Subsystem provides signals and logic for operating the DST Transfer Pump Subsystem and is used to monitor equipment status indicators attributable to the transfer pump.

a. The DST Transfer Pump Subsystem shall be designed to operate using industry standard control signals.

3.1.2.2 Physical Interfaces

Detailed physical interface definition and requirements associated with the DST Transfer Pump 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 Transfer Pump 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 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 Transfer Pump Subsystem.

3.2.1.1 Pump Waste/Diluent

The DST Transfer Pump Subsystem shall be capable of removing supernatant, dissolved salts, and suspended solids from source tanks and transferring them to destination tanks.

a. Transfer pump hydraulic performance design shall be based on newtonian fluid properties after in-line dilution and mixing at the transfer pump suction.

b. The transfer pump shall be capable of delivering 630 L/min (166 gal/min) (2.2 m/s [7.2 ft/s] in 80 mm [3 in.] schedule 40 pipe) at heads ranging from 314 m (1030 ft) down to 15 m (50 ft), as measured at the pump discharge above the mounting flange.

c. The transfer pump shall have a continuously rising head/capacity curve from the rated capacity to shutoff.

d. The shutoff head of the transfer pump shall not exceed 408 m (1340 ft) as measured at the pump discharge above the mounting flange.

e. The transfer pump shall be able to remove waste to within 25.4 cm (10 in.) of the tank bottom.

f. The transfer pump shall deliver rated head and flow at a minimum net positive suction head available ($NPSH_a$) of 4.6 m (15 ft). Designer must consider the effects of upstream components (such as flex hose) on $NPSH_a$.

3.2.1.2 Position Transfer Pump Suction Intake (Types 1 and 3)

Missions that require the transfer pump to decant waste above the solids layer shall employ a system capable of taking suction at a wide range of heights.

a. The system shall be capable of adjusting the pump intake from 6.1 m (20 ft) above the bottom of the tank to the level defined by Section 3.2.1.1.e for an empty tank. The pump intake should be capable of tracking the waste level from the top of a full tank.

b. The system shall be capable of starting to within 117 cm (46 in.) of the tank bottom.

c. The system shall provide the full range of intake adjustment while the pump is operating (without having to stop the pump for readjustment).

3.2.1.3 Measure Position of Transfer Pump Suction Intake (Types 1 and 3)

Missions that require the transfer pump to decant waste above the solids layer shall monitor the position of the transfer pump suction.

3.2.1.4 Confine Waste in Transfer Pump

The DST Transfer Pump Subsystem shall confine waste within the transfer pump casing and associated nozzles, flanges, and other pressure boundary connections.

a. The DST Transfer Pump Subsystem pressure boundaries shall have a design pressure rating no less than the maximum pressure of the pump at shutoff when it is pumping fluid of the highest specific gravity specified herein.

3.2.1.5 Carry Diluent/Flush Water to Transfer Pump Suction

The DST Transfer Pump Subsystem shall accept and route diluent to the pump suction intake.

a. The DST Transfer Pump Subsystem shall be capable of routing water to the pump suction at 630 L/min (166 gal/min).

3.2.1.6 Measure Transfer Pump Operation

The DST Transfer Pump Subsystem shall measure pump equipment parameters including the following:

a. Pump speed (if variable speed drive is utilized)

b. Motor amperage or power indication

c. Any other parameter, if required by design.

NOTE: Requirement(s) for measurement of transfer pump discharge pressure are located in HNF-4160, *Double-Shell Tank Transfer Valving Subsystem Specification*.

3.2.2 Physical Characteristics

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

a. The transfer pump nozzles shall be of the Plutonium-Uranium Extraction (PUREX)-type design in accordance with drawings H-2-90185 and H-2-90186.

b. Transfer pump components below the riser flange shall be designed to fit within the riser and to be capable of being removed from the tank. Said components shall have a maximum insertion diameter of 2.54 cm (1 in.) less than the nominal diameter of the riser in which the transfer pump is to be installed.

c. Lifting bails shall be provided that enable handling of the transfer pump in the horizontal and vertical positions, while allowing straight vertical insertion of the system into the DST.

d. The DST Transfer Pump Subsystem shall provide fixed, nonrotating, environmentally protected field terminations that comply with applicable *National Electric Code* (NFPA 70) requirements for all power and signal connections and grounding lug.

e. Electrical equipment enclosures shall meet National Electrical Manufacturers Association (NEMA) Standards.

f. The DST Transfer Pump Subsystem shall be designed to preclude leakage above the pump mounting plate. Seals, if used, shall direct any potential leakage back into the tank.

g. The DST Transfer Pump Subsystem shall be provided with an adapter flange capable of mating to a bag-out assembly for retracting the transfer pump into a "flexible receiver" during pump removal operations.

h. The electric motor shall conform to NEMA MG-1 standards.

i. The transfer pump design shall be self-venting.

3.2.3 Reliability

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

a. The DST Transfer Pump Subsystem shall have a minimum design life of 5,000 hours of operation over a 5-year period.

b. Transfer pump manufacturers shall provide written recommendations of operational practices such as bumping and flushing to maximize the pump's useful life.

3.2.4 Maintainability

The design shall consider the maintainability factors peculiar to the specific equipment to be used in the DST Transfer Pump Subsystem.

a. The DST Transfer Pump Subsystem shall be designed for 5 years without maintenance that would require removal of the pump pit cover blocks.

b. The transfer pump shall tolerate reverse rotation or shall be provided with an anti-reverse rotation device if reverse rotation is unacceptable.

c. The DST Transfer Pump Subsystem design shall minimize the accumulation of solids where process lubricated bearings and mechanical seals are used. The pump should have the capability of flushing such areas.

d. Whenever possible, instruments that can be operated without calibration or maintenance throughout the design life of the system or component should be selected.

e. Motors for line-shaft driven transfer pumps shall be provided with a manual pump shaft/impeller rotation device and shall be installed such that manual shaft rotation can be performed without removing the pump pit cover blocks.

f. The equipment design shall minimize the time required to physically disconnect, remove, and replace the transfer pump.

g. The equipment design shall allow access to maintainable components for repair and/or troubleshooting.

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 conditions (e.g., weather).

a. The subsystem shall be designed for the natural environmental conditions specified in HNF-SD-GN-ER-501.

b. The subsystem shall be designed to withstand the natural phenomena hazards as specified in RPP-PRO-097. The system does not have to operate after a design-basis earthquake; it only needs to be removable.

3.2.5.2 Induced Environments

This section defines the induced environment impinging on the subsystem including waste chemistry, radiation, impingement loads, thermal, and fluid rheology.

3.2.5.2.1 Chemistry. The subsystem components shall be designed to perform their intended function in the chemical environment defined in *Best-Basis Inventory* (database).

3.2.5.2.2 Radiation. The subsystem shall be designed for the 1,000 rad/h radiation environment for direct contact with tank waste as defined in HNF-2004.

3.2.5.2.3 Impingement Loads. The DST Transfer Pump Subsystem shall withstand external loads.

a. The transfer pump shall remain removable from the tanks following a gas release rollover event and crust impact.

b. Transfer pumps Types 2 and 3 shall operate while under the loads induced by the mixer pump described in HNF-4164.

3.2.5.2.4 Thermal. The transfer pump subsystem shall withstand the following induced temperature conditions and loads.

a. The in-tank temperature range for transfer pump design is 10 to 104 °C (50 to 220 °F).

b. The transfer pump shall be able to withstand the thermal shock of <38 °C (100 °F) during pump installation and <16 °C (60 °F) during pump operation.

3.2.5.2.5 Fluid Rheology. The transfer pump shall be designed to pump fluids with the range of properties defined in RPP-5346, Table 5-1.

3.2.6 Transportability

Steps shall be taken to ensure that equipment is not damaged during transportation.

3.2.7 Flexibility and Expansion

Not applicable.

3.3 DESIGN AND CONSTRUCTION

The subsystem shall comply with the general design guidelines provided in DOE Order 6430.1A, Sections 1300-7 and 1323.

3.3.1 Materials, Processes, and Parts

This section defines transfer pump requirements governing the use of materials and processes.

a. All transfer pumps shall meet the applicable design, fabrication, labeling, and testing requirements contained in API 610. The highest degree of dynamic balancing shall be specified.

b. Welding shall be performed and inspected in accordance with American Welding Society and/or American Society of Mechanical Engineers requirements.

3.3.2 Electromagnetic Radiation

The subsystem shall comply with electromagnetic radiation emission requirements set forth in 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 Transfer Pump 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 HNF-IP-0842, Volume II, Section 6.1.

b. Non-submersible electric motors shall be provided with permanently attached nameplates in accordance with NEMA MG-1.

c. Pump rotation arrows shall be marked on the top of the motor bell housing. This does not apply if a submerged motor pump is selected.

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 radiological design review process of HNF-IP-0842, Volume VII, Section 12.4, shall be used to keep personnel exposures ALARA.

b. The system shall incorporate design features that comply with the applicable requirements of 29 CFR 1910, Subparts D, E, G, J, L, M, O, and S.

3.3.6.2 Equipment Protection

The subsystem shall be designed to avoid damage to other components.

a. Dome load evaluation shall be performed in accordance with HNF-IP-1266, Chapter 5.16.

3.3.6.3 Environmental Safety

The DST Transfer Pump Subsystem shall be designed to protect the public and environment in accordance with the following requirements:

a. The DST Transfer Pump 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 Sections 6.9–6.12 of HNF-IP-0842, Volume IV, based on the guidelines in HNF-SD-WM-SAR-067, Section 3.0. Unreviewed safety question screening will be required for system installation in accordance with "Unreviewed Safety Questions," HNF-IP-0842, Volume IV, Section 5.4.

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 requirement is unclear.

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 Transfer Pump 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. Designs should simplify removal and packaging of contaminated pumps.

c. Any portions of the pump assembly that are subject to contact with waste material shall be flushable and completely self-draining (when the long axis of the pump is in a vertical position) to facilitate decontamination.

d. The system design shall provide a means of flushing the pump internals to enable reducing the internal contamination levels before and during pump removal from the tank.

e. Internal and external cracks, crevices, and hold-up points shall be minimized to facilitate pump cleanup for disposal.

3.4 DOCUMENTATION

This section defines the procedures that will control various documents associated with the DST Transfer Pump Subsystem.

a. Records, documents, and drawing control pertinent to design functions shall be in accordance with RPP-PRO-222 and HNF-PRO-224. Drafting standards for drawings and interface control shall be in accordance with RPP-PRO-709.

b. All DST Transfer Pump Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with the component index process requirements defined in Section 7.3 of HNF-IP-0842, Volume V.

c. Vendor information shall be managed in accordance with HNF-IP-0842, Volume IV, Section 4.23.

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. Transfer pumps shall be designed to require no routine "hands-on" maintenance in contaminated or high dose rate areas.

3.5.2 Supply

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

a. A minimum number of spares for like components shall be determined based on mean time between failure and number of like components installed.

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 Transfer Pump Subsystem are as follows:

- Motor
- Pump
- Pump instrumentation
- Pump suction level adjustment.

3.7.1 Motor

The pump motor provides the motive force to rotate the pump shaft.

3.7.2 Pump

A pump transports liquids by converting mechanical energy into work on the liquid. The transfer pump provides the motive force to move the waste from one tank to another through pipes and fittings.

3.7.3 Pump Instrumentation

Pump instrumentation provides equipment status data for evaluating pump operating performance. The type and extent of the supervisory instrumentation suitable for a given pump installation are based on the pump application, the pump design and size, experience with similar equipment, and the vendor recommendations.

3.7.4 Pump Suction Level Adjustment

Pump suction level adjustment provides the capability to draw fluid into the pump from an operator-specified tank elevation.

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 (local implementation of 10 CFR 835).

3.10 COMPUTER RESOURCE RESERVE CAPACITY

Not applicable.

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4.0 QUALITY ASSURANCE PROVISIONS

Quality assurance for the DST Transfer Pump Subsystem shall be performed in accordance with 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 Transfer Pump 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 all 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 Transfer Pump 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. Each transfer pump shall be tested for hydraulic and mechanical performance, in accordance with *Hydraulic Institute Standards* and API 610.

b. Electrical materials and equipment shall be qualification tested unless they are Underwriters Laboratories, Inc. (UL) listed, or factory mutual tested, with label attached, and for the purpose intended, whenever such products are available. Where no UL or factory mutual listed products are available, testing and certification by another nationally recognized testing agency may be acceptable, as long as the design agent documents the acceptance of the testing agency.

c. It shall be demonstrated that the transfer pump assembly, when suspended, hangs plumb such that it can be inserted into or removed from the tank riser without interference with the riser.

d. Pump insertion into and removal from the tank shall be demonstrated for each Type 1, 2, 3, and 4 design.

e. Transfer pumps that have been stored for 1 year or longer shall be subjected to a run-in test before they are inserted in the waste tank, unless waived by the RPP Design Authority or the RPP project manager.

4.2 DESIGN VERIFICATION

Design verification shall be performed on the DST Transfer Pump 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 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 apply 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 Transfer Pump Subsystem performance/design features and acceptance inspection of construction is called out in Section 2.5.2 of RPP-PRO-1819.

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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, Subpart 2.2, Section 3-2. Lower level specifications (e.g., procurement specifications) will establish the specific packaging requirements for all SSCs.

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6.0 NOTES

6.1 DEFINITIONS

General Service (GS) SSC—Structures, systems, and components (SSC) not classified as either Safety-Class or Safety-Significant.

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

Safety-Class (SC) SSC—Safety functions performed by Safety-Class SSCs prevent or mitigate releases to the public that would otherwise exceed the offsite radiological risk guidelines or prevent a nuclear criticality.

Safety-Significant (SS) SSC—Safety functions performed by Safety-Significant SSCs prevent or mitigate releases of radiological materials to onsite workers and toxic chemicals to the offsite public and onsite workers. Safety-Significant SSCs also include those safety SSCs that protect the facility worker from serious injury (or fatality) because of hazards not controlled by institutional safety programs.

> 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 5480.23).

Self-Venting Pump—A pump with characteristics that passively allow any vapors trapped within its internal running cavities to exit upon pump startup.

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.

Tank Opening—Tank risers and pits with an open path to the tank.

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
API	American Petroleum Institute

ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
AWS	American Welding Society
DOE	U.S. Department of Energy
DST	double-shell tank
GS	General Service
HLW	high-level waste
Hz	hertz
LAW	low-activity waste
NEMA	National Electrical Manufacturers' Association
$NPSH_a$	net positive suction head available
PUREX	plutonium-uranium extraction
RPP	River Protection Project
SC	Safety-Class
SS	Safety-Significant
SSC	structures, systems, and components
TBD	to be determined
TBR	to be refined
UL	Underwriters Laboratories, Inc.
V ac	volts alternating current
WAC	*Washington Administrative Code*
WFD	waste feed delivery

7.0 REFERENCES

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

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-4160, 2001, *Double-Shell Tank Transfer Valving Subsystem Specification*, Rev. 1, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-5136, 2000, *Functional Analysis for Double-Shell Tank Subsystems,* Rev. 0, Lockheed Martin Hanford Corporation for Fluor Daniel Hanford, Inc., Richland, Washington

HNF-SD-WM-SP-012, 1999, *Tank Waste Remediation System Operation and Utilization Plan to Support Waste Feed Delivery*, Rev. 1, Numatec Hanford Corporation, Lockheed Martin Hanford Corporation, and COGEMA Engineering Corporation for Fluor Daniel Hanford, Inc., Richland, Washington.

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

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APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS

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APPENDIX A

SOURCE DOCUMENTS AND TEST METHODS (13 SHEETS)

Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.1.2.1.1.a	The DST Transfer Pump Subsystem shall be provided water at a pressure of 7.2 kPa (150 lbf/in^2) and flow rate of 630 L/min (166 gal/min).	HNF-4716, Appendix C; RPP-5346	The required water pressure and flow must be provided by the DST Diluent and Flush Subsystem			X	X	
3.1.2.1.1.b	The DST Transfer Pump Subsystem shall accept 8.8 L/s (140 gal/min) backflush of water through the discharge of the pump, without damaging the pump.	HNF-4716, Appendix C				X	X	
3.1.2.1.2.a	DST transfer pumps shall operate with 480 V ac, 3-phase, 60 Hz, electric power.	WHC-SD-WM-DGS-006, Section 4.6.5		X				
3.1.2.1.3.a	The DST Transfer Pump Subsystem shall be physically supported by the DST Confinement Subsystem.	NA		X				
3.1.2.1.3.b	The DST Transfer Pump Subsystem shall be capable of moving waste out of the DST Confinement Subsystem as required.	NA		X				
3.1.2.1.5.a	The DST Transfer Pump Subsystem shall be designed to operate using industry standard control signals.	HNF-4553, Section 5.2		X				
3.2.1.1.a	Transfer pump hydraulic performance design shall be based on newtonian fluid properties after in-line dilution and mixing at the transfer pump suction.	RPP-5346	Extensive search for and study of property and rheological data to support the hydraulic analysis of RPP-5346 indicated that the waste exhibits newtonian behavior once it has been mobilized. Addition of diluent will ensure that the transfer pump is always moving a newtonian fluid.				X	

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Inspection Element: Demo	Inspection Element: Test	Inspection Element: Anal	Inspection Element: N/A
3.2.1.1.b	The transfer pump shall be capable of delivering 630 L/min (166 gal/min) (2.12 m/s [7.2 ft/s] in 80 mm [3 in.] schedule 40 pipe) at heads ranging from 314 m (1030 ft) down to 15 m (50 ft), as measured at the pump discharge above the mounting flange.	RPP-5346				X		
3.2.1.1.c	The transfer pump shall have a continuously rising head/capacity curve from the rated capacity to shutoff.	API 610				X		
3.2.1.1.d	The shutoff head of the transfer pump shall not exceed 408 m (1340 ft) as measured at the pump discharge above the mounting flange.	RPP-5346	Decision in the RPP-5346 evaluation is to limit head (pressure) rise to 37% from the transfer pump best efficiency point (BEP) to shutoff. A small margin between the required head (pressure) developed by the transfer pump and the waste transfer line design pressure rating is desired. Pumps with a steeply rising head/capacity curve would have to be "de-rated" in their sizing to ensure that they did not exceed transfer line pressure limits in a shutoff condition, such that the transfer pump would no longer be capable of satisfying some expected transfer conditions. The 37% head rise limit is reasonable for pumps of the radial-vane area or Francis-vane area impeller design; however, some vertical turbine pumps of the mixed flow area (open) impeller design (including many existing tank farm transfer pumps) are effectively ruled out as a result.			X		

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.2.1.1.e	The transfer pump shall be able to remove waste to within 25.4 cm (10 in.) of the tank bottom.	HNF-SD-WM-SP-012, Section 3.5	WFD process planning goal.			X	X	
3.2.1.1.f	The transfer pump shall deliver rated head and flow at a minimum net positive suction head available ($NPSH_a$) of 4.6 m (15 ft). Designer must consider the effects of upstream components (such as flex hose) on NPSH[a].	HNF-4716, Appendix C	$NPSH_a$ value is based on 0 m (0 ft) submergence at a waste temperature of 85 °C (185 °F). Waste property data (vapor pressure and density) per RPP-5585.			X	X	
3.2.1.2	Missions that require the transfer pump to decant waste above the solids layer shall employ a system capable of taking suction at a wide range of heights.	HNF-SD-WM-SP-012; Letter 73600-99-006			X			
3.2.1.2.a	The system shall be capable of adjusting the pump intake from 6.1 m (20 ft) above the bottom of the tank to the level defined by Section 3.2.1.1.e for an empty tank. The pump intake should be capable of tracking the waste level from the top of a full tank.	HNF-SD-WM-SP-012; HNF-4716, Appendix C	Low intake level capability High intake level capability		X			
3.2.1.2.b	The system shall be capable of starting to within 117 cm (46 in.) of the tank bottom.	HNF-4716, Appendix C	Process requires multiple batch transfers. Decision made is that the pump shall be capable of starting to remove the last batch of HLW from a tank.		X	X		
3.2.1.2.c	The system shall provide the full range of intake adjustment while the pump is operating (without having to stop the pump for readjustment).	HNF-4716, Appendix C	Process stoppage for sole purpose of reconfiguring pump intake as unacceptable operating constraint.		X	X		
3.2.1.3	Missions that require the transfer pump to decant waste above the solids layer shall monitor the position of the transfer pump suction.	Letter 73600-99-006	Using the current process strategy, the system operator needs only a general indication where the intake is located, as a starting point, and feedback on the direction (up, down) of intake movement. Lower level project design documentation shall define monitoring accuracy commensurate with the particular design.		X	X		

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.2.1.4.a	The DST Transfer Pump Subsystem pressure boundaries shall have a design pressure rating no less than the maximum pressure of the pump at shutoff when it is pumping fluid of the highest specific gravity specified herein.	ASME B31.3	Standard Design Code	X			X	
3.2.1.5.a	The DST Transfer Pump Subsystem shall be capable of routing water to the pump suction at 630 L/min (166 gal/min).	RPP-5346	Transfer pump to provide the motive force to flush the waste transfer line.			X	X	
3.2.1.6.a	Pump speed (if variable speed drive is utilized)	WHC-SD-WM-DGS-006, Section 4.2.2		X				
3.2.1.6.b	Motor amperage or power indication	WHC-SD-WM-DGS-006, Section 4.2.2.		X				
3.2.1.6.c	Any other parameter, if required by design	WHC-SD-WM-DGS-006, Section 4.2.2		X				
3.2.2.a	The transfer pump nozzles shall be of the Plutonium-Uranium Extraction (PUREX)-type design in accordance with drawings H-2-90185 and H-2-90186.	H-2-90185; H-2-90186	Ensures compatibility with existing connector heads.	X				
3.2.2.b	Transfer pump components below the riser flange shall be designed to fit within the riser and to be capable of being removed from the tank. Said components shall have a maximum insertion diameter of 2.54 cm (1 in.) less than the nominal diameter of the riser in which the transfer pump is to be installed.	WHC-SD-WM-DGS-006; HNF-4553			X			
3.2.2.c	Lifting bails shall be provided that enable handling of the transfer pump in the horizontal and vertical positions, while allowing straight vertical insertion of the system into the DST.	WHC-SD-WM-DGS-006, Section 4.1.5			X			

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.2.2.d	The DST Transfer Pump Subsystem shall provide fixed, nonrotating, environmentally protected field terminations that comply with applicable *National Electric Code* (NFPA 70) requirements for all power and signal connections and grounding lug.	WHC-SD-WM-DGS-006, Section 4.2.2 (NFPA 70)		X				
3.2.2.e	Electrical equipment enclosures shall meet National Electrical Manufacturers Association (NEMA) Standards.	NEMA ICS 6	Standard Design Code	X				
3.2.2.f	The DST Transfer Pump Subsystem shall be designed to preclude leakage above the pump mounting plate. Seals, if used, shall direct any potential leakage back into the tank.	WHC-SD-WM-DGS-006, Section 4.1.6	Good ALARA practice.	X	X			
3.2.2.g	The DST Transfer Pump Subsystem shall be provided with an adapter flange capable of mating to a bag-out assembly for retracting the transfer pump into a "flexible receiver" during pump removal operations.		Design must accommodate pump removal	X			X	
3.2.2.h	The electric motor shall conform to NEMA MG-1 standards.	WHC-SD-WM-DGS-006, Section 4.2.1; NEMA MG-1		X				
3.2.2.i	The transfer pump design shall be self-venting.	HNF-4553	Lesson learned from Tank 241-C-106 sluicing project	X		X		
3.2.3.a	The DST Transfer Pump Subsystem shall have a minimum design life of 5,000 hours of operation over a 5-year period.	WHC-SD-WM-DGS-006, Section 4.1.9	Design life values are conclusion of pump expert committee after study of all aspects (retrieval plans, history, cost/benefit, manufacturing achievability, judgment, etc.).	X	X	X	X	
3.2.3.b	Transfer pump manufacturers shall provide written recommendations of operational practices such as bumping and flushing to maximize the pump's useful life.	HNF-3218; WHC-SD-WM-DGS-006, Section 4.2.3			X			

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.2.4.a	The DST Transfer Pump Subsystem shall be designed for 5 years without maintenance that would require removal of the pump pit cover blocks.	WHC-SD-WM-DGS-006, Section 4.2.3		X			X	
3.2.4.b	The transfer pump shall tolerate reverse rotation or shall be provided with an anti-reverse rotation device if reverse rotation is unacceptable.	WHC-SD-WM-DGS-006, Section 4.1.4; API 610	In past some pumps have had shaft couplings unscrew when rotated in reverse		X			
3.2.4.c	The DST Transfer Pump Subsystem design shall minimize the accumulation of solids where process lubricated bearings and mechanical seals are used. The pump should have the capability of flushing such areas.	WHC-SD-WM-DGS-006, Sections 4.1.10.2 and 4.1.10.3; HNF-3218	Shaft seizure is the leading mode of pump failure. Solids crystallization between close tolerance bearing surfaces is the hypothesized cause. Also want to avoid abrasive particles in these areas.	X	X			
3.2.4.d	Whenever possible, instruments that can be operated without calibration or maintenance throughout the design life of the system or component should be selected.	HNF-4553	States a preference.	X				
3.2.4.e	Motors for line-shaft driven transfer pumps shall be provided with a manual pump shaft/impeller rotation device and shall be installed such that manual shaft rotation can be performed without removing the pump pit cover blocks.	HNF-4553; WHC-SD-GN-DGS-30011, Section 3.4		X	X			
3.2.4.f	The equipment design shall minimize the time required to physically disconnect, remove, and replace the transfer pump.	WHC-SD-GN-DGS-30011		X	X			
3.2.4.g	The equipment design shall allow access to maintainable components for repair and/or troubleshooting.	DOE 6430.1A, Section 1300-12		X				
3.2.5.1.a	The subsystem shall be designed for the natural environmental conditions specified in HNF-SD-GN-ER-501.	HNF-SD-GN-ER-501, Rev 1	"Above the cover block" conditions.				X	

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.2.5.1.b	The subsystem shall be designed to withstand the natural phenomena hazards as specified in RPP-PRO-097. The system does not have to operate after a design-basis earthquake; it only needs to be removable.	RPP-PRO-097, Section 5.1; RPP-PRO-1819	Details design loads due to natural phenomena.				X	
3.2.5.2.1	The subsystem components shall be designed to perform their intended function in the chemical environment defined in *Best-Basis Inventory* (database).	*Best-Basis Inventory*	"Best available" chemical environment per CH2M HILL Hanford Group, Inc., process engineering.	X				
3.2.5.2.2	The subsystem shall be designed for the 1,000 rad/h radiation environment for direct contact with tank waste as defined in HNF-2004.	HNF-2004		X			X	
3.2.5.2.3.a	The transfer pump shall remain removable from the tanks following a gas release rollover event and crust impact.	WHC-SD-WM-DGS-006, Section 4.1.7	Loads determined during safety analyses and/or design.				X	
3.2.5.2.3.b	Transfer pumps Types 2 and 3 shall operate while under the loads induced by the mixer pump described in HNF-4164.	HNF-1939, Volume IV, page 3-18	Loads determined during design.		X		X	
3.2.5.2.4.a	The in-tank temperature range for transfer pump design is 10 to 104 °C (50 to 220 °F).	WHC-SD-WM-DGS-006, Section 4.4.4					X	
3.2.5.2.4.b	The transfer pump shall be able to withstand the thermal shock of a <38 °C (100 °F) during pump installation and <16 °C (60 °F) during pump operation.	Reasonable limits pump manufacturers can meet.	Equipment limitation based on material expansion relative to temperature gradients.				X	
3.2.5.2.5	Fluid Rheology. The transfer pump shall be designed to pump fluids with the range of properties defined in RPP-5346, Table 5-1.	RPP-5346	Waste property ranges "best available" per CH2M HILL process engineering			X	X	
3.2.6	Steps shall be taken to ensure that equipment is not damaged during transportation.	Not applicable.						X

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element				
				Exam	Demo	Test	Anal	N/A
3.3.1.a	All transfer pumps shall meet the applicable design, fabrication, labeling, and testing requirements contained in API 610. The highest degree of dynamic balancing shall be specified.	API 610	Standard Design Code.	X		X	X	
3.3.1.b	Welding shall be performed and inspected in accordance with American Welding Society and/or American Society of Mechanical Engineers requirements.	RPP-PRO-097, Table B-1	Standard Design Code.	X				
3.3.2	The subsystem shall comply with electromagnetic radiation emission requirements set forth in HNF-2962.	HNF-2962		X			X	
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 HNF-IP-0842, Volume II, Section 6.1.	HNF-IP-0842, Volume II, Section 6.1		X				
3.3.3.b	Non-submersible electric motors shall be provided with permanently attached nameplates in accordance with NEMA MG-1.	NEMA MG-1		X				
3.3.3.c	Pump rotation arrows shall be marked on the top of the motor bell housing. This does not apply if a submerged motor pump is selected.	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.	HNF-4553		X				
3.3.6.1.a	The radiological design review process of HNF-IP-0842, Volume VII, Section 12.4, shall be used to keep personnel exposures ALARA.	WHC-SD-GN-DSG-30011 HNF-IP-0842, Volume VII					X	

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	N/A
3.3.6.1.b	The system shall incorporate design features that comply with the applicable requirements of 29 CFR 1910, Subparts D, E, G, J, L, M, O, and S.	RPP-PRO-097, Table B-1		X				
3.3.6.2.a	Dome load evaluation shall be performed in accordance with HNF-IP-1266, Chapter 5.16.	HNF-IP-1266, Chapter 5.16					X	
3.3.6.3.a	The DST Transfer Pump 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 Sections 6.9-6.12 of HNF-IP-0842, Volume IV, based on the guidelines in HNF-SD-WM-SAR-067, Section 3.0. Unreviewed safety question screening will be required for system installation in accordance with "Unreviewed Safety Questions," HNF-IP-0842, Volume IV, Section 5.4.	HNF-SD-WM-SAR-067, Section 3.0; HNF-IP-0842					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 requirement is unclear.	HNF-SD-WM-TSR-006, Section 5.10		X			X	
3.3.7.a	Subsystem design shall comply with DOE Order 6430.1A, Section 1300.12, "Human Factors Engineering."	DOE Order 6430.1A, Section 1300.12	"Human Factors Engineering"	X				

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element				
				Exam	Demo	Test	Anal	N/A
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, Sections 0110-99.0.1, 0205-2, and 1300-11; WHC-SD-GN-DGS-30011, Section 3.4		X				
3.3.8.b	Designs should simplify removal and packaging of contaminated pumps.	DOE Order 6430.1A, Section 1300-11.2	"Decommissioning"	X				
3.3.8.c	Any portions of the pump assembly that are subject to contact with waste material shall be flushable and completely self-draining when the long axis of the pump is in a vertical position) to facilitate decontamination.	WHC-SD-WM-DGS-006, Section 4.3.3; WHC-SD-GN-DGS-30011, Section 3.4		X				
3.3.8.d	The system design shall provide means of flushing the pump internals to enable reducing the internal contamination levels before and during pump removal from the tank.	WHC-SD-WM-DGS-006, Section 4.1.8; WHC-SD-GN-DGS-30011, Section 3.4		X				
3.3.8.e	Internal and external cracks, crevices, and hold-up points shall be minimized to facilitate pump cleanup for disposal.	WHC-SD-WM-DGS-006, Section 4.3.3; WHC-SD-GN-DGS-30011, Section 3.4		X				
3.4.a	Records, documents, and drawing control pertinent to design functions shall be in accordance with RPP-PRO-222 and HNF-PRO-224. Drafting standards for drawings and interface control shall be in accordance with RPP-PRO-709.	RPP-PRO-222; HNF-PRO-224; RPP-PRO-709		X				
3.4.b	All DST Transfer Pump Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with the component index process requirements defined in Section 7.3 of HNF-IP-0842, Volume V.	HNF-IP-0842						X

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				Exam	Demo	Test	Anal	N/A
3.4.c	Vendor information shall be managed in accordance with HNF-IP-0842, Volume IV, Section 4.23.	HNF-IP-0842						X
3.5.1.a	Transfer pumps shall be designed to require no routine "hands-on" maintenance in contaminated or high dose rate areas.	WHC-SD-WM-DGS-006, Section 4.2.3; HNF-4553	Access to below-the-coverblock components may be limited because of contamination. Maintenance frequency per Section 3.2.4.a.	X				
3.5.2.a	A minimum number of spares for like components shall be determined based on mean time between failure and number of like components installed.	HNF-4553		X			X	
3.5.3	Facility and Facility Equipment	Not applicable.						X
3.6	Personnel and Training	Not applicable.						X
3.7.1	Motor	Not applicable.						X
3.7.2	Pump	Not applicable.						X
3.7.3	Pump instrumentation	Not applicable.						X
3.7.4	Pump suction level adjustment	Not applicable.						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.	Not applicable.						X

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element: Exam	Demo	Test	Anal	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 (local implementation of 10 CFR 835).	HNF-5183						X
3.10	Computer Resource Reserve Capacity	Not applicable.						X
4.0	Quality assurance for the DST Transfer Pump Subsystem shall be performed in accordance with HNF-IP-0842, Volume XI, Section 1.0.	HNF-IP-0842, Volume XI, Section 1.0; HNF-SD-WM-SAR-067, Section 14.3.1						X
4.1.2.a	Each transfer pump shall be tested for hydraulic and mechanical performance, in accordance with *Hydraulic Institute Standards* and API 610.	*Hydraulic Institute Standards*, API 610	Standard Design Codes			X		
4.1.2.b	Electrical materials and equipment shall be qualification tested unless they are Underwriters Laboratories, Inc. (UL) listed, or factory mutual tested, with label attached, and for the purpose intended, whenever such products are available. Where no UL or factory mutual listed products are available, testing and certification by another nationally recognized testing agency may be acceptable, as long as the design agent documents the acceptance of the testing agency.	DOE Order 6430.1A, Section 1605-1	"Electrical – General"			X		
4.1.2.c	It shall be demonstrated that the transfer pump assembly, when suspended, hangs plumb such that it can be inserted into or removed from the tank riser without interference with the riser.	WHC-SD-WM-DGS-006	Required to demonstrate vertical insertion capability of each pump.			X		
4.1.2.d	Pump insertion into and removal from the tank shall be demonstrated for each Type 1, 2, 3, and 4 design.	WHC-SD-WM-DGS-006, Section 4.1.5	"First-of-a-kind" demonstration that design can be satisfactorily inserted and removed from the tank.			X		

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Section	Function/Requirement	Source Document(s)	Remarks	Inspection Element				
				Exam	Demo	Test	Anal	N/A
4.1.2.e	Transfer pumps that have been stored for 1 year or longer shall be subjected to a run-in test before they are inserted in the waste tank, unless waived by the RPP Design Authority or the RPP project manager.	HNF-3218	Historical evidence shows that pump run-in testing has been very effective in preventing "dead-on-arrival" failures.			X		
4.2	Design Verification	RPP-PRO-1819, Sections 2.9.1 and 2.9.2						X

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