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1	1	Design Authority W.J. Powell S5-13 8/31/00	1	1	K.D. A. White R3-42 8/31/00
		Design Agent	1	1	G.W. McLellan R3-47 8/31/00
1	1	Cog. Eng. T.H. May R3-73 8/29/00			
1	1	Cog. Mgr. N.W. Kirch ~~R3-73~~ R2-11 8/29/00			
		QA			
		Safety			
		Env.			

18.	19.	20.	21. DOE APPROVAL (if required)
T.H. May 8/29/00	K.D. A. White 8/31/00	N.W. Kirch 9-6-00	Ctrl No. _____
Signature of EDT Originator / Date	Authorized Representative for Receiving Organization / Date	Design Authority/ Cognizant Manager / Date	☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

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Test and Evaluation Plan for Waste Feed Delivery Project W-521

Thomas H. May
CH2MHILL Hanford Group
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-99RL14047

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Abstract: This Test and Evaluation Plan identifies the T&E activities required to confirm that the SSCs provided by Project W-521 will satisfy the Level 2 Specifications and operational requirements.

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RPP-6483
Revision 0

Test and Evaluation Plan Waste Feed Delivery Project W-521

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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Revision 0

Test and Evaluation Plan Waste Feed Delivery Project W-521

T. H. May

Date Published
August 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

CONTENTS

APPENDIX

TERMS

ATP	Acceptance Test Procedure
CTI	Construction Test and Inspection
CWP	Construction Work Package
DOE	U.S. Department of Energy
DST	Double-Shell Tank
OTP	Operational Test Procedure
QTP	Qualification Test Procedure
RPP	River Protection Project
SSC	systems, structures, and components
T&E	Test and Evaluation
TEP	Test and Evaluation Plan
VTI	Vendor Tests and Inspections

1.0 PURPOSE

The purpose of this Test and Evaluation Plan (TEP) is to identify the Test and Evaluation (T&E) activities required to confirm that design and installation of systems, structures, and components (SSCs) provided by Project W-521 will satisfy Level 2 and operational requirements, and to describe the T&E program to be implemented during the various project phases. This TEP establishes a sequence of test and evaluation activities to provide confidence that all required T&E activities will be accomplished successfully to support a smooth and timely turnover of completed SSCs to the River Protection Project (RPP) operations organization. In addition, organizational responsibilities for managing and performing the T&E activities are outlined. This TEP was prepared in accordance with the guidance and requirements of the RPP Test and Evaluation Management Plan.

The Project W-521 TEP documents the process that will show that the SSCs are (1) compliant with the requirements of the Level 2 Specifications, (2) constructed in accordance with approved design drawings and procurement/construction specifications, (3) installed properly and appropriately integrated into the existing systems, and (4) will operate adequately on turnover to the customer.

2.0 PROJECT SCHEDULE AND MILESTONE

HNF-5383, *Project Execution Plan for Waste Feed Delivery Systems*, includes the upper-level schedule for providing retrieval systems, milestones established via Performance Agreement, and milestones included in the Multi-Year Work Plan. The lower level logic that provides the basis for the schedule baseline includes important events in the project life cycle that are useful to depict the relationship of T&E to the overall project schedule. Detailed project schedules account for the T&E activities during the project life cycle, and are reflected in the Project W-521 Conceptual Design documents.

3.0 TEST SYSTEM DESCRIPTION

Project W-521 will provide systems for retrieval of radioactive waste from eight double-shell tanks (DST) at the U.S. Department of Energy's (DOE) Hanford, Washington facility. The tanks contain various combinations of supernate liquids and settled solids that must be mixed before being transferred to treatment facilities or other DSTs. Project W-521 will equip the tanks with waste retrieval systems that will mix the waste and transfer the resultant slurry out of the tanks, to provide feed to processing plants, allow for consolidation of similar wastes to more effectively managed existing storage capacity, and ultimately reduce the risks associated with continued storage of Watch List waste. Although there are variations from tank-to-tank, a typical retrieval system consists of mixer pumps, a transfer pump, piping jumpers, a camera, in-tank instruments,

a dilution/caustic supply system, and a control system housed in an instrument building. Project W-521 also will provide a new valve pit and transfer lines to the vitrification facility.

The TEP encompasses the overall set of T&E activities for Project W-521. These activities include Design Verification, Qualification Test Procedures (QTP), Vendor Tests and Inspections (VTI), Construction Tests and Inspections (CTI), Acceptance Test Procedures (ATP), and Operational Test Procedure (OTP) activities.

- Design Verification (HNF-IP-0842, *RPP Administration*, Volume IV, Section 4.24, "Design Verification") includes reviews performed by a team comprising Design Authority, Project Management, Operations, Maintenance, Quality Assurance, Environmental and Safety representatives, as appropriate. Subject matter experts are included on an as-needed basis. In addition, Design Verification may include other supporting services. Design Verifications determine characteristics, adequacy, and conformance with specified requirements and acceptance criteria by examination of items (such as engineering drawings, specifications, analyses, procedures, and vendor information). Design Verifications will be a continuing activity throughout the project life cycle, which generally begins during the preconceptual activities and continues into the turnover phase.

- Qualification Test Procedures are used to confirm that the unit being tested satisfies acceptance criteria under simulated operational environmental conditions with a margin of safety. The two primary types of qualification tests are environmental and functional.

- Vendor Tests and Inspections are performed offsite to verify manufacturing or fabrication methods of procured equipment or materials. Items will be tested or inspected to determine if they meet required functions and/or acceptance criteria. VTIs include quality assurance overview, in process and final inspections, and testing.

- Construction Tests and Inspections are used to verify construction methods performed by contractors and screen for failures of workmanship and material quality deficiencies at all levels of assembly. CTIs include quality assurance overview, in process and final inspections, and testing.

- Acceptance Test Procedures verify operational modes, output performance, and support functions. ATPs include testing of interface between segments, verifying performance of the system by testing at the required performance level.

- Operational Test Procedures are tests performed by CH2M HILL Hanford Group, Inc. (CHG). These tests verify operational performance of the complete system.

4.0 TESTING AND EVALUATION CONSTRAINTS

The initial planning activities for Project W-521 have not identified any constraints preventing realistic operational testing. Some factors that may impact realistic operational testing are safety (equipment and personnel), radiation exposure, weather, and program schedule conflicts. Tests will have to accommodate the requirement that waste cannot be transferred until DOE authorization has been obtained.

Testing will have to be coordinated with several major interfacing projects. Projects W-211 and W-314 are installing piping and jumpers into the same pits as Project W-521. Joint testing will be required. Project W-314 is installing a new Master Pump Shutdown System which will be used to test a few of the instruments installed by Project W-521. The new valve pit and transfer lines to the vitrification facility will have to be tested in conjunction with the vitrification facility.

5.0 TEST LOCATIONS

Project W-521 T&E activities will take place primarily in the 200 East and 200 West Areas of the Hanford Site. Integrated pre-operational testing will take place within these farms. Some T&E activities may be performed at the Maintenance and Storage Facility located in the 400 Area (e.g., run in testing of mixer pumps), other Hanford Site locations (e.g., pressure switch testing in Building 306, 300 Area), or offsite at vendor facilities (e.g., slurry pump performance testing at Sulzer Pumps in Portland, Oregon).

6.0 TEST MANAGEMENT

This section identifies the principal organizations responsible for planning and conducing T&E activities. The authority and responsibility for scheduling test resources, and management direction for conducting individual T&E activities, are identified.

6.1 PROJECT MANAGEMENT

The Project Management team reports to the RPP, Project Management. The Project Management team is responsible for planning, organizing, directing, and controlling project resources for the project life cycle. Project Management responsibilities related to T&E activities include the following:

- Ensure appropriate review and approval for design media, including drawings and specifications. It is anticipated that the design verification process will be the formal design review process.

- Ensure appropriate review and approval of test plans and procedures, including QTPs, VTIs, CTIs, and ATPs.
- Initiate and manage the procurement process for advance procurement equipment.
- Witness VTIs, CTIs, and ATPs.
- Provide management oversight on work performed during T&E activities.
- Assist in OTPs, startup activities, and procedure/training development.
- Interface with Waste Feed Delivery program and Tank Farm operations, as required.

6.2 DESIGN AGENT

The Design Agent for Project W-521 provides engineering for design documents and test procedures, participates in the T&E activities in resolution of punch-list items, and concurs with the test results. Design Agent responsibilities related to T&E activities include the following:

- Provide specifications that define test requirements for SSCs, including acceptance criteria.
- Define the verification method and test plan/procedures.
- Perform internal design reviews as required by their procedures and QTPs.
- Prepare test documentation including QTPs, CTIs, and ATPs.
- Witness VTIs, CTIs, and ATPs as required by the applicable procurement, construction, or testing document.
- Prepare system operating characteristics and descriptions to be used in development of Operating Maintenance Procedures.

6.3 CONSTRUCTION MANAGEMENT

The Construction Management contractor provides construction management, construction material procurement, craft support personnel, and construction document control. Construction responsibilities related to T&E activities include the following:

- Review construction specifications, drawings, and test procedures.
- Prepare and maintain Construction Work Packages (CWPs) that include the CTIs.
- Perform acceptance testing.
- Support OTPs and startup activities.

6.4 TANK FARM OPERATIONS

Tank Farm Operations provide Design Authority personnel with responsibility for input and participation in technical reviews of the design media and T&E activities. Responsibilities related to T&E activities include the following:

- Review and approve design media, work packages, and ATPs.
- Provide an Operations Engineer to act as a Test Director for OTPs. Tank Farm Operations has the primary responsibility for OTPs.

6.5 TANK FARM MAINTENANCE

Tank Farm Maintenance provides input and participation in technical reviews of the design media and T&E activities.

6.6 JOINT TEST REVIEW GROUP

The Joint Test Review Group conducts reviews of ATPs and OTPs to ensure compliance with applicable procedural requirements, to ensure the ATPs and OTPs can be done safely, and to ensure the scope of testing and inspections provides a product that satisfies operational and safety requirements.

7.0 TRAINING REQUIREMENTS

The initial planning results for Project W-521 have not identified any unique training requirements relating to T&E. The Project W-521 Qualification and Training Plan requires that all Project W-521 personnel meet specific qualification requirements and be trained to applicable procedures. Records are maintained to reflect current status of personnel training and qualifications. Any special training or qualification requirements for analysts or test team members will be defined in specific test documents (e.g., ATPs, QTPs, OTPs).

8.0 CRITICAL ISSUES FOR TESTING AND EVALUATION

The critical operational requirements for Project W-521 are to provide systems with the ability to retrieve the radioactive waste from eight DSTs on time, at the specific quantity, and within the specified quality. Risk events of significance that are deserving of management attention are identified and controlled using the Project W-521 Risk List. The Project W-521 Risk List is managed on a "real time" basis as risks and mitigation actions evolve, and is reviewed and updated at least semi-annually.

9.0 TESTING AND EVALUATION APPROACH

Table A-7 (Appendix A) identifies T&E processes to be used for verifying each project functional requirement. The T&E approaches that are applicable to each retrieval system are provided in appendix A. The initial project T&E is the verification that the design will meet the requirements followed by verification of construction (including procurement and installation). Appendix A reflects the T&E approaches that are applicable to each retrieval system for Project W-521 assigned tanks. Additional appendices will be added as future designs complete. The T&E approaches for each project life cycle phase are described in the following sections.

9.1 DESIGN PHASE

Activities during the design phase are focused on determining that the SSCs, as designed, will meet the specified requirements in the Level 2 Specifications. Design Verification and Qualification Test Procedures will accomplish this.

The design approach for Project W-521 SSCs is to use commercially available products to the extent possible. Review of vendor information, evaluation of similar hardware under similar use, and review of the design drawings and construction or procurement specifications meet Design Verification objectives.

9.2 CONSTRUCTION PHASE

Construction testing activities comprise various tests and inspections that demonstrate compliance with procurement and construction specifications. T&E activities conducted during the construction phase are focused on demonstrating the SSCs have been manufactured or fabricated to the design requirements, and are properly constructed or installed. T&E activities that occur during procurement and construction phase are VTIs, CTIs, and ATPs.

The objective of the VTIs is to determine that the vendor-supplied SSCs meet design requirements, as specified in the contract/procurement documents. The VTI is used to document compliance with design requirements through demonstration, examination, and/or testing. VTIs may contain hold points that require witness signatures, confirming that all acceptance requirements are met. Vendor test documents are generated by the vendor when the vendors design is in progress, and successfully completed before delivery to the Hanford Site.

CTIs are identified in CWPs based on requirements found on drawings and construction specifications. The CTIs (e.g., hydro tests, pneumatic tests, megger tests) are used to document compliance with design requirements through demonstration, examination, and testing. CTIs ensure that the SSCs are fabricated and/or installed properly. Detailed CTI procedures are used for conducting nonroutine functional checks and/or inspections during SSC installations. For CTIs, the acceptance criteria are specified either in the CTI documents or in approved drawings and specifications.

VTIs and CTIs are performed by the responsible organizations (i.e., vendor or construction contractor). Test reports are provided at project turnover as identified in the Acceptance for Beneficial Use process.

ATPs are separate documents that obtain their requirements from equipment functional characteristics and vendor data. Detailed ATPs (e.g., fire protection functional test, camera system test, comprehensive functional test) are required after the CTI functional checks and/or inspections are completed to validate overall SSC installation. For ATPs, the acceptance criteria are specified in the ATP.

CTI and ATP implementation varies depending on the complexity and risk factor involved with the applicable SSC. CTIs require quality assurance and/or quality control to witness and approve the installation. All CTIs and ATPs document the results and any follow-up activities necessary for turnover to the customer. CTIs are documented in the applicable CWP. An Acceptance Test Report is generated when a successful ATP is completed.

9.3 TURN-OVER PHASE

T&E activities conducted during the turnover phase focus on demonstrating the installed SSCs function properly within the system, and that the system operates under normal conditions and/or off-normal conditions.

OTPs are conducted on installed SSCs after completion of all other tests. OTPs demonstrate the installed SSCs function as intended when integrated into the system as a whole. Systems are brought on-line and operated under anticipated standard operations and off-normal conditions. Included in the OTP are acceptance criteria. Operational testing is performed with actual plant equipment, operating procedures, and personnel. An Operational Test Report is generated when the test has been successfully completed.

Because this is an integrated system level test, the acceptance criteria are based on the requirements specified in the design media, operational procedures, existing operational requirements, and the Authorization Basis.

10.0 PERFORMANCE REQUIREMENTS

Overall system performance requirements are documented in the DST Level 2 Specifications. As mentioned in Section 9.0, Table A-7 (Appendix A) identifies T&E processes to be used for verifying each functional requirement. Detailed design documents, from which T&E requirements are derived, identify SSC-specific performance requirements. As the Project W-521 design progresses, appendices will be added to provide a listing of tank-specific documents applicable to each verification method under the column heading "Document Defining T&E Requirements." Technical performance measures are monitored by evaluation of T&E results. Appendix A is an example of what will be provided as the design progresses.

11.0 TEST ACCEPTANCE CRITERIA

Acceptance criteria are specified in the design documents, contract documents, and specific test procedures for the item or system being verified. Applicable tank-specific documents are listed in Appendix A under the column heading "Document Defining T&E Requirements."

12.0 DATA MANAGEMENT

The data management strategy for Project W-521, including how data will be collected, recorded, and controlled, will follow the requirements identified in the Project W-521 Configuration Management Plan and the Project W-521 Quality Assurance Program Plan.

13.0 TEST AND EVALUATION MATRIX

Matrix 13.1 lists the functional requirements from the design basis for Project W-521. The matrix identifies the T&E processes that are applicable for each functional requirement.

14.0 AUTHORIZATION BASIS REQUIREMENTS

Unique T&E activities required for SSCs that perform a safety function are included in the design documents and are concurred with by the Design Authority. Additional T&E activities for commercial grade equipment that will serve a safety function will be documented using the CGH CGI process contained in HNF-IP-0842 (Volume IV, Section 3.11, "Commercial Grade Item Upgrades Dedication").

15.0 REFERENCES

15.1 REFERENCES

HNF-5383, 2000, *Project Execution Plan Waste Feed Delivery Systems*, Rev. 0, Draft, CH2M HILL Hanford Group, Inc., Richland Washington.

HNF-IP-0842, 2000, *RPP Administration*, CH2M HILL Hanford Group, Inc., Richland, Washington.

- Vol. IV, Section 3.11, "Commercial Grade Item Upgrade Dedication"

- Vol. IV, Section 4.24, "Title"

Project W-521 Technical Baseline Reports: electronic database through CH2M HILL.

15.2 SOURCE DOCUMENTS

HNF-5372, "Quality Assurance Program Plan Conceptual Design Phase of Project W-521 Waste Feed Delivery System,"

HNF-2029, "RPP Testing and Evaluation Management Plan"

GPG-FM-005, "Good Practice Guide for Test and Evaluation"

HNF-IP-0842, Vol. II, Section 4.13, "Joint Test Review Process"

HNF-IP-0842, Vol IV, Section 2.12, "Test and Evaluation."

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APPENDIX A

TANK FARM 241-SY TESTING AND EVALUATION

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APPENDIX A

TANK FARM 241-SY TESTING AND EVALUATION

A.1 RETRIEVAL SYSTEM DESCRIPTION FOR SY FARM

The SY Farm retrieval systems consists of the following major SSCs:

- Two 300 HP mixer pumps in each tank
- One 150 HP transfer pump in each tank
- One in-tank camera in each tank
- One temperature probe (replacement) in each tank
- TBD piping jumpers
- TBD Pit coverblocks (replacements) in each tank
- Replacement of non-compliant transfer piping
- Flush system (W-058) modifications
- ICE building
- Retrieval Control System
- Electrical system modifications
- Raw water modifications
- Sludge instrumentation in each tank.

A.2 T&E PROCESS FOR SY FARM

A.2.1 Design Verification

The following table lists the evaluations or reviews performed by expert reviewers during design.

Table A-1. Design Verifications.

Level 2 Specification Section #	SSC Description	Document Verifying T&E Requirements	Document Type
3.2.5.1.a	General	TBD	TBD
3.2.5.1.b	General	TBD	TBD
3.2.5.2	General	TBD	TBD
3.2.5.2	General	TBD	TBD
3.3	General	TBD	TBD
3.3.2	General	TBD	TBD
3.3.3.a	General	TBD	TBD

A.2.2 Qualification Test Procedures

The following table lists the tests performed to qualify the use of commercially available products. This includes multiple products assembled together in sub-systems.

Table A-2. Qualification Test Procedures.

Level 2 Specification Section #	SSC Description	Document Verifying T&E Requirements	Document Type
3.2.3.a	Mixer Pump	TBD	TBD
3.3.1.j	Mixer Pump	TBD	TBD

A.2.3 Vendor Tests & Inspections

The following table lists the tests that are performed by vendors to demonstrate compliance with W-521 procurement specifications or drawings.

Table A-3. Vendor Tests & Inspections.

Level 2 Specification Section #	SSC Description	Document Verifying T&E Requirements	Purchase Order Number	CVI Number
4.1.2	General	TBD	TBD	TBD
3.1.2.1.4.a	Diluent & Flush	TBD	TBD	TBD
3.2.1.1.a	Diluent & Flush	TBD	TBD	TBD
3.2.1.1.b	Diluent & Flush	TBD	TBD	TBD
3.2.1.1.c	Diluent & Flush	TBD	TBD	TBD

A.2.4 Construction Tests & Inspections

The following table lists the tests and inspections that are preformed during fabrication, modification, and installation of SSCs. Note that acceptance criteria are included in the individual tests, drawings, specifications, procedures, and CWPs.

Table A-4. Construction Tests & Inspections.

Level 2 Specification Section #	SSC Description	Document Verifying T&E Requirements	Document Type
3.3.1.a	Diluent & Flush	TBD	TBD
3.3.1.b	Diluent & Flush	TBD	TBD
3.3.1.c	Diluent & Flush	TBD	TBD
3.3.1.d	Diluent & Flush	TBD	TBD
3.3.1.e	Diluent & Flush	TBD	TBD
3.3.1.f	Diluent & Flush	TBD	TBD

A.2.5 Acceptance Test Procedures

The following table lists ATPs, which obtain their requirements from the Level 2 Specifications, drawings, and vendor data. ATPs are performed on components in their installed conditions but may not exercise the entire system as an operational unit. Acceptance Test Reports are generated when all test exceptions have been successfully completed.

Table A-5. Acceptance Test Procedures.

Level 2 Specification Section #	SSC Description	Document Verifying T&E Requirements	Document Type
3.1.2.1.1.a	Diluent & Flush	TBD	TBD
3.1.2.1.2.a	Diluent & Flush	TBD	TBD
3.1.2.1.4.b	Diluent & Flush	TBD	TBD
3.2.1.1.a	Diluent & Flush	TBD	TBD
3.2.1.1.b	Diluent & Flush	TBD	TBD

A.2.6 Operational Test Procedures

The following table lists OTPs that will be conducted on the installed SSCs, after completion and acceptance of all other test results. Operational testing is performed with actual plant equipment, operating procedures, and personnel. Operational Test Reports are generated when all test exceptions have been successfully completed.

Table A-6. Operational Test Procedures.

Level 2 Specification Section #	SSC Description	Document Verifying T&E Requirements	Document Type
3.1.2.1.1.a	Diluent & Flush	TBD	TBD
3.1.2.1.2.a	Diluent & Flush	TBD	TBD
3.1.2.1.4.b	Diluent & Flush	TBD	TBD
3.2.1.1.a	Diluent & Flush	TBD	TBD
3.2.1.1.b	Diluent & Flush	TBD	TBD

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
General Requirements Identical for All Level 2 Specifications									
1	3.2.5.1.a	The subsystem shall be designed for the natural environmental conditions specified in HNF-SD-GN-ER-501.	X						
2	3.2.5.1.b	The subsystem shall be designed to withstand the natural phenomena hazards as specified in RPP-PRO-097.	X						
3	3.2.5.2	The subsystem components shall be designed to perform their intended function in the chemical environment defined in HNF-2937.	X		X	X			As applicable
4	3.2.5.2	The subsystem shall be designed for the maximum (calculated) bounding radiation environment for direct contact with tank waste as defined in HNF-2004.	X		X	X			As applicable
5	3.3	The subsystem shall comply with the general design guidelines provided in DOE Order 6430.1A, Sections 1300-7 and 1323.	X		X	X	X		As applicable
6	3.3.2	The subsystem shall comply with electromagnetic radiation emission requirements set forth in HNF-2962. Note: does not apply to transfer piping.	X					X	
7	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.	X				X	X	Walkdowns and procedures
8	3.3.4	Not applicable. (Workmanship)							
9	3.3.5	All like equipment and parts shall be interchangeable/standardized to the maximum extent practical.	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
10	3.3.6.1.b	The subsystems shall incorporate occupational safety and health design features that comply with the requirements of HNF-SD-WM-HSP-002 and other applicable safety and health requirements.	X			X			As applicable
11	3.3.6.2	Tank dome loading shall satisfy the requirements specified in HNF-IP-1266, Chapter 5.16.	X			X			
12	3.3.6.3.a	The subsystems and components shall be designed in accordance with the safety classification for each. The safety classification shall be determined using the process described in RPP-PRO-700, RPP-PRO-702, RPP-PRO-703, 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.	X		X	X	X	X	As necessary
13	3.3.6.3	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.	X		X	X			
14	3.3.7.a	Subsystem design shall comply with DOE Order 6430.1A, Section 1300-12, "Human Factors Engineering."	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
15	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.	X						
16	3.3.9	The subsystem shall be designed such that access controls to radiation and high-radiation areas meet the requirements of DOE/RL-96-109.	X						
17	3.4.a	Records, documents, and drawing control pertinent to design functions shall be in accordance with RPP-PRO-222 and RPP-PRO-224. Drafting standards for drawings and interface control shall be in accordance with RPP-PRO-709.	X						
18	3.4.b	All subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list in accordance with <TBD>.	X						
19	3.5.2	The subsystem shall use readily available commercial parts and components to the greatest extent practical.	X						
20	3.5.2.a	Minimum numbers of spares for like components shall be determined during design, based on mean time between failure and the number of like components installed.	X						
21	3.6	Not applicable. (Personnel and Training)							
22	3.7	Not applicable. (General descriptions of components)							

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
23	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.	X						
24	3.9	The subsystem design shall be verified to RPP-PRO-1819.	X						
25	3.10	Not applicable. (Computer Resource Reserve Capacity)							
26	4.0	Quality assurance for the DST Transfer Valving Subsystem shall be performed in accordance with HNF-IP-0842, Volume XI, Section 1.0.	X						
27	4.1.2	Electrical materials and equipment shall be Underwriters Laboratories, Inc. (UL), or factory-mutual tested, with label attached, 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.	X		X				
28	4.2	Not applicable. (Design Verification)							

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
HNF-4163 Diluent and Flush Subsystem Requirements									
1	3.1.2.1.1.a	The DST Diluent and Flush Subsystem shall be capable of receiving 480 V ac, 3 phase power. The interface control documents shall be the means to manage power requirements.	X		X	X	X	X	
2	3.1.2.1.2.a	The DST Diluent and Flush Subsystem shall be capable of receiving raw water at a continuous flow rate of at least 0.606 m^3/min (160 gal/min) and a minimum pressure of 552 kPa (80 lb/in^2 gauge).	X				X	X	
3	3.1.2.1.4.a	The DST Diluent and Flush Subsystem shall be capable of receiving industry standard control signals.	X		X		X	X	
4	3.1.2.1.4.b	The DST Diluent and Flush Subsystem shall be capable of receiving a control function to terminate diluent/flush water supply at preset volumes from the DST Monitor and Control Subsystem.	X				X	X	
5	3.1.2.1.5.a	The DST Diluent and Flush Subsystem shall use concentrated commercial-grade sodium hydroxide (commonly referred to as caustic soda) at a concentration of up to 50 wt% provided by the DST Maintenance and Recovery Subsystem.	X		X		X	X	
6	3.1.2.1.5.b	The DST Diluent and Flush Subsystem shall use concentrated commercial-grade 40 wt% sodium nitrite ($NaNO_2$) provided by the DST Maintenance and Recovery Subsystem.	X		X		X	X	As applicable

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
7	3.2.1.1.a	The DST Diluent and Flush Subsystem shall have the capability to preheat waste transfer lines by providing a continuous flow of water or solution that is at least two times the volume of the longest planned waste transfer line volume.	X		X		X	X	
8	3.2.1.1.b	The DST Diluent and Flush Subsystem shall have the capability to provide heated water or solution at a flow rate of 0.53 m^3/min (140 gal/min) at up to 4,480 kPa (650 lbf/in^2).	X		X		X	X	
9		The DST Diluent and Flush Subsystem shall have the capability to provide solutions to be used for waste transfer line preheating, in-line dilution, in-tank dilution, and tank-heel flushing at temperatures as high as 40 °C (140 °F) <TBR>.	X		X		X	X	
10	3.2.1.1.d	The DST Diluent and Flush Subsystem shall have the capability to provide solutions to be used for in-line dilution at a flow rate as high as 0.175 m^3/min (46 gal/min) for periods up to 5 days <TBR>.	X		X		X	X	
11	3.2.1.1.e	The DST Diluent and Flush Subsystem shall provide concentrated sodium hydroxide solution at a concentration up to 50 wt% to adjust the chemical composition of DSTs <TBR>.	X		X		X	X	
12	3.2.1.1.f	The DST Diluent and Flush Subsystem shall be capable of adjusting the composition of sodium hydroxide from 0.010 M to <TBD> M and the composition of sodium nitrite from 0.011 M to <TBD> M to prepare needed diluent solutions.	X		X		X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
13	3.2.1.1.g	The DST Diluent and Flush Subsystem shall be capable of unloading the chemicals identified in Section 3.1.2.1.5.	X		X		X	X	
14	3.2.1.2.a	Duplicate of 3.2.1.1.g							
15	3.2.1.2.b	The DST Diluent and Flush Subsystem shall be capable of preparing and providing flush solutions with compositions that are at least 0.01 M hydroxide and at least 0.011 M nitrite.	X		X		X	X	
16	3.2.1.2.c	The DST Diluent and Flush Subsystem shall be capable of flushing each waste transfer line with a volume of solution that is twice the volume of the transfer line.	X		X		X	X	
17	3.2.1.2.d	The DST Diluent and Flush Subsystem shall be capable of providing a flow of 0.606 m^3/min (160 gal/min) at a pressure of 4,480 kPa (650 lbf/in^2) to the DST Transfer Valving Subsystem for flushing waste transfer lines.	X				X	X	
18	3.2.1.3.a	The DST Diluent and Flush Subsystem shall monitor temperature, pressure, flow rate, and solution compositions.	X				X	X	
19	3.2.1.3.b	The DST Diluent and Flush Subsystem shall measure the quantity of heated water or solution provided to the transfer- associated structure.	X				X	X	
20	3.2.1.3.c	The DST Diluent and Flush Subsystem shall have the capability to control the diluent solution temperature to within ±5 °C (9 °F).	X		X		X	X	
21	3.2.1.3.d	In the event of a loss of power, the system shall fail such that no further water or chemicals can be added to a tank.	X		X		X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
22	3.2.2.a	Physical constraints on DST Diluent and Flush Subsystems located outside the tank farm will be determined during design.							No testing required
23	3.2.3.a	The design life of the DST Diluent and Flush Subsystem shall be 35 years. Replacement of major components is allowable if this is the most cost-effective approach.	X						
24	3.2.3.b	The DST Diluent and Flush Subsystem shall be capable of providing heated diluent/flush water after a single failure of an active component.	X		X		X	X	
25	3.2.3.c	The DST Diluent and Flush Subsystem shall allow for local restart by the operator following actuation of a leak detector for the purpose of flushing the line.	X		X		X	X	
26	3.2.4.a	Mean time to repair for the DST Diluent and Flush Subsystem, during unplanned outages, shall be less than 24 hours. This time does not include logistics delay time or administrative delay time.	X				X		Demo selected components
27	3.2.4.b	A single replaceable component of the DST Diluent and Flush Subsystem shall be designed to enable replacement within 8 hours. This time does not include logistics delay time or administrative delay time.	X				X		Demo selected components
28	3.2.5.1.c	The containment skid shall be resistive to pressure gradients above and below the foundation and shall be capable of preventing failure caused by settlement, compression, or uplift.	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
29	3.2.5.2.1.a	The DST Diluent and Flush Subsystem equipment shall be capable of receiving and mixing concentrated caustic solutions obtained from a supplier that are up to 50 wt%.	X		X		X	X	Duplicate of 3.2.1.1.g
30	3.2.5.2.1.b	The DST Diluent and Flush Subsystem equipment shall be capable of receiving and mixing concentrated nitrite solutions obtained from a supplier that are up to 40 wt%.	X		X		X	X	Duplicate of 3.2.1.1.g
31	3.3.1.a	The piping shall meet the applicable design and construction requirements contained in ASME B31.3.	X			X			
32	3.3.1.b	All valves shall meet the applicable design and construction requirements contained in ASME B16.34.	X			X	X		
33	3.3.1.c	All concrete work shall meet the applicable design and construction requirements contained in ACI 318.	X			X			
34	3.3.1.d	Electrical equipment enclosures shall be, as a minimum, NEMA-Type 4 or 4X, per NEMA ICS 6. Electrical enclosures shall have the cover secured by a toggle-actuated handle to minimize difficulties in opening and fully securing the enclosure.	X			X	X		
35	3.3.1.e	Dry disconnect couplings shall be provided for connections to the chemical supply.	X			X			
36	3.3.1.f	Buried portions of the diluent/flush supply lines shall be back-filled with a noncorrosive, porous, homogeneous medium to ensure that the piping is fully and uniformly supported.	X			X			
37	3.3.1.g	DST Diluent and Flush Subsystem routing valves shall be provided with position switches.	X			X	X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
38	3.3.1.h	There shall be provisions for prevention and detection of backflow from the DST Transfer Valving Subsystem. Requirements for prevention and detection of waste backflow are contained in HNF-4160, Sections 3.2.1.14 and 3.2.1.15.	X			X	X	X	
39	3.3.1.i	Polyethylene (or equivalent) sleeving shall be provided around sodium hydroxide delivery piping.	X			X	X	X	Sleeving will be installed for ATP/OTP
40	3.3.1.j	The DST Diluent and Flush Subsystem shall be designed for positive removal (such as a locked drainage valve) of contaminated liquids and uncontaminated precipitation.	X			X	X	X	
41	3.3.1.k	For the connection to the DST Transfer Valving Subsystem, the DST Diluent and Flush Subsystem shall use material that can be welded to 304L stainless steel and is compatible with 304L stainless steel.	X		X	X			
42	3.3.1.l	The DST Diluent and Flush Subsystem shall comply with "Carriage By Public Highway," "General," Title 49 CFR 177.834, parts (I)(2)-(5), during tanker unloading.	X						
43	3.3.1.m	The DST Diluent and Flush Subsystem shall be capable of immediately (without interruption of flow) transitioning from providing a flush solution to providing a diluent solution and from providing a diluent solution to providing a flush solution.	X		X		X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
44	3.a3.1.n	The piping for conveying dilute sodium nitrite and sodium hydroxide solutions from the Diluent and Flush Station to the appropriate valve pit shall meet the requirements of DOE Order 6430.1A, Sections 1300-7.1 and 1300-7.4.	X			X	X	X	As applicable
45	3.3.1.o	The DST Diluent and Flush Subsystem shall be controllable by the DST Monitor and Control Subsystem. Chemical adjustments to flush and diluent solutions, temperature adjustments of the solutions, flow rate adjustments of the solutions, and the shutdown of the subsystem shall be possible from the DST Monitor and Control Subsystem.	X			X	X	X	
46	3.3.1.p	The DST Diluent and Flush Subsystem shall be capable of adjusting the flow rate of water or solution to support transitions from the line preheating application to the in-line dilution application.	X		X	X	X	X	
47	3.3.1.q	The DST Diluent and Flush Subsystem shall be capable of adjusting the flow rate and chemical composition of solutions to support transitions from the in-line dilution application to the waste transfer line flush application.	X		X	X	X	X	
48	3.3.1.r	The diluent/flush supply piping to the valve and pump pits shall have a design pressure rating at least 4,480 kPa (650 lbf/in^3).	X			X	X		
49	3.3.3.b	All chemical and other pipelines shall be individually marked in accordance with DOE Order 6430.1A, Section 1323.4.3, and ASME B31.3.	X			X	X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
50	3.3.6.1.b	The DST Diluent and Flush Subsystem shall be designed to keep personnel exposure as low as reasonably achievable (ALARA) in accordance with RPP-PRO-1621 and RPP-PRO-622.	X						
51	3.3.6.1.c	Safety shower and eyewash stations shall be provided at the Diluent and Flush Stations and shall comply with ANSI Z358.1	X			X	X	X	
52	3.3.6.2.a	The DST Diluent and Flush Subsystem pipeline shall be designed and operated such that water hammer events are precluded from occurring, or an analysis is performed to determine the adequacy of the design to handle maximum water hammer events.	X			X	X	X	
53	3.3.6.3.b	The Diluent and Flush Station (containing piping, tanks, pumps, etc.) shall have adequate containment for possible leaks or spills.	X						
54	3.5.1.a	Accessible portions of the DST Diluent and Flush Subsystem shall be designed for limited contact maintenance and operation.	X						
55	3.5.1.b	The diluent/flush supply lines shall be designed to require no maintenance.	X						
56	4.1.2.a	Seat closure tests shall be performed for diluent and flush valves in accordance with the test methods in ASME B16.34 and MSS-SP-61. Seat leakage from each flow side to the isolated port shall be within the limits specified in MSS-SP-61.	X		X		X		

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
57	4.1.2.b	Shell tests shall be performed for diluent and flush valves in accordance with ASME B16.34. No visible leakage at pressure boundary walls is permissible at the 52° C (125 °F) test pressure conditions except for valve stem leakage. There shall be no indication of valve stem leakage at the 38 °C (100 °F) test pressure condition.	X		X		X	X	
HNF-4164 Mixer Pump Subsystem Requirements									
1	3.1.2.1.1.a	The mixer pumps shall receive 480 V ac, 3-phase, 60 Hz electric power. The interface control documents shall be the means to manage power requirements.	X			X	X	X	Same as DST Diluent and Flush Subsystem 3.1.2.1.1.a
2	3.1.2.1.2.a	The DST Mixer Pump Subsystem shall not exceed the following demand for strained raw water. Filtering to ≤5 micron at the mechanical seal (if required by design) is part of pump design. ▪ Supply pressure = 551 kPa (80 lbf/in^2 gauge) ▪ Flow rate = 0.3 L/s (5 gal/min).	X				X	X	
3	3.1.2.1.2.b	The DST Mixer Pump Subsystem shall not exceed the following demand for strained raw water. Filtering to ≤75 micron at the pump column (if required by design) is part of pump design. ▪ Supply pressure = 551 kPa (80 lbf/in^2 gauge) ▪ Flow rate = 0.3 L/s (5 gal/min).	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
4	3.1.2.1.3.a	The DST Mixer Pump Subsystem shall be flushed with raw water at 12.6 L/s <TBR> (200 gal/min) minimum at 551 kPa <TBR> (80 lbf/in^2) for internal pump washdown and internal cavity flush. See Appendix C for <TBR> discussion.	X				X	X	
5	3.1.2.1.4.a	The DST Mixer Pump Subsystem shall be designed for remote control of pump operation by the DST M&C Subsystem.	X				X	X	
6	3.1.2.1.5.a	The DST Mixer Pump Subsystem shall be limited to loading the transfer valving subsystem to that allowed by HNF-IP-1266.	X						
7	3.1.2.1.6.a	The DST Mixer Pump Subsystem shall be limited to loading the DST Confinement Subsystem to that allowed by HNF-IP-1266.	X			X			
8	3.2.1.1.a	Each mixer pump shall be capable of producing two jets, 180 degrees opposed, with a velocity-nozzle diameter product (U_oD) that is a minimum of 2.73 m^2/s (29.4 ft^2/s) <TBR> at 100 percent speed with a minimum impeller submergence of 91 cm (3 ft).	X		X			X	
9	3.2.1.1.b	The mixer pump shall be capable of oscillating the mixer pump nozzles +/- 180 degrees at an adjustable speed of 0.005 to 0.021 rad/s (0.05 to 0.2 r/min).	X		X		X	X	
10	3.2.1.1.c	Mixer pumps should be equipped with a VSD drive system capable of operating the mixer pump between 0% and 100% of rated full speed.	X		X		X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
11	3.2.1.1.d	The range of continuous vertical indexing for Type 3 mixer pumps shall be determined based on information from HNF-EP-0182 and HNF-SD-WM-SP-012.	X		X			X	
12	3.2.1.2 thru 3.2.1.9	*Note: these sections are the same as Section 3.2.1.1.*							
13	3.2.1.10	The DST Mixer Pump Subsystem shall measure mixer pump operation parameters to allow monitoring and control from a DST monitoring and control station located outside the tank farm radiation zone. Measure the following pump operating parameters: a. Motor bearing temperature b. Pump vibration c. Motor stator winding temperature d. Turntable rotation and orientation e. Motor radians per second (revolutions per minute) f. Motor amperes.	X		X		X	X	
14	3.2.2.a	For pumps installed in 107 cm (42-in.) nominal diameter risers, the maximum diameter of pump components below the mounting flange shall be limited to 99 cm (39 in.).	X		X				
15	3.2.2.b	For pumps installed in 86 cm (34-in.) nominal diameter risers, the maximum diameter of pump components below the mounting flange shall be limited to 79 cm (31 in.).	X		X				
16	3.2.2.c	Water supply connections to the mixer pump shall be located above grade.	X			X	X		

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
17	3.2.2.d	Mixer pumps installed over pump pits shall be supported from the cover blocks.	X						
18	3.2.2.e	The pump turntable assembly shall be located above grade.	X						
19	3.2.2.f	The DST Mixer Pump Subsystem should provide a connection capable of providing water at ≥12.6 L/s (200 gal/min) <TBR> with a pressure drop of less than 69 kPa (10 lbf/in^2) to the pump cavity. See Appendix C for <TBR> discussion.	X				X	X	
20	3.2.2.g	Isolation valves shall be provided above grade to isolate the water supply lines to the mixer pumps. Water systems that see pump discharge pressure shall be protected to prevent potential backflow. Water connections must comply with the requirements of HNF-SD-WM-TSR-006, Section 3.1.2 (LCO 3.1.2).	X				X	X	
21	3.2.3.a	The DST Mixer Pump Subsystem shall be designed for 5,000 hours of operation over a 10-year period.	X	X					
22	3.2.3.b	Mixer pump manufacturers shall provide written recommendations of operational practices such as bumping and flushing to maximize useful life.	X						
23	3.2.3.c	Reliability requirements shall be met without the need for maintenance of components located within pump pits or below the mounting flange.	X						
24	3.2.4.a	The equipment design shall minimize the time required to physically disconnect, remove, and replace the mixer pump.	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
25	3.2.4.b	The DST Mixer Pump Subsystem shall not fail in such a way as to prevent removal of the pump from the tank following any applicable DBA.	X						
26	3.2.5.2.1	The DST Mixer Pump Subsystem components shall be designed to perform their intended function in the chemical environment defined in *Best-Basis Inventory* (database) <TBR>.	X						Duplicate of General 3.2.5.2
27	3.2.5.2.3	In situ conditions regarding depths of solids, slurries, and supernants shall be assessed based on information in HNF-EP-0182. This information shall guide the selection between Type 1, 2, or 3 mixer pumps. Initial in situ waste physical properties are still <TBR> from the perspective of suction side pump design (see Appendix C).	X						
28	3.2.5.2.4	Mixer pumps shall be designed to operate with the NPSH available defined in RPP-5585.	X		X				
29	3.2.5.2.5	The in-tank temperature range for mixer pump design is 10 to 104 °C (50 to 220 °F).	X		X				
30	3.2.5.2.6	The DST Mixer Pump Subsystem shall be capable of withstanding impingement forces placed on them by other mixer pumps in the same tank, with no damage or reduction in design life.	X		X				
31	3.2.6	Steps shall be taken to ensure that equipment is not damaged during transportation.	X			X	X		
32	3.2.7	To the extent practical, mixer pump designs shall be standardized to allow use in multiple tanks.	X						Duplicate General 3.3.5

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
33	3.3	The DST Mixer Pump Subsystem shall comply with the specific sections of DOE Order 6430.1A. Only those sections specifically cited apply.	X						Not a requirement
34	3.3.1.b	The mixer pump shall meet the applicable design, fabrication, and the highest degree of dynamic balancing requirements contained in API 610.	X		X				
35	3.3.1.c	All pump structural connections that require welding shall be welded in accordance with AWS.	X		X				
36	3.3.1.d	All pump piping connections shall be welded in accordance with ASME (none of the interface connections are welded).	X		X				
37	3.3.1.e	The electric motor shall conform to NEMA MG-1 requirements.	X		X	X			
38	3.3.1.f	Electrical equipment enclosures shall meet NEMA ICS 6 standards.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.d
39	3.3.1.g	Lifting lugs or eye bolts for handling shall have a safety factor of 3 based on yield strength or 5 based on ultimate strength, whichever is more conservative.	X						
40	3.3.1.h	The DST Mixer Pump Subsystem support foundations shall be designed in accordance with ACI 318.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.c
41	3.3.1.i	The DST Mixer Pump Subsystem's net positive suction head (NPSH) required shall be less than the NPSH available (see Section 3.2.5.2.4).	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
42	3.3.1.j	Low-speed torque/power characteristic of the motor/VSD should be suitable for operational and initial in situ starting waste conditions in Section 3.2.5.2.	X	X					
43	3.3.1.k	Lifting bails and any special yokes or spreaders shall be provided that enable handling of the mixer pump in the horizontal and vertical positions, while allowing a plumb insertion of the system into the DST.	X		X	X			
44	3.3.1.l	The DST Mixer Pump Subsystem shall be capable of being lifted by a crane to an upright position from a horizontal to vertical position, without strong back and without damage to the pump or its components.	X		X	X			
45	3.3.1.m	The DST Mixer Pump Subsystem shall provide fixed, nonrotating, environmentally protected field terminations and grounding lugs for power and signal connections that comply with applicable national electrical codes and standards.	X			X			
46	3.3.1.n	Pump seals or other design features (if required by design), upon failure, shall not provide a pathway for tank waste liquids or gases to the environment.	X		X				
47	3.3.1.o	Mixer pumps shall include a sluice ring to aid installation	X		X	X			

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
48	3.3.3.b	Mixer pumps shall be provided with a stamped stainless steel tag with the following data: ▪ Manufacturer's name ▪ Manufacturer's part/item number ▪ Drawing number ▪ Year manufactured ▪ Specification number and revision(s).	X		X	X	X		
49	3.3.3.c	The identification of the installed mixer pump shall be visible above the cover block.	X		X	X	X		
50	3.3.3.d	Non-submersible motors shall be provided with a stamped stainless steel identification tag in accordance with NEMA MG-1 requirements.	X		X	X	X		
51	3.3.6.1.a	Mixer pump shielding shall be designed to keep personnel exposures as low as reasonably achievable (ALARA) in accordance with RPP-PRO-1621, and RPP-PRO-1622.	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b
52	3.3.6.2.a	The DST Mixer Pump Subsystem shall be designed to prevent collateral damage to tank structures during any applicable design-basis accident (DBA).	X						
53	3.3.8.b	All welds that will be in contact with waste shall be full penetration to eliminate crud traps.	X		X				
54	3.3.8.c	Designs should simplify dismantlement, removal, and packaging of contaminated pumps.	X						Duplicate general 3.3.8
55	3.3.8.d	The pump column (if required by design) shall be drainable.	X		X				

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
56	3.3.8.e	Surface finishes of pump components below the riser flange shall be a cost/benefit analysis at detail design by the project.	X						
57	3.3.8.f	The DST Mixer Pump Subsystem design shall provide means of internally flushing the pump bowl or volute to enable reduction of internal contamination levels before or during pump removal from the tank.	X		X				
58	3.3.8.g	Internal and external cracks, crevices, and hold-up points shall be minimized to facilitate pump cleanup for disposal.	X		X				
59	3.3.8.h	Non-flushable internal voids below the maximum waste level shall be pressurized, filled, or sealed to minimize the pump's source term of radioactive material at the end of life.	X		X				
60	3.3.8.i	The DST Mixer Pump Subsystem should use stainless steel for components that will be in contact with the waste and vapor-space environments to aid in decontamination.	X						
61	3.5.1.a	Components located below the mounting flange or internal to a pump pit shall be designed for no maintenance other than flushing or bumping.	X						
62	4.1.2.b	Capability shall be demonstrated to lift the mixer pump assembly and lower it allowing straight vertical insertion into the DST.	X		X	X			
63	4.1.2.c	Mixer pumps shall be demonstrated for installation, removal, and vertical indexing performance.	X		X	X			

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
64	4.1.2.d	The DST Mixer Pump Subsystem shall be tested in accordance with *Hydraulic Institute Standards*.	X		X				
HNF-4155 Monitor and Control Subsystem Specification									
1	3.2.1.2.a	Temperature sensor probes: Range: -10 to 200 °C (14 to 392 °F) <TBR> Resolution: 0.55 °C (1 °F) Loop accuracy: ± 2.8 °C (± 5 °F).	X				X	X	
2	3.2.1.3	The DST instrument and control component of the DST Monitor and Control Subsystem shall monitor the DST liquid waste levels. Monitoring includes measuring waste levels and transmitting the data to the DST Monitoring and Control Subsystem and/or the TMACS <TBD, see Appendix C (b)> that will receive, record, display, and compare the waste level data with operational limits: Range: 0- to 1072 cm (0- to 422 in.) AN, AP, AW, and SY tanks Range: 0- to 940 cm (0- to 370 in.) AY and AZ tanks Resolution: + 0.03 cm (0.1 in.) Loop accuracy: + 0.6 cm (1/4 in.).	X		X		X	X	
3	3.2.1.4.a	Minimum continuously detectable level of leak in annulus: 2.54 cm (1 in.).							702-AZ annulus
4	3.2.1.4.b	All DSTs equipped with operating annulus CAMs shall be monitored daily for airborne releases into the annulus that could give an indication of a leak from the primary tank structure into the annulus.							702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
5	3.2.1.5	DST Monitor and Control Subsystem shall monitor (receive, record, and display) the DST Ventilation System operational parameters to provide local, integrated status to the tank farm operator at the DST Monitor and Control Subsystem operator interface station and/or TMACS <TBD see Appendix C (b)>.	X			X	X	X	
6	3.2.1.5.a	The parameters monitored include: Tank vapor space pressure Annulus exhaust stack beta (CAM) continuous air monitor alarm status Primary exhaust stack beta CAM alarm status Standard hydrogen monitor system (SHMS) hydrogen concentration and alarm status Primary exhauster run status Annulus exhauster run status HEPA filter differential pressure.	X			X	X	X	
7	3.2.1.6.1.a	All remote-controlled valve auto/manual and position selections and indications will be provided by the DST Monitor and Control Subsystem.	X			X	X	X	
8	3.2.1.7.1.a	Project W-314 valve position sensors are connected to the DST master pump shutdown PLCs.							702-AZ annulus
9	3.2.1.7.1.b	All remote-controlled valve auto/manual and position selections and indications will be provided at the DST retrieval control system component of the DST Monitor and Control Subsystem.	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
10	3.2.1.7.2.a	The valve positions are verified according to the logic diagram, "Valve Position Verification Mode Logic" using the valve position verification screens.	X				X	X	
11	3.2.1.7.3.a	Provide prioritized, grouped, and time/date stamped alarm summary screen and event log of the DST Monitor and Control Subsystem.	X				X	X	
12	3.2.1.7.4.a	Operational Requirements – shall be able to display the valve position graphically.	X				X	X	
13	3.2.1.7.4.b	The symbol for each open valve port will be green. The symbol each closed port will be white. When in transition, the valve symbols will be yellow.	X				X	X	
14	3.2.1.7.5.a	Monitor for selected DST master pump shutdown system inputs and automatically provide an interlock to prevent a transfer if a valve located in the transfer route is in the incorrect position.	X			X	X	X	
15	3.2.1.8.1.a	The monitoring frequency of the leak detection system shall be continuous.	X				X	X	
16	3.2.1.8.2.a	The required response time of the leak detection system shall be instantaneous (less than or equal to 1 second).	X				X	X	
17	3.2.1.8.3.a	The DST master pump shutdown system shall be able to log alarms to computer disk in sequence as they occur with time and date.							Not a W-521 requirement
18	3.2.1.8.4.a	DST Monitor and Control Subsystem shall display leak detection (backflow) status.	X				X	X	
19	3.2.1.8.5.a	Respond to backflow detected by shutting down transfer pump.	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
20	3.2.1.9.1.a	The DST Monitor and Control Subsystem shall monitor and display the position of the suction bell by monitoring winch cable drum position. The DST Monitor and Control Subsystem also shall provide the capability to raise the suction bell to its uppermost position and hold it there while the mixer pump is operating.	X		X		X	X	Vendor will demo
21	3.2.1.10.1.a	The DST Monitor and Control Subsystem will monitor and display the position of the suction bell by monitoring winch cable drum position. The DST Monitor and Control Subsystem also shall provide the capability to raise the suction bell to its uppermost position and hold it there while the mixer pump is operating.	X				X	X	
22	3.2.1.10.2.a	The tank level must be a least 61-cm (24-in.) above the winch (suction) position.	X				X	X	
23	3.2.1.10.3	The DST Monitor and Control Subsystem shall record transfer pump suction intake position data <TBD>.	X				X	X	
24	3.2.1.10.4.a	The nominal winch (suction) position will be shown on the overview and tank-specific screens. Range and resolution <TBD>.	X				X	X	
25	3.2.1.11.1.a	The DST Monitor and Control Subsystem will provide pump auto/manual, on/off and start/stop selections and indications.	X				X	X	
26	3.2.1.12.1.a	Instrumentation will provide the following transfer pump monitoring and control functions to the DST Monitor and Control Subsystem: motor speed and amperage, seal gas flow and pressure and motor winding temperature. Signal scaling <TBD>.	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
27	3.2.1.12.2.a	Interlocks will be provided to prevent equipment damage or harm to the environment or personnel. Operational limits <TBD>.	X				X	X	
28	3.2.1.12.3.a	The DST Monitor and Control Subsystem shall provide on-line historical and real-time trending (recording) of process parameters with report capability for a period of one week.	X				X	X	
29	3.2.1.12.4.a	The running status of waste transfer pumps shall be displayed at the waste transfer annunciator set of master pump shutdown system human machine interface (HMI) graphical screens. Ranges and resolution <TBD>.	X				X	X	
30	3.2.1.12.5.a	The DST Monitor and Control Subsystem shall shut down transfer pump on -High-High motor current or -High-High-motor winding temperature. Off-normal values <TBD>.	X				X	X	
31	3.2.1.13.1.a	The DST Transfer Valving Subsystem shall provide the capability to measure and transmit the waste flow rate at the transfer pump discharge.	X				X	X	
32	3.2.13.2.a	Monitoring and control of the waste transfer flow rate will be programmed into the PLC, including proportional, integral, and derivative (PID) algorithms.	X				X	X	
33	3.2.13.2.b	Flow rate (mass flow and volumetric flow) loop accuracy shall be $\pm$5 percent of process range.	X		X		X	X	
34	3.2.13.3.a	The DST Monitor and Control Subsystem shall record transfer pump flow rate continuously (mass flow and volumetric flow).	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
35	3.2.1.13.4.a	The dynamic process and equipment operating data associated with waste transfer routes shall be displayed on the waste transfer annunciator set of master pump shutdown machine interface graphical screens.	X				X	X	
36	3.2.1.13.4.b	Flow-rate range is 0- to 757 L/min (0- to 200 gal/min) <TBR>.	X		X		X	X	
37	3.2.1.13.5	The DST Monitor and Control Subsystem shall respond to abnormal waste transfer flow rate <TBD>. [See Appendix C (c)].	X				X	X	
38	3.2.1.14.1.a	The DST Transfer Valving Subsystem shall provide the capability to measure and transmit transfer pump discharge pressure.	X				X	X	
39	3.2.1.14.2.a	Pressure loop accuracy shall be $\pm$5 percent of process range.	X		X		X	X	
40	3.2.1.14.3.a	The DST Monitor and Control Subsystem shall continuously record transfer pump discharge pressure.	X				X	X	
41	3.2.1.14.4.a	The dynamic process and equipment operating data associated with waste transfer routes shall be displayed on the waste transfer annunciator set of master pump shutdown machine interface graphical screens.	X				X	X	
42	3.2.1.14.4.b	Pressure range is 0- to 5960 kPa (0- to 850 lbf/in^2) <TBR>.	X		X		X	X	
43	3.2.1.14.5.a	The transfer pump shall have a discharge pressure High-High interlock. (Pressure value <TBD>)	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
44	3.2.1.15.1.a	The DST Transfer Valving Subsystem shall provide the capability to measure and transmit waste density (and temperature) at the transfer pump discharge.	X				X	X	
45	3.2.1.15.2.a	Density shall have a loop accuracy of ±5 percent of process range.	X		X		X	X	
46	3.2.1.15.2.b	Temperature shall have a loop accuracy of ±2.8 °C (±5 °F).	X		X		X	X	
47	3.2.1.15.3.a	The system shall continuously record density and temperature of waste being transferred.	X				X	X	
48	3.2.1.15.4.a	The dynamic analog data associated with waste transfer routes shall be displayed on the waste transfer annunciator set of master pump shutdown HMI graphical screens.	X				X	X	
49	3.2.1.15.4.b	Density range is 0.9000 to 1.5000 g/cm^3 with an accuracy of 0.0005 g/cm^3 <TBR>.	X		X		X	X	
50	3.2.1.15.4.c	Temperature range is -10 to 200 °C (14 to 392 °F) with an accuracy of ±2.8 °C (±5 °F).	X		X		X	X	As applicable
51	3.2.1.15.5	The DST Monitor and Control Subsystem shall respond to abnormal waste density/temperature <TBD see Appendix C (d)>.	X				X	X	
52	3.2.1.16.1.a	The leak detection system sensor shall be compatible with the DST Monitor and Control Subsystem and the master pump shutdown system.	X				X	X	
53	3.2.1.16.2.a	The monitoring frequency of the pit leak detection system shall be continuous.	X				X	X	Same as Monitor and Control Subsystem 3.2.1.8.1.a

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
54	3.2.1.16.3.a	The required response time of the pit leak detection system shall be instantaneous (less than or equal to 1 second).	X				X		Same as Monitor and Control Subsystem 3.2.1.8.2.1.a
55	3.2.1.16.4.a	The DST master pump shutdown system shall be able to log alarms to computer disk in sequence as they occur with time and date.	X				X	X	
56	3.2.1.16.5.a	The DST master pump shutdown system shall be able to display graphically on the HMIs the selected transfer routes (including status of input/output elements) in the waste transfer annunciator mode of operation.	X				X	X	
57	3.2.1.16.6.a	Monitor for selected DST master pump shutdown system inputs and automatically shut down the transfer pump if an input is detected.	X				X	X	
58	3.2.1.17.1.a	The DST Transfer Piping System shall detect leakage from the primary confinement piping into the secondary confinement piping.	X				X	X	
59	3.2.1.17.2.a	The monitoring frequency of the low point leak detection system shall be continuous.	X				X	X	Same as Monitor and Control Subsystem 3.2.1.8.1.a
60	3.2.1.17.3.a	The required response time of the low point leak detection system shall be instantaneous (less than or equal to 1 second).	X				X	X	Same as Monitor and Control Subsystem 3.2.1.8.2.1.a
61	3.2.1.17.4	DST Monitor and Control Subsystem shall record primary confinement piping leak detection data.	X				X	X	
62	3.2.1.17.5.a	The DST master pump shutdown system shall be able to display graphically on the HMIs the selected transfer routes (including status of input/output elements) in the waste transfer annunciator mode of operation.	X				X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
63	3.2.1.17.6.a	Monitor for selected DST master pump shutdown system inputs and automatically shuts down the transfer pump if an input is detected.	X				X	X	
64	3.2.1.18.a	Accuracy: ±0.6 cm (±1/4 in.) in sending and receiving tank plus transfer line volume as applicable for tank level to tank level material balance.	X		X		X	X	
65	3.2.1.18.b	Accuracy: ±5 percent of range for flow and ±0.6 cm (±1/4 in.) for level for totalized flow to tank level comparison.	X		X		X	X	
66	3.2.1.19.a	Accuracy: ±0.6 cm (±1/4 in.) in sending and receiving tank plus transfer line volume as applicable for tank level to tank level material balance.	X		X		X	X	Same as Monitor and Control Subsystem 3.2.1.18.a
67	3.2.1.19.b	Accuracy: ±5 percent of range for flow and ±0.6 cm (±1/4 in.) for level for totalized flow to tank level comparison.	X		X		X	X	Same as Monitor and Control Subsystem 3.2.1.18.b
68	3.2.1.20.1.a	All pump auto/manual, on/off, and start/stop selections and indications will be provided to the monitoring system.	X				X	X	
69	3.2.1.21.1.a	Instrumentation shall provide the following monitoring and control functions for the mixer pump: motor speed and amperage, motor bearing temperature, motor stator winding temperature, turntable rotation and orientation, pump vibration, and nozzle discharge pressure. Signal scaling <TBD>.	X		X		X	X	

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
70	3.2.1.21.2.a	Interlocks will be provided to prevent equipment damage or harm to the environment or personnel (this implies that a pump parameter is compared with an operational limit). Operational limits <TBD>.	X				X	X	Same as Monitor and Control Subsystem 3.2.1.12.2.a
71	3.2.1.21.3.a	The DST Monitor and Control Subsystem shall provide on-line historical and real-time trending (recording) of process parameters with report capability for a period of one week.	X				X	X	
72	3.2.1.21.4.a	The DST Monitor and Control Subsystem shall provide indication of monitored parameters. Ranges and resolution <TBD>.	X				X	X	
73	3.2.1.21.5.a	Shut down mixer pump for the following reasons: Motor Vibration (High-High) Motor current (High-High) Motor winding temperature (High-High) Bearing temperature (High-High) Off-normal values <TBD>.	X		X		X	X	
74	3.2.2.a	All permanently installed operator interface screens shall be sized such that they are readable from a distance of 1.52 m (5 ft) [suggest a minimum 53 cm (21 in.) diagonal measurement].	X				X	X	
75	3.2.2.b	The physical arrangement and location of controls, displays, and alarms on control panels and HMI displays shall provide for efficient use of controls and rapid and accurate viewing of the displays and shall be in-accordance with *General Design Criteria*, DOE Order 6430.1A.	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
76	3.2.4.a	The maintainability guidance provided in *Human Factors Design Guidelines for Maintainability of DOE Nuclear Facilities*, UCRL, 15673, shall be considered during subsystem design.	X						
77	3.2.4.b	Equipment and instruments requiring personnel access for periodic calibration or maintenance shall not be located beneath cover blocks or in areas where personnel exposures are not as low as reasonably achievable (ALARA).	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b
78	3.2.4.c	Instrument isolation valves for instrument sensor isolation and equalization shall be located outside of the primary transfer-associated structures.	X						
79	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.	X						Duplicate of General 3.2.5.1.a
80	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.	X						Same as General 3.2.5.1.b
81	3.2.5.2.1	The subsystem components 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.	X						Duplicate of General 3.2.5.2

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
82	3.2.5.2.2	Components in contact with the waste shall be designed for the 1,000 rad/h 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.	X						Duplicate of General 3.2.5.2
83	3.2.7.a	The DST Monitor and Control Subsystem design shall allow for the provision of spare or expandable input/output capability and the flexibility to change software to provide for future expansion.	X						
84	3.3	The DST Monitor and Control Subsystem shall comply with DOE Order 6430.1A, Sections 1300-7 and 1323.	X						Duplicate of General 3.3
85	3.3.1.a	Drawings for projects shall be prepared in accordance with the requirements of *Preparation and Control Standard for Engineering Drawings*, RPP-PRO-709.	X						Duplicate of General 3.4.a
86	3.3.1.b	Electrical materials and equipment shall be Underwriters Laboratories, Inc. (UL)- or factory material (FM)-tested, with label attached, for the purpose intended, whenever such products are available. Where there are no UL- or FM-listed products of the type, testing, and certification by another nationally recognized testing agency may be acceptable. Installation methods shall be in accordance with the manufacturer's instructions, with *National Electrical Code*, NFPA 70, and with other applicable requirements.	X		X				Duplicate of General 4.1.2

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
87	3.3.2	The subsystem shall comply with electromagnetic radiation emission requirements set forth in *A List of EMI/EMC Requirements*, HNF-2962.	X						Duplicate of General 3.3.2
88	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," HNF-IP-0842, Volume II, Section 6.1. Equipment identifiers within the HMI interface screens shall be consistent with the equipment label in the field.	X						Duplicate of General 3.3.3.a
89	3.3.4	Reserved. The requirements for workmanship are to be addressed in lower level project design documentation (drawings, procurement specifications, etc.).							Not a requirement
90	3.3.5	All like equipment and parts shall be interchangeable/standardized to the maximum extent practical.	X						Duplicate of General 3.3.5
91	3.3.6.1.a	The subsystem shall incorporate design features that comply with the requirements of *Tank Farms Health and Safety Plan*, HNF-SD-WM-HSP-002.	X						Duplicate of General 3.3.6.1.b
92	3.3.6.1.b	The DST Monitor and Control Subsystem shall be designed to keep personnel exposures as low as reasonably achievable (ALARA) in accordance with *Radiological Design Review Process*, RPP-PRO-1622, and *ALARA Decision-Making Methods*, RPP-PRO-1621.	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
93	3.3.6.1.c	Warning and alarm systems shall be designed to ensure that they can be heard at the local noise levels of the area they are intended to cover.	X				X	X	
94	3.3.6.2.a	All activities shall satisfy the tank dome loading requirements specified in HNF-SD-WM-TSR-006, Section 5.16.	X						Same as General 3.3.6.2
95	3.3.6.3.a	The DST Monitor and Control Subsystem and components shall be designed in accordance with safety classifications. The safety classification shall be determined using the processes described in *Safety Analysis and Technical Safety Requirements*, RPP-PRO-700; *Safety Analysis Process - Facility Change or Modification*, RPP-PRO-702; *Safety Analysis Process - New Project*, RPP-PRO-703; and *Hazard and Accident Analysis Process*, RPP-PRO-704. Preliminary safety classifications area provided for reference in Appendix B.	X						
96	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.	X		X		X		As appropriate
97	3.3.7.a	Subsystem design shall comply with DOE Order 6430.1A, Section 1300.12, "Human Factors Engineering."	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
98	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.	X						
99	3.3.8.b	Designs should simplify cut-up, dismantlement, removal, and packaging of contaminated components.	X						Same and General 3.3.8
100	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 RPP-PRO-709.	X						Same as General 3.4.a
101	3.4.b	All DST Monitor and Control Subsystem structures, systems, and components (SSC) shall be incorporated into the master equipment list and Safety Equipment List in accordance with <TBD>.	X						Same as General 3.4.b
	3.4.c	Procured software within the definitions of *Computer Software Quality Assurance Requirements*, RPP-PRO-309, shall be subject to the controls and documentation requirements listed in RPP-PRO-309, Section 2.3.	X		X		X		

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
102	3.4.d	Software generated on site and within the definitions of RPP-PRO-309 shall be developed, verified and validated, meet the documentation requirements and be under the configuration management controls of RPP-PRO-309.	X						
103	3.5.1	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:	X						
104	3.5.1.a	Instrument components external to transfer-associated structures shall be designed for minimal contact maintenance and hands-on operation.	X						
105	3.5.1.b	All components requiring maintenance, calibration, or hands-on operation shall be located external to the pits. Transmitters for the liquid level, flow, and pressure shall be located external to the pits.	X						
106	3.5.2	The subsystem shall use readily available commercial parts and components to the greatest extent practical.	X						
107	3.5.2.a	Minimum numbers of spares for like components shall be determined during design, based on mean time between failure and the number of like components installed.	X						

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
108	3.7	The major elements of the DST Monitor and Control Subsystem are as follows: DST master pump shutdown system DST instrument and control system.							Not a requirement
109	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 a requirement
110	3.9.a	Operator interface station and engineering workstations must maintain personnel access software so that the system will only allow certain log-in groups to perform the desired functions.	X				X	X	
111	4.0	Quality assurance for the DST Monitor and Control Subsystem shall be performed in accordance with "Quality Assurance Program," HNF-IP-0842, Volume XI, Section 1.0.	X						
HNF-4161Transfer Piping Subsystem Specification									
1	3.2.1.1.a	The primary confinement piping shall confine waste at a design pressure of 3103 kPa (650 lbf/in^2 gauge) <TBR> (see Appendix C).	X			X	X		Same as DST Diluent and Flush Subsystem 3.3.1.r

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
2	3.2.1.2.a	The secondary confinement piping should confine waste at the same design pressure as the primary confinement pipe.	X			X	X		
3	3.2.1.3.a	The leak detector sensor combined with the secondary confinement seal loop jumper (from the DST Transfer Valving Subsystem) shall be designed and operated such that it will detect the failure of the primary containment or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within 24 hours. The amount of anticipated leakage to actuate the leak detector shall be calculated during design of the system. The Washington State Department of Ecology, through the final status permitting process, may approve or disapprove the final system design.	X						
4	3.2.1.3.b	The leak detector sensors shall be compatible with the leak detection system requirements in the DST Monitor and Control Subsystem specification.	X				X	X	
5	3.2.1.4.a	The primary confinement piping shall confine the diluent/flush water at the design pressure defined in Section 3.2.1.1.a.	X			X	X		
6	3.2.2.a	Primary confinement piping should be 80-mm (3-in.) inside diameter <TBR> (See Appendix C.)	X						
7	3.2.2.b	Transfer piping shall slope continuously from the high point(s) to a transfer-associated structure(s) with a minimum slope greater than 0.25%.	X			X			

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
8	3.2.2.c	The heat transfer properties of the as-installed piping subsystem shall be such that the waste heat loss is less than 25.6 Joules (26.2 Btu/h per foot) of pipe at the maximum waste temperature and flow rate.	X						
9	3.2.3.a	The DST Transfer Piping Subsystem shall have a design life of 35 years.	X						Same as DST Diluent and Flush Subsystem 3.2.3.a
10	3.2.3.b	Pipe bends in the primary confinement piping should have a minimum bend radius of five pipe diameters.	X			X			
11	3.2.4.a	The low point leak detector sensors shall be repairable or replaceable within 8 hours. Time to repair does not include preparatory work, such as preparing procedures, staging personnel and equipment, or conducting preparatory training.	X						
12	3.2.4.b	The continuous leak detectors shall be repairable or replaceable within <TBD> hours. Time to repair does not include preparatory work, such as preparing procedures, staging personnel and equipment, or conducting preparatory training.	X						
13	3.2.5.2.3	The subsystem components shall be fabricated using materials compatible with the pumping of solutions over the range specified in Waste Feed Delivery Transfer System Analysis, RPP-5346, Table 5-1..	X						
14	3.2.6	Not applicable. (Transportation)							Not A Requirement
15	3.2.7	Not applicable. (Flexibility and Expansion)							Not A Requirement

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
16	3.3.1.a	The primary and secondary confinement piping and leak detector riser pressure boundary, shall be designed, fabricated, and installed in accordance with ASME B31.3.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.a
17	3.3.1.b	Primary confinement pipe shall be ASTM A312, Type 304L stainless steel.	X			X			
18	3.3.6.1.a	Routing and shielding of the transfer piping shall be designed to keep personnel exposures as low as reasonable achievable (ALARA) in accordance with RPP-PRO-1621 and RPP-PRO-1622.	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b
19	3.3.6.2.a	The subsystem shall incorporate corrosion prevention and control features in accordance with WAC 173-303-640(3) for final status facilities and 40 CFR 265, Subpart J for interim status facilities; DOE Order 6430.1A, Section 0262; and DOE Order 5820.2A, Chapter 1, Sec. 3.b(2)(g). The design of the subsystem shall allow for detection of a leak within 24 hours.	X						
20	3.3.6.2.b	Cathodic Protection Systems, if required, shall be designed in accordance with the guidelines provided in NACE RP 0285-95 and NACE RP 0169-96.	X				X		
21	3.3.6.2.c	The subsystem shall be designed to withstand soil loads imposed by an AASHTO H20-44 wheel loading and a 100,000-lb crane loading in the tank farm area.	X						
22	3.3.8.b	Primary piping and encasements shall be fully drainable.	X				X		

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
23	3.3.8.c	Piping shall be designed and fabricated to minimize crud traps.	X			X			
24	3.5.1.a	Below-grade portions of the subsystem either shall not require preventive or corrective maintenance over the design life or shall be designed for preventive or corrective maintenance without requiring excavation.	X						
25	3.5.1.b	If cathodic protection is required, test stations shall be designed for limited contact maintenance and operation.	X						Same as DST Diluent and Flush Subsystem 3.5.1.a
26	3.5.1.c	If cathodic protection is required, the subsystem shall be designed to have the capability to periodically test sources of impressed current.	X				X		
27	3.5.1.d	Leak detectors shall be capable of being functionally tested.	X				X	X	
28	3.5.3	The subsystem shall provide the connections to periodically test the integrity of the primary and secondary confinement piping.	X				X	X	
29	4.1.2.b	The encasement pipe will be examined in accordance with Paragraph 341 of ASME B31.3 for normal fluid service. The requirement for 5% random radiography will be increased to 20%. In-process examination in accordance with Paragraph 344.7 may be substituted for the radiographic examination. If in-process examination is used, the root pass shall be examined by either the liquid penetrant or magnetic particle method.	X			X			

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
30	4.1.2.c	In addition to the requirements of ASME B31.3, all secondary confinement piping welds will be examined either by the liquid penetrant test or by the magnetic particle test. The exception is longitudinal welds, which are required to be examined by ultrasonic test. The requirement for ultrasonic examination of longitudinal welds is in addition to any nondestructive examination required during the manufacture of the pipe. Examinations by liquid penetrant test, magnetic particle test, and ultrasonic test will be performed in accordance with the requirements of ASME Section V. The acceptance criteria for these examinations will be in accordance with the requirements of ASME Section III, ND-5300.	X			X			
31	4.1.2.d	Material coupons, traceable to the heat number(s) of the pipe, will be tested to verify that the chemical and physical properties comply with the applicable ASTM Standards for the pipe. Certified Material Test Reports for the pipe will be submitted as a quality record.	X			X			
32	4.1.2.e	Secondary confinement piping shall be leak tested hydrostatically or pneumatically. Hydrostatic tests shall be performed at 150% of design pressure in accordance with the test methodology in ASME B31.3. Pneumatic tests shall be performed to 120% of design pressure in accordance with the test methodology in ASME B31.3.	X			X			

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
33	4.1.2.f	In addition to the requirements of ASME B31.3, all primary pipe welds shall be examined by 100% radiography.	X			X			
HNF-4162 Transfer Pump Subsystem Specification									
1	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 8.8 L/s (140 gal/min) <TBR>.	X				X	X	
2	3.1.2.1.1.b	The DST Transfer Pump Subsystem shall accept 8.8 L/s (140 gal/min) <TBR> backflush of water through the discharge of the pump, without damaging the pump.	X				X	X	
3	3.1.2.1.2.a	DST transfer pumps shall operate with 480 V ac, 3-phase, 60 Hz, electric power.	X		X	X	X	X	
4	3.1.2.1.3.a	The DST Transfer Pump Subsystem shall be physically supported by the DST Confinement Subsystem.	X			X			
5	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.	X	X	X			X	
6	3.1.2.1.5.a	The DST Transfer Pump Subsystem shall be designed to operate using industry standard control signals.	X				X	X	
7	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.	X						

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
8	3.2.1.1.b	The transfer pump shall be capable of delivering 10.1 L/s (160 gal/min) <TBR> (2.16 m/s [7.1 ft/s] <TBR> in 80 mm [3 in.] schedule 40 pipe) at heads ranging from 195 m (640 ft) <TBR> down to 15 m (50 ft), as measured at the pump discharge above the mounting flange.	X		X		X	X	
9	3.2.1.1.c	The transfer pump shall have a continuously rising head/capacity curve from the rated capacity to shutoff.	X		X				
10	3.2.1.1.d	The shutoff head of the transfer pump shall not exceed 268 m (880 ft) <TBR> as measured at the pump discharge above the mounting flange.	X		X				
11	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.	X		X				
12	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) <TBR>.	X		X				
13	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.	X		X				
14	3.2.1.2.a	The system shall be capable of adjusting the pump intake from 6.1 m (20 ft) <TBR> above the bottom of the tank to the level defined by Section 3.2.1.1.e for an empty tank.	X		X		X	X	
15	3.2.1.2.b	The system shall be capable of starting to within 117 cm (46 in.) <TBR> of the tank bottom.	X		X				

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
16	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.	X		X		X	X	
17	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.	X		X				
18	3.2.1.5.a	The DST Transfer Pump Subsystem shall be capable of routing water to the pump suction at 6.3 L/s (100 gal/min) <TBR>.	X		X		X	X	
19	3.2.1.6.a	The DST Transfer Pump Subsystem shall monitor Pump speed (if variable speed drive is utilized)	X		X				
20	3.2.1.6.b	The DST Transfer Pump Subsystem shall monitor motor amperage or power indication	X		X				
21	3.2.1.6.c	The DST Transfer Pump Subsystem shall monitor any other parameter, if required by design	X		X				
22	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.	X			X			
23	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.	X		X	X			

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
24	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.	X		X	X			
25	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.	X		X	X			Same as Mixer Pump Subsystem 3.3.1.m
26	3.2.2.e	Electrical equipment enclosures shall meet National Electrical Manufacturers Association (NEMA) Standards.	X		X	X			Same as DST Diluent and Flush Subsystem 3.3.1.d
27	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.	X		X	X			
28	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.	X			X			
29	3.2.2.h	The electric motor shall conform to NEMA MG-1 standards.	X			X			Same as Mixer Pump Subsystem 3.3.1.e
30	3.2.2.i	The transfer pump design shall be self-venting.	X		X	X			
31	3.2.3.a	The DST Transfer Pump Subsystem shall have a minimum design life of 5,000 hours of operation over a 10-year period.	X		X				

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
32	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.	X			X			Same as Mixer Pump Subsystem 3.2.3.b
33	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.	X						
34	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.	X						
35	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.	X						
36	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.	X						
37	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.	X			X	X	X	
38	3.2.4.f	The equipment design shall minimize the time required to physically disconnect, remove, and replace the transfer pump.	X						

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
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39	3.2.4.g	The equipment design shall allow access to maintainable components for repair and/or troubleshooting.	X						
40	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).	X						
41	3.2.5.2.3.a	The transfer pump shall remain removable from the tanks following a gas release rollover event and crust impact.	X						
42	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.	X						
43	3.2.5.2.4.a	The in-tank temperature range for transfer pump design is 10 to 104 °C (50 to 220 °F).	X						
44	3.2.5.2.4.b	The transfer pump shall be able to withstand the thermal shock of a 38 °C (100 °F) temperature difference, corresponding to insertion of a cold pump in a hot tank and the use of cold flush/dilution water into a hot pump.	X	X					
45	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.	X		X				
46	3.2.6	Steps shall be taken to ensure that equipment is not damaged during transportation.	X			X			Same as Mixer Pump Subsystem 3.2.6
47	3.3.1.a	All transfer pumps shall meet the applicable design, fabrication, and testing requirements contained in API 610. The highest degree of dynamic balancing shall be specified.	X		X		X		Same as Mixer Pump Subsystem 3.3.1.b

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
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48	3.3.1.b	Welding shall be performed and inspected in accordance with American Welding Society and/or American Society of Mechanical Engineers requirements.	X		X				
49	3.3.3.b	Transfer pumps shall be provided with a manufacturer's nameplate securely attached to the top of the mounting/adapter flange. The nameplate shall be stamped with the following information, at the minimum: ▪ Purchase order number ▪ Manufacturer's size and model # ▪ Pump serial number ▪ Capacity ▪ Pumping head ▪ Casing hydrostatic test pressure ▪ Rated speed ▪ Rated power (if pump has submersible-type motor) ▪ Bearing part number identification ▪ Assembly weight (dry)	X			X			
50	3.3.3.c	Non-submersible electric motors shall be provided with permanently attached nameplates in accordance with NEMA MG-1.	X			X			Same as Mixer Pump Subsystem 3.3.1.e
51	3.3.3.d	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.	X			X			
52	3.3.6.1.a	The radiological design review process of RPP-PRO-1622 shall be used to keep personnel exposures ALARA.	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
53	3.3.8.b	Designs should simplify cut-up, dismantlement, removal, and packaging of contaminated pumps	X						Same as General 3.3.8
54	3.3.8.c	The complete pump assembly column shall be self-draining.	X		X				
55	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.	X		X				
56	3.3.8.e	Internal and external cracks, crevices, and hold-up points shall be minimized to facilitate pump cleanup for disposal.	X		X				Same as Mixer Pump Subsystem 3.3.8.g
57	3.4.c	Vendor information shall be managed in accordance with HNF-IP-0842, Volume IV, Section 4.23.	X						
58	3.5.1.a	Transfer pumps shall be designed to require no routine "hands-on" maintenance.	X						
59	4.1.2.a	Each transfer pump shall be tested for hydraulic and mechanical performance, in accordance with *Hydraulic Institute Standards* and API 610.	X		X				
60	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.	X		X	X			Same as Mixer Pump 3.3.1.k
61	4.1.2.d	Pump insertion into and removal from the tank shall be demonstrated for each Type 1, 2, 3, and 4 design.	X		X	X			

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
62	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.	X			X			
HNF-4157 Utility Subsystem Specification									
1	3.1.2.1.1.a	The DST Electrical Power Subsystem shall obtain electricity from the Central Plateau Electrical System as indicated in Table 3-1.	X			X			
2	3.1.2.1.2.a	The DST Raw Water Subsystem shall be designed to operate within the values in Table 3-2.	X			X	X	X	
3	3.1.2.1.3.a	The DST Potable Water Subsystem shall be designed to operate within the values in Table 3-3.	X				X	X	
4	3.1.2.1.4.a	The DST Service Air Subsystem shall be designed to operate with 480 V ac 60 Hz, three-phase electrical power.	X				X	X	
5	3.1.2.1.5.1.a	The DST Instrument Air Subsystem shall be designed to operate with 240/120 V ac 60 Hz.	X				X	X	
6	3.1.2.1.5.2.a	The DST Instrument Air Subsystem shall be designed to operate within the values in Table 3-5.	X				X	X	
7	3.2.1.1.a	The DST farm electrical distribution subsystem shall have a leading or lagging power factor of greater than 85 percent.	X				X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
8	3.2.1.1.1.a	RPP-5228, Assessment of the Electrical Power Requirements for Continued Safe Storage and Waste Feed Delivery Support (SSTs/DSTs) includes a detailed assessment of existing electrical demand and projected demand required for Waste Feed Delivery. The results of this assessment are included in Table 3-1. Actual tank farm loads shall be as determined by detail design and controlled by xx-xxx <TBD>, *Tank Farm Contractor Electrical Load Study*.	X				X	X	
9	3.2.1.1.1.b	The DST Electrical Power Subsystem distribution shall provide voltage regulation in compliance with ANSI C84.1.	X				X	X	
10	3.2.1.1.2.a	Exterior and interior lighting shall comply with The IESNA Lighting Handbook.	X			X			
11	3.2.1.1.3.a	The DST electrical power subsystem distribution shall provide 240/120 V ac or 208/120 V ac services to the DST System equipment.	X			X	X	X	
12	3.2.1.1.4.a	A back-up power source shall be provided for DST System components that require backup power on the failure of the normal power source.	X				X	X	
113	3.2.1.2.a	RPP-5227 includes a detailed assessment of existing raw and strained water demand and projected demand required for Waste Feed Delivery. The results of this assessment are included in Table 3-2. Actual tank farm loads shall be as determined by detail design and controlled by xx-xxx <TBD>, *Tank Farm Contractor Water Load Study*.	X				X	X	

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
14	3.2.1.2.b	The DST Raw Water Subsystem shall provide connections to allow up to 12.6 L/s (200 gal/min) <TBR> of strained raw water at 552 kPa (80 lbf/in^2 gauge) <TBR> to the DST Maintenance and Recovery Subsystem.	X			X	X	X	
15	3.2.1.2.c	DST Raw Water from the Central Plateau Water System shall be strained and distributed to the DST System Components requiring strained raw water. As a minimum, the water shall be strained to eliminate particulates greater than <TBD>.	X			X	X	X	
16	3.2.1.2.d	Where strained raw water can be connected to sources of contamination, a backflow prevention device shall be installed between the potential contamination source and the strained water piping. A pressure switch with interlock, or isolation with two closed valves and a pressure switch, may be used.	X			X	X	X	
17	3.2.1.3.a	RPP-5227 includes a detailed assessment of existing potable water demand and projected demand required for Waste Feed Delivery. The results of this assessment are included in Table 3-3. Actual tank farm loads shall be as determined by detail design and controlled by xx-xxx <TBD>, *Tank Farm Contractor Water Load Study*.	X				X	X	
18	3.2.1.4.a	RPP-5227 includes a detailed assessment projected demand for Service Air required for Waste Feed Delivery. The results of this assessment are included in Table 3-4. Actual tank farm loads shall be as determined by detail design.	X				X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
19	3.2.1.5.a	RPP-5227 includes a detailed assessment projected demand for Instrument Air required for Waste Feed Delivery. The results of this assessment is included in Table 3-5. Actual tank farm loads shall be as determined by detail design.	X				X	X	
20	3.2.1.5.b	The instrument air shall be conditioned to obtain a dew point of at least –40 °C (-40 °F), particulate filtered to a maximum particle size of 3 microns, and oil content not to exceed 1 p/m.	X				X	X	
21	3.2.2.a	Underground utility lines such as sanitary sewer, water, and air shall not be placed under existing or proposed pavements, except when crossing such pavements or when adequate space is not available. Utility lines shall be placed between backslope of road ditch and building or back of curb.	X			X			
22	3.2.2.b	Water mains shall not be installed in the same trench with sewer lines. Where water mains and sewer lines are installed parallel to roadways, they shall, if practicable, be located on opposite sides of roadways.	X			X			
23	3.2.2.c	Where feasible, sewer lines shall not be routed within 3 m (10 ft) of potable water lines or fire lines. Where potable water lines must cross sewer lines, water lines shall pass 0.6 m (2 ft) above the sewer line.	X			X			

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
24	3.2.3.a	The 480/277 V ac electrical distribution subsystem reliability shall comply with IEEE 493 to ensure a continuous power supply to systems and equipment designated as critical.	X				X	X	
25	3.2.3.b	All of the DST utility subsystems shall have a design life of 35 years.	X						Same as DST Diluent and Flush Subsystem 3.2.3.a
26	3.2.4.a	The DST Electrical Subsystem distribution should be designed such that required preventive maintenance or calibration can be performed outside of the tank farms.	X						
27	3.2.4.b	The DST Raw Water Subsystem distribution shall be designed such that required testing of raw water backflow preventers can be performed outside of the tank farms.	X		X		X	X	
28	3.2.4.c	The DST Raw Water Subsystem shall provide shut-off valves to isolate equipment, valves, or appurtenances for ease of maintenance.	X			X			
29	3.3.1.1.a	All general service DST Utilities Subsystem structures shall meet the applicable design, test, and construction requirements contained in ACI 318.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.c
30	3.3.1.2.a	Indoor electrical equipment enclosures shall be NEMA Type 12.	X			X			

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
31	3.3.1.2.b	Adverse effects of voltage-level variations, transients, and frequency variations (i.e., power quality) on equipment operation shall be minimized, and sensitive electrical equipment, such as monitoring and control and data-processing equipment, shall be isolated as needed for power quality protection.	X						
32	3.3.1.2.c	The DST Electrical Power Subsystem distribution system modification shall comply with NFPA 70.	X			X			
33	3.3.1.2.d	Subsystem protection shall comply with Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems, IEEE 242.	X			X			
34	3.3.1.2.e	Switchgear (i.e., motor control centers and control panels) shall comply with IEEE Standards Collection: IEEE C37 Series.	X			X			
35	3.3.1.2.f	Exterior lighting system control shall use time clocks and/or photocells to provide illumination only when needed.	X			X			
36	3.3.1.2.g	Interior lighting shall make maximum use of florescent and/or high-intensity discharge lighting.	X						
37	3.3.1.2.h	Outdoor electrical equipment enclosures shall be NEMA Type 4 or Type 4x.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.d

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
38	3.3.1.2.i	The following electrical calculations shall be provided or existing calculations shall be revised when any addition to the electrical system load is required. SKM Power Tool Electrical Engineering Software by SKM System Analysis shall be used. Load Flow Calculation Coordination Study Calculation Short Circuit Fault Study.	X						
39	3.3.1.2.j	Any modifications to the Site electrical utilities distribution system, including the 13.8 kV ac – 480 V ac transformers, shall conform to the ANSI C2.	X			X			
40	3.3.1.2.k	New or upgraded Electrical Utility transformers shall be sized and installed in accordance with IEEE C57.	X			X			
41	3.3.1.2.l	Electrical equipment, identified as Electrical Utilities-owned, shall be designed in accordance with Electrical Utilities Design Authority project design criteria.	X						
42	3.3.1.2.m	Electrical design and installation shall comply with the electrical safety installations requirements outlined in RPP-PRO-089, Rev. 0.	X						
43	3.3.1.3.a	All valves shall meet the applicable design and fabrication requirements contained in ASME B16.34.	X		X				Same as DST Diluent and Flush Subsystem 3.3.1.b

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
44	3.3.1.3.b	For raw water lines entering a tank farm or radiation zone, cross connection control devices (backflow prevention assemblies) shall be installed to prevent contamination of the potable water supply. Cross connection control shall be in accordance with Washington State cross connection control regulations (RCW 19.27 and WAC-246-290-490). Backflow prevention devices shall be selected from the Washington State Approved list of backflow prevention assemblies. The devices shall be installed and the installation shall be tested in accordance with the Manual of Cross-Connection Control published by the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, and the Cross-Connection Control Manual, Accepted Practice and Procedure published by the Pacific Northwest Section of the American Water Works Association.	X				X		
45	3.3.1.3.c	All water piping shall be designed in accordance with the Uniform Plumbing Code of the International Association of Plumbing and Mechanical Officials.	X			X			
46	3.3.1.3.d	Extension of existing Central Plateau Water System distribution headers required to obtain additional raw/potable water capacity to a given tank farm shall be designed and installed in accordance with the DOH 331-123; RCW 19.27; WAC-246-290; and *Criteria for Sewage Works Design*.	X				X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
47	3.3.1.3.e	For branch lines in the Central Plateau Raw and Potable Water distribution systems, the DST Raw Water Subsystem and DST Potable Water Subsystem shall provide flow meters capable of sending compatible signals to the DST Monitor and Control Subsystem for totalizing flows for leak-detection analysis. Flow meters shall include local indication.	X			X	X	X	
48	3.3.1.3.f	When piping branches of the DST Raw Water Subsystem can be connected such that there is potential contamination to the subsystem piping, the branch line(s) shall be equipped with backflow prevention devices to prevent contamination via siphoning or backflow of waste.	X			X	X	X	
49	3.3.1.3.g	Air compressors shall be skid mounted, self-contained units with built-in cooling capability.	X			X	X	X	
50	3.3.1.3.h	All piping shall be designed, constructed, installed, and tested per ASME B31.3.	X			X	X	X	
51	3.3.3.b	To maintain control over the supply of electricity, the first downstream 480 V ac disconnect switch from the serving 13.8 kV ac – 480 V ac transformer shall be labeled with the Site electrical utilities standardized labeling program as specified in KEH-SD-LL-RD-004, and WHC-IP-0558, DI-52660-3.01.	X				X	X	
52	3.3.6.1.a	The DST Utilities Subsystems shall be designed to keep personnel exposures as low as reasonably achievable (ALARA) in accordance with RPP-PRO-1621 and RPP-PRO-1622.	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
53	3.3.6.1.c	The DST Electrical Power Subsystem distribution system shall be designed such that power can be locked out in compliance with "Lock and Tag Program," HNF-IP-0842, Volume II, Section 4.9.1, Rev. 5e.	X				X	X	
54	3.3.6.1.d	Required fire protection piping shall be in accordance with NFPA 24.	X				X	X	Test if required by NFPA 24
55	3.3.6.2.a	The DST Utilities Subsystems shall incorporate corrosion prevention and control features in accordance with WAC 173-303-640(3); DOE Order 6430.1A, Section 0262; and DOE Order 5820.2A, Chapter 1, Sec. 3.b (2)(g).	X				X	X	
56	3.3.6.2.b	Cathodic protection systems, if required, shall be designed in accordance with the guidelines provided in NACE RP 0285-95, and NACE RP 0169-96.	X				X	X	
57	3.3.6.2.c	The equipment used for installation and maintenance shall not exceed the DST dome loading constraints given in *Tank Farms Operations Administrative Controls*, HNF-IP-1266.	X			X			Same as general 3.3.6.2
58	3.3.6.2.d	Underground piping shall be protected from external chemical and electrolytic attacks caused by soil conditions.	X			X			
59	3.3.6.2.e	Lightning protection, if required, shall be designed in accordance with NFPA 780.	X			X			
60	3.3.6.3.c	Water pressure detection systems that are physically connected to an active waste transfer pump not under administrative lock shall comply with HNF-SD-WM-TSR-006, LCO 3.1.2.	X		X	X	X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
61	3.3.7.b	Control devices shall be designed in accordance with NUREG 0700, Section 6.4, and MIL-STD-1472C, Section 5.4.	X						
62	3.5.1.a	Below-grade components either shall not require preventive maintenance over their design life or shall be designed for preventive or corrective maintenance to be performed without any excavation.	X						
63	3.5.1.b	If cathodic protection is required, the system shall be designed with the capability to periodically test sources of impressed current. Test stations shall be designed for limited-contact maintenance and operation.	X				X	X	Same as DST Diluent and Flush Subsystem 3.5.1.a
64	3.5.1.c	Backflow-preventers shall be easily accessible for annual testing and acceptance by a state-certified inspector.	X			X	X	X	
65	4.1.2.b	Control equipment shall comply with NEMA ICS standards and UL 508.	X			X	X	X	
HNF-4169 Transfer Valving Subsystem Specification									
1	3.1.2.1.1.a	The DST Transfer Valving Subsystem shall transfer and route the waste or diluent from the DST Transfer Pump Subsystem at a pressure not to exceed the design pressure defined in Section 3.2.1.4.c.	X				X	X	
2	3.1.2.1.2.a	The DST Transfer Valving Subsystem shall route the waste, diluent, and filtered raw water from the DST Transfer Piping system at a pressure not to exceed the design pressure defined in Section 3.2.1.4.c.	X				X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
3	3.1.2.1.2.b	The DST Transfer Valving Subsystem shall provide a seal loop jumper to block and route the flow of waste, diluent, or water from the DST Transfer Piping Subsystem secondary confinement drain.	X			X	X	X	
4	3.1.2.1.3.a	The DST Transfer Valving Subsystem shall route the filtered raw water from the DST Raw Water Subsystem at a pressure not to exceed the design pressure defined in Section 3.2.1.4.c.	X				X	X	
5	3.1.2.1.4.a	The DST Transfer Valving Subsystem valve motor operators shall be designed to operate using the 120 V ac power source provided by the DST Electrical Power Subsystem.	X				X	X	
6	3.1.2.1.6.a	The DST Transfer Valving Subsystem shall transfer and route the flush or diluent from the DST Diluent and Flush Subsystem at a pressure not to exceed the design pressure defined in Section 3.2.1.4.c.	X				X	X	
7	3.1.2.1.7.a	The DST Transfer Valving Subsystem transfer-associated structure shall contain the leakage from the mixer pump and route it to the tank as required.	X			X			
8	3.1.2.1.8.a	The DST Transfer Valving Subsystem shall be designed using motor-operated valves where required.	X			X			
9	3.2.1.1.a	The valves shall remain closed when within 5 degrees of full closed position.	X		X		X	X	
10	3.2.1.2.1.a	Mechanical (local) position indication for valves shall be accurate to within ±5 degrees with respect to the actual valve position.	X		X		X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
11	3.2.1.2.1.b	Mechanical (local) indication of the valve's position shall be visible from the top of the cover block.	X			X	X	X	
12	3.2.1.2.2.a	Measurement device(s) for remote indication of valve position shall be compatible with the requirements of the DST Monitor and Control Subsystem specification.	X				X	X	
13	3.2.1.3.a	A method of minimizing aerosol generation should provided for Tanks 241-AP-102 and 241-AP-104.	X				X	X	
14	3.2.1.3.b	A drop-leg or other method of discharging liquid beneath the tank waste surface shall be provided for Tanks 241-AZ-101 and 241-AZ-102.	X			X	X	X	
15	3.2.1.3.c	Slurry distributors with directional control shall be provided with an indexing diagram on the pump pit cover blocks for identification of the slurry distribution orientation. Slurry distributors shall be adjustable remotely from within the transfer-associated structure to any given position from an established zero-degree reference point.	X			X	X	X	
16	3.2.1.4.a	The DST Transfer Valving Subsystem shall be designed to transfer waste up to 606 L/min (160 gal/min).	X				X	X	
17	3.2.1.4.b	Pressure boundaries shall be designed for no visible leakage at test pressure in accordance with ASME B31.3.	X			X	X	X	Same as DST Diluent and Flush Subsystem 3.3.1.a

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
18	3.2.1.4.c	The threshold design pressure of new DST Transfer Valving Subsystem components shall be 4580 kPa (650 lb/in^2 gauge) <TBR> (see Appendix C).	X			X	X	X	Same as DST Diluent and Flush Subsystem 3.3.1.r
19	3.2.1.5.a	The DST Transfer Valving Subsystem shall be designed to transfer and route diluent/flush water at a flow rate up to 606 L/min (160 gal/min). <TBR>	X				X	X	
20	3.2.1.5.b	The DST Transfer Valving Subsystem shall be designed to transfer and route filtered raw water at a pressure not to exceed the design pressure defined in Section 3.2.1.4.a.	X				X	X	
21	3.2.1.6.a	The valves shall be capable of being positioned in the full-open or full-closed positions for every port. The valve position is defined as fully closed and seated in Section 3.2.1.1.a.	X		X		X	X	
22	3.2.1.7.1.a	The flow-rate measurement device shall be capable of measuring a range of 0-757 L/min (0-200 gal/min) with an accuracy of 0.5 percent of range <TBR>.	X			X	X	X	
23	3.2.1.7.2.a	The pressure measurement device(s) shall be capable of measuring a range of 0-5960 kPa (0-850 lbf/in^2) with an accuracy of 0.5 percent of range <TBR>.	X				X	X	
24	3.2.1.7.3	Not used.							Not A requirement
25	3.2.1.7.4.a	The density measurement device shall be capable of measuring a range of 0.9 to 1.5 g/cm^3 with an accuracy of 0.0005 g/cm^3 <TBR>.	X		X		X	X	

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
26	3.2.1.8.a	Cover blocks shall be designed to align with the transfer-associated structure to prevent the direct release of aerosol to the atmosphere from a spray leak.	X			X			
27	3.2.1.8.b	The design of the transfer-associated structure shall be in accordance with WAC 173-303-640 for final status facilities and 40 CFR 265, Subpart J, for interim status facilities. The design of the structure shall allow for detection of a leak within 24 hours.	X						Same as Transfer Piping 3.3.6.2.a
28	3.2.1.9.a	Transfer-associated structures, including clean-out boxes, shall have leak detectors placed at the lowest point of the structure such that a leak can be detected within 24 hours.	X			X	X	X	
29	3.2.1.9.b	A new pit leak-detector assembly and conductivity probe shall be designed and operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of dangerous waste or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time, if the owner or operator can demonstrate to the department that existing detection technologies or site conditions will not allow detection of a release within 24 hours and if the Washington State Department of Ecology approves the deviation from the requirements specified above.	X			X	X	X	
30	3.2.1.9.c	The leak detection system shall be compatible with the DST Monitor and Control Subsystem specification and the master pump shutdown system.	X				X	X	

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
31	3.2.1.10	Not used.							Not a requirement
32	3.2.1.11.a	A means of breaking the vacuum in the transfer line should be provided as required to allow gravity liquid draining. The drain piping shall be sloped continuously from high point to low point with a minimum slope of 0.25%.	X			X			
33	3.2.1.12.a	The valves shall be capable of being positioned in the full-open or full-closed positions for every port. The valve position is defined as fully closed and seated in Section 3.2.1.1.a.	X		X				
34	3.2.1.13.a	The valves shall be capable of being positioned in the full-open or full-closed positions for every port. The valve position is defined as fully closed and seated in Section 3.2.1.1.a.	X		X				
35	3.2.1.14.a	The detection instrumentation shall be compatible with the requirements of the DST Monitor and Control Subsystem specification. The detection instrumentation shall be installed between the pump discharge and the backflow prevention device required in Section 3.2.1.15.a.	X				X	X	
36	3.2.1.15.a	The backflow prevention device shall be compatible with the requirements for jumpers and jumper components. The backflow prevention device shall be installed between the flush/diluent supply and the backflow prevention instrumentation required in Section 3.2.1.14.a.	X			X			

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
37	3.2.1.16.a	The seal loop jumper shall be designed to impede the flow of any dangerous waste or liquid in the secondary confinement drain pipe to ensure that the leak detector in the DST Transfer Piping Subsystem will detect the failure of the primary containment or the presence of any dangerous waste or accumulated liquid in the secondary containment within 24 hours. The amount of anticipated leakage to actuate the leak detector shall be calculated during design of the system. The Washington State Department of Ecology, through the final status permitting process, may approve or disapprove the final system design.	X						
38	3.2.2.a	Transfer valve manifolds and jumpers should be 7.6 cm (3 in.) internal diameter	X						
39	3.2.2.b	Valves or operators shall be provided with mechanical stops located as shown in Table 3-3. The operators and stops shall prevent overtorquing and plastic deformation of the valves.	X				X	X	
40	3.2.2.c	Valves shall be capable of being manually or electrically operated from above the pit cover blocks.	X				X	X	
41	3.2.2.d	Except for the check valves, all jumper valves shall be ball valves designed for installation in the stem-up position.	X			X			

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
42	3.2.2.e	New cover blocks shall be sloped to allow water to drain off the top of the cover and shall extend over the outside of the pit walls. Existing cover blocks shall be modified with drip shields or other mechanical means, as required, to meet the requirements of WAC 173-303-640(4)(e).	X			X			
43	3.2.2.f	Cover blocks shall have penetrations to facilitate operation and/or functional testing of the components inside transfer-associated structures. Operations include, but are not limited to, decontamination by washdown, removing standing water with a portable pump, retrieving gas and particulate samples, and taking still and motion pictures of valve stem position and of the entire structure interior.	X			X			
44	3.2.2.g	Cover block penetrations shall be sealed adequately to stop rain/snow water intrusion.	X						
45	3.2.2.h	Cover blocks shall prevent radiation streaming.	X						
46	3.2.2.i	Cover blocks and jumpers shall be provided with lifting bails positioned suitable for balanced lifting by crane.	X						
47	3.2.2.j	Nozzle, manifold, and jumper assembly connections installed in new pump or valve pits should be of the Plutonium-Uranium Extraction (PUREX)-type designed in accordance with drawings H-2-32430 and H-2-32420 or H-2-821324 and H-2-821325.	X			X			
48	3.2.2.k	Manifold and jumper assembly connections installed in existing pump and valve pits and diversion boxes shall be designed to mate to existing nozzles.	X			X			

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
49	3.2.2.l	Not used.							Not a requirement
50	3.2.2.m	The valve position hardware, as applicable, shall be designed to facilitate quick mechanical/electrical disconnect for ease of cover block removal and replacement.	X			X			
51	3.2.2.n	Two-way valves shall be designed to close in the clockwise direction.	X		X		X	X	
52	3.2.2.o	In existing pits where as low as reasonably achievable (ALARA) practices preclude accurate determination of existing nozzle locations by pit entry or photogrammatry, flexible piping sections should be used to facilitate jumper installation.	X						
53	3.2.2.p	All valves shall prevent spray leaks resulting from overtorquing of valve stems.	X			X			
54	3.2.2.q	Taps for instrumentation and test connections shall be made on the top of the pipe.	X			X			
55	3.2.3.a	Process pits and cover blocks shall have a design life of 35 years.	X						Same as DST Diluent and Flush Subsystem 3.2.3.a
56	3.2.3.b	Where practical, removable components located beneath cover blocks, including valves and jumpers, should have a design life of 12 years without maintenance. <TBR>	X						
57	3.2.3.c	Valve manufacturers shall provide written recommendations of operational practices such as preventive maintenance to maximize the valve's useful life.	X			X			Same as Mixer Pump Subsystem 3.2.3.b
58	3.2.3.d	Valves shall be designed for at least 1,000 cycles over their design life.	X		X				

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			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
59	3.2.3.e	Valve operator closure shall be sufficiently slow to prevent damage from water hammer.	X				X	X	Same as DST Diluent and Flush Subsystem 3.3.6.2.a
60	3.2.3.f	Pipe elbow and bends should have a bend radius greater than or equal to a long-radius elbow.	X						
61	3.2.4.a	The design of valve manifolds, jumpers, and process instrumentation installed in process pits shall include features to minimize contamination of other equipment within the pit, and the pit itself, during routine operation and removal or repair activities.	X						
62	3.2.4.b	Not used							Not a requirement
63	3.2.4.c	Not used.							Not a requirement
64	3.2.4.d	Instrument isolation valves for instrument sensor isolation and equalization shall be located outside of the primary transfer-associated structures. These valves shall be located in a supplemental structure constructed per Section 3.3.1.e.	X			X			
65	3.2.4.e	The valve position switches shall be located above the pit cover block.	X			X			
66	3.2.4.f	All electrical connections shall be designed as applicable with quick-disconnects for ease of cover block removal and replacement.	X			X			
67	3.2.4.g	Jumpers and jumper components shall be repairable or replaceable within 24 hours <TBD>. This timeframe does not include preparatory work such as preparing procedures, staging personnel and equipment, or preparatory training.	X						

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
68	3.2.4.h	The low-point leak detector sensors shall be repairable or replaceable within 8 hours <TBD>. Time to repair does not include preparatory work such as preparing procedures, staging personnel and equipment, or preparatory training.	X						
69	3.2.5.1.c	For permanent structures, subsurface conditions shall be determined by means of borings or other methods that adequately disclose soil and groundwater conditions. Data and other information obtained from prior subsurface investigations may be used, supplemented by additional investigations at the specific location, as deemed necessary by the RPP Design Authority.	X						Document all design calculations in SDs
70	3.2.5.2.1.a	The subsystem components shall be designed to perform their intended function in the chemical environment defined in HNF-2937.	X						
71	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.	X						
72	3.2.5.2.3	Transfer valves and manifolds shall be fabricated using materials compatible with the transfer of solutions over the range specified in RPP-5346, Table 5-1. These waste properties reflect conditions at the transfer pump discharge.	X						
73	3.2.6	Not applicable. (Transportation)							Not a requirement
74	3.2.7.a	All open piping, conduits, or penetrations protruding through the cover block shall be sealed or plugged.	X			X			

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
75	3.3.1.a	The transfer jumper and nozzle components should be 304L stainless steel. All piping shall be ASTM A312 type 304L stainless steel.	X			X			
76	3.3.1.b	All ball valves shall be full-ported, zero-cavity, and shall meet the applicable design and fabrication requirements contained in ASME B16.34.	X			X			
77	3.3.1.c	Valve manifold piping and DST addition drop-legs shall meet the applicable design and fabrication requirements contained in ASME B31.3.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.a
78	3.3.1.d	Jumpers shall meet the applicable design and fabrication requirements contained in HS-BS-0084.	X			X			
79	3.3.1.e	All transfer-associated structures shall be designed to provide the required minimum functions of containment, shielding, and drainage. New transfer-associated structures shall be either welded structural steel per ANSI/AISC N690 or reinforced concrete per ACI 349 (safety class) or ACI 318 (general service or safety significant).	X			X			
80	3.3.1.f	Leak detection devices for transfer-associated structures shall comply with NFPA 70.	X						
81	3.3.1.g	Electrical equipment enclosures shall be as a minimum NEMA-Type 4, per NEMA ICS 6.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.d
82	3.3.1.h	All structural welds shall be in accordance with AWS D1.1.	X			X			Same as Mixer Pump Subsystem 3.3.1.c

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
83	3.3.1.i	Cover blocks for new pump pits and valve pits shall be sealed to the transfer-associated structure by a compressible gasket.	X			X			
84	3.3.1.j	Cooling media used in the pump pit cooling system, if required, shall be compatible with tank waste.	X						
85	3.3.1.k	Capillary fluids used in sensing elements shall be compatible with tank waste.	X						
86	3.3.1.l	The transfer-associated structure drain design shall allow drainage from the pump pits, valve pits, clean-out boxes, and diversion boxes to a level below the leak detector sensor position.	X						
87	3.3.1.m	New process pits (a pit that redirects waste flow) shall be equipped with stainless steel liners that extend to the top of the pit, where the cover block steps start.	X						
88	3.3.1.n	Cover blocks and existing process pits shall have a special protective coating to prevent waste absorption from a spray leak.	X						
89	3.3.1.o	The pump pits shall be designed so that the bulk concrete temperature remains less than 66 °C (150 °F), except for local areas such as around penetrations, where the temperature shall be maintained less than 93 °C (200 °F).	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
90	3.3.3.b	Valves shall be marked in accordance with ASME B16.34. In addition, the valves shall be provided with a stainless steel tag stamped with the following data: Valve working pressure Maximum seat temperature rating Trim material Seat and seal material Figure number Year manufactured Manufacturer's order number.	X			X			
91	3.3.3.c	Each valve T-handle shall be uniquely identified by valve and pit number.	X			X	X	X	
92	3.3.3.d	Valve manifolds, jumpers, and cover blocks shall be marked to indicate the center of gravity and weight.	X			X			
93	3.3.6.1.a	Transfer-associated structure shielding shall be designed to keep personnel exposures ALARA in accordance with RPP-PRO-1621 and RPP-PRO-1622.	X						Same as DST Diluent and Flush Subsystem 3.3.6.1.b
94	3.3.6.1.c	Nuclear and physical property reporting used in concrete radiation shielding design for transfer-associated structures shall comply with ANS 6.4.	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
95	3.3.6.2.a	The subsystem shall be designed in accordance with WAC 173-303-640(3) for final status facilities and 40 CFR 265, Subpart J, for interim status facilities; DOE Order 6430.1A, Section 0262; and DOE Order 5820.2A, Chapter 1, Sec. 3.b(2)(g). The design of the subsystem shall allow for detection of a leak within 24 hours.	X						Same as transfer piping 3.3.6.2.a
96	3.3.6.3.b	Waste transfer paths connected to active waste transfer routes shall be provided with two isolation valves. (Note: Three-way valves are considered isolation valves in the context of this requirement.)	X						
97	3.3.8.b	DST Transfer Valving Subsystem designs shall provide for ease of cut-up, dismantling, removal, and packaging of contaminated equipment (e.g., removal and packaging of components within transfer-associated structures) from the facility.	X						Same as M&CS 3.3.8.b
98	3.3.8.c	Piping shall be designed and fabricated to minimize crud traps.	X						
99	3.3.8.d	Isolation valves for waste transfer branch lines, diluent addition lines, and service water flush lines shall be located as close to the main transfer line as practical.	X						
100	3.5.1.a	Components internal to transfer-associated structures shall be designed to be remotely removed, repaired or replaced, and operated.	X						
101	3.5.1.b	Components external to transfer-associated structures shall be designed for minimal contact maintenance and hands-on operation.	X						

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
102	3.5.1.c	Not used.							Not a requirement
103	3.5.1.d	Cover blocks, valve manifolds, jumpers, and DST addition drop-legs shall be provided with lifting attachment points for installation of the assembly into position. Lifting attachment points for valve manifolds, jumpers, and DST addition drop-legs shall be designed such that the assembly can be adjusted to hang plumb within ±2.54 cm (1 in.) over its length during installation with a crane. Below-the-hook lifting hardware, if required, shall be designed and provided with the assembly. Design shall be in accordance with ANSI/ASME B30.2 and DOE/RL-92-36.	X			X			
104	3.5.1.e	Cover blocks and pit walls shall be marked to facilitate alignment of the cover blocks for proper sealing.	X						
105	3.5.1.f	All components requiring maintenance, calibration, or hands-on operation shall be located external to the pits. Transmitters for the liquid level, flow, and pressure shall be located external to the pits.	X						
106	3.5.1.g	Designs shall provide for the detection and isolation of electronic faults associated with valve position switches, pressure and flow elements, and leak detectors.	X						
107	3.5.3	Remotely operated impact wrenches shall be provided for installation/removal of PUREX jumper assemblies.	X			X			

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
108	4.1.2.b	Seat closure tests shall be performed for all transfer valves in accordance with the test methods in ASME B16.34 and API 598. Seat leakage from each flow side to the isolated port shall be within the limits specified in API 598.	X		X		X		Pressure tests in ATP
109	4.1.2.c	Shell tests shall be performed for all transfer valves in accordance with ASME B16.34.	X		X		X		Same as DST Diluent and Flush Subsystem 4.1.2.b
110	4.1.2.d	All valve manifold and jumper pipe welds shall be examined by 100% radiography.	X			X			
HNF-5196 Ventilation Subsystem Specification									
1	3.1.2.1.1.a	The DST Ventilation Subsystem shall be capable of ventilating the DST primary vapor space (AY Farm, AZ Farm, and Tank 241-AN-107) while the air lift circulators are operating at a maximum airflow rate of 5.66 m^3/min (200 ft^3/min standard).							702-AZ annulus
2	3.1.2.1.2.a	The DST Ventilation Subsystem shall receive up to 480 V ac, 3-phase, 60 Hz power from the DST Electrical Power Subsystem (*National Electrical Code*, NFPA 70, 1999). Interface control documents shall be used to manage power requirements.	X						
3	3.1.2.1.3.a	<TBD>.							Not A Requirement
4	3.1.2.1.4.a	<TBD>.							Not A Requirement
5	3.2.1.1.1.a	The subsystem shall be capable of maintaining the pressure in the DST primary tank between -15 cm w.g. (-6.0 in. w.g.) <TBR> and -0.76 cm w.g. (-0.3 in. w.g.).							702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
6	3.2.1.1.1.b	The subsystem shall be capable of maintaining pressure in the annulus tank relative to the primary tank <15 cm w.g. (6 in. w.g.).	X				X	X	
7	3.2.1.1.2.a	The subsystem shall monitor DST primary vapor space pressure over the ranges identified in Section 3.2.1.1.1.a.							702-AZ annulus
8	3.2.1.1.3.a	The subsystem shall monitor radioactive emissions per the requirements of Sections 2.1 and 2.2 of RPP-PRO-450.							702-AZ annulus
9	3.2.1.1.3.b	The subsystem shall sample radioactive air emissions in accordance with Sections 2.7, 2.9, 2.11, 2.12, 2.13, and 2.14 of RPP-PRO-2364.							702-AZ annulus
10	3.2.1.1.3.c	The subsystem shall monitor nonradioactive emissions in accordance with the requirements of Sections 2.1.1, 2.2.2, 2.2.3, and 2.5.1 of RPP-PRO-2595.							702-AZ annulus
11	3.2.1.1.4.a	The subsystem shall control releases to the atmosphere within the acceptable source impact levels established through the new source review and air emissions approval process as defined in WAC 173-400, and WAC 173-460. In addition, the subsystem shall prevent exceeding emission limits listed in the Hanford Sitewide air operating permit and HNF-4474, and in the permissible exposure levels identified in 29 CFR 1910, Subpart Z.							702-AZ annulus
12	3.2.1.1.5.a	Primary ventilation subsystems shall be capable of providing an individual tank flow rate of 14.2 m^3/min (500 ft^3/min standard) when the mixer pumps are operating, to ensure that applicable temperature limits can be met.							702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
13	3.2.1.1.6.a	The subsystem shall monitor vapor flammability over the range 1 to <TBD> lower flammability limit.							702-AZ annulus
14	3.2.1.1.7.a	The subsystem shall alarm high flammable gas concentrations within <TBD> minutes of a high flammability gas concentration occurrence.							702-AZ annulus
15	3.2.1.2.1.a	The subsystem shall be capable of maintaining pressure in the annulus less than or equal to –0.76 cm w.g. (-0.3 in. w.g.).							702-AZ annulus
16	3.2.1.2.1.b	The subsystem shall be capable of maintaining pressure in the annulus tank relative to the primary tank <15 cm w.g. (6 in. w.g.).							702-AZ annulus
17	3.2.1.2.2.a	The subsystem shall monitor the annulus pressure over the range identified in Section 3.2.1.2.1.a and the annulus-to-primary differential pressure over the range of 25 cm w.g. (10 in. w.g.) to -50 cm w.g. (-20 in. w.g.).							702-AZ annulus
18	3.2.1.2.4.a	The subsystem shall control releases to the atmosphere within the acceptable source impact levels established through the new source review and air emissions approval process as defined in WAC 173-400, and WAC 173-460. In addition, the subsystem shall prevent exceeding emission limits listed in the Hanford Sitewide air operating permit and HNF-4474, and in the permissible exposure levels identified in 29 CFR 1910, Subpart Z.							702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
19	3.2.1.2.5.a	The subsystem shall be capable of providing the airflow for each individual tank as specified in Table 3-1 when the mixer pumps are operating.							702-AZ annulus
20	3.2.2.a	The subsystem shall comply with the guidelines listed in *Tank Farms Operations Administrative Controls*, HNF-IP-1266, Chapter 5.16, for dome loading and equipment lifts within 6.1 m (20 ft) of the DSTs.	X			X			
21	3.2.3.a	The subsystem shall be designed for continuous operations over 35 years.	X						Same as DST Diluent and Flush Subsystem 3.2.3.a
22	3.2.4.a	The subsystem design shall incorporate human factors features per UCRL 15673.	X						
23	3.2.4.b	The subsystem shall be designed to allow independent aerosol testing of filters that may be used.	X				X	X	702-AZ annulus
24	3.2.5.2.1.a	The primary ventilation subsystem components shall be designed to perform their intended function in the chemical environment identified in RPP-6023.	X						
25	3.2.5.2.2.a	The subsystem shall be designed for the radiation environment as defined in <TBD>.	X		X				As required or ^{60}Co pool tests on site
26	3.2.5.2.3.a	The subsystem shall meet the requirements specified in ASME N509, Sections 5.6.4.2, 5.6.4.3, 5.6.4.4, and 5.6.4.5.	X						702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
27	3.2.5.2.3.b	The primary ventilation subsystem shall be designed for confinement exhaust air temperatures ranging from the minimum ambient temperature identified in HNF-SD-GN-ER-501 to 90.6 °C (195 °F) at 100% or less relative humidity.	X						702-AZ annulus
28	3.3.1.1.a	The subsystem shall be designed per ASME AG-1; ASME N509; and ASME N510 requirements.	X						702-AZ annulus
29	3.3.1.1.b	The subsystem shall meet the applicable design and construction requirements contained in ACI 318, for concrete work for general service and safety-significant structures.	X						702-AZ annulus Same as DST Diluent and Flush Subsystem 3.3.1.c
30	3.3.1.1.c	The subsystem shall meet the design and construction requirements contained in ACI 349, for concrete work for safety-class components.	X				X	X	702-AZ annulus
31	3.3.1.1.d	The subsystem shall meet, at a minimum, the requirements of National Electrical Manufacturer's Association Type 4, per NEMA ICS 6, for electrical equipment enclosures.	X			X			Same as DST Diluent and Flush Subsystem 3.3.1.d
32	3.3.1.1.e	The air filtration subsystems shall be designed for ease of decontamination of fissile and other components after normal and post-accident conditions.	X						702-AZ annulus
33	3.3.1.1.f	The subsystem shall maintain the flow velocity through the stack outlet at ≥610 m/min (2,000 ft/min).	X				X	X	702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
34	3.3.1.2.a	All primary and annulus ventilation condensate drain lines shall be designed, fabricated, and inspected per ASME B31.3.	X			X			702-AZ annulus Same as DST Diluent and Flush Subsystem 3.3.1.a
35	3.3.1.2.b	The condensate drainage piping shall be fabricated from 300 series stainless steel material and shall be of welded construction.	X		X	X			702-AZ annulus
36	3.3.1.2.c	The cathodic protection subsystem shall be designed in accordance with the guidelines provided in DOE 6430.1A, Section 0262.3; NACE RP 0285-95; and NACE RP 0169-96.	X				X	X	702-AZ annulus
37	3.3.1.3.a	The subsystem shall meet the applicable design and construction requirements contained in *1997 ASHRAE Handbook - Fundamentals*, Chapter 15, for exhaust stacks.	X			X			702-AZ annulus
38	3.3.1.3.b	Each filter housing and its internal components/mechanism shall be constructed of 300 series stainless steel.	X		X				702-AZ annulus
39	3.3.1.3.c	The exhaust stack shall be constructed of 300 series stainless steel.	X		X				702-AZ annulus
40	3.3.1.3.d	The subsystem should use circular ducts of all-welded construction for primary confinement subsystems to minimize particulate settling. The longitudinal seams should be placed in the top quadrant of ductwork.	X			X			702-AZ annulus
41	3.3.1.3.e	An adequate ventilation exhaust discharge path shall be provided in the event of stack failure.	X						702-AZ annulus
42	3.3.1.3.f	The design of the primary and annulus ventilation air inlets shall prevent intrusion by animals or large debris.	X						702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
43	3.3.1.3.g	The primary and annulus subsystem stacks shall be designed to be free standing. Free-standing design may include a small structure with a small platform for easy access to the record sampler and CAM.	X						702-AZ annulus
44	3.3.1.4.a	The centrifugal exhaust fans shall be designed and constructed to meet the requirements of ASME N509; ASME AG-1; AMCA 99-0200.	X						702-AZ annulus
45	3.3.1.4.b	The subsystem shall be certified and meet the requirements of AMCA 210, for exhaust fan performance.	X						702-AZ annulus
46	3.3.1.4.c	The exhaust fans shall be equipped with gravity back-draft dampers to prevent back draft through the fan while the fan is in a standby mode.	X						702-AZ annulus
47	3.3.1.4.d	Exhaust fans shall be located downstream of air-cleaning filters to minimize contamination of the air-moving equipment and avoid pressurizing contaminated ducts.	X						702-AZ annulus
48	3.3.1.4.e	The subsystem should provide shaft seals for each fan to reduce in-leakage to a minimum.	X						702-AZ annulus
49	3.3.1.4.f	The exhaust fan/motors shall be in compliance with ASME N509, Section 5.8, "Fan Drives," and ASME AG-1, Section BA-4324, "Electrical Design Requirements."	X						702-AZ annulus
50	3.3.1.4.g	The fans shall be constructed of material that is compatible with the ducting and stack.	X						702-AZ annulus
51	3.3.1.5.a	Butterfly valves shall be installed to allow isolating each tank from the primary ventilation subsystems and allow isolating the annulus space from the annulus ventilation subsystem.							702-AZ annulus

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
52	3.3.1.5.b	The subsystem shall provide motor-operated isolation valves at the inlet to each ventilation subsystem and at the outlets to enable remote isolation of each subsystem.	X						702-AZ annulus
53	3.3.1.5.c	The subsystem should use isolation valves that operate in compliance with ASME N509, Section 5-9.5, "Operators," and ASME AG-1, Section DA-4300, "Actuators."	X						702-AZ annulus
54	3.3.1.5.d	The subsystem isolation valves shall meet the seat leakage criteria specified in ASME N509 and ASME N510.	X				X	X	702-AZ annulus
55	3.3.1.5.e	The valves shall be constructed of material that is compatible with the stainless steel used to make the ducting and stack.	X		X				702-AZ annulus
56	3.3.3.b	The subsystem components shall have stainless steel tags stamped with the following data: • Equipment part number • Manufacturer's name • Year manufactured • Manufacturer's order number • Manufacturer's model number • Serial number • Operating data • Applicable construction codes.	X				X	X	702-AZ annulus
57	3.3.6.1.b	The subsystem shall be designed to keep personnel exposures as low as reasonably achievable (ALARA) in accordance with RPP-PRO-1621, and RPP-PRO-1622.	X						702-AZ annulus Same as DST Diluent and Flush Subsystem 3.3.6.1.b

Table A-7. Project W-521 Test and Evaluation Requirements.

Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
58	3.3.6.1.c	The warning and alarm subsystems shall be designed to ensure that they can be heard in the local noise levels of the area they are intended to cover.	X				X	X	702-AZ annulus
59	3.3.6.1.d	Radiation shielding, where necessary, shall be in accordance with ANS 6.4.	X				X		702-AZ annulus
60	3.3.6.2.a	The subsystem shall provide corrosion protection for belowgrade piping, ducting and enclosure material.	X			X	X	X	702-AZ annulus
61	3.3.6.3.c	The subsystem shall be designed to collect and adequately remove radioactive particulates to meet the best available control technology regulations.	X					X	702-AZ annulus
62	3.4.c	Design and test records shall be in accordance with Section 8 of ASME N510	X		X	X	X	X	702-AZ annulus
63	3.5.1.a	Above grade portions of the primary and annulus ventilation subsystems shall be designed for limited contact maintenance and operation.	X				X		702-AZ annulus Same as DST Diluent and Flush Subsystem 3.5.1.a
64	3.5.1.b	All items that require frequent maintenance or hands-on operation shall be easily accessible.	X			X	X	X	702-AZ annulus
65	3.5.1.c	Below grade portions of the primary ventilation subsystem shall be designed for no maintenance and for remote operation.	X				X	X	702-AZ annulus
66	3.5.1.d	The record sampler shall be inspected and maintained in accordance with ANSI/HPS N13.1.	X				X	X	702-AZ annulus

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Item #	Section #	Complete Requirement Text	T & E Process						Comment
			Design Verification		End Product Verification				
			DV	QTP	VTI	CTI	ATP	OTP	
67	3.5.1.e	Filters that may be part of exhaust treatment equipment shall be provided with injection and sampling ports for aerosol testing for independent testing of each filter stage. The sampling and injection manifolds shall meet the requirements listed in ASME N509 and ASME N510.	X			X			702-AZ annulus
68	3.5.1.f	The particulate removal subsystem filter housing shall be designed to maintain containment during filter change out.	X						702-AZ annulus
69	4.1.2.a	The DST Ventilation Subsystem shall be tested in accordance with the methods described in ASME N510 to verify compliance with the requirements of ASME N509.	X				X	X	702-AZ annulus
70	4.1.2.b	The minimum flow required to satisfy the minimum vacuum requirements of Sections 3.2.1.1.1.a and 3.2.1.2.1.a shall be determined by testing per the *1997 ASHRAE Handbook - Fundamentals*, Chapter 14.	X			X	X	X	702-AZ annulus

A.2.6 References

HNF-5196, "DST Ventilation Subsystem Specification."

HNF-4163, "DST Diluent and Flush Subsystem Specification."

HNF-4162, "DST Transfer Pump Subsystem Specification."

HNF-4157, " DST Utilities Specification."

HNF-4164, "DST Mixer Pump Subsystem Specification."

HNF-4155, "DSTS Monitor and Control Subsystem Specification."

HNF-4161, "DST Transfer Piping Subsystem Specification."

HNF-4169, "DST Transfer Valving Subsystem Specification."

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